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VIA THE TCEQ PUBLIC COMMENT SYSTEM

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RE: Public Comments regarding Houston-Galveston-Brazoria (HGB) Severe Area Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standards (NAAQS), Docket No. 2023-1223-SIP/Project No. 2023-110-SIP-NR

Dear Chief Clerk and Air Quality State Implementation Plan Team:

Earthjustice, Air Alliance Houston, Environment Texas, Public Citizen, Sierra Club, and Texas Environmental Justice Advocacy Services ("t.e.j.a.s.") hereby submit the following comments explaining why the Texas Commission on Environmental Quality's ("TCEQ's") proposed attainment demonstration (in citations, "AD") for the Houston-Galveston-Brazoria nonattainment area under the 2008 national ambient air quality standard for ozone is illegal and arbitrary, and must be significantly strengthened to accord with the law, drive timely attainment of the ozone standard, and improve the health and wellbeing of the millions of people living in this community.

I. Introduction

There is no real dispute that ozone air pollution seriously harms the health and wellbeing of Houston area residents. Reducing ozone pollution levels—and the levels of the also dangerous pollutants that react in the atmosphere to form ozone—is legally required under the Clean Air Act. And, especially because the burdens of air pollution are not equitably distributed, pollution reduction is also necessary to achieve justice.

Though longstanding, the Houston area's dangerous ozone pollution levels can be and have been meaningfully reduced in the past, as the proposal itself describes. Here, however, TCEQ proposes to require no new ozone controls. In doing so, TCEQ once more signals it would prefer to take a familiar—and disappointing—path: hope the problem goes away on its own. In its most recent two attainment demonstration plans under the 2008 national ambient air quality standard for ozone, TCEQ's modeling showed Houston would not timely attain the standard.[1] In both instances, rather than require more pollution reductions, TCEQ instead sought to explain away the modeled nonattainment (76 ppb and 79 ppb in 2020 and 2017, respectively) with "weight of evidence" demonstrations. 2020 AD at 5-65 to 5-67; 2016 AD at 5-56 to 5-58. Not only were proffered explanations overly optimistic, so too was the modeling: in the 2020 and 2017 attainment years, the actual design values for the Houston area were 79 and 81 ppb, respectively.[2] Now, the most recent official design value, for 2022, is 78 ppb, *id.*, and TCEQ's own unofficial design value for 2023 is 83 ppb, with numerous other monitors registering violations, too.[3] TCEQ's current approach of hoping for the best is not working.

TCEQ must significantly strengthen its proposed attainment demonstration. Despite a recent history of generally stagnant ozone levels—accompanied by similarly steady ambient levels of ozone precursors—the proposal includes no new control requirements to compel further reductions in emissions of ozone precursors. Instead, TCEQ proposes to weaken control requirements. Though the proposal models attainment by a slim margin, the conclusion is not credible: Beyond the fact that the status quo does not suggest ozone levels are decreasing, TCEQ itself reports its modeling often underestimates ozone levels, including at the current high monitor, and TCEQ fails to account for changed monitoring methods that will go into effect next year.

The proposal further fails to undertake any rational analysis to support the finding that Texas's existing reasonably available control technology ("RACT") requirements meet Clean Air Act requirements. To the contrary, a brief review of RACT standards governing emissions of oxides of nitrogen ("NOx") in other jurisdictions finds stronger RACT standards are supported and thus required. For at least one source, its own performance shows stronger RACT standards are necessary. Similar analysis of sources of volatile organic compounds ("VOCs") is also necessary to rationally back any proposal for RACT for VOC sources.

Consistent with carrying out a lawful, rational RACT analysis, TCEQ must also improve its analysis of reasonably available control measures ("RACM") that can hasten attainment. It must

[1] In TCEQ's 2020 serious classification attainment demonstration (in citations, "2020 AD"), modeling projected a design value of 76 ppb in the 2020 attainment year. HGB 2008 Eight-Hour Ozone Serious Classification AD SIP Revision (Rule Project No. 2019-077-SIP-NR) at ES-3 & tbl. ES-2, Texas Commission on Environmental Quality (Feb. 14, 2020), available at https://wayback.archive-it.org/414/20210529055709/https:/www.tceq.texas.gov/assets/public/implementation/air/sip/hgb/hgb_serious_AD_2019/HGB_AD_SIP_19077SIP_adoption_web.pdf; In TCEQ's 2016 moderate classification attainment demonstration (in citations, "2016 AD"), modeling projected a design value of 79 ppb in the 2017 attainment year. HGB 2008 Eight-Hour Ozone AD SIP Revision (SIP Project No. 2016-016-SIP-NR) at ES-3 to ES-4 & tbl. ES-2, TCEQ (Nov. 30, 2016), available at https://wayback.archive-it.org/414/20210529060020/https:/www.tceq.texas.gov/assets/public/implementation/air/sip/hgb/HGB_2016_AD_RFP/AD_Adoption/16016SIP_HGB08AD_ado.pdf.
[2] Ozone Design Values, 2022, tbl. 3b, https://www.epa.gov/system/files/documents/2023-05/O3_DesignValues_2020_2022_FINAL_05_22_23.xlsx.
[3] Compliance with Eight-Hour Ozone Standard, TCEQ, available at https://www.tceq.texas.gov/cgi-bin/compliance/monops/8hr_attainment.pl (set "Year" to "2023" and click "Generate Report").

further examine whether improved controls on sources of ozone-forming pollution outside the Houston area are necessary or appropriate for attaining timely.

TCEQ's proposed contingency measures are also lacking: TCEQ fails to propose any contingency measures to control NOx, one contingency measure incorporates limits that are actually required presently as RACT, and one contingency measure arbitrarily weakens certain standards. TCEQ must strengthen its proposed contingency measures to meet the mandates of the Clean Air Act and to ensure that Texans in the Houston area are protected if ozone levels do not decrease as expected.

The negative health effects of ground-level ozone are serious and undisputed, and people in the Houston area have been breathing high ozone pollution for many years. With this SIP revision, TCEQ is legally required—and empowered—to alleviate that harm as expeditiously as possible. Without amendments to strengthen pollution controls, however, this proposal will predictably continue to delay attainment of the 2008 ozone standard.

II. Comments

A. The proposal fails to make a rational showing of timely attainment.

Without adopting additional controls for NO_x and VOCs, it is irrational for TCEQ to claim that existing control strategies will produce the pollution reductions necessary to bring the area into attainment by the 2026 attainment year.

There are several reasons why it is unreasonable for TCEQ to rely solely on existing controls to timely bring the area into attainment.

For one, ozone levels in the Houston region have stagnated over the past decade, and TCEQ provides no credible reason to believe that existing controls are sufficient to reduce ambient ozone levels. Since 2014, the official ozone design values in the Houston area have stayed between 77 ppb and 81 ppb. AD at 5-4 & fig. 5-1. The unofficial 2023 design value is 83 ppb, as noted above. TCEQ's own analysis of monitored ozone trends from 2010 to 2022 "indicates that overall, ozone in the area is not changing very much and that changes at individual monitors are likely due to changes in shifting wind directions on high ozone days rather than changes in emissions." AD at 5-8. TCEQ acknowledges that from 2012 to 2022, ambient ozone trends are overall "very flat, even more so when ozone is adjusted for meteorology." AD at 5-24. The number of ozone exceedance days has also stagnated in the area since 2014, with "almost no change in exceedance days after 2012." AD Appendix B (in citations, "App. B") at 2-6.

Supporting that existing controls are not reducing ozone levels, ambient levels of ozone precursors have also stagnated in recent years. Median ambient NOx levels have stayed relatively flat since 2012. AD at 5-11 to 5-12 & fig. 5-6. TCEQ asserts that modeling shows on-road and non-road NOx emissions decreasing from 1999 through 2022 and continuing to decrease over time with fleet turnover. AD at 5-12. But the modeling that TCEQ refers to was conducted in 2015 with the now-outdated MOVES2014a model. AD at 5-12. TCEQ provides no justification for relying on fleet turnover projections in this almost decade-old study and no justification for relying on the study's use of MOVES2014a. TCEQ's reliance on this modeling is also inconsistent with its use of more updated models, such as MOVES3 and TexN2.2, to estimate emissions inventories for various mobile sources. AD at 3-10 to 3-11 & tbl. 3-4.

Despite TCEQ's modeling, ambient NOx levels in the Houston area have hardly budged since 2012. AD at 5-12 & fig. 5-6. To the extent that fleet turnover has generated continuing NOx reductions, these reductions have been entirely subsumed in reality by a 7% increase in point source NOx emissions from 2012 through 2021. *See* AD at 5-13. TCEQ acknowledges that this increase in point source emissions correlates with ambient NOx trends, which have "showed little change from 2012 through 2021." AD at 5-13. In fact, after 2017, NOx trends "even increased in some years." App. B at 3-1.

VOC monitoring data also shows trends of either stagnating or increasing VOC levels. Like it does with NOx, TCEQ points to the same 2015 modeling conducted with MOVES2014a as support for the assertion that on-road and non-road VOC emissions have decreased from 1999 to the present and will continue with fleet turnover. AD at 5-16. But, just as with NOx, this prediction is undercut by monitoring data, which shows that median levels of ambient total non-methane organic compound ("TNMOC"), which represent total VOC concentration, have barely changed since 2012. *See* AD at 5-16 & fig. 5-8. This correlates with the fact that between 2012 and 2022, the 11 largest VOC emitters, accounting for 41% of the area's total VOC emissions, had "almost no change" in emissions. AD at 5-16. And TCEQ does not plan for VOC emission trends to change—the proposal's emissions inventory modeling predicts that VOC emissions will increase by 4.62 tons per day ("tpd") between the 2019 base case episode day and the 2026 future year episode day, with these increases driven primarily by higher VOC emissions from non-road, area, and point sources. AD at 3-12 & tbls. 3-5 to 3-6. In the associated proposed DFW-HGB Severe Area RFP SIP Revision for the 2008 Eight-Hour Ozone NAAQS (in citations, "RFP"), TCEQ predicts that uncontrolled VOC emissions will increase by 11.62 tpd and controlled VOC emissions will increase by 3.03 tpd between 2023 and 2026. RFP at 2-19 to 2-20 & tbls. 2-7 to 2-8.

Trends for highly reactive volatile organic compounds ("HRVOC") have also stagnated or shown growth. Between 2012 and 2022, median ambient levels of HRVOC increased by 10%. AD at 5-15. Between 2012 and 2021, the top nine HRVOC emitters, accounting for 51% of the area's total HRVOC emissions, had a 3% increase in HRVOC emissions. AD at 5-17. TCEQ acknowledges that these emissions trends correlate with ambient HRVOC trends, which show "little change" from 2012 through 2021. AD at 5-17. HRVOCs are the largest VOC group with high ozone formation potential in the Houston area, making up 20% to 50% of VOC composition as captured by monitors. App. B at 3-12 to 3-14. Growing HRVOC trends in the Houston area reinforce the reality that ozone improvements have ceased over the last decade.

The abrupt, temporary drop in ozone and precursor levels that TCEQ repeatedly notes occurred in 2020, but does not seek to explain, is almost certainly explained by changes in commuting and other patterns stemming from the onset of the COVID-19 pandemic in the United States in March-April 2020. *See, e.g.*, AD at 5-8, 5-11, App. B at 2-7, 3-2 to 3-4 & figs. 3-1 to 3-4, 3-7 to

3-8. Notably, consistent with that explanation and with the overall trend of non-progress in pollution reduction, TCEQ acknowledges that the 2020 VOC reductions were not caused by the biggest industrial polluters that "typically emit large amounts of HRVOC in the Houston Ship Channel area." App. B at 3-8. And, to the extent TCEQ relies on the unusually low pollution levels in 2020 to support its purported demonstration of timely attainment, such reliance is irrational because there is no reasonable basis—and TCEQ certainly identifies none—to expect the pollution levels in that year to recur.

In light of stagnating or increasing trends in ambient ozone, NOx, and VOC, consistent with the stagnant or increasing trends in point source NOx and VOC emissions, TCEQ cannot rationally conclude that the area will attain the ozone standard without taking steps to ensure additional emissions reductions. At the very least, TCEQ provides no reasonable explanation for how it could so conclude.

It is instructive to consider how TCEQ's 2020 Serious Attainment Demonstration SIP Revision failed to bring the Houston area into attainment. In that revision, TCEQ modestly strengthened VOC controls for storage tanks and otherwise relied on existing controls and fleet turnover to attain the ozone standard. The Houston area did not attain on time and was reclassified from serious to severe. 87 Fed. Reg. 60,926 (Oct. 7, 2022). TCEQ provides no reason to believe that emissions reductions from existing controls and fleet turnover will accelerate such that repeating a plan of inaction will achieve attainment this time. Far from it. As detailed above, there is no demonstrated recent history of empirical, monitored reductions in ozone or ozone-forming precursors, which controverts TCEQ's reliance on modeling to assert otherwise. These stagnating trends in real-world conditions make it irrational and arbitrary for TCEQ to conclude that no additional emissions reductions are necessary for attainment.

Moreover, TCEQ's plan of inaction arbitrarily relies on emissions reductions associated with fleet turnover or federal actions and, with the exception of contingency measures, neglects to include enforceable emissions controls. *See* AD at 3-12, 5-12, 5-16, & tbls. 3-5 to 3-6. Whether these reductions will actually occur is not within TCEQ's control, and it is not clear how, if at all, the realization of such reductions could be enforced. The Clean Air Act requires SIPs to "include enforceable emission limitations and other control measures, means, or techniques … as may be necessary or appropriate to meet the applicable requirements of [the Act]." 42 U.S.C. § 7410(a)(2)(A); *see also id.* § 7407(d)(3)(E)(iii) (for nonattainment area to be redesignated to attainment, attainment must result from "permanent and enforceable reductions in emissions"). Demonstration of attainment is one applicable requirement of the chapter. 42 U.S.C. § 7511a(c)(2)(A). Accordingly, TCEQ must amend this proposal to include clearly enforceable mechanisms to reduce emissions in order to meet these Clean Air Act mandates.

The current proposal is deficient because it relies on reductions that are hardly within TCEQ's control and TCEQ explains no way of enforcing those reductions. In TCEQ's modeling of 2019 and 2026 June 12 Episode Days, the bulk of NOx reductions (41.98 tpd) come from on-road and non-road emission sources. AD at 3-12 & tbls. 3-5 to 3-6. In addition, 12.34 tpd of VOC reductions are expected from on-road sources. *Id*. TCEQ expects that these reductions will be generated by projected fleet turnover. AD at 5-12. TCEQ must make clear how fleet turnover can be enforced.

The next largest source category reduction comes from commercial marine vehicles (CMVs), which was modeled to have a reduction of 14.13 tpd of NOx. AD at 3-12 & tbls. 3-5 to 3-6. This reduction is overstated. Part of this reduction is due to TCEQ's anticipation that the Houston Ship Channel expansion project, conducted by the U.S. Army Corps of Engineers ("USACE"), will generate traffic flow improvements in the Channel. AD at 2-4.

As an initial matter, TCEQ must ensure that it factors any NOx and VOC emissions resulting from construction on the Channel expansion project into its attainment demonstration. The proposal does not state that emissions from the expansion's construction equipment were factored into the non-road emissions inventory. *See* AD at 3-10 to 3-11, Appendix A (in citations, "App. A") at A-36 to A-38. Construction began on the expansion in 2021, and will produce significant emissions in the coming years.[4] Depending on the plan chosen and equipment used, the expansion could generate as much as 3,280 tons of NOx between 2023 and 2026 and as much as 213 tons of VOC between 2023 and 2026.[5] Potential emissions from the expansion may be even greater than these figures because USACE and Port Houston accelerated the project timeline in August 2021—after these emissions estimates were developed.[6] Accordingly, TCEQ must ensure these emissions are factored into emissions modeling because they will likely contribute to higher ozone levels in the Houston area during the highly relevant 2024-26 period.

As for reduced emissions due to the expansion, TCEQ improperly reduced the 2026 NOx emissions estimates for all ocean-going vessels by 3% because it said the project is scheduled to be completed by 2026 under the accelerated schedule.[7] AD at 2-4. However, as of August 2023, the Houston Port Authority said that the project will be completed in "late 2026."[8] In October

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[4] *History Is Made as Project 11 Begins Construction*, Business Wire (May 10, 2021), available at https://www.businesswire.com/news/home/20210510005836/en/History-Is-Made-as-Project-11-Begins-Construction.

[5] Final Integrated Feasibility Report – Environmental Impact Statement, Appendix G at 3-30 & tbl. G3.1-5, U.S. Army Corps of Engineers (Jan. 2020), available at https://www.swg.usace.army.mil/Portals/26/docs/Planning/Public%20Notices-Civil%20Works/HSC-ECIP%20FIFR-EIS/App%20G%20-%20Environmental%20Supporting%20Document%20(3Mar2020).pdf?ver=2020-04-29-094501-380.

[6] Kristen Hays, *Port Houston chief say* [sic] *$1.1 billion project underway to deepen, widen ship channel*, S&P Global Commodity Insights (Nov. 11, 2021), available at https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/petrochemicals/111121-port-houston-chief-say-11-billion-project-underway-to-deepen-widen-ship-channel.

[7] Without the accelerated timeline, the Port Authority states that the project "would likely not be completed until 2030 at best." *Contact Us & FAQ*, Houston Ship Channel Expansion Project 11 (last visited Jan. 12, 2024), available at https://www.expandthehoustonshipchannel.com/contact-us/.

[8] *Capital Enhancements to Support Rapid Growth: Accelerating Infrastructure Investments to Meet Demand*, Port Houston (Aug. 13, 2023), available at https://porthouston.com/capital-enhancements-to-support-rapid-growth/.

2023, the Greater Houston Port Bureau, a trade organization, similarly stated that the expansion is scheduled for completion "at the end of 2026," with this timeline subject to additional federal funding. Thus, even under the project's current accelerated timeline, any emissions reductions attributable to the expansion would not manifest in time for the 2026 ozone season and TCEQ cannot rationally include them in its attainment demonstration.

Moreover, TCEQ has no control over the rate at which the project will be completed, the traffic patterns of CMVs, or the rate of turnover from older higher-emitting ships to newer lower-emitting ships, all of which directly bear on the emissions reductions that can be expected from the Channel expansion. TCEQ must explain how achievement of the reductions it claims from the project will be enforceable.

Therefore, it is unlawful and arbitrary for TCEQ to rely upon these reductions to demonstrate attainment when the statute requires SIPs to contain "enforceable emission limitations and other control measures, means, or techniques." 42 U.S.C. § 7410(a)(2)(A). Confirming the importance of enforceable emission limitations in attainment planning, in particular, is the Act's provision for redesignation of a nonattainment area. That provision requires not only that a nonattainment area must have actually attained the standard, but also that "the improvement in air quality [must be] due to permanent and enforceable reductions in emissions." *Id.* § 7407(d)(3)(E)(iii). The main emission reductions TCEQ relies on are not assured to occur, and it is not immediately evident—and TCEQ fails to explain—how their occurrence can be enforced.

What TCEQ can control is emissions from large stationary sources that are significantly contributing to ozone exceedance in the Houston area. In 2021, the top reporting sources of NOx, VOC, and HRVOC in the area accounted for a tremendous proportion of total point source emissions. The top ten NOx reporting sources produced 52% of total point source NOx emissions, the top ten VOC reporting sources produced 41% of total point source VOC emissions, and the top nine HRVOC sites produced 51% of total point source HRVOC emissions. App. B at 3-15 to 3-17. These sources are primarily power plants, chemical facilities, and refineries and are concentrated around the Houston Ship Channel. App. B at 3-15 to 3-21 & figs. 3-12 to 3-17. As noted above, the stagnant or increasing trend of these emissions tracks with the stagnant or increasing trends in ambient levels of ozone and ozone-precursors. Accordingly, TCEQ must reduce these emissions to have a chance of effectively controlling ozone levels in the Houston area.

The fact that a bulk of emissions driving high ozone in the Houston area is being generated by facilities near the Houston Ship Channel is supported by monitoring of rapid ozone formation and ozone exceedance days. TCEQ's analysis shows that monitors closer to the Houston Ship Channel typically measure more frequent rapid ozone formation compared to monitors further from the urban core. App. B at 2-14. Studies have also suggested that rapid ozone formation near monitors is likely due to large quantities of HRVOC and NOx from industrial facilities, and the highest rapid ozone increases consistently lead to ozone exceedances. App. B at 2-12 to 2-13. TCEQ's analysis also suggests that "[f[or many ozone exceedance days, the winds appear to come from in the direction of the Houston Ship Channel, before slowly moving across the urban area and ending at the downwind monitor." App. B at 5-9. This indicates that these high-emitting industrial sources are significant contributors to the Houston area's nonattainment, and that controlling emissions from these sources could reduce rapid ozone formation and ozone exceedance days.

In sum, it is unreasonable and unlawful for TCEQ to, as it has in this proposal, rely primarily on unenforceable reductions from fleet turnover to attain the ozone standard. This is especially true given the stagnating trends in ambient ozone and ozone-precursor levels, which correlate with the trends in emissions of NOx and VOC from point sources. For TCEQ to meet its requirement under the Clean Air Act to demonstrate that the Houston area will attain the ozone standard as expeditiously as practicable, and by no later than the attainment deadline, TCEQ must amend the proposal to include actually permanent and enforceable controls of ozone precursors. TCEQ itself already has identified where to look to obtain the necessary reductions: from the industrial polluters that are emitting the most ozone-forming pollution.

The proposal will interfere with the Houston area's attainment of the 2008 standards and thus violate CAA Section 110(*l*).

EPA cannot approve a SIP revision if it "would interfere with any applicable requirement concerning attainment and reasonable further progress … or any other applicable requirement." 42 U.S.C. § 7410(*l*). As explained above, TCEQ's failure to impose any controls on NOx and VOC will interfere with the Houston nonattainment area's ability to attain the 2008 NAAQS, and, as explained below, TCEQ's modeling that purports to find the contrary is not credible. Thus, EPA will be unable to find non-interference under 42 U.S.C. § 7410(*l*).

TCEQ is also acting illegally and arbitrarily by proposing rule updates that will weaken necessary emissions monitoring requirements. TCEQ's concurrently proposed amendments to 30 T.A.C. Chapter 117 would remove the current requirement for certain stationary diesel engines to have continuous or predictive emissions monitoring systems (CEMS or PEMS) to verify that internal NOx exhaust controls achieve reductions necessary to meet emission limits. AD at 4-8; TCEQ Rule Project No. 2023-117-117-AI (in citations, "Chapter 117 proposed rule") at 6-8. TCEQ's concurrently proposed amendments to 30 T.A.C. Chapter 115 weaken VOC monitoring requirements for certain natural gas processes by providing for reduced monitoring frequency and allowing visual, audio, and/or olfactory ("OVA") inspections of fugitive components in heavy liquid service in lieu of instrument monitoring. AD at 4-9; TCEQ Rule Project No. 2023-116-115-AI (in citations, "Chapter 115 proposed rule") at 8-9.

These proposed changes will interfere with the Act's mandate for TCEQ to "provide for establishment and operation of appropriate devices, methods, systems, and procedures necessary to … monitor, compile, and analyze data on ambient air quality." 42 U.S.C. § 7410(a)(2)(B)(i). The lack of continuous or predictive emissions monitoring on these stationary diesel engines makes it more difficult to discern the contribution that this NOx source category makes to ambient ozone and NOx levels. Similarly, OVA inspections of fugitive components in heavy liquid service cannot generate standardized or quantifiable data to assess the impact these leaks have on ambient ozone and VOC levels.

Weakening monitoring requirements would also be arbitrary. Continuous and predictive emissions monitoring of NOx from all stationary diesel engines is particularly necessary in light of TCEQ's modeling showing NOx emissions increasing significantly from area and point sources between 2019 and 2026. AD at 3-12 & tbls. 3-5 to 3-6. As for TCEQ's 30 T.A.C. Chapter 115 proposed rule, there is no reason that OVA inspections to detect heavy liquid service leaks cannot be conducted in addition to regular instrument monitoring. TCEQ's justification for this change is that OVA inspections can detect leak evidence more quickly, Chapter 115 proposed rule at 9, but human senses are imprecise and cannot precisely characterize leaks as instrumental monitoring can. Instrumental monitoring in these contexts is already in place and necessary to accurately assess and record the quantity of VOCs emitted from leaks, so TCEQ must not adopt this change.

Overall, weakened monitoring will make it more difficult or impossible for TCEQ to show that decreases in ambient ozone are results from "permanent and enforceable reductions in emissions" as is required for redesignation to attainment under 42 U.S.C. § 7407(d)(3)(E)(iii). By reducing the amount of available and precise emissions data, TCEQ makes it harder—or impossible—to demonstrate that future attainment has resulted from actual emission reductions. Moreover, if the attainment plan fails, as we expect it will, TCEQ will need to engage in further planning. *Id*. § 7511(b)(4). In that circumstance, accurate data will be important to ensure the planning is effective at reducing ozone and its precursors.

Because the proposal barely models attainment with a predicted 2026 design value of 75 ppb, a forthcoming update to ozone monitoring alone has the potential to bring the area out of attainment. In October 2023, EPA finalized a rule on ozone measuring requirements that improves the accuracy of ozone monitoring and brings the United States into alignment with international ozone monitoring standards. 88 Fed. Reg. 70,595, 70,595-97 (Oct. 12, 2023). The starting implementation date for the new method is January 1, 2025. *Id*. at 70,597. EPA expects that the new rule could result in increases in measured ozone concentrations by up to 1.23%.[9] A 1.23% increase would raise the Aldine monitor's 2026 future design value to 76 ppb, putting the Houston area out of attainment. AD at 3-21 & tbl. 3-10. For this proposal to rationally demonstrate attainment, TCEQ must reduce NOx and VOC emissions to ensure that the imminent update to ozone monitoring methods will not cause failure to attain.

Lastly, TCEQ's reliance on its air quality modeling is irrational. TCEQ's own modeling performance evaluation (MPE) casts doubt upon the modeling's accuracy in demonstrating attainment. In TCEQ's analysis comparing modeling results to measured ozone concentrations, the model underpredicts ozone levels at most regulatory monitors in the Houston-Galveston-

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[9] Joann Rice, Ozone Traceability, Surface Monitoring Impacts, and Potential Implementation Issues in the United States at 7, EPA, Office of Air Quality Planning & Standards (Oct. 7, 2020), available at https://www.bipm.org/documents/20126/45209611/Ozone+Workshop+2020+DAY+3.2+Joann+Rice.pdf/661b7b84-3e68-79d3-09a1-62178cbc702c (noting "[p]otential" effect of change on monitored levels as "increase of 1.23%").

Brazoria nonattainment area, with several underpredictions falling outside the normalized mean bias range indicating good model performance. AD at 3-15 to 3-16 & tbl. 3-7, figs. 3-10 to 3-11. In particular, the MPE shows that modeling for the Aldine monitor underestimates ozone levels by more than 5%. AD at 3-16 & fig. 3-10. The MPE also showed that TCEQ's modeling underestimates ozone levels by more than 5% at the Bayland Park, Galveston 99th Street, and Conroe Relocated monitors. *Id*. These monitors have historically captured the highest ozone levels in the Houston area. 87 Fed. Reg. 21,833 (Apr. 13, 2022). The modeling predicts that the Aldine monitor will set the Houston area's design value of 75 ppb in 2026. AD at 3-21 & tbl. 3-10. It is irrational for TCEQ to demonstrate attainment using the Aldine monitor's modeled 2026 design value of 75 ppb given that modeling for this monitor has been shown to underestimate ozone levels by, on average, 5%, or 3.75 ppb.

In sum, TCEQ's modeling underestimates ozone levels in areas that have historically had the highest ozone levels in the Houston area. Because the areawide design value is determined by the highest design value at a regulatory monitor in the area, this systematic underestimation of ozone levels raises material concerns about the credibility of the model's demonstration of attainment. Accordingly, TCEQ is arbitrarily claiming that the modeling credibly demonstrates attainment in the absence of any additional control measures.

Further, TCEQ did not use the most up-to-date data in developing its flawed attainment demonstration. It used the EPA 2016v1 modeling platform for non-power plants, non-Texas point sources, off-road airports (outside Texas nonattainment areas), off-road locomotives (outside Texas nonattainment areas), and some off-road shipping emissions. AD at 3-10 to 3-11 & tbl. 3-4. That 2016v1 platform was available by March 2021.[10] Since that time, but well before the release of the proposed attainment demonstration in late 2023, EPA released several updated modeling platforms, with 2016v2 coming out in February 2022 and 2016v3 released in January 2023.[11]

B. The failure to enact additional controls will allow NOx and VOC emissions to continue to disproportionately accumulate in low-income communities and communities of color.

The failure to enhance NOx and VOC controls exacerbates an already egregious environmental justice issue in the Houston area. To ensure emissions are controlled at a level requisite for the entire public's health, TCEQ must consider the fact that ozone precursor emissions are

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[10] Technical Support Document (TSD): Preparation of Emissions Inventories for the 2016v1 North American Emissions Modeling Platform, U.S. EPA (Mar. 2021), available at https://www.epa.gov/sites/default/files/2020-11/documents/2016v1_emismod_tsd_508.pdf.

[11] Technical Support Document (TSD): Preparation of Emissions Inventories for the 2016v2 North American Emissions Modeling Platform, U.S. EPA (Feb. 2022), available at https://www.epa.gov/system/files/documents/2022-02/2016v2_emismod_tsd_february2022.pdf; Technical Support Document (TSD): Preparation of Emissions Inventories for the 2016v3 North American Emissions Modeling Platform, U.S. EPA (Jan. 2023), available at https://www.epa.gov/system/files/documents/2023-03/2016v3_EmisMod_TSD_January2023_1.pdf.

concentrated in communities that are already disproportionately burdened by air pollution. These communities may be especially susceptible to the health impacts of ozone not only because they experience higher exposure to ozone, but also because they may have greater rates of preexisting health conditions, greater social vulnerability, and limited access to healthcare.[12]

Environmental injustice of air pollution burdens in the Houston area is well established. A 2020 study on emissions burdens of different Houston communities found that on average, people of color, people living in poverty, and limited-English households live in Census tracts with higher emissions densities than their more advantaged counterparts. Attachment 6b at 14, 34; *see also* Attachments 6c and 6d (regionwide maps of emissions of pollutants of concern). Both vulnerability due to such socioeconomic factors and emissions burden overlap around the Houston Ship Channel. *See* Attachment 6b at 34-35.

In 2022, EPA conducted an environmental justice analysis to determine whether to grant TCEQ's request for a one-year extension to the area's 2008 ozone NAAQS serious classification attainment deadline. EPA denied that request in part because the environmental justice analysis "demonstrated that there are populations in the Houston area that are potentially already significantly overburdened by pollution compared to the wider U.S. population." 87 Fed. Reg. 21,825, 21,832 (Apr. 13, 2022).

EPA analyzed the pollution burden indicators and demographic indicators for two sets of communities that are disproportionately burdened by pollution: 1) communities near the Houston Ship Channel, and 2) communities near monitors that have historically measured the highest ozone levels in the Houston area: Aldine, Bayland Park, Galveston 99th Street, and Conroe Relocated.

Communities within three miles of the Channel experience relatively higher particulate matter pollution compared to Houston as a whole, as well as higher likelihood for exposure to lead paint, closer proximity to Superfund sites, and closer proximity to hazardous waste. *Id*. at 21,833 & tbl. 3. Compared to the Houston area as a whole, these communities also have higher populations of people of color, people with low incomes, people who are linguistically isolated, and people with less than a high school education. *Id*. TCEQ's analysis of the largest point sources of NOx, VOC, and HRVOC sources in the Houston area shows that these industrial sources are concentrated around the Houston Ship Channel. App. B at 3-19 to 3-21 & figs. 3-15 to 3-17. In 2021, the top ten NOx reporting sites reported total emissions from 890 to 5,667 tpy and the top ten VOC reporting sites reported 654 to 2,202 tpy. Attachment 1.

Similarly, communities within one mile of the Aldine, Bayland Park, and Conroe Relocated monitors had higher particulate matter, closer proximity to Superfund sites, and closer proximity to hazardous waste than the Houston area. 87 Fed. Reg. at 21,834 & tbl. 4. Communities close to the Aldine and Bayland Park monitors had higher populations of people of color, people with low incomes, people who are linguistically isolated, and people with less than a high school diploma. *Id*. Moreover, ozone at these historically high-ozone monitors was "considerably worse

[12] Evaluation of Vulnerability and Stationary Source Pollution in Houston at 6, Sustainable Systems Research, LLC (rev. Sept. 2020) (Attachment 6b).

than the rest of Houston" —for the five most recent design value periods considered in EPA's analysis, 75% of the Houston area's monitors had attaining ozone design values. *Id.*

These analyses plainly indicate that the burdens of ozone and other types of environmental pollution have historically been concentrated in disadvantaged communities in the Houston area. TCEQ's proposal allows this pattern to continue, failing to even acknowledge these environmental inequities let alone implement measures to abate them. In 2023, the Bayland Park monitor had a preliminary design value of 83 ppb, the highest of all monitors.[13] TCEQ modeling predicts that in 2026, the Aldine and Bayland Park monitors will have design values of 75 ppb and 73 ppb, two of the three highest design values out of all monitors. AD at 3-21 & tbl. 3-10. To protect Houstonians who are already vulnerable and overburdened due to other sources of pollution, this proposal must be amended, at a bare minimum, to include additional controls on ozone precursors.

C. The proposal fails to meet RACT requirements.

Under the Clean Air Act, moderate and higher ozone nonattainment areas must develop plans that require "implementation of reasonably available control technology under [42 U.S.C. §] 7502(c)(1)" for sources covered by a Control Techniques Guidelines (CTG) and all major stationary sources of VOC and NOx. 42 U.S.C. §§ 7511a(b)(2), 7511a(f).

RACT "defines the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility."[14] RACT "means devices, systems, process modifications, or other apparatus or techniques that are reasonably available taking into account: (1) [t]he necessity of imposing such controls in order to attain and maintain a national ambient air quality standard; [and] (2) [t]he social, environmental, and economic impact of such controls" 40 C.F.R. § 51.100(o).

In fact, RACT may even encompass "stringent, or even 'technology forcing,' requirement[s]."[15] EPA has stated that anything less than "the toughest controls considering technological and economic feasibility … is by definition less than RACT and not acceptable for areas where it is not possible to demonstrate attainment." Strelow Memo at 3.

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[13] Compliance with Eight-Hour Ozone Standard, TCEQ, available at https://www.tceq.texas.gov/cgi-bin/compliance/monops/8hr_attainment.pl (set "Year" to "2023" and click "Generate Report").

[14] Memorandum from R. Strelow, Asst. Adm'r, EPA, Office or Air and Waste Management, to Reg'l Adm'rs, EPA Regions I-X, re: Guidance for Determining Acceptability of SIP Regulations in Non-Attainment Areas at 2 (Dec. 9, 1976), available at https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19761209_strelow_ract.pdf (in citations, "Strelow Memo").

[15] Strelow Memo at 2; *accord Sierra Club v. EPA*, 972 F.3d 290, 294 (3d Cir. 2020) ("RACT is a technology-forcing standard designed to induce improvements and reductions in pollution for existing sources."); *see also Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457, 492 (2001) (Breyer, J., concurring) (noting that technology forcing requirements "are still paramount in today's [Clean Air] Act").

The proposal appears to incorrectly presume that consistency with recommended controls in a CTG or Alternative Control Techniques document constitutes RACT compliance. However, EPA has long maintained the position that CTG and ACT documents are to be a starting point for analysis, and states should consider "all relevant information (including recent technical information and information received during the public comment period) that is available at the time." 80 Fed. Reg. 12,264, 12,279 (Mar. 6, 2015). TCEQ fails to meet its statutory requirements under the Clean Air Act by seeking approval of its existing RACT controls without rationally evaluating additional measures that could reduce emissions in the Houston area. Instead of "determin[ing] whether the existing controls or emissions reduction approach at [existing] source[s] can be updated or improved with reasonably available controls or strategies to achieve increased levels of emission reduction," 81 Fed. Reg. 58,010, 58,037 (Aug. 24, 2016), Texas reflexively relies on its existing controls, which are more than a decade old at this point.

TCEQ provides no analysis to back its bald statements that its existing rules—many of which are decades old, *see* attachment 2 at 19-20, 39-40—continue to satisfy RACT requirements. *See* AD at 4-10 to 4-11, App. D at 6-8. That failure to provide any analysis is itself unlawful and arbitrary.

And that failure is especially glaring because TCEQ's rules no longer are adequately stringent to represent RACT. Below are some examples of NOx emission limits adopted as RACT in two other states—New York and California (South Coast)—within the past fourteen years for boilers, stationary gas turbines, gas-fired internal combustion engines, and electricity generating units at electricity generating facilities. All four types of units are present in the Houston area and are subject to TCEQ's comparatively weak NOx emission limits. The other states' emission limits shown here are lower than those TCEQ proposes to maintain, demonstrating that TCEQ can, and indeed must, set lower RACT emission limits for NOx in its SIPs. The comparison between TCEQ's standards and those of other states was fairly simple, requiring only a review of the relevant section in each state's regulations. TCEQ can and must swiftly undertake and complete a similar review to determine what is being done in other states and adjust RACT emission limits for NOx and VOCs downward accordingly.

In addition, TCEQ has failed to meet RACT requirements for pesticide application, glass furnaces, and industrial cleaning solvents, as also explained below.[16]

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[16] Attachments 2 and 6a provide additional comments on the myriad shortcomings of TCEQ's prior claims regarding RACT.

Gas-Fired Boilers and Process Heaters

TCEQ's RACT NOx emission limits apply to gas-fired boilers and process heaters with a maximum rated capacity of 100 MMBtu/hour or greater. 30 T.A.C. § 117.305(b). For low heat release gas-fired boilers in that group, NOx emission limits range from 0.10-0.20 lb. NOx/MMBtu of heat input, depending on whether there is preheated air and the temperature of the preheated air. 30 T.A.C. § 117.305(b)(1). Similarly, the limits for gas-fired process heaters range from 0.10-0.18 lb. NOx/MMBtu of heat input depending on either preheated air temperature or firebox temperature. 30 T.A.C. § 117.305(b)(2). High heat release boilers are limited to 0.20-0.28 lb./MMBtu of heat input depending on the temperature of the preheated air. 30 T.A.C. § 117.305(b)(1).

TCEQ – Gas-Fired Boilers and Process Heaters

Boiler/process heater type*	TCEQ Emission limits		Emission limit unit	Reg
Gas-fired, low heat release, ≥ 100 MMBtu/hr	0.10	no preheated air/preheated air < 200 F	lb. NOx/MMBtu heat input	30 T.A.C. § 117.305(b)(1)
	0.15	200 F ≤ preheated air < 400 F		
	0.20	preheated air ≥ 400 F		
Gas-fired, high heat release, ≥ 100 MMBtu/hr	0.20	no preheated air/preheated air < 250 F	lb. NOx/MMBtu heat input	30 T.A.C. § 117.305(b)(1)
	0.24	250 F ≤ preheated air < 500 F		
	0.28	preheated air ≥ 500 F		
Gas-fired process heater, ≥ 100 MMBtu/hr	0.10	preheated air < 200 F	lb. NOx/MMBtu heat input	30 T.A.C. § 117.305(b)(2)
	0.13	200 F ≤ preheated air < 400 F		
	0.20	preheated air ≥ 400 F		
	OR			
	0.10	firebox temp < 1,400 F		
	0.125	1,400 F ≤ firebox temp < 1,800 F		
	0.15	firebox temp ≥ 1,800 F		

* Only applies to boilers and process heaters with a maximum heat release capacity ≥ 100 MMBtu/hr.

By contrast, other states/districts have more stringent emissions limitations on gas-fired boilers and process heaters. The South Coast Air Quality Management District ("South Coast" or "SCAQMD") applies a NOx emission limit of 30 ppm for all industrial and commercial boilers, steam generators, and process heaters with greater than or equal to 5 MMBtu/hour rated heat input capacity that burn gaseous fuel, at 3 percent volume stack gas oxygen (O_2). SCAQMD Rule 1146(c)(1)(A), last amended Dec. 4, 2020. Converting 30 ppmv to the units the TCEQ presents its emission limits in, lbs. NOx/MMBtu, results in a comparison value of 0.036 lb. NOx/MMBtu far lower than even the lowest TCEQ limit for gas-fired boilers, 0.10 lb. NOx/MMBtu, and drastically lower than the highest limit for the hottest high-heat gas-fired boiler of 0.28 lb. NOx/MMBtu.

The 30 ppm (0.036 lb./MMBtu) emission limit on boilers having 5 MMBtu/hour or more heat input capacity appears to act as a ceiling, with the limit lowered down to 5 ppm, or 0.0062 lb.

NOx/MMBtu, for the largest category of boilers. South Coast's NOx emission limits for its largest gas-fired boilers (greater than or equal to 75 MMBtu/hour) is two orders of magnitude lower than TCEQ's limits for gas-fired boilers and process heaters, proving that there is ample room for control technology improvements even for the largest boilers and process heaters. Additionally, TCEQ sets no RACT emission limits at all for gas-fired boilers and process heaters with less than 100 MMBtu/hour heat input capacity. South Coast's inclusion of NOx emission limitations for boilers and process heaters with 5 to 99 MMBtu/hour heat input capacity demonstrates that NOx emission limits for this subset of gas-fired boilers and process heaters are consistent with, and thus required by, RACT, at least to the extent those sources are major under the 25 tpy threshold that once again applies. TCEQ must include limits for similarly-rated boilers and process heaters at major sources in its SIP.

South Coast – Gas-Fired Boilers and Process Heaters

Boiler/process heater type	SCAQMD Emission limits	Emission limit unit	Reg
Industrial, institutional, and commercial boilers, steam generators, and process heaters ≥ 5 MMBtu/hr, gas-fired	30	ppm	SCAQMD R. 1146(c)(1)(A)
	0.036	lb. NOx/MMBtu	
Industrial, institutional, and commercial boilers, steam generators, and process heaters ≥ 75 MMBtu/hr, natural gas-fired* ("Group I")	5	ppm	SCAQMD R. 1146(c)(1)(F)
	0.0062	lb. NOx/MMBtu	
Industrial, institutional, and commercial boilers, steam generators, and process heaters < 75 and ≥ 20 MMBtu/hr, gas-fired*† ("Group II")	5-9	ppm	SCAQMD R. 1146(c)(1)(G)-(I)
	0.0062-0.011	lb. NOx/MMBtu	
Industrial, institutional, and commercial boilers, steam generators, and process heaters < 20 and ≥ 5 MMBtu/hr, and all units operated at schools and universities ≥ 5 MMBtu, gas-fired† ("Group III")	5-7	ppm	SCAQMD R. 1146(c)(1)(J)-(K)
	0.0062-0.0085	lb. NOx/MMBtu	
Industrial, institutional, and commercial boilers, steam generators, and process heaters ≥ 5 MMBtu/hr, landfill gas-fired	25	ppm	SCAQMD R. 1146(c)(1)(C)
Industrial, institutional, and commercial boilers, steam generators, and process heaters ≥ 5 MMBtu/hr, digester gas-fired	15	ppm	SCAQMD R. 1146(c)(1)(D)

* Excludes thermal fluid heaters and units operated at schools and universities.
† Excludes digester and landfill gases.

New York State similarly has more protective RACT NOx emission limits for boilers. 6 CRR-NY 227-2.4, last amended 2010. Limits for boilers fired on gas only range from 0.05 lb. NOx/MMBtu for mid-size boilers to 0.08 lb. NOx/MMBtu for very large boilers lower than the lowest TCEQ standard for gas-fired boilers.

New York State – Gas-Fired Boilers

Boiler/process heater type	NYS Emission limits		Emission limit unit	Reg
Very large boilers	0.08	Gas only	lb. NOx/MMBtu heat input	6 CRR-NY 227-2.4(a)
	0.15-0.20	Gas/oil		
Large boilers	0.06	Gas only	lb. NOx/MMBtu heat input	6 CRR-NY 227-2.4(b)
	0.15	Gas/oil		
Mid-size boilers	0.05	Gas only	lb. NOx/MMBtu heat input	6 CRR-NY 227-2.4(c)
	0.08-0.20	Gas/oil		

In summary, TCEQ's unexplained proposal continues to set NOx emission limitations only for boilers with a maximum capacity rating of 100 MMBtu/hr. or greater, and those standards range from 0.10 to 0.28 lb. NOx/MMBtu heat input. Yet, other states set tighter limits—one to two orders of magnitude lower—on the largest boilers, and, additionally, set limits on smaller boilers for which TCEQ has no NOx emission limits. As New York State and South Coast show and the Clean Air Act requires, TCEQ can and must tighten its RACT standards for NOx from gas-fired boilers.

<u>Stationary Gas Turbines</u>

TCEQ RACT rules set an emission limit of 42 parts per million by volume (ppmv) NOx at 15% O2, dry basis, for stationary gas turbines with a megawatt (MW) rating greater than or equal to 10.0 MW. 30 T.A.C. § 117.305(c).

TCEQ – Stationary Gas Turbines

	TCEQ Emission limit	Emission limit unit	Reg
Stationary gas turbine	42	ppmv NOx	30 T.A.C. § 117.305(c)

South Coast, in its Rule 1134, sets limits for all stationary gas turbines, 0.3 MW and larger. SCAQMD Rule 1134(a)-(b), last amended Feb. 4, 2022. The limits for stationary gas turbines in South Coast's jurisdiction range from 2 ppmv to 30 ppmv, as described below. The highest emission limit, 30 ppmv, is a mere 71% of the 42 ppmv NOx allowed for stationary gas turbines under TCEQ's rules. As with gas-fired boilers, South Coast's RACT emission limits for NOx demonstrate that TCEQ can and must apply limits to smaller turbines. Whereas TCEQ only sets its (inadequately high) emission limits for stationary gas turbines rated 10 MW or greater, South Coast applies its lower standards to any stationary gas turbine 0.3 MW or larger. Again, to the extent such turbines are at major sources in the Houston area, they must be subject to RACT.

South Coast – Stationary Gas Turbines

Stationary gas turbine type	SCAQMD Emission limits	Emission limit unit	Reg
Liquid fuel, turbines located on Outer Continental Shelf	30	ppmv NOx	SCAQMD R. 1134(d)(3)
Natural gas, combined cycle/cogeneration turbine	2	ppmv NOx	SCAQMD R. 1134(d)(3)
Natural gas, simple cycle turbine	2.5	ppmv NOx	SCAQMD R. 1134(d)(3)
Produced gas	9	ppmv NOx	SCAQMD R. 1134(d)(3)

Produced gas, turbines located on Outer Continental Shelf	15	ppmv NOx	SCAQMD R. 1134(d)(3)
Other (includes recuperative gas turbines)	2.5	ppmv NOx	SCAQMD R. 1134(d)(3)

Gas-Fired, Stationary, Internal Combustion Engines

TCEQ sets a limit of 2.0 grams NOx per horsepower-hour (g/hp-hr) for gas-fired, rich-burn, stationary, reciprocating internal combustion engines rated 150 horsepower (hp) or greater. 30 T.A.C. § 117.305(d).

TCEQ – Gas-Fired, Stationary, Internal Combustion Engines

	TCEQ Emission limit	Emission limit unit	Reg
Gas-fired, rich-burn, stationary, reciprocating internal combustion engines, 150 hp or greater	2.0	g/hp-hr	30 T.A.C. § 117.305(d)

New York State limits all-natural gas-fired, stationary internal combustion engines with a mechanical output rating of 200 brake hp or greater to 1.5 grams per brake horsepower-hour. 6 CRR-NY 227-2.4(f)(1), last amended 2010. This standard applies to rich-burn engines, which TCEQ's rule covers, and to lean-burn engines, which TCEQ's rule does not cover. New York's standard clearly shows that there is room for TCEQ to tighten its limit for gas-fired, stationary internal combustion engines to keep up with current RACT, as well as to expand the range of internal combustion engines to which the standard applies to encompass both rich- and lean-burn.

New York State – Gas-Fired, Stationary, Internal Combustion Engines

	NYS Emission limit	Emission limit unit	Reg
Natural gas-fired, stationary internal combustion engines, 200 brake hp or greater	1.5	g/hp-hr	6 CRR-NY 227-2.4(f)(1)

Electricity Generating Facilities

In 2007, TCEQ established its still-governing RACT rules, which set various emission limits for NOx, depending on the type of unit and fuel(s) used. 30 T.A.C. § 117.1205; *see also id.* § 117.1210. These 17-year-old requirements must be updated.

On January 7, 2022, South Coast proposed to amend its requirements for electricity generating facilities (EGF), over a 60-minute rolling average. SCAQMD Proposed Rule 1135(d)(1), last amended Jan. 7, 2022.

South Coast – Electricity Generating Units at EGFs

Electric generating units at EGFs	SCAQMD Emission limit	Emission limit unit	Reg
Boiler	5	ppmv, 3% O_2 dry	

	0.0061	lb. NOx/MMBtu	Proposed SCAQMD R. 1135(d)(1)
Combined cycle gas turbine and associated duct burner	2	ppmv, 15% O_2 dry	Proposed SCAQMD R. 1135(d)(1)
	0.0074	lb. NOx/MMBtu	
Simple cycle gas turbine	2.5	ppmv, 15% O_2 dry	Proposed SCAQMD R. 1135(d)(1)
	0.0092	lb. NOx/MMBtu	

South Coast's limits provide a good model for what RACT is possible in the Houston area.

TCEQ must also do more to strengthen RACT to control NOx emissions at the W.A. Parish Electric Generating Station, which has long been the largest single NOx emitter in the Houston area. In 2021, the W.A. Parish plant released 5,667.15 tons of NOx, over twice as much as the next largest emitter, the Baytown Olefins Plant. Attachment 1. As the attached analysis shows, Units 5-8 at the W.A. Parish plant are not operating their Selective Catalytic Reduction (SCR) systems according to their NOx reduction capacity.

Units 5-8 at the W.A. Parish plant have SCR installed to reduce NOx emissions but have consistently reported NOx emissions greater than what they should be achieving with properly operated SCR systems. Monthly reported NOx emissions data from October 2017 to October 2022 shows that Unit 5 can reliably achieve NOx emission rates below 0.06 lb./MMBtu, but regularly exceeds this level. Attachment 7 at 4-5. Similarly, Units 6-8 can consistently achieve less than 0.07 lb./MMBtu in monthly average NOx emissions, but periodically exceed this level. Attachment 3 at 21-24. These excess NOx emissions are not due to low-capacity factors or minimum operating temperatures not being met since these units have produced these lower emissions when operating over a range of capacity factors. Rather, excess NOx emissions are likely due to deterioration in SCR performance either because the SCR catalyst is not being appropriately replaced or re-activated in these units. Attachment 2 at 15.

Therefore, these units at the W.A. Parish plant can reasonably be required to achieve lower emission rates on a consistent basis. Because these units are regularly emitting NOx at levels higher than what they can reasonably achieve with existing control technology, TCEQ's current standard does not represent RACT. TCEQ must introduce stronger operating and maintenance rules for electricity-generating units utilizing SCR systems so that they consistently reduce NOx emissions to levels they are demonstrably capable of.

Pesticide Application

TCEQ alleges that it does not need to demonstrate RACT controlling VOCs in pesticide application because "TCEQ does not regulate the use of agricultural pesticides" and because the relevant ACT guidance for pesticides lacks presumptive controls. App. D at 12 & tbl. D-2.

The fact that TCEQ does not regulate the use of pesticides does not abrogate the state's mandate under the Clean Air Act to adopt RACT for all source categories addressed in CTG guidance and all major sources of VOC. 42 U.S.C. § 7511a(b)(2). If this were true, TCEQ could escape RACT requirements by declining to regulate source categories at all, an absurd result. The Clean Air Act's SIP requirements pertain to "States," not specific agencies within states. *See, e.g.*, 42 U.S.C. § 7410(a)(1) ("Each State shall … adopt and submit to the Administrator … a plan which provides for implementation, maintenance, and enforcement [of a primary NAAQS]"). The responsibility to meet SIP requirements, including RACT requirements, falls upon the state of Texas with its multitude of agencies. Texas Department of Agriculture ("TDA") is the state's lead agency for pesticide regulation and authorized to regulate the use of pesticides, including their concentration and manner of use. Texas Agricultural Code, § 76.104(b)(2) (allowing TDA to adopt rules regulating the "time, place, manner, method, amount, or concentration of pesticide application"). Therefore, TDA is required to identify sources where VOC emissions from pesticide application exceed 25 tons per year, 42 U.S.C. § 7511a(d), and to adopt rules implementing RACT for those sources.

The lack of presumptive controls in the ACT guidance does not establish that no RACT exists to control VOCs from pesticide application. Various nonattainment areas in California are subject to rules controlling VOC from pesticides as part of their attainment plans, with controls including specific fumigation methods and emissions allowances.[17] TCEQ has made no showing that similar controls would not be technologically or economically feasible in the Houston area. The proposal must be amended to include additional provisions applying RACT to control VOC emissions from pesticide application, whether these controls are implemented by TCEQ or TDA. Alternatively, to the extent true, the proposal must be amended with a negative declaration.

Glass Furnaces

There is one glass furnace major source in the Houston area, and TCEQ states that RACT has been implemented for this source via TCEQ Permit Number 42623 (Special Condition 7B). App. D at 7. This permit requires the facility's oxy-fired glass furnace to meet a NOx emission specification of 1.48 pounds per ton of glass produced. *Id*. However, this limit is out of alignment with EPA's 1994 glass furnace ACT, which states that oxyfiring can control NOx to a level of 0.812 lb./ton of glass produced.[18] To meet RACT requirements, TCEQ must amend this permit or otherwise impose requirements ensuring that NOx emissions from this facility are controlled to RACT standards.

Industrial Cleaning Solvents

EPA issued a CTG in 2006 for industrial cleaning solvents that is applicable to sources emitting 15 lb./day or more of VOCs, so these sources in the Houston area must adopt RACT.[19]

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[17] Reducing VOC Emissions from Field Fumigants, CA Department of Pesticide Regulation, https://www.cdpr.ca.gov/docs/emon/vocs/vocproj/reg_fumigant.htm (last visited Jan. 5, 2024).
[18] Alternative Control Techniques Document—NOx Emissions from Glass Manufacturing (EPA-453/R-94-037) at 2-8 & tbl. 2-5, U.S. EPA (June 1994), available at https://nepis.epa.gov/Exe/ZyPDF.cgi/2000NTW4.PDF?Dockey=2000NTW4.PDF.
[19] Control Techniques Guidelines: Industrial Cleaning Solvents (EPA-453/R-06-001) at 5, U.S. EPA (Sept. 2006), available at https://nepis.epa.gov/Exe/ZyPDF.cgi/P1009NYV.PDF?Dockey=P1009NYV.PDF (in citations, "Industrial Cleaning Solvent CTG").

In this proposal, TCEQ proposes stronger VOC limits for industrial cleaning solvents as a contingency measure. AD at 4-15. But these stronger limits are actually RACT that must be implemented presently, rather than in the case of failure to attain or make reasonable further progress. TCEQ's current VOC limits for industrial cleaning solvents are significantly higher than rules that have proven to be technologically and economically feasible in other jurisdictions.

For example, TCEQ's existing VOC limit to clean all materials is 0.42 lb. VOC/gallon (50 g/l). 30 T.A.C. § 115.463. But other jurisdictions, including SCAQMD and the Sacramento Metropolitan Air Quality Management District ("SMAQMD"), have adopted limits of 25 g/l.[20] The proposed contingency measure would make VOC limits for industrial cleaning solvents identical to stronger limits that have been in place for over a decade in these other jurisdictions. TCEQ has not provided justification that these stricter standards are not technologically or economically feasible for the Houston area. Absent this showing, TCEQ must strengthen its rules limiting VOC content in industrial cleaners to meet RACT requirements.

Additionally, TCEQ must amend the applicability of its VOC limits on industrial cleaning solvents. The CTG for industrial cleaning solvents applies to facilities that emit at least 15 lb./day, or 2.7 tons per calendar year of VOC before consideration of controls in an ozone nonattainment area. Industrial Cleaning Solvent CTG at 5. But TCEQ's applicability limit is more lax, applying to facilities that emit at least 3.0 tons per year of VOC emissions. 30 T.A.C. § 115.461(a). Because the Clean Air Act requires RACT for all sources covered by a CTG document, 42 U.S.C. § 7511a(b)(2), TCEQ must amend its proposal and state regulations to cover industrial cleaning solvent facilities emitting at least 2.7 tons of VOCs per calendar year.

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The above examples are not meant to reflect a comprehensive review of Texas's regulations implementing RACT. Rather, they show that additional reductions are reasonably available from at least these source categories. TCEQ must both revise its proposal to implement RACT for these source categories and conduct a thorough evaluation of RACT for all sources that must adopt RACT under the Clean Air Act. It is not enough that existing rules merely comport with decades-old CTG and ACT guidance—where TCEQ believes that existing rules constitute RACT, it must provide justification, not the unsupported assertions it makes in the proposal that stronger controls are infeasible.

D. TCEQ has acted arbitrarily and unlawfully by failing to provide analysis of reasonably available control measures (RACM).

Under the Act, nonattainment plans "shall provide for the implementation of all reasonably available control measures as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology)." 42 U.S.C. § 7502(c)(1). In addition,

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[20] SCAQMD Rule 1171 at 1171-7 to 1171-8 (amended May 1, 2009); SMAQMD Rule 466 at 466-9 (amended Oct. 28, 2010); Chapter 115 proposed rule at 687-689.

EPA's implementing rules for the 2008 ozone NAAQS require TCEQ to submit "a SIP revision demonstrating that it has adopted all RACM necessary to demonstrate attainment as expeditiously as practicable." 40 C.F.R. § 51.1112(c).

TCEQ incorrectly concludes that no RACM exists that could advance the attainment date by one year. The proposal provides a calculation showing that any RACM must provide 2.06 tpd in NOx reductions and be implementable by January 1, 2025 to advance the attainment date by one year. AD at 4-12. But TCEQ failed to analyze the NOx reductions that could be gained from regulating the largest NOx point source in the Houston area, the W.A. Parish plant.

As discussed above, adequate operation and maintenance of the existing SCR controls on Units 5-8 at the W.A. Parish plant are required as RACT because proper SCR operation and maintenance is effective at controlling NOx emissions and readily implementable. TCEQ further must assess whether optimizing SCR controls at the W.A. Parish plant could also provide the amount of NOx reductions necessary to advance the attainment date under TCEQ's calculations. The attached analysis shows that if the SCR system on Unit 6 was optimally operated and maintained, the unit's NOx emissions in 2017 could have been 1091 tons less than they actually were. Attachment 2 at 15. This 1091 ton reduction would have been possible from Unit 6 alone, meaning that improvements to the SCR systems in all four coal-fired units at the W.A. Parish plant could reduce NOx emissions in the area by an even more considerable degree. Moreover, as explained above, optimal operation and maintenance of these SCR systems comes down to adequately replacing and/or re-activating their catalysts, which can be done quickly and at a modest cost. Attachment 2 at 15.

Consequently, 42 U.S.C. § 7502(c)(1) and 40 C.F.R. § 51.1112(c) require TCEQ to assess whether rules ensuring that SCR systems achieve their maximum demonstrated NOx-reducing potential are necessary as RACM (in conjunction with other control measures that are reasonably available, like others described above) and adopt them where they would hasten attainment.

TCEQ irrationally provides no explanation for its conclusion that "no control strategies were identified that could provide at least 2.06 tpd of NOx reductions and be implemented by the January 1, 2025 deadline." *See* AD at 4-12. Neither the proposal nor its appendices further describe any potential RACM that were considered or rejected.

This departs from TCEQ's previous practice in this regard. In the HGB serious classification AD SIP revision that TCEQ adopted in 2020, the agency included an appendix listing all the control measures it evaluated that could potentially qualify as RACM and why each individual measure was rejected. 2020 AD Appendix G.

Without providing further explanation of specific RACM that TCEQ considered and rejected, there is no way for reviewing authorities or the public to determine whether the agency has met its RACM obligations under Clean Air Act Section 172. When EPA determines that certain potential RACM are not required under Section 172, EPA is required to "(1) demonstrate that it has examined relevant data, and (2) provide a satisfactory explanation for its rejection of those proposed RACMs and why they, individually and in combination, would not advance [the area's] attainment date." *Sierra Club v. EPA*, 314 F.3d 735, 745 (5th Cir. 2002). TCEQ has acted arbitrarily under *Sierra Club* by failing to provide the necessary analysis of RACMs that could advance the area's attainment date.

Longstanding EPA guidance has also required a far greater showing than what is included in this proposal, including justifications as to why measures within the arena of potentially reasonable measures were not adopted.[21] In the past, EPA has requested that TCEQ provide the specific emissions reductions associated with each potential RACM to "help determine which measures, separately or in combination, would assist in advancing the attainment date." Attachment 4 at 2.

TCEQ's failure to provide this analysis and explanation is thus arbitrary.

TCEQ also arbitrarily fails to consider controls on sources outside the Houston area that would contribute to attainment within the Houston area.

The Clean Air Act requires nonattainment plans to include "enforceable emission limitations, and such other control measures, means or techniques … as may be necessary or appropriate to provide for attainment of such standard in such area by the applicable attainment date." 42 U.S.C. § 7502(c)(6). EPA has long interpreted this provision to require states to consider controls on sources outside the nonattainment area where those sources contribute to attainment in the nonattainment area. Specifically, EPA has said that states must consider "measures and technologies that can be applied to any emissions source within the state's jurisdiction, including those outside of a nonattainment area" because "failure to consider and require, as appropriate, reasonable control measures for [upwind sources within a state] may preclude attainment of a NAAQS by the attainment date." 83 Fed. Reg. 62,998, 63,015 (Dec. 6, 2018).

We attach an analysis of coal-fired EGUs in Texas (with and without SCR controls) and their impacts on regulatory air quality monitors and environmental justice communities located in the Houston nonattainment area (zip codes 77469, 77471, and 77479). Attachment 5. The analysis considers days where monitoring concentrations in the Houston area exceeded the 75 ppb NAAQS and models the ozone contributions from various coal-fired facilities in Texas on those days.

The analysis shows that coal EGUs in other parts of Texas contribute meaningfully—at least 0.5% of the NAAQS—to elevated ozone levels in the Houston nonattainment area and particularly in EJ communities. *See* Attachment 5 at 37, 39 & tbls. 22, 24. In 2016, there is one instance where out-of-area coal EGUs contributed more than 1% of the NAAQS to an exceeding monitor, and five instances where those emissions contributed more than 0.5% of the NAAQS to a monitor, as well as three instances of contribution of more than 0.5% of the NAAQS to an EJ zip code in the Houston area. *Id.* Emissions from units at the Welsh facility *individually*

[21] Guidance on the Reasonably Available
Control Measures (RACM) Requirement and Attainment Demonstration Submissions for Ozone Nonattainment Areas, John S. Seitz, Director, U.S. EPA Office of Air Quality Planning and Standards (Nov. 30, 1999), available at
https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19991130_seitz_racm_guide_ozone.pdf.

contributed at least 0.5% (0.37 ppb) of the 2008 ozone NAAQS to several monitors and EJ zip codes on exceedance days in 2016. Attachment 5 at 37 & tbl. 23.

As the analysis makes clear, TCEQ must evaluate controls on these sources to ensure that the Houston area achieves timely attainment as required by the Clean Air Act. The highest contributing coal EGU units outside of Houston—at the Fayette Power Project, Limestone, Martin Lake, and Welsh facilities—do not have SCR installed. *Id*. It is under TCEQ's jurisdiction to require SCR controls at these facilities, which would likely have a meaningful positive impact on ozone levels in the Houston nonattainment area.

Even if the proposal's existing analysis were sufficient to show an absence of RACM to control NOx, it fails to apply the same analysis to show an absence of RACM to control VOCs. The proposal's analysis of VOC and NOx limitation in the Houston nonattainment area indicates that areas near the urban core are more VOC limited and industrial areas are transitional areas, meaning VOC reductions in both urban and industrial areas can likely contribute to ozone reductions. AD at 5-20. Additionally, the proposal's contingency measures are entirely associated with VOC reductions, indicating TCEQ's perspective that VOC reductions would effectively reduce ozone in the region. AD at 4-15 to 4-16. Therefore, this proposal fails to meet the mandate of Section 172 and is arbitrary by failing to provide analysis of potential RACM to reduce VOC emissions.

E. The proposal does not meet requirements for contingency measures.

Clean Air Act §§ 172(c)(9) and 182(c)(9) require nonattainment areas SIPs to include contingency measures to be undertaken if the area fails to attain or fails to make reasonable further progress. 42 U.S.C. §§ 7502(c)(9), 7511a(c)(9). The Clean Air Act requires contingency measures must be conditional and prospective. *Sierra Club v. EPA*, 21 F.4th 815, 827-28 (D.C. Cir. 2021).

TCEQ's proposed contingency plan is deficient in several respects: it fails to include NOx-reducing measures, includes one measure that must be implemented presently as RACT, and includes one measure that arbitrarily relaxes standards.

Without explanation, the proposal only includes contingency measures controlling VOC, not NOx. EPA has stated that if a state demonstrates RFP using reductions of both VOC and NOx, then the state should submit contingency measures for both VOC and NOx. 57 Fed. Reg. 13,498, 13,520 (Apr. 16, 1992). The concurrently proposed DFW-HGB Severe Area RFP SIP Revision for the 2008 Eight-Hour Ozone NAAQS includes a demonstration of RFP using both VOC and NOx reductions. RFP at 3-10 to 3-11 & tbls. 3-9 to 3-10. Therefore, contingency measures for the Houston area must be amended to include NOx-reducing measures. NOx controls would help reduce ozone in the nonattainment area because monitors in industrial areas measured near the midpoint of transitional conditions and monitors in more suburban areas measured closer to NOx limited conditions. AD at 5-20.

TCEQ is also acting in violation of Clean Air Act Section 182 by proposing a contingency measure for industrial cleaning solvents that must be adopted presently as RACT. As detailed above, the proposed contingency measure for industrial cleaning solvents involves controls that must be implemented as RACT. 42 U.S.C. § 7511a(b)(2)(b). EPA issued a CTG in 2006 for industrial cleaning solvents that is applicable to sources emitting 15 lb./day or more of VOCs, so these sources in the Houston area must adopt RACT.[22] TCEQ's current VOC limits for this source category are not the strongest controls that are technologically and economically feasible. Therefore, TCEQ must impose these limits as RACT under this proposal rather than as contingency measures to be applied in the case of failure to meet RFP or failure to attain.

TCEQ must then develop new contingency measures that replace the prospective emissions reductions associated with this contingency measure, because contingency measures must be conditional and prospective and thus cannot be controls relied upon to meet other SIP requirements. *Sierra Club*, 21 F.4th at 827-28. TCEQ estimates reductions from the proposed VOC limits on industrial cleaning solvents to be 1.71 tpd in the Houston area. Under current TCEQ rules, sources that emit less than 3.0 tons per calendar year of VOCs are exempt from VOC limits on industrial cleaning solvents. 30 T.A.C. § 115.461(a). The proposed contingency measure would eliminate this exemption. Chapter 115 proposed rule at 681. The lower VOC limits, required as RACT, would apply to sources emitting at least 2.7 tpy. Industrial Cleaning Solvent CTG at 5. Though the reductions from this contingency measure attributable to sources emitting less than 2.7 tpy would still be valid contingency measure reductions, the remaining reductions would not be because they would constitute reductions from RACT. TCEQ thus must develop additional contingency measure to replace the reductions that must presently be implemented as RACT for this source category.[23]

Additionally, the proposed contingency measure for industrial adhesives arbitrarily weakens the VOC emissions limits for four categories of adhesives. If triggered, this measure would impose VOC limits for four categories of adhesives that are less stringent than existing controls. AD at 4-16. Even if the contingency measure overall would provide a net reduction from stricter limits on other adhesive categories, there is no reason and no reason given for the contingency measure's weakening of existing standards. Weakening existing controls directly contravenes the purpose of contingency measures, which is to generate additional emissions reductions in the case of failure to meet RFP or failure to attain. TCEQ must amend this proposed contingency measure such that if it is triggered, standards for these four adhesive categories are not weakened.

F. TCEQ must ensure its new source review ("NSR") program complies with the Clean Air Act.

The Act's NSR program limits pollution from new and modified major sources of VOC and NOx. In particular, whenever a major source is to be built or modified to increase emissions of

[22] Control Techniques Guidelines: Industrial Cleaning Solvents (EPA-453/R-06-001) at 5, U.S. EPA (Sept. 2006), available at https://www3.epa.gov/airquality/ctg_act/200609_voc_epa453_r-06-001_ind_cleaning_solvents.pdf.

[23] We agree with TCEQ that contingency measures must account for a 3% reduction in emissions, which has long been EPA's interpretation of the Clean Air Act's contingency measure provisions. 80 Fed. Reg. at 12,286; 42 U.S.C. §§ 7502(c)(9), 7511a(c)(9).

an ozone precursor by at least a certain amount, it must obtain emission reductions of that same precursor that more than offset the proposed increase in emissions from that precursor. Thus, emissions from major sources in the Houston area should be decreasing. Absent changes, Texas's existing NSR program does not meet legal requirements.

TCEQ must make clear that sources cannot use interprecursor trading to meet new source review requirements. TCEQ expressly relies on 30 T.A.C. § 116.12 and 30 T.A.C. § 116.150 to meet the Clean Air Act's nonattainment NSR requirements under the severe classification for the Houston nonattainment area. AD at 4-18. These regulatory provisions could be read to authorize the use of interprecursor trading in nonattainment new source review. But such trading is unlawful under the D.C. Circuit's nationally controlling decision in *Sierra Club*, 21 F.4th 815, and TCEQ must accordingly make clear that any state implementation plan it will submit for EPA's approval does not authorize sources to meet NSR requirements by relying on interprecursor trading.

TCEQ must ensure polluters do not evade NSR requirements. A recent investigation describes ways in which polluters structure expansion projects to avoid being subject to NSR.[24] Such subterfuges are not consistent with the Clean Air Act. They prolong and exacerbate the Houston area's dangerous ozone pollution levels: they result in illegal pollution that harms community members' health, property, and wellbeing.

III. Conclusion

For the foregoing reasons, TCEQ must substantially strengthen the attainment demonstration proposal so it complies with the Clean Air Act and is rational. Despite modeling claiming decreasing emissions from mobile sources, monitoring data undeniably shows that ambient ozone, NOx, and VOC levels have stagnated since 2012. Relying on the status quo—essentially, doing nothing—has failed to bring the area into attainment since the 2008 ozone NAAQS went into effect, and TCEQ has provided no rational basis to conclude that this time things will turn out different.

Without additional controls, TCEQ's modeling lacks credibility in its prediction that Houston will (barely) attain 75 ppb by the 2026 attainment year. In light of stagnating ambient ozone levels, TCEQ cannot rationally conclude that the Houston area will achieve timely attainment without stronger controls. Monitoring data is inherently more reflective of ozone trends than modeling and indicates clearly that changes are necessary for the Houston area to attain as expeditiously as possible. Among other arbitrary actions, TCEQ relies on outdated modeling of mobile source emissions that has been proven incorrect by monitoring data, fails to implement RACT by relying on outdated controls, neglects to provide analysis of RACM that could advance the attainment date, and fails to propose a legally adequate contingency plan.

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[24] *See* Dylan Baddour et al., *Texas Regulators Often Downplay Major Pollution Sources As Companies Sidestep Permitting Process*, Houston Chronicle (Dec. 26, 2023), https://www.houstonchronicle.com/business/article/texas-environmental-oversight-questioned-18569038.php (copy attached as Attachment 8).

TCEQ must use its authority to reduce ozone precursor emissions from stationary sources and particularly from the largest emitters. Significant emissions reductions from EGUs can be achieved for little additional cost by simply requiring the adequate operation and maintenance of already-installed control technology. Stronger controls on stationary sources, many of which are concentrated by the Houston Ship Channel, can create significant progress in the Houston area's attainment of the 2008 ozone NAAQS. These air quality improvements are especially crucial for communities that have historically experienced the highest ozone levels in the region, which are also disproportionately burdened by other types of air pollution and environmental risks.

In sum, to comport with the requirements of the Clean Air Act and to fulfill its duty to protect the health of Houstonians, TCEQ must amend its proposal consistent with this comment.

Sincerely,

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ATTACHMENT 1

Attachment 1

Top 10 NOx Point Source Emission Facilities in the Eight County HGB Nonattainment Area and Ten County DFW Nonattainment Area

ACCOUNT	RN	COMPANY	SITE	COUNTY	REGION	SIC	SIC DESCRIPTION	REPORTING YEAR	NOX TPY
FG0020V	RN100888312	NRG TEXAS POWER LLC	WA PARISH ELECTRIC GENERATING STATION	FORT BEND	12	4911	ELECTRIC SERVICES	2021	5,667.15
HG0228H	RN102212925	EXXON MOBIL CORPORATION	BAYTOWN OLEFINS PLANT	HARRIS	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	2,258.20
HG0232Q	RN102579307	EXXON MOBIL CORPORATION	BAYTOWN REFINERY	HARRIS	12	2911	PETROLEUM REFINING	2021	1,930.25
GB0004L	RN102535077	BLANCHARD REFINING COMPANY LLC	GALVESTON BAY REFINERY	GALVESTON	12	2911	PETROLEUM REFINING	2021	1,526.65
BL0082R	RN100225945	THE DOW CHEMICAL COMPANY	DOW TEXAS OPERATIONS FREEPORT	BRAZORIA	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	1,508.58
HG0659W	RN100211879	SHELL CHEMICAL LP	DEER PARK CHEMICALS	HARRIS	12	2911	PETROLEUM REFINING	2021	1,309.88
BL0758C	RN100825249	CHEVRON PHILLIPS CHEMICAL COMPANY LP	SWEENY OLD OCEAN FACILITIES	BRAZORIA	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	1,130.31
HG0033B	RN100542281	EQUISTAR CHEMICALS LP	CHANNELVIEW COMPLEX	HARRIS	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	1,109.21
BL0002S	RN100238708	INEOS USA LLC	CHOCOLATE BAYOU PLANT	BRAZORIA	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	991.10
CI0012D	RN100825371	NRG TEXAS POWER LLC	CEDAR BAYOU GEN STATION	CHAMBERS	12	4911	ELECTRIC SERVICES	2021	890.01

ACCOUNT	RN	COMPANY	SITE	COUNTY	REGION	SIC	SIC DESCRIPTION	REPORTING YEAR	NOX TPY
ED0066B	RN100217199	TXI OPERATIONS LP	MIDLOTHIAN PLANT	ELLIS	4	3241	CEMENT, HYDRAULIC	2021	1,495.19
ED0099J	RN100219286	HOLCIM US INC	MIDLOTHIAN PLANT	ELLIS	4	3241	CEMENT, HYDRAULIC	2021	1,249.65
KB0176S	RN100213420	LUMINANT GENERATION COMPANY LLC	FORNEY POWER PLANT	KAUFMAN	4	4911	ELECTRIC SERVICES	2021	1,099.27
JH0045I	RN100210889	TEXAS LIME COMPANY	TEXAS LIME	JOHNSON	4	3274	LIME	2021	609.78
ED0034O	RN100225978	ASH GROVE CEMENT COMPANY	MIDLOTHIAN PLANT	ELLIS	4	3241	CEMENT, HYDRAULIC	2021	531.15
ED0011D	RN100216472	CHAPARRAL STEEL MIDLOTHIAN LP	CHAPARRAL STEEL MIDLOTHIAN PLANT	ELLIS	4	3312	BLAST FURNACES AND STEEL MILLS	2021	411.19
WN0021G	RN100223619	ENLINK MIDSTREAM SERVICES LLC	BRIDGEPORT GAS PLANT	WISE	4	1321	NATURAL GAS LIQUIDS	2021	299.74
ED0332D	RN102596400	MIDLOTHIAN ENERGY LLC	MIDLOTHIAN ENERGY FACILITY	ELLIS	4	4911	ELECTRIC SERVICES	2021	241.96
DB0252S	RN101559235	MOUNTAIN CREEK POWER LLC	MOUNTAIN CREEK STEAM ELECTRIC STATION	DALLAS	4	4911	ELECTRIC SERVICES	2021	234.43
WN0211W	RN102584844	WISE COUNTY POWER COMPANY LLC	WISE CO POWER PLANT	WISE	4	4911	ELECTRIC SERVICES	2021	155.81

Top 10 VOC Point Source Emission Facilities in the Eight County HGB Nonattainment Area and Ten County DFW Nonattainment Area

ACCOUNT	RN	COMPANY	SITE	COUNTY	REGION	SIC	SIC DESCRIPTION	REPORTING YEAR	VOC TPY
HG0232Q	RN102579307	EXXON MOBIL CORPORATION	BAYTOWN REFINERY	HARRIS	12	2911	PETROLEUM REFINING	2021	2,202.17
GB0004L	RN102535077	BLANCHARD REFINING COMPANY LLC	GALVESTON BAY REFINERY	GALVESTON	12	2911	PETROLEUM REFINING	2021	1,684.57
BL0082R	RN100225945	THE DOW CHEMICAL COMPANY	DOW TEXAS OPERATIONS FREEPORT	BRAZORIA	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	780.97
HG0659W	RN100211879	SHELL CHEMICAL LP	DEER PARK CHEMICALS	HARRIS	12	2911	PETROLEUM REFINING	2021	745.12
CI0008R	RN102323268	ENTERPRISE PRODUCTS OPERATING LLC	MONT BELVIEU COMPLEX	CHAMBERS	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	732.33
HG0033B	RN100542281	EQUISTAR CHEMICALS LP	CHANNELVIEW COMPLEX	HARRIS	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	732.07
HG0261J	RN100224815	KM LIQUIDS TERMINALS LLC	PASADENA TERMINAL	HARRIS	12	4226	SPECIAL WAREHOUSING AND STORAGE	2021	727.20
HG0229F	RN102574803	EXXON MOBIL CORPORATION	BAYTOWN CHEMICAL PLANT	HARRIS	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	726.20
HG0048L	RN100218130	HOUSTON REFINING LP	HOUSTON REFINING	HARRIS	12	2911	PETROLEUM REFINING	2021	679.51
HG0310V	RN103919817	CHEVRON PHILLIPS CHEMICAL COMPANY LP	CEDAR BAYOU PLANT	HARRIS	12	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	2021	654.58

ACCOUNT	RN	COMPANY	SITE	COUNTY	REGION	SIC	SIC DESCRIPTION	REPORTING YEAR	VOC TPY
ED0168P	RN100213537	DARTCO OF TEXAS LLC	DARTCO OF TEXAS WAXAHACHI	ELLIS	4	3089	PLASTICS PRODUCTS, NEC	2021	611.37
TA0157I	RN102505963	GENERAL MOTORS LLC	ARLINGTON ASSEMBLY PLANT	TARRANT	4	3711	MOTOR VEHICLES AND CAR BODIES	2021	418.71
ED0011D	RN100216472	CHAPARRAL STEEL MIDLOTHIAN LP	CHAPARRAL STEEL MIDLOTHIAN PLANT	ELLIS	4	3312	BLAST FURNACES AND STEEL MILLS	2021	332.10
JHA012L	RN104928676	ETC TEXAS PIPELINE LTD	GODLEY PLANT	JOHNSON	4	1321	NATURAL GAS LIQUIDS	2021	216.93
ED0099J	RN100219286	HOLCIM US INC	MIDLOTHIAN PLANT	ELLIS	4	3241	CEMENT, HYDRAULIC	2021	188.07
TA0156K	RN100212356	LOCKHEED MARTIN CORPORATION	US AIR FORCE PLANT 4	TARRANT	4	3721	AIRCRAFT	2021	139.44
JH0025O	RN100213719	JOHNS MANVILLE	JOHNS MANVILLE CLEBURNE PLANT	JOHNSON	4	3296	MINERAL WOOL	2021	135.51
ED0051O	RN100223585	OWENS CORNING INSULATING SYSTEMS LLC	WAXAHACHIE PLANT	ELLIS	4	3296	MINERAL WOOL	2021	84.28
DBA039N	RN100641752	POLY-AMERICA INC	POLY-AMERICA	DALLAS	4	3089	PLASTICS PRODUCTS, NEC	2021	77.89
WN0021G	RN100223619	ENLINK MIDSTREAM SERVICES LLC	BRIDGEPORT GAS PLANT	WISE	4	1321	NATURAL GAS LIQUIDS	2021	71.27

ATTACHMENT 2

Comments on EPA's Proposed Approval of the May 13, 2020 Revisions to the Texas State Implementation Plan (SIP) Concerning the Houston-Galveston-Brazoria (HGB) 2008 8-Hour Ozone NAAQS VOC and NOx Reasonably Available Control Technology (RACT) Requirements

by

Dr. Ranajit (Ron) Sahu, Consultant[1]

April 8, 2021

1.0 Summary

EPA has proposed to approve, with one exception, the volatile organic compounds (VOC) and nitrogen oxides (NOx) RACT requirements for the HGB 2008 8-hour ozone nonattainment area relying on the fact that current TCEQ rules in 30 TAC 115 (for VOCs) and 30 TAC 117 (for NOx) cover, with a few exceptions, the types of sources in the HGB area for which EPA has promulgated Control Techniques Guidelines (CTGs) and Alternative Control Techniques (ACT) documents in the past. In other words EPA's approval simply relies on the fact that the rules exist. The HGB area continues to experience significant exceedances of the 2008 (and the even more stringent 2015) 8-hour ozone NAAQS. Emissions of VOC and NOx from stationary sources subject to RACT are very large. In its approval EPA relies on the fact that it has provided similar approvals for RACT for prior rules including the 1-hour ozone and 1997 8-hour ozone rules. The CTG and ACT documents, which purport to presumptively establish RACT requirements (specifically the CTG documents) are outdated and EPA has not promulgated any updates or new documents in the last decade or longer with one exception. Similarly, the TCEQ rules in 30 TAC 115 and 30 TAC 117 are also outdated and have not been updated, with few exceptions, in the last decade or longer. As such the *contents* of the TCEQ rules and the CTG/ACT documents – i.e., the numerical emissions requirements or control efficiency requirements or work practices – do not reflect current levels of performance that are readily achievable. In its current proposed approval, EPA did not discuss any of the actual rule requirements in the rules found at 30 TAC Sections 115 and 117. I show, by example, that had EPA reviewed the contents of the rules themselves as opposed to simply accepting that the rules exist without reviewing their contents, EPA would have readily seen how outdated the rule requirements are and how they do not meet the definition of RACT. Based on this EPA's approval is cursory and its conclusion that the extant TCEQ rules, with one exception, in fact, meet the definition of RACT is wholly unsupported.

[1] Resume provided in Attachment A.

2.0 Documents Reviewed

In preparing the comments provided in this report, I have reviewed the following materials:

(i) Proposed Rule[2]

(ii) Technical Support Document, Reasonably Available Control Technology Application Analysis (RACT) for the Houston-Galveston-Brazoria (HGB) Ozone Serious Nonattainment Area (HGB Area), Docket No. EPA-R06-OAR-2020-0165, August 2020 (hereafter "TSD").[3]

(iii) TCEQ, Revisions to the State of Texas Air Quality Implementation Plan for the Control of Ozone Air Pollution, Houston-Galveston-Brazoria 2008 Eight-Hour Ozone Standard Nonattainment Area, May 4, 2020.[4]

(iv) TCEQ, Appendix F, RACT Analysis, May 4, 2020 (hereafter "Appendix F").[5]

(v) TCEQ Response to Comments (RTC) received concerning the HGB Serious Classification Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 8-Hour Ozone National Ambient Air Quality Standard;[6]

(vi) Other documents and references, as cited in these comments.

3.0 Introductory Materials

3.1 VOCs and NOx are Ozone precursors

Atmospheric chemistry has firmly established that VOCs and NOx are "ozone precursors," in that they react with oxygen and sunlight to form O3 in the atmosphere via photochemical reactions. Numerous sources including many stationary sources emit VOCs including chemical manufacturing plants, refineries, chemical distribution facilities, etc. All combustion sources that use air emit NOx. Only by controlling sources of NOx and VOC emissions can lower O3 levels in the ambient air be achieved.

3.2 Ozone Nonattainment Status of the HGB Area

EPA has promulgated numerous, increasing more stringent NAAQS for ozone over time.[7] Of interest here, and not delving into the statistical form of the standard and just focusing on the numerical values, in 1979 EPA promulgated a 1-hour ozone NAAQS at the level of 120 parts per

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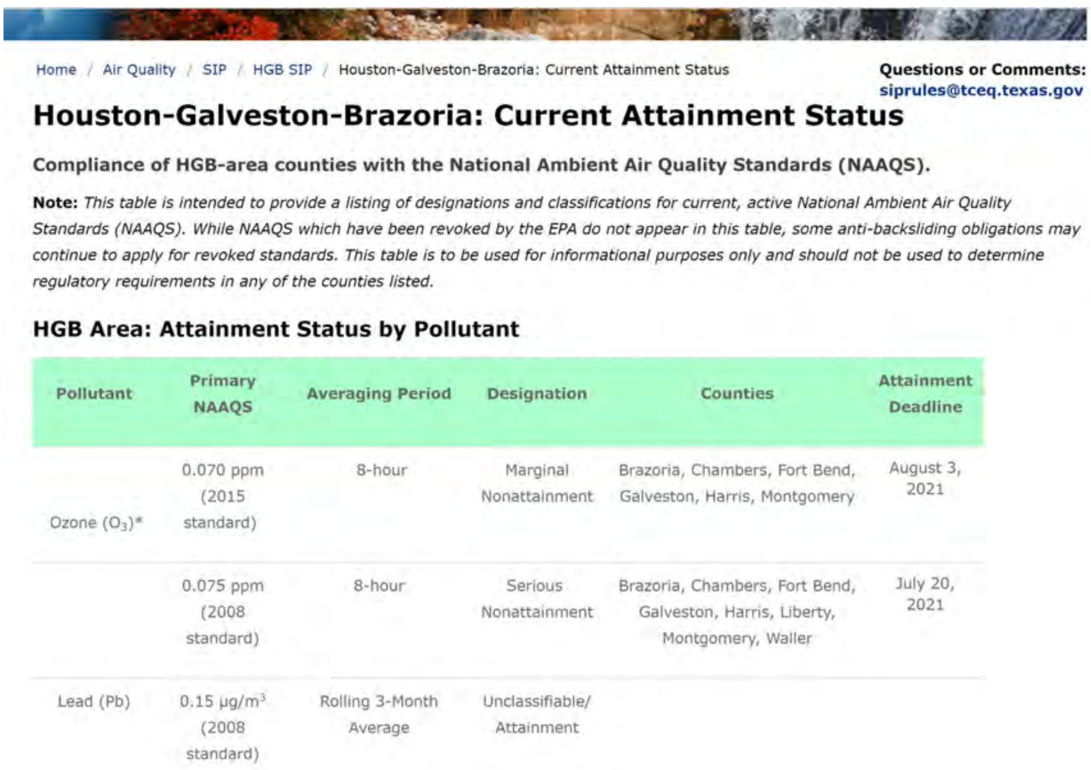
[2] 86 FR 13679-13683, Wednesday, March 10, 2021.
[3] Docket ID EPA-R06-OAR-2020-0165-0002.
[4] Docket ID EPA-R06-OAR-2020-0165-0003.
[5] Docket ID EPA-R06-OAR-2020-0165-0004.
[6] Among others, I had provided comments on the RACT and Reasonably Achievable Control Measures (RACM) portion of this SIP Revision in a report dated October 18, 2019, which is part of the record.
[7] https://www.epa.gov/ground-level-ozone-pollution/timeline-ozone-national-ambient-air-quality-standards-naaqs

billion (ppb), followed by an 8-hour NAAQS of 84 ppb in 1997. In 2008, the 8-hour standard (the subject of the current proposed RACT approval) was tightened to 75 ppb. And, in 2015 this 8-hour standard was further tightened to 70 ppb.

Areas of the country are designated as varying levels of ozone non-attainment, depending on ozone levels in the area, i.e., how much they exceed the NAAQS: marginal, moderate, serious, severe (two levels severe-15 and severe-17), and extreme.[8]

The HGB area is designated as serious ozone nonattainment and it consists of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties. Per TCEQ, Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties are designated as marginal nonattainment of the 2015 8-hour standard. The HGB area's current attainment deadline, per TCEQ for the 2008 8-hour ozone NAAQS is July 20, 2021 and the current attainment deadline for the 2015 8-hour standard is just a few weeks later on August 3, 2021. This is confirmed by a screen shot of the relevant TCEQ website shown below.[9]



Home / Air Quality / SIP / HGB SIP / Houston-Galveston-Brazoria: Current Attainment Status

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Houston-Galveston-Brazoria: Current Attainment Status

Compliance of HGB-area counties with the National Ambient Air Quality Standards (NAAQS).

Note: *This table is intended to provide a listing of designations and classifications for current, active National Ambient Air Quality Standards (NAAQS). While NAAQS which have been revoked by the EPA do not appear in this table, some anti-backsliding obligations may continue to apply for revoked standards. This table is to be used for informational purposes only and should not be used to determine regulatory requirements in any of the counties listed.*

HGB Area: Attainment Status by Pollutant

Pollutant	Primary NAAQS	Averaging Period	Designation	Counties	Attainment Deadline
Ozone (O_3)*	0.070 ppm (2015 standard)	8-hour	Marginal Nonattainment	Brazoria, Chambers, Fort Bend, Galveston, Harris, Montgomery	August 3, 2021
	0.075 ppm (2008 standard)	8-hour	Serious Nonattainment	Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller	July 20, 2021
Lead (Pb)	0.15 μg/m³ (2008 standard)	Rolling 3-Month Average	Unclassifiable/ Attainment		

[8] https://www.epa.gov/green-book/ozone-designation-and-classification-information
[9] https://www.tceq.texas.gov/airquality/sip/hgb/hgb-status

Relying on monitored levels of ozone in the HGB area there is almost no likelihood that either of these attainment deadlines, now mere months away, will be met. As such, the HGB area will continue to be nonattainment for both the 2008 and 2015 8-hour ozone NAAQS.

3.3 Ozone Monitored Values in the HGB

By convention May-September are typically considered to be the "ozone" season given the prevalence of high temperatures/sunlight which is essential for ozone formation from the precursor VOC and NOx compounds. The design value for ozone in the HGB for 2018-2020 exceeds the 2008 and 2015 8-hour ozone NAAQS. Attachment B shows a series of tables, taken from TCEQ's website which show the 2019 and 2020 May-September (i.e., ozone season) monitored ozone 8-hour average values at various monitoring sites in the HGB.[10] The tables clearly show the widespread nature of the ozone exceedances, both spatially and temporally.

The tables in Attachment B show, by day, the maximum 8-hour ozone value recorded at each station. The color coding (light yellow to dark yellow, to orange, and then red) shows progressively higher ozone values. While not all of the monitoring stations are "official" nonetheless the general consistency between the official and unofficial stations makes it clear that the HGB area is simply no where close to meeting its ozone NAAQS. I note that 2020 data, for a least certain months, may be affected by the COVID-19 pandemic and/or weather disturbances which could have affected monitor uptimes and data reliability. Even so, the consistent episodic exceedances of the ozone NAAQS during the ozone season months are obvious.

Three of TCEQ's regulatory ozone monitoring sites have 2018 to 2020 design values above the 2008 8-hr standard of 75 ppb. Nine of TCEQ's regulatory ozone monitoring sites have 2018 to 2020 design values above the 2015 8-hr standard of 70 ppb.

Ozone trends can also be investigated by looking at the number of days that the maximum eight-hour ozone levels were above a NAAQS threshold, termed an ozone exceedance day. For the 2008 eight-hour ozone NAAQS, an eight-hour ozone exceedance day is considered any day that any monitor in the area measures an eight-hour average ozone concentration greater than 75 ppb. In the SIP TCEQ indicated that the number of eight-hour ozone exceedance days occurring in the HGB area has fallen 78% when comparing 2005 through 2018. However, this does not reflect recent trends.

In Table 3-1 of the SIP, TCEQ indicates that June of 2013 only had two days with MDA8 ozone concentrations greater than 75 ppb as opposed to 6 days in 2011 and 2012. Based on monitoring data from June of 2019, there were 8 days with MDA8 ozone concentrations greater than 75 ppb with 7 exceedance days occurring within a 10-day period between June 8, 2019 through June 17, 2019.

[10] https://www.tceq.texas.gov/cgi-bin/compliance/monops/8hr_monthly.pl

A summary of the data presented in Attachment B is shown in the table below, which shows the annual fourth highest ozone concentrations and the design values at several HGB monitoring locations.

Monitoring Site	2018	2019	2020	Design Value
Houston East C1/G316	82	70	67	73.0
Houston Aldine C8/AF108/X150	88	81	68	79.0
Channelview C15/AH115	79	67	62	69.3
Northwest Harris Co. C26/A110/X154	77	73	71	73.7
Hou.DeerPrk2 C35/235/1001/AFH139FP239	85	76	73	78.0
Seabrook Friendship Park C45	82	64	64	70.0
Houston Bayland Park C53/A146	77	80	73	76.7
Conroe Relocated C78/A321	75	74	75	74.7
Manvel Croix Park C84	71	79	70	73.3
Clinton C403/C304/AH113	68	73	71	70.7
Houston North Wayside C405	66	67	61	64.7
Houston Monroe C406	68	71	62	67.0
Lang C408	74	75	69	72.7
Houston Croquet C409	70	75	66	70.3
Houston Westhollow C410/C3003	69	73	66	69.3
Park Place C416	77	72	70	73.0
Lynchburg Ferry C1015/A165	74	68	61	67.7
Lake Jackson C1016	67	63	65	65.0
Baytown Garth C1017	81	69	66	72.0
Galveston 99th St. C1034/A320/X183	76	79	68	74.3

Annual fourth highest ozone concentrations and design value in ppb [11]

The ozone nonattainment problem in the HGB is long-standing. As noted in the TSD, "[T]he HGB area…was classified as a severe nonattainment area for the 1997 O3 standard (73 FR 56983, October 1, 2008).[12]

3.4 Clean Air Act Requirements for Nonattainment Areas

As summarized in the TSD accompanying EPA's proposed approval, the Federal Clean Air Act and its Amendments (CAA) requires states with areas in violation of the NAAQS to develop and submit for approval to the EPA State Implementation Plans (SIP), including RACT, that will bring

[11] Consistent with EPA regulations at 40 CFR pt.50 app.P, § 2.2, app.U, § 3(e), when making determinations, EPA uses truncated values. That is, for example, 73 instead of 73.7. Data provided here use the full figure for illustrative purposes.

[12] The TSD states that "[O]n April 2, 2013, April 15, 2014, August 4, 2014 and March 27, 2015, EPA approved RACT analyses for all affected VOC and NOx emission sources in the HGB area for the 1997 eight-hour ozone NAAQS (78 FR 19599, 79 FR 21144, 79 FR 45105, and 80 FR 16291)."

the areas into compliance with the NAAQS for a regulated pollutant. As noted earlier, in 2008, EPA revised the 8-hour ozone NAAQS to a level of 75 ppb and the HGB area has been classified as a "serious" ozone nonattainment area for this NAAQS.

Texas has proposed a SIP to bring the area into attainment and EPA has proposed to approve the SIP requirements for RACT in the proposed rule.

3.5 RACT Definition

EPA's longstanding definition of RACT is the lowest emissions limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological factors and economic feasibility.[13]

As noted in the TSD, "…the CAA, Section 172(c)(1) requires that the state SIP "provide for the implementation of all reasonably available control measures as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology) and shall provide for attainment of the national primary ambient air quality standards."[14] (internal citation omitted)…The text of the CAA Section 182(b) states the SIP shall include reasonably available control technology requirements for each category of VOC sources in the nonattainment area covered by control technology guidance document issued by the EPA and effective at the time of attainment of the area and all other major stationary sources of VOC located in the NA area. The text of the CAA Section 182(f) requires the state SIP to include RACT requirements for major sources of NO_x emissions in the non-attainment area." (internal citation omitted)[15]

3.6 RACT and CTGs/ACT

Sections 172(c)(1) and 182 of the CAA require ozone nonattainment areas that are classified as moderate or above to adopt RACT requirements for VOC source categories subject to Control Techniques Guidelines (CTGs) issued by EPA and also for "major sources" of VOCs and NOx not covered by CTGs. CTGs provide guidance on control techniques and establish a "presumptive norm" for RACT, as confirmed by the TSD.

The TSD notes that "EPA has issued a number of CTGs to assist States in implementing RACT requirements. These documents are available at https://www.epa.gov/ozone-pollution/control-techniques-guidelinesand-alternative-control-techniques-documents-reducing and provide information on the available control technology for various source categories and establish a "presumptive norm" for RACT for these source categories. State rules that conform to the

[13] 44 FR 53762, September 17, 1979.
[14] TSD, p. 2. (internal citation omitted).
[15] TSD, p. 2-3 (internal citation omitted)..

presumptive norm established in the CTG have generally been approved as RACT. As noted, the Clean Air Act requires that SIPs implement RACT for all CTG categories."[16]

The TSD also notes that "EPA has also issued Alternative Control Technique (ACT) Guidelines for some source categories. ACTs do not provide a presumptive norm, but rather describe available control technologies and their respective cost effectiveness. ACTs provide information that is sometimes useful for implementing RACT for non-CTG major source categories or achieve VOC reductions necessary to meet RACM requirements or otherwise achieve attainment. EPA has also issued ACTs for NO_x source categories but has not issued CTGs for sources of NO_x."[17]

4.0 EPA's Current Proposed Approval Simply Relies on Prior RACT Approvals

A review of the proposed approval and accompanying TSD makes it clear that EPA's current proposed approval of VOC and RACT simply relies on its prior approvals of RACT – without an analysis of the appropriateness of the specific emissions limits or control efficiencies or work practices contained in either the CTGs or TCEQ rules and therefore without any analysis showing why such limits contained in the rules would meet the definition of RACT under the CAA.

For starters, EPA states that "EPA previously found that the Texas rules meet VOC and NO_x RACT for major sources using the 25 tons per year definition, as well as VOC RACT requirements for all applicable CTG categories in the eight county HGB 1997 8-hour ozone NAAQS nonattainment area. 78 FR 19599, April 2, 2013, docket number EPA-R06-OAR-2012-0100, and reaffirmed at 80 FR 16291, March 27, 2015, docket number EPA-R06-OAR-2013-0804. We last approved RACT for sources in the HGB area April 30, 2019 (84 FR 18145). We are not proposing to alter this previous determination."[18]

Confirming this, in the proposal, EPA states that it "…has approved the 30 TAC Chapter 115 VOC rules as RACT for the HGB area under the 1-hour and 1997 8-hour ozone NAAQS (71 FR, 52670, September 6, 2006; 78 FR 19599, April 2, 2013; 79 FR 21144, April 15, 2014; 79 FR 45105, August 4, 2014; and 80 FR 16291, March 27, 2015) and later the 2008 Moderate NAAQS area designation (84 FR 18145, April 30, 2019). The EPA determined that VOC RACT is in place for all CTG and non-CTG major sources in the HGB area for the 1-hour, 1997 8-hour ozone NAAQS and 2008 moderate area NAAQS (71 FR 52676, September 6, 2006; 79 FR 21144, April 15, 2014; and 84 FR 18145, April 30, 2019), respectively. Texas's May 13, 2020 submittal relies on those EPA-approved Chapter 115 rules for the 1-hour, 1997 8-hour and 2008 8-hour ozone NAAQS to fulfill RACT requirement for CTG and non-CTG VOC major sources for the 2008 8-hour serious ozone NAAQS."[19]

Finally, EPA simply states, "[W]e are proposing to find that the rules we approved as meeting RACT for the 1-hour and 1997 8-hour ozone NAAQS also meet RACT for the 2008 8-hour ozone

[16] TSD, p. 4.
[17] TSD, p. 4.
[18] TSD, p. 5.
[19] 45 FR 13681, first column (emphasis added, internal citation omitted).

NAAQS. We have determined this is appropriate because the fundamental control techniques described in the CTG and ACT documents and implemented in the Texas Rules are still applicable. This is supported by the implementing rule for the 2008 ozone NAAQS. The Chapter 115 rules provide appropriate VOC emissions reductions that are equivalent to control options cited in the CTG and ACT documents and any non-CTG major sources are appropriately controlled."[20]

4.1 EPA's Only Exception to the Proposed Approval is Telling

As I will show later, EPA's CTGs and ACT documents containing "presumptive" RACT levels are very old and have not been updated. Therefore, simply as a matter of passage of time, they are obsolete for the most part and cannot meet the definition of RACT which is "the lowest emissions limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological factors and economic feasibility…" as noted earlier.

There is only one CTG that EPA has promulgated in the last decade, namely for Oil and Gas, in 2016. Yet, even though this has now been promulgated for around 5 years, TCEQ has not taken steps to incorporate it into the rules and the SIP. EPA was therefore forced to disapprove this one aspect. As EPA states, "EPA issued a finding of failure to submit an implementation plan revision to adopt the Oil and Gas CTG published on November 16, 2020. This FR action establishes an eighteen month window for the state to submit a complete SIP revision request to include the Oil and Gas CTG into their SIP and a two year time frame in which EPA must either affirmatively approve the Texas SIP submittal requesting inclusion of the Oil and Gas CTG into the state SIP or finalize a Federal Implementation Plan addressing this CTG in each Ozone NA area in the state. Texas is expected to submit a SIP revision to address this requirement."[21]

Elaborating further, in the proposal, EPA states that the "…state did not include any revisions to implement the new CTG for the Oil and Natural Gas Industry (EPA-453/B-16-001, October 2016) in the HGB area. As explained in EPA's implementing memo for this CTG, Texas was required to adopt and submit revisions to the SIP by no later than two years after the availability of the said CTG. In this case, the date of the notice of availability was October 27, 2016 (See 81 FR 74798). EPA issued a notice of failure to submit on November 16, 2020 (85 FR 72963) establishing a 24-month deadline for EPA to either approve SIPs or finalize Federal Implementation Plans (FIPs) that address the Oil and Natural Gas Industry CTG in the HGB area….The EPA is committed to working with Texas to expedite the development and submission of the required SIP revisions addressing the Oil and Natural Gas Industry CTG for the affected areas, and to review and act on their submissions in accordance with the requirements of the CAA."[22]

In other words, TCEQ simply did not take any action as it was required to by October 2018 (two years after promulgation of the 2016 CTG, which was itself over two years ago. In spite of this tardiness, and HGB's ongoing ozone nonattainment status, and the need to deploy all tools

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[20] 45 FR 13681, second column (emphasis added, internal citation omitted).
[21] TSD, p. 20-21 (emphasis added)..
[22] 45 FR 13681, second column (emphasis added).

including RACT to bring the area into attainment, EPA's mild disapproval comes with a commitment to working with TCEQ. EPA's disapproval should have been more forceful.

5.0 EPA's CTG and ACT Documents are Old and Outdated

This is readily ascertained by simply reviewing EPA's list of CTGs and ACTs. I have provided the list in the table below and have color coded the date of the document, including any updated. Red denotes documents that were issued (including any updates) in 2010 or before, or at least 10 years ago. As the table clearly shows, with one exception (the Oil and Gas CTG discussed earlier, which was issued in 2016 (itself almost 5 years old now), every single CTG/ACT document is over 10 years old. The earlier CTG dates to 1975, i.e., it is over 45 years old.

For EPA to claim, as it has done, that these old documents contain "presumptive" RACT meeting the definition that is per the CAA would only make sense if these documents were being kept up to date. As such they cannot be presumptive for current RACT.

EPA CTG and ACT Documents and Their Age		
Pollutant	**EPA Report**	**Description**
Control Techniques Guidelines (CTG)		
VOC	EPA-450/R-75-102	Design Criteria for Stage I Vapor Control Systems – Gasoline Service Stations (PDF 15 pp, 766KB)
	1975/11	*Note – This document is regarded as a CTG although it was never published with an EPA document number.*
VOC	EPA-450/2-76-028	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume I: Control Methods for Surface Coating Operations (PDF 174 pp, 4.6MB)
	1976/11	*Note – Although often listed with the CTGs for historical reasons, this document does not define RACT for any source. It is a compilation of control techniques.*
VOC	EPA-450/2-77-008 *1977/05*	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks (PDF 232 pp, 2.7MB)
VOC	EPA-450/2-77-022 *1977/11*	Control of Volatile Organic Emissions from Solvent Metal Cleaning (PDF 229 pp, 7.0MB)
VOC	EPA-450/2-77-025 *1977/10*	Control of Refinery Vacuum Producing Systems, Wastewater Separators, and Process Unit Turnarounds (PDF 50 pp, 1.3MB)
VOC	EPA-450/2-77-026 *1977/10*	Control of Hydrocarbons from Tank Truck Gasoline Loading Terminals (PDF 62 pp, 1.6MB)
VOC	EPA-450/2-77-032 *1977/12*	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume III: Surface Coating of Metal Furniture (PDF 66 pp, 1.9MB)
VOC	EPA-450/2-77-033 *1977/12*	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume IV: Surface Coating of Insulation of Magnet Wire (PDF 44 pp, 1.1MB)
VOC	EPA-450/2-77-034	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume V: Surface Coating of Large Appliances (PDF 70 pp, 2.1MB)

	1977/12	
VOC	EPA-450/2-77-035 *1977/12*	Control of Volatile Organic Emissions from Bulk Gasoline Plants (PDF 49 pp, 1.3MB)
VOC	EPA-450/2-77-036 *1977/12*	Control of Volatile Organic Emissions from Storage of Petroleum Liquids in Fixed-Roof Tanks (PDF 43 pp, 1.1MB)
VOC	EPA-450/2-77-037 *1977/12*	Control of Volatile Organic Emissions from Use of Cutback Asphalt (PDF 18 pp, 481KB)
VOC	EPA-450/2-78-022 *1978/05*	Control Techniques for Volatile Organic Emissions from Stationary Sources (PDF 580 pp, 21.9MB) *Note – This document is often listed with CTGs, but it does not define RACT for any particular source*
VOC	EPA-450/2-78-015 *1978/06*	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VI: Surface Coating of Miscellaneous Metal Parts and Products (PDF 82 pp, 2.6MB)
VOC	EPA-450/2-78-032 *1978/06*	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VII: Factory Surface Coating of Flat Wood Paneling (PDF 66 pp, 2.0MB)
VOC	EPA-450/2-78-036 *1978/06*	Control of Volatile Organic Compound Leaks from Petroleum Refinery Equipment (PDF 78 pp, 6.0MB)
VOC	EPA-450/2-78-029 *1978/12*	Control of Volatile Organic Emissions from Manufacture of Synthesized Pharmaceutical Products (PDF 134 pp, 3.8MB)
VOC	EPA-450/2-78-030 *1978/12*	Control of Volatile Organic Emissions from Manufacture of Pneumatic Rubber Tires (PDF 72 pp, 1.6MB)
VOC	EPA-450/2-78-033	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VIII: Graphic Arts-Rotogravure and Flexography (PDF 64 pp, 1.9MB)

	1978/12	
VOC	EPA-450/2-78-047 *1978/12*	Control of Volatile Organic Emissions from Petroleum Liquid Storage in External Floating Roof Tanks (PDF 66 pp, 2.0MB)
VOC	EPA-450/2-78-050 *1978/12*	Control of Volatile Organic Emissions from Perchloroethylene Dry Cleaning Systems (PDF 76 pp, 2.5MB) *Note – Perchloroethylene has been exempted as a VOC, so this CTG is no longer relevant. However, there is a MACT standard for perchloroethylene dry cleaners.*
VOC	EPA-450/2-78-051 *1978/12*	Control of Volatile Organic Compound Leaks from Gasoline Tank Trucks and Vapor Collection Systems (PDF 32 pp, 887KB)
VOC	EPA-450/3-82-009 *1982/09*	Control of Volatile Organic Compound Emissions from Large Petroleum Dry Cleaners (PDF 174 pp, 5.0MB)
VOC	EPA-450/3-83-008 *1983/11*	Control of Volatile Organic Compound Emissions from Manufacture of High-Density Polyethylene, Polypropylene, and Polystyrene Resins (PDF 308 pp, 14.0MB)
VOC	EPA-450/3-83-007 *1983/12*	Control of Volatile Organic Compound Equipment Leaks from Natural Gas/Gasoline Processing Plants (PDF 194 pp, 6.3MB)
VOC	EPA-450/3-83-006 *1984/03*	Control of Volatile Organic Compound Leaks from Synthetic Organic Chemical Polymer and Resin Manufacturing Equipment (PDF 148 pp, 6.2MB)
VOC	EPA-450/3-84-015 *1984/12*	Control of Volatile Organic Compound Emissions from Air Oxidation Processes in Synthetic Organic Chemical Manufacturing Industry (PDF 259 pp, 9.4MB)
VOC	EPA-450/4-91-031 *1993/08*	Control of Volatile Organic Compound Emissions from Reactor Processes and Distillation Operations in Synthetic Organic Chemical Manufacturing Industry (PDF 277 pp, 8.7MB)
VOC	EPA-453/R-96-007	Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations (PDF 288 pp, 13.8MB)

	1996/04	*Note – Wood Furniture (CTG-MACT) – Draft MACT out 5-1994; Final CTG issued 4-1996. See also 61 FR-25223, May 20, 1996 and 61 FR-50823, September 27, 1996.*
VOC	EPA-453/R-94-032	Alternative Control Technology Document – Surface Coating Operations at Shipbuilding and Ship Repair Facilities (PDF 217 pp, 9.8MB)
	1994/04	*Note – For CTG, see 61 FR-44050, August 27,1996*
VOC	61 FR-44050 8/27/96	Control Techniques Guidelines for Shipbuilding and Ship Repair Operations (Surface Coating) (PDF 30 pp, 4.0MB)
	1996/08	*Note – See also EPA-453/R-94-032.*
VOC	59 FR-29216 6/06/94	Aerospace MACT (PDF 37 pp, 6MB)
	1994/06	*Note – See also EPA-453/R-97-004.*
VOC	EPA-453/R-97-004	Aerospace (CTG & MACT) (PDF 62 pp, 288KB)
	1997/12	*Note – See also 59 FR-29216, June 6, 1994.*
VOC	EPA-453/R-06-001 *2006/09*	Control Techniques Guidelines for Industrial Cleaning Solvents (PDF 290 pp, 7.6MB)
VOC	EPA-453/R-06-002 *2006/09*	Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing (PDF 52 pp, 349KB)
VOC	EPA-453/R-06-003 *2006/09*	Control Techniques Guidelines for Flexible Package Printing (PDF 33 pp, 216KB)
VOC	EPA-453/R-06-004 *2006/09*	Control Techniques Guidelines for Flat Wood Paneling Coatings (PDF 27 pp, 212KB)
VOC	EPA 453/R-07-003 *2007/09*	Control Techniques Guidelines for Paper, Film, and Foil Coatings (PDF 102 pp, 488KB)
VOC	EPA 453/R-07-004	Control Techniques Guidelines for Large Appliance Coatings (PDF 44 pp, 374KB)

	2007/09	
VOC	EPA 453/R-07-005 *2007/09*	Control Techniques Guidelines for Metal Furniture Coatings (PDF 100 pp, 293KB)
VOC	EPA 453/R-08-003 *2008/09*	Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings (PDF 143 pp, 897KB)
VOC	EPA 453/R-08-004 *2008/09*	Control Techniques Guidelines for Fiberglass Boat Manufacturing Materials (PDF 41 pp, 336KB)
VOC	EPA 453/R-08-005 *2008/09*	Control Techniques Guidelines for Miscellaneous Industrial Adhesives (PDF 47 pp, 350KB)
VOC	EPA 453/R-08-006 *2008/09*	Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings (PDF 44 pp, 2.64MB) *Note – See also EPA-453/R-08-002.*
VOC	EPA 453/R-08-002 *2008/09*	Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Primer-Surfacer and Topcoat Operations (PDF 129 pp, 450KB) *Note – See also EPA-453/R-08-006.*
VOC	EPA-453/B-16-001 *2016/10*	Control Techniques Guidelines for the Oil and Natural Gas Industry (343 pp, 1.6 MB)
Alternative Control Technology (ACT)		
VOC	EPA-450/3-83-012 *1983/05*	Control Techniques for Organic Emissions from Plywood Veneer Dryers (PDF 113 pp, 3.4MB) *Note – This document is labeled as a control technique document (CTD) rather than an ACT. However, the information is similar to that in an ACT.*
VOC	EPA-450/3-88-007 *1988/08*	Reduction of Volatile Organic Compound Emissions from the Application of Traffic Markings (PDF 52 pp, 1.6MB) *Note – The Architectural and Industrial Maintenance coatings (AIM) national rule issued in 1998 includes limits for traffic coatings and superseded the ACT.*

VOC	EPA-450/3-89-007 *1989/03*	Alternative Control Technology Document – Ethylene Oxide Sterilization / Fumigation Operations (PDF 102 pp, 3.2MB)
VOC	EPA-450/3-89-030 *1989/08*	Alternative Control Technology Document – Halogenated Solvent Cleaners (PDF 239 pp, 6.7MB)
VOC	EPA-450/3-91-007 *1990/12*	Alternative Control Technology Document – Organic Waste Process Vents (PDF 192 pp, 6.9MB)
VOC	EPA-450/3-90-020 *1990/09*	Control of VOC Emissions from Polystyrene Foam Manufacturing (PDF 113 pp, 3.5MB)
VOC	EPA-453/R-92-017 *1992/12*	Alternative Control Technology Document – Bakery Ovens (PDF 126 pp, 1.2MB)
VOC	EPA-453/R-92-018 *1992/12*	Control Techniques for Volatile Organic Compound Emissions from Stationary Sources (PDF 287 pp, 9.2MB)
VOC	EPA-453/D-93-056 *1992/09*	Control of Volatile Organic Compound Emissions from Industrial Wastewater CTG (draft) (PDF 234 pp, 9.4MB) *Note – CTG not finalized but issued as ACT in 1994.*
VOC	(No Report ID) *1994/04*	Industrial Wastewater Alternative Control Technology (PDF 266 pp, 9MB) *Note – ACT consists of cover memo with option tables + CTG (draft) EPA-453/D-93-056.*
VOC	EPA-453/R-92-011 *1993/03*	Control of VOC Emissions from the Application of Agricultural Pesticides (PDF 250 pp, 9.8MB)
VOC	EPA-453/R-94-001 *1994/01*	Alternative Control Techniques Document – Volatile Organic Liquid Storage In Floating and Fixed Roof Tanks (PDF 202 pp, 8.6MB)

VOC	EPA-453/R-93-020	Control of Volatile Organic Compound Emissions from Batch Processes ACT (PDF 377 pp, 11.9MB)
	1994/02	*Note – Document also released under the Report ID of EPA-453/R-93-017.*
VOC	EPA-453/R-94-015	Alternative Control Techniques Document – Industrial Cleaning Solvents (PDF 234 pp, 10.6MB)
	1994/02	
VOC	EPA-453/R-94-017	Alternative Control Techniques Document – Surface Coating of Automotive/Transportation and Business Machine Plastic Parts (PDF 207 pp, 6.3MB)
	1994/02	
VOC	EPA-453/R-94-031	Alternative Control Techniques Document – Automobile Refinishing (PDF 90 pp, 3.6MB)
	1994/04	*Note – A national rule for autobody refinishing was issued in 1998 after the ACT.*
VOC/PM	EPA-453/R-94-032	Alternative Control Techniques Document – Surface Coating Operations at Shipbuilding and Ship Repair Facilities (PDF 217 pp, 9.0MB)
	1994/04	*Note – This was superseded by the Ship Building CTG which was issued in August 1996.*
VOC	EPA-453/D-95-001	Control of Volatile Organic Compound Emissions from Offset Lithographic Printing (PDF 246 pp, 8.6MB)
	1993/09	*Note – Draft CTG predecessor to the ACT released under the Report ID of EPA-453/R-94-054.*
VOC	EPA-453/R-94-054	Alternative Control Techniques Document: Offset Lithographic Printing – Supplemental Information Based on Public Comment on Draft Control Techniques Guidance announced in Federal Register November 8, 1993 (PDF 25 pp, 57KB)
	1994/06	*Note – See draft CTG (EPA-453/D-95-001) September 1993.*
NOx	EPA-453/3-91-026	NOx Emissions from Nitric and Adipic Acid Manufacturing Plants (PDF 146 pp, 312KB)
	1991/12	
NOx	EPA-453/R-93-007	NOx Emissions from Stationary Combustion Turbines (PDF 399 pp, 1.2MB)
	1993/01	
NOx	EPA-453/R-93-034	NOx Emissions from Process Heaters (PDF 216 pp, 8.5MB)
	1993/09	*Note – Revised September 1993.*

NOx	EPA-453/R-93-032	NOx Emissions from Stationary Internal Combustion Engines (PDF 340 pp, 13.3MB)
	1993/07	*Note – Updated September 2000.*
NOx	EPA-453/R-94-004	NOx Emissions from Cement Manufacturing (PDF 198 pp, 624KB)
	1994/03	*Note – Updated September 2000. See document EPA-457/R-00-002.*
NOx	EPA-457/R-00-002	NOx Control Technologies for the Cement Industry: Final Report (PDF 123 pp, 1.09MB)
	2000/09	*Note – Update to March 1994 ACT document EPA-453/R-94-004.*
NOx	EPA-453/R-94-022 *1994/03*	NOx Emissions from Industrial, Commercial & Institutional Boilers (PDF 479 pp, 18.8MB)
NOx	EPA-453/R-94-023 *1994/03*	Alternative Control Techniques Document – NOx Emissions from Utility Boilers (PDF 538 pp, 18.8MB)
NOx	EPA-453/R-94-037 *1994/06*	Alternative Control Techniques Document – NOx Emissions from Glass Manufacturing (PDF 161 pp, 4.2MB)
NOx	EPA 453/R-94-065 *1994/09*	Alternative Control Techniques Document – NOx Emissions from Iron and Steel Mills (PDF 170 pp, 7.9MB)
VOC	EPA-450/3-88-009 *1988/10*	Reduction of Volatile Organic Compound Emissions from Automobile Refinishing (PDF 112 pp, 896KB)
Other Control Technology Documents		
SOx	EPA-450/2-77-019 *1977/09*	Final Guideline Document: Control of Sulfuric Acid Mist Emissions from Existing Sulfuric Acid Production Units (PDF 188 pp, 5.3MB)
NOx	EPA-450/1-78-001	Control Techniques for Nitrogen Oxides Emissions from Stationary Sources – Second Edition (PDF 396 pp, 14.0MB)

	1978/01	*Note – This document is the second edition of the EPA document entitled: Control Techniques for Nitrogen Oxides Emissions from Stationary Sources. This document was first published in 1970 as National Air Pollution Control Administration Publication No. AP-67.*
VOC	EPA-450/2-78-022 *1978/05*	Control Techniques for Volatile Organic Emissions from Stationary Sources (PDF 580 pp, 21.9MB)
VOC	EPA-453/R-95-010 *1996/04*	Beyond Volatile Organic Compound-Reasonably Available Control Technology – Control Technology Guidelines Requirements (PDF 442 pp, 10.6MB)
VOC	EPA-453/R-97-002 *1997/09*	A Guide to the Wood Furniture CTG and NESHAP (PDF 177 pp, 8.5 MB)
VOC	EPA-453/R-00-004 *1998/09*	Preliminary Industry Characterization: Wood Building Products Surface Coating (PDF 50 pp, 1.8 MB)

(Source: https://www.epa.gov/ground-level-ozone-pollution/control-techniques-guidelines-and-alternative-control-techniques). Accessed 3.25.21

Last Modified 2010 or Before
Last Modified Between 2011-2019
Modified After 2019

6.0 TCEQ 30 TAC Chapter 115 (VOC) Rules Are Old and Outdated

Like the EPA CTG and ACT documents noted earlier, much of TCEQ's 30 TAC Chapter 115 rules dealing with VOCs are also outdated since they were promulgated years ago and have not been updated, with few exceptions. The table below shows the relevant rules – i.e., those containing emissions limits or control efficiencies and work practices, etc.

I use the same color coding scheme as with the EPA documents. As the table clearly shows, with one exception, most of the rules have not been updated recently (i.e., after 2019) and many are over a decade old (red).

30 TAC 115 (VOC RACT Rules)		
Subchapter A: Definitions	**Description**	**Last Modified**
Rule 115.10	Definitions *(10)*	
Subchapter B: General Volatile Organic Compound Sources		
Division 1	Storage of Volatile Organic Compounds *(112)*	2020
Division 2	Vent Gas Control *(121)*	2015
Division 3	Water Separation *(131)*	1995
Division 4	Industrial Wastewater *(140)*	2003
Division 5	Municipal Solid Waste Landfills *(152)*	1994
Division 6	Batch Processes *(160)*	2001
Subchapter C: Volatile Organic Compound Transfer Operations		
Division 1	Loading and Unloading of Volatile Organic Compounds *(211)*	2003
Division 2*3	Filling of Gasoline Storage Vessels (Stage I) for Motor Vehicle Fuel Dispensing Facilities *(221)*	2014
Division 3*3	Control of Volatile Organic Compound Leaks from Transport Vessels *(221)*	1999
Division 4*3	Stage II Vapor Recovery Definitions *(240)*	2013
Division 5*3	Control of Reid Vapor Pressure of Gasoline *(252)*	-
Subchapter D: Petroleum Refining and Petrochemical Processes		
Division 1	Process Unit Turnaround and Vacuum-Producing Systems in Petroleum Refineries *(311)*	2003
Division 2	Fugitive Emission Control in Petroleum Refineries in Gregg, Nueces, and Victoria Counties *(322)*	-
Division 3	Fugitive Emission Control in Petroleum Refining, Natural Gas/Gasoline Processing, and Petrochemical Processes in Ozone Nonattainment Areas *(352)*	2010
Subchapter E: Solvent-Using Processes		
Division 1	Degreasing and Clean-Up Processes *(412)*	2004
Division 2	Surface Coating Processes *(421)*	2015
Division 3	Graphic Arts (Printing) by Flexographic and Rotogravure Processes *(432)*	2011
Division 4	Offset Lithographic Printing *(442)*	2015
Division 5	Control Requirements for Surface Coating Processes *(450)*	2015
Division 6	Industrial Cleaning Solvents *(460)*	2011
Division 7	Miscellaneous Industrial Adhesives *(470)*	2015

Last Modified 2010 or Before	
Last Modified Between 2011-2019	
Modified After 2019	

6.1 TCEQ's Top VOC Sources

Table F-5 in Appendix F of TCEQ's submittal contains a list of VOC sources in the HGB area based on actual 2017 reported VOC emissions. In the table below, I have excerpted all of the sources in Table F-5 with 100 tons per year or greater reported 2017 emissions. Collectively, these sources alone account for 17,518 tons per year of VOC emissions. In each case, the last column shows the VOC RACT rules that apply to each source per TCEQ. Specifically, I have highlighted two sets of rules that apply to almost all of the sources: namely 115.352 relating to fugitive emissions from components such as pump and compressor seals; and 115.211 to 115.212 dealing with VOC emissions from loading/transfer operations.

In the next discussion, I show that these rules are outdated and should have been updated by TCEQ and EPA to meet current RACT standards, and that is not being done as part of EPA's proposed approval. I should also note that in my October 2019 comments on TCEQ's proposed SIP revisions, I had provided several examples of deficient RACT (and RACM) measures. This applies to VOC and NOx RACT (which I discuss later) and includes not just technology issues but also maintenance aspects that should be considered in the context of RACT. I have reviewed TCEQ's response to these previous comments, i.e., the RTC previously noted, and it is clear that TCEQ did not meaningfully respond to previous comments.

VOC: Sources With Greater Than 100 tons/year Actual VOC in 2017 *(Source: TCEQ Appendix F, Table F-5)*							
RN	**Account**	**Company**	**County**	**SIC**	**SIC Description**	**2017 VOC Actual tpy**	**Rule Addressing RACT**
RN100218049	BL0021O	BASF CORPORATION	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS	198.7	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100225945	BL0082R	DOW CHEMICAL COMPANY	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS	583	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.160 - §115.169
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 - §115.419
							§115.460 - §115.460
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100237668	BL0268B	EQUISTAR CHEMICALS	BRAZORIA	2821	PLASTICS MATERIALS AND SYNTHETIC RESINS	330.9	§115.110 - §115.119
							§115.120 - §115.129
							§115.211 - §115.219
							§115.352 - §115.359
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789

RN100238708	BL0002S	INEOS USA	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS	498.6	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 - §115.419
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100825249	BL0758C	CHEVRON PHILLIPS CHEMICAL COMPANY	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS	461.1	§115.110 - §115.119
							§115.120 - §115.129
							§115.211 - §115.219
							§115.352 - §115.359
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN101619179	BL0042G	PHILLIPS 66 COMPANY	BRAZORIA	2911	PETROLEUM REFINING	279.9	§115.110 - §115.119
							§115.120 - §115.129
							§115.211 - §115.219
							§115.311 - §115.319
							§115.352 - §115.359
							§115.780 - §115.789
RN108772245	BLA044R	BLUE CUBE OPERATIONS	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS	103.8	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.412 - §115.419
							§115.460 - §115.469
							§115.540 - §115.549
RN100222900	CI0022A	TARGA MIDSTREAM SERVICES	CHAMBERS	1321	NATURAL GAS LIQUIDS	257.8	§115.110 - §115.119
							§115.120 - §115.129

							§115.352 - §115.359
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN102323268	CI0008R	ENTERPRISE PRODUCTS OPERATING	CHAMBERS	2869	INDUSTRIAL ORGANIC CHEMICALS	345.1	§115.110 - §115.119
							§115.120 - §115.129
							§115.211 - §115.219
							§115.352 - §115.359
							§115.420 - §115.429
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN102501020	CI0009P	EXXONMOBIL CHEMICAL COMPANY	CHAMBERS	2821	PLASTICS MATERIALS AND SYNTHETIC RESINS	134	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 – §115.139
							§115.140 – §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 – §115.419
							§115.540 - §115.549
							§115.420 – §115.429
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100888312	FG0020V	NRG TEXAS POWER	FORT BEND	4911	ELECTRIC SERVICES	120.8	§115.110 - §115.119
							§115.131 - §115.139
							§115.211 - §115.219
RN100210608	GB0055R	MARATHON PETROLEUM COMPANY	GALVESTON	2911	PETROLEUM REFINING	176.9	§115.110 - §115.119
							§115.120 - §115.129
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 - §115.419

RN100219351	GB0076J	UNION CARBIDE CORPORATION	GALVESTON	2869	INDUSTRIAL ORGANIC CHEMICALS	129.4	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 - §115.419
							§115.420 - §115.429
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100238385	GB0073P	VALERO REFINING TEXAS	GALVESTON	2911	PETROLEUM REFINING	605.5	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.211 - §115.219
							§115.311 - §115.319
							§115.352 - §115.359
RN102535077	GB0004L	BLANCHARD REFINING COMPANY	GALVESTON	2911	PETROLEUM REFINING	1460.5	§115.110 - §115.119
							§115.120 - §115.129
							§115.211 - §115.219
							§115.352 - §115.359
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN102536307	GB0001R	BP AMOCO CHEMICAL	GALVESTON	2869	INDUSTRIAL ORGANIC CHEMICALS	101.2	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.211 - §115.219
							§115.352 - §115.359
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100210319	HG0770G	EQUISTAR CHEMICALS	HARRIS	2869		120.1	§115.110 - §115.119

					INDUSTRIAL ORGANIC CHEMICALS		§115.120 - §115.129 §115.131 - §115.139 §115.140 - §115.149 §115.211 - §115.219 §115.352 - §115.359 §115.410 - §115.419 §115.720 - §115.729 §115.760 - §115.769 §115.780 - §115.789
RN100210806	HG0403N	INTERCONTINENTAL TERMINALS COMPANY	HARRIS	4226	SPECIAL WAREHOUSING & STORAGE	173.5	§115.110 - §115.119 §115.211 - §115.219 §115.352 - §115.359 §115.720 - §115.729
RN100211697	HG0030H	ANHEUSER BUSCH	HARRIS	2082	MALT BEVERAGES	193.9	§115.120 - §115.129
RN100211879	HG0659W	SHELL CHEMICAL	HARRIS	2911	PETROLEUM REFINING	1075.3	§115.110 - §115.119 §115.120 - §115.129 §115.131 - §115.139 §115.140 - §115.149 §115.211 - §115.219 §115.352 - §115.359 §115.720 - §115.729 §115.760 - §115.769 §115.780 - §115.789
RN100214212	HG0786O	TARGA DOWNSTREAM	HARRIS	5171	PETROLEUM BULK STATIONS & TERMINALS	110.1	§115.110 - §115.119 §115.211 - §115.219 §115.352 - §115.359 §115.410 - §115.419 §115.720 - §115.729
RN100218130	HG0048L	HOUSTON REFINING	HARRIS	2911	PETROLEUM REFINING	819.9	§115.110 - §115.119 §115.120 - §115.129 §115.140 - §115.149

							§115.211 - §115.219
							§115.311 - §115.319
							§115.352 - §115.359
							§115.420 - §115.429
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100218247	HG0225N	ALBEMARLE CORPORATION	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	120.2	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.160 - §115.169
							§115.211 - §115.219
							§115.410 - §115.419
							§115.420 - §115.429
							§115.720 - §115.729
							§115.760 - §115.769
RN100219310	HG0130C	VALERO REFINING TEXAS	HARRIS	2911	PETROLEUM REFINING	160.1	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.211 - §115.219
							§115.311 - §115.319
							§115.352 - §115.359
							§115.410 - §115.419
							§115.720 - §115.729
RN100219526	HG0562P	TPC GROUP	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	115.1	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 - §115.419
							§115.720 - §115.729
							§115.760 - §115.769

RN100221589	HG0459J	LUBRIZOL CORPORATION	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	204.8	§115.110 - §115.119 §115.120 - §115.129
RN100223205	HG0632T	ROHM AND HAAS TEXAS	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	227.4	§115.110 - §115.119 §115.120 - §115.129 §115.131 - §115.139 §115.140 - §115.149 §115.160 - §115.169 §115.211 - §115.219 §115.352 - §115.359 §115.410 - §115.419 §115.780 - §115.789
RN100224740	HG0531D	ENTERPRISE PRODUCTS OPERATING	HARRIS	4226	SPECIAL WAREHOUSING & STORAGE	154.5	§115.110 - §115.119 §115.131 - §115.139 §115.352 - §115.359 §115.410 - §115.419 §115.420 - §115.429
RN100224815	HG0261J	KM LIQUIDS TERMINALS	HARRIS	4226	SPECIAL WAREHOUSING & STORAGE	588.4	§115.110 - §115.119 §115.211 - §115.219
RN100225093	HG0629I	VOPAK TERMINAL DEER PARK	HARRIS	4226	SPECIAL WAREHOUSING & STORAGE	287	§115.110 - §115.119 §115.211 - §115.219 §115.352 - §115.359
RN100227016	HG0126Q	CELANESE	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	126	§115.110 - §115.119 §115.120 - §115.129 §115.140 - §115.149 §115.211 - §115.219 §115.352 - §115.359 §115.410 - §115.419 §115.420 - §115.429 §115.720 - §115.729 §115.760 - §115.769 §115.780 - §115.789

RN100229905	HG0665E	INEOS USA	HARRIS	2821	PLASTICS MATERIALS AND SYNTHETIC RESINS	283	§115.110 - §115.119
							§115.120 - §115.129
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 – §115.419
							§115.420 - §115.429
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100237452	HG0262H	KM LIQUIDS TERMINALS	HARRIS	4226	SPECIAL WAREHOUSING & STORAGE	429.9	§115.110 - §115.119
							§115.211 - §115.219
							§115.352 - §115.359
RN100542281	HG0033B	EQUISTAR CHEMICALS	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	646.7	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.420 - §115.429
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN100633650	HG1575W	LYONDELL CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	279	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.420 - §115.429
							§115.720 - §115.729
							§115.760 - §115.769
RN100677491	HGA197O	CONTANDA TERMINALS	HARRIS	4226		106	§115.110 - §115.119

					SPECIAL WAREHOUSING & STORAGE		§115.211 - §115.219 §115.352 - §115.359
RN100716661	HG0175D	PASADENA REFINING SYSTEM INC.	HARRIS	2911	PETROLEUM REFINING	561.7	§115.110 - §115.119 §115.120 - §115.129 §115.131 - §115.139 §115.211 - §115.219 §115.311 - §115.319 §115.352 - §115.359 §115.410 - §115.419 §115.420 - §115.429 §115.720 - §115.729 §115.760 - §115.769 §115.780 - §115.789
RN100870898	HG0289K	GOODYEAR TIRE & RUBBER COMPANY	HARRIS	2822	SYNTHETIC RUBBER	207.7	§115.110 - §115.119 §115.120 - §115.129 §115.131 – §115.139 §115.211 - §115.219 §115.352 - §115.359 §115.420 – §115.429 §115.720 - §115.729 §115.760 - §115.769 §115.780 - §115.789
RN100909373	HG4662F	TOTAL PETROCHEMICALS & REFINING	HARRIS	2821	PLASTICS MATERIALS AND SYNTHETIC RESINS	149.8	§115.110 - §115.119 §115.120 - §115.129 §115.211 - §115.219 §115.352 - §115.359 §115.420 - §115.429 §115.720 - §115.729 §115.760 - §115.769 §115.780 - §115.789
RN101062610	HG0565J	PHILLIPS 66 PIPELINE	HARRIS	5171	PETROLEUM BULK STATIONS & TERMINALS	128.3	§115.110 - §115.119 §115.131 - §115.139

							§115.211 - §115.219 §115.410 - §115.419
RN101851517	HG0467K	MARATHON PIPE LINE	HARRIS	4613	REFINED PETROLEUM PIPELINES	113.2	§115.110 - §115.119
RN102018322	HG0566H	CHEVRON PHILLIPS CHEMICAL COMPANY	HARRIS	2821	PLASTICS MATERIALS AND SYNTHETIC RESINS	493.4	§115.110 - §115.119 §115.120 - §115.129 §115.211 - §115.219 §115.352 - §115.359 §115.410 – §115.419 §115.420 – §115.429 §115.720 - §115.729 §115.760 - §115.769 §115.780 - §115.789
RN102180486	HG0017W	MAGELLAN TERMINALS HOLDINGS	HARRIS	4226	SPECIAL WAREHOUSING & STORAGE	222.1	§115.110 - §115.119 §115.211 - §115.219 §115.131 - §115.139
RN102212925	HG0228H	EXXONMOBIL CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	436.2	§115.110 - §115.119 §115.120 - §115.129 §115.140 - §115.149 §115.211 - §115.219 §115.352 - §115.359 §115.410 - §115.419 §115.420 - §115.429 §115.720 - §115.729 §115.760 - §115.769 §115.780 - §115.789
RN102523107	HG0537O	LYONDELL CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	146.3	§115.110 - §115.119 §115.120 - §115.129 §115.140 - §115.149 §115.211 - §115.219 §115.352 - §115.359

							§115.410 - §115.419
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN102574803	HG0229F	EXXONMOBIL CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	705.6	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 - §115.419
							§115.420 - §115.429
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN102579307	HG0232Q	EXXONMOBIL REFINING & SUPPLY CO	HARRIS	2911	PETROLEUM REFINING	1903	§115.110 - §115.119
							§115.120 - §115.129
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 - §115.419
RN103919817	HG0310V	CHEVRON PHILLIPS CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS	332.4	§115.110 - §115.119
							§115.120 - §115.129
							§115.131 - §115.139
							§115.140 - §115.149
							§115.211 - §115.219
							§115.352 - §115.359
							§115.410 - §115.419
							§115.720 - §115.729
							§115.760 - §115.769
							§115.780 - §115.789
RN109290692	HGA164H	VALERO ENERGY PARTNERS	HARRIS	5171	PETROLEUM BULK STATIONS & TERMINALS	110.5	§115.110 - §115.119
							§115.311 - §115.319

							§115.352 - §115.359
							§115.540 - §115.549
							§115.780 - §115.789

6.2 *Example 1 (30 TAC 115.352)*

For reference, I reproduce portions of this rule which deal with fugitive VOC emissions from components such as valves, flanges, pump seals, and the like. It applies to the HGB area VOC sources, including almost every one of the high emitting VOC sources that I have listed in the previous table, based on TCEQ's own analysis.

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 115	CONTROL OF AIR POLLUTION FROM VOLATILE ORGANIC COMPOUNDS
SUBCHAPTER D	PETROLEUM REFINING, NATURAL GAS PROCESSING, AND PETROCHEMICAL PROCESSES
DIVISION 3	**FUGITIVE EMISSION CONTROL IN PETROLEUM REFINING, NATURAL GAS/GASOLINE PROCESSING, AND PETROCHEMICAL PROCESSES IN OZONE NONATTAINMENT AREAS**
RULE §115.352	**Control Requirements**

For the Beaumont-Port Arthur, Dallas-Fort Worth, El Paso, and Houston-Galveston-Brazoria areas as defined in §115.10 of this title (relating to Definitions), no person shall operate a petroleum refinery; a synthetic organic chemical, polymer, resin, or methyl-tert-butyl ether manufacturing process; or a natural gas/gasoline processing operation, as defined in §115.10 of this title, without complying with the following requirements.

(1) Except as provided in paragraph (2) of this section, no component may be allowed to have a volatile organic compound (VOC) leak for more than 15 calendar days after the leak is found that meets the following:

(A) for all components except pump seals and compressor seals, a screening concentration greater than 500 parts per million by volume (ppmv) above background as methane, or the dripping or exuding of process fluid based on sight, smell, or sound;

(B) for pump seals and compressor seals, a screening concentration greater than 10,000 ppmv above background as methane, or the dripping or exuding of process fluid based on sight, smell, or sound; and

…..

Source Note: The provisions of this §115.352 adopted to be effective December 3, 1993, 18 TexReg 8538; amended to be effective May 27, 1994, 19 TexReg 3703; amended to be effective May 22, 1997, 22 TexReg 4213; amended to be effective May 16, 2002, 27 TexReg 4113; amended to be effective January 17, 2003, 28 TexReg 113; amended to be effective November 13, 2003, 28 TexReg 9835; amended to be effective December 23, 2004, 29 TexReg11705; amended to be effective June 24, 2010, 35 TexReg 5293

As highlighted in the table above, the rule, which was last updated in June 2010 (i.e., over 10 years ago) requires that pump and compressor seals meet a limit of 10,000 ppmv before they are considered as leaking components which then subject them to the repair provisions of the rule. This 10,000 ppm requirement is no longer appropriate as current RACT in my opinion. It is my experience that there is no technological barrier to achieving much lower levels of leaks for pump and compressor seals. And, that they are routinely required. As support for this, I excerpt below the table from TCEQ's guidance for fugitive emissions[23] which shows clearly that there are at least

[23] TCEQ Air Permit Technical Guidance for Chemical Sources, Fugitive Guidance, APDG 6422, June 2018. Available at https://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/fugitive-guidance.pdf

three TCEQ LDAR programs that define the maximum allowable concentration much lower than 10,000 ppmv, including 28VHP (2000 ppmv), 28MID (500 ppmv), and 28LAER (500 ppmv). Other jurisdictions in ozone non-attainment have lower thresholds. For example, in the Central Valley in California, Rule 4455 of the San Joaquin Valley Air Pollution Control District (SJVAPCD) applicable to components at petroleum refineries, gas liquids processing facilities and chemical plants, adopted as RACT in 2005, contains leak thresholds that are significantly lower. In this rule, minor leaks (which cannot be found in more than 1 or 2 components when 200 or fewer are sampled, for example, start at 100 ppm to 1000 ppm depending on the component and service.[24] The SJVAPCD rule is itself over 15 years old and more stringent than the one EPA proposes to approve here.

Not only did EPA (or TCEQ) not review the rule and recognize that the 10,000 ppmv level specified is old and obsolete, the agencies did not provide any cost calculations to show that the 2000 ppmv or the 500 ppmv levels would not be cost effective as RACT for pump and compressor seals. This is an example of why TCEQ's proposal and EPA's approval of this old and outdated rule as RACT is improper.

Table III: Leak Detection and Repair (LDAR) Program Instrument Monitoring Options

LDAR Program	28M	28RCT	28VHP	28MID	28LAER	28CNTQ	28CNTA
Leak Definition for Pumps and Compressors	10,000 ppmv	10,000 ppmv	2,000 ppmv	500 ppmv	500 ppmv	N/A	N/A
Leak Definition for All Other Components	10,000 ppmv	500 ppmv	500 ppmv	500 ppmv	500 ppmv	500 ppmv	500 ppmv
Applicable Vapor Pressure	>0.5 psia at 100°F	>0.044 psia at 68°F	>0.044 psia at 68°F	>0.044 psia at 68°F	>0.044 psia at 68°F	>0.044 psia at 68°F	>0.044 psia at 68°F
Monitoring Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Annually
Directed/Nondirected Maintenance	Nondirected	Nondirected	Nondirected	Directed	Directed	Nondirected	Nondirected
Most Common State/Federal Programs with Similar Requirements	40 CFR Part 60 Subpart VV 40 CFR Part 61 30 TAC §115.322	30 TAC §115.352[1]	40 CFR Part 60 Subpart VVa 40 CFR Part 63 Subparts H, CC	N/A	Nonattainment NSR	N/A	40 CFR Part 60Subpart VVa, 40 CFR Part 63 Subparts H, CC

Endnotes Table III

[1] **Except in Gregg, Nueces, and Victoria Counties where 28M applies.**

I also note that TCEQ itself has been incorporating better methods for leak detection than Method 21-based sniffing alone, such as incorporating Optical Gas Imaging (OGI) along with Method 21, called Enhanced LDAR, into permits. I excerpt the following from a permit issued permit to

[24] https://www.valleyair.org/rules/currntrules/r4455.pdf; 71 FR 14652 (Mar. 23, 2006).

Motiva[25] by the TCEQ, dealing with the required use of enhanced LDAR and OGI for controlling VOC emissions from fugitives.

> "11. The following enhancements to the 28MID program specified in Special Condition 10 shall be implemented. The enhancements were specified in order for the permit holder to be allowed to calculate fugitive emissions using the EPA Petroleum Industry Screening Value/Leak Rate Correlation Equations as specified in Special Condition 58.C.
>
> A. The EPA Method 21 monitoring shall be conducted with data loggers capable of assigning time stamps to individual monitoring events.
>
> B. Any component found to be leaking by physical inspection (i.e., sight, sound, or smell) shall be repaired or monitored with an approved gas analyzer within 15 days to determine whether the component is leaking in excess of 500 ppmv of VOC. If the component is found to be leaking in excess of 500 ppmv of VOC, it shall be subject to the repair and replacement requirements contained in Special Condition 10.
>
> C. The holder of this permit shall make a "first attempt" at repair on any valve that has a reading greater than 100 ppm of VOC, excluding control valves, pumps, and components that LDAR personnel are not authorized to repair. As part of the "first attempt at repair program," the holder of this permit shall record, track and re-monitor leaks above the leak definitions in Special Condition 10. However, the holder of this permit shall immediately re-monitor all valves that personnel attempted to repair to ensure that the leaks have not been made worse. If the holder of this permit can demonstrate with sufficient monitoring data that "first attempt" repair at 100 ppm worsen leaks, after 2 years the holder of this permit may request that the Executive Director reconsider or amend this requirement.
>
> D. The holder of this permit will conduct annual training of all LDAR technicians in the application of Method 21 consistent with the requirements of this permit. Documentation of this training and the technicians trained shall be recorded.
>
> E. The holder of this permit shall obtain a third party audit by no later than December 31, 2015 and then at least once every two years thereafter to verify whether EPA Method 21 is being properly applied such that the resulting screening values are reliable when used to calculate emissions as required by Special Condition 58.C. The audit shall, at a minimum, focus on comparative monitoring, records review, tagging, data management, and observation of the LDAR technicians' calibration and monitoring techniques. During the audits, leak rates shall be calculated for each process unit where comparative monitoring was performed. The audit-calculated leak rates shall be compared to the permit-authorized emission rates including any subsequent Permits by Rule. A detailed audit protocol shall be submitted to the TCEQ for approval at least 6 months prior

[25] Special Conditions for Permit Numbers 6056, PSDTX1062M2, and GHGPSDTX121.

to the first scheduled audit. Copies of the report detailing the results of the audit shall be sent to the TCEQ Air Permits Division and Regional Office.

F. Beginning no later than October 1, 2014, the holder of this permit will apply the following optical gas imaging (OGI) enhanced monitoring program for equipment leaks at those process units subject to EPA Method 21 monitoring pursuant to the special conditions of this permit. The Executive Director may extend the date for initiation of this OGI monitoring program provided the holder of this permit provides documentation demonstrating that the monitoring equipment was not available for purchase in the time frame needed to initiate the program by that date. The monitoring will be conducted using an optical gas imaging instrument as defined in 40 CFR 60.18(g)(4). OGI surveys will occur every two months at each applicable process unit at pre-established viewing stations. The number and location of the viewing stations will be designed to ensure that two thirds of the fugitive equipment components in each process unit can be viewed. Each viewing station will have a unique identification number. Any OGI leaks observed will be tagged as close as possible to the leaking component. OGI leaks will be managed in accordance with the requirements in Special Condition 10.H of this permit. Leak repairs for equipment in gas/vapor and light liquid service will be remonitored in accordance with Method 21. Leak repairs for equipment in heavy liquid service will be re-monitored with the OGI monitoring instrument. Each OGI survey will be manually documented and saved electronically. Documentation will include the OGI technician's name, process unit name, date, time, viewing station identification number and results (leaks, no leaks). Electronic records will also be maintained of individual leaks found, repairs, and re-monitor results.

After the OGI monitoring program has been implemented for a period of at least four years, the holder of this permit may evaluate the effectiveness of the program in identifying and repairing leaks. If undertaken, this evaluation will be based on the costs of conducting the OGI monitoring program and on emission rates before and after repairs of leaks detected by the program. Emission rates will be determined as specified in Special Condition 58.C. Based on the results of that evaluation, the holder of the permit may make a request to the Executive Director that the OGI monitoring program be modified or eliminated based on a demonstration that the program as originally implemented is not economically reasonable in reducing or eliminating VOC emissions."

This permit was issued in 2014. It is my opinion that, taken collectively, the above enhanced LDAR program with OGI, should be included as RACT as compared to what is currently provided in this rule.

6.2 Example 2 (30 TAC 115.212)

Next, I discuss the requirements in 115.212 that apply to loading and unloading VOC compounds. I have excerpted portions of the rule below, highlighting the requirement that a vapor control system meet a control efficiency of "at least 90%", which appears in several locations in the rule.

The rule also requires that certain transport vessels be kept vapor-tight, without defining that requirement, making it unenforceable in my opinion.

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 115	CONTROL OF AIR POLLUTION FROM VOLATILE ORGANIC COMPOUNDS
SUBCHAPTER C	VOLATILE ORGANIC COMPOUND TRANSFER OPERATIONS
DIVISION 1	LOADING AND UNLOADING OF VOLATILE ORGANIC COMPOUNDS
RULE §115.212	**Control Requirements**

(a) The owner or operator of each volatile organic compound (VOC) transfer operation, transport vessel, and marine vessel in the Beaumont/Port Arthur, Dallas/Fort Worth, El Paso, and Houston/Galveston areas shall comply with the following control requirements.

(1) General VOC loading. At VOC loading operations other than gasoline terminals, gasoline bulk plants, and marine terminals, vapors from the transport vessel caused by the loading of VOC with a true vapor pressure greater than or equal to 0.5 psia under actual storage conditions must be controlled by:
(A) a vapor control system which maintains a control efficiency of at least 90%; or
(B) a vapor balance system, as defined in §115.10 of this title (relating to Definitions); or
(C) pressurized loading.

(2) Disposal of transported vapors. After unloading, transport vessels must be kept vapor-tight until the vapors in the transport vessel are returned to a loading, cleaning, or degassing operation and discharged in accordance with the control requirements of that operation.

(3) Leak-free requirements. All land-based VOC transfer to or from transport vessels shall be conducted such that:
(A) All liquid and vapor lines are:
(i) equipped with fittings which make vapor-tight connections that close automatically when disconnected; or
…

(5) Gasoline bulk plants. The following additional control requirements apply to transfer of gasoline at gasoline bulk plants.
(A) A vapor balance system must be used between the storage tank and transport vessel. Alternatively, a vapor control system which maintains a control efficiency of at least 90% may be used to control the vapors.
…

(6) Marine terminals. The following control requirements apply to marine terminals in the Houston/Galveston area.
(A) VOC emissions shall not exceed 0.09 pound from the vapor control system vent per 1,000 gallons (10.8 mg/liter) of VOC loaded into the marine vessel, or the vapor control system shall maintain a control efficiency of at least 90%. Alternatively, a vapor balance system or pressurized loading may be used to control the vapors.
...

Source Note: The provisions of this §115.212 adopted to be effective February 19, 1990, 15 TexReg 549; amended to be effective July 17, 1991, 16 TexReg 3719; amended to be effective August 1, 1992, 17 TexReg 4683; amended to be effective December 3, 1993, 18 TexReg 8538; amended to be effective May 27, 1994, 19 TexReg 3703; amended to be effective June 16, 1995, 20 TexReg 4048; amended to be effective March 7, 1996, 21 TexReg 1548; amended to be effective May 22, 1997, 22 TexReg 4213; amended to be effective July 21, 1999, 24 TexReg5488;amended to be effective December 2, 1999, 24 TexReg 10559; amended to be effective January 18, 2001, 26 TexReg 493

This rule was last updated in January 2001 or over 20 years ago. While the requirement to maintain a control efficiency of the vapor control system at 90% may have been appropriate 20 years ago, it does not represent current RACT in my opinion. It is my experience that current control efficiencies are typically 98% and even higher and there are no technological barriers to achieving 98% vapor control efficiencies that I am aware of. And, while there may be certain additional costs associated with increasing the control efficiency from 90% to 98%, neither EPA nor TCEQ has provided any cost analysis showing that such costs are unreasonable. Since control efficiencies of 98% and 99% are widely used in permitting for these types of vapor control systems, it is my opinion that they are not cost prohibitive. Therefore, it is my opinion that EPA's approval of this 20 year old requirement as current RACT is improper and plainly does not meet the definition of RACT that I have noted prior.

7.0 TCEQ 30 TAC Chapter 117 (NOx) Rules Are Old and Outdated

Like the EPA CTG and ACT documents noted earlier, and many of TCEQ's VOC rules, all of the TCEQ's 30 TAC Chapter 117 rules dealing with NOx are also outdated since they were last updated in 2007 and have not been updated since. The table below shows the relevant rules – i.e., those containing emissions limits or control efficiencies and work practices, etc.

I use the same color coding scheme as with the EPA documents. As the table clearly shows, all of them are over a decade old (red).

30 TAC 117 (NOx RACT Rules)		
Subchapter	**Description**	**Last Modified**
SUBCHAPTER B	COMBUSTION CONTROL AT MAJOR INDUSTRIAL, COMMERCIAL, AND INSTITUTIONAL SOURCES IN OZONE NONATTAINMENT AREAS	2007
SUBCHAPTER C	COMBUSTION CONTROL AT MAJOR UTILITY ELECTRIC GENERATION SOURCES IN OZONE NONATTAINMENT AREAS	2007
SUBCHAPTER D	COMBUSTION CONTROL AT MINOR SOURCES IN OZONE NONATTAINMENT AREAS	2007
SUBCHAPTER E	MULTI-REGION COMBUSTION CONTROL	2007
SUBCHAPTER F	ACID MANUFACTURING	2007

Last Modified 2010 or Before
Last Modified Between 2011-2019
Modified After 2019

7.1 TCEQ's Top NOx Sources

Table F-4 in Appendix F of TCEQ's submittal contains a list of NOx sources in the HGB area based on actual 2017 reported NOx emissions. In the table below, I have excerpted all of the sources in TCEQ's Table F-4 with 100 tons per year or greater reported 2017 emissions. Collectively, these sources alone account for 29,084 tons per year of NOx emissions. In each case, the last column shows the NOx RACT rules that apply to each source per TCEQ. As is clear, the rules in 117.300 through 117.356 apply to almost every one of these sources. Included in these rules is 117.305 dealing with the NOx emissions from gas-fired combustion equipment, such as boilers and heaters burning natural gas, expressed in pounds per million Btu's (lb/MMBtu) of heat input to such devices. I show below that the requirements of 117.305 for gas-fired combustion equipment are outdated and are not consistent with current RACT.

NOx: Sources With Greater Than 100 tons/year Actual NOx in 2017 *(Source: TCEQ Appendix F, Table F-4)*							
RN	**Account**	**`**	**County**	**SIC**	**SIC Description**	**2017 NOx Actual tpy**	**Rules Addressing RACT**
RN100888312	FG0020V	NRG TEXAS POWER LLC	FORT BEND	4911	ELECTRIC SERVICES	5658.8	§117.1200 - §117.1256 §101.350 - §101.363
RN102212925	HG0228H	EXXONMOBIL CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	1885.8	§117.300 - §117.356 §101.350 - §101.363
RN102579307	HG0232Q	EXXONMOBIL REFINING & SUPPLY CO	HARRIS	2911	PETROLEUM REFINING	1815.5	§117.300 - §117.356 §101.350 - §101.363
RN102535077	GB0004L	GALVESTON BAY REFINING LOGISTICS	GALVESTON	2911	PETROLEUM REFINING	1673.4	§117.300 - §117.356 §101.350 - §101.363
RN100211879	HG0659W	SHELL CHEMICAL LP	HARRIS	2911	PETROLEUM REFINING	1495.2	§117.300 - §117.356 §101.350 - §101.363
RN100225945	BL0082R	DOW CHEMICAL COMPANY	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	1439.1	§117.300 - §117.356 §101.350 - §101.363
RN100238708	BL0002S	INEOS USA LLC	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	1403.3	§117.300 - §117.356 §101.350 - §101.363
RN100542281	HG0033B	EQUISTAR CHEMICALS LP	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	1089.6	§117.300 - §117.356 §101.350 - §101.363
RN100825249	BL0758C	CHEVRON PHILLIPS CHEMICAL	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	1055.6	§117.300 - §117.356 §101.350 - §101.363
RN100218130	HG0048L	HOUSTON REFINING LP	HARRIS	2911	PETROLEUM REFINING	748.2	§117.300 - §117.356 §101.350 - §101.363
RN100210319	HG0770G	EQUISTAR CHEMICALS LP	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	737.4	§117.300 - §117.356 §101.350 - §101.363
RN102323268	CI0008R	ENTERPRISE PRODUCTS	CHAMBERS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	730.2	§117.300 - §117.356 §101.350 - §101.363
RN100218049	BL0021O	BASF CORPORATION	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	568.6	§117.300 - §117.356 §101.350 - §101.363
RN100716661	HG0175D	PASADENA REFINING SYSTEM INC	HARRIS	2911	PETROLEUM REFINING	491.1	§117.300 - §117.356 §101.350 - §101.363
RN101619179	BL0042G	PHILLIPS 66 COMPANY	BRAZORIA	2911	PETROLEUM REFINING	485.7	§117.300 - §117.356 §101.350 - §101.363
RN100217033	BL0622F	SWEENY COGENERATION LP	BRAZORIA	4961	STEAM AND AIR CONDITIONING SUPPLY	430.9	§117.300 - §117.356 §101.350 - §101.363
RN100238385	GB0073P	VALERO REFINING TEXAS LP	GALVESTON	2911	PETROLEUM REFINING	397.5	§117.300 - §117.356 §101.350 - §101.363
RN108772245	BLA044R	BLUE CUBE OPERATIONS LLC	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	380.2	§117.300 - §117.356 §101.350 - §101.363

RN100223122	BL0378Q	FREEPORT POWER LIMITED	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	366.9	§117.300 - §117.356 §101.350 - §101.363
RN100219526	HG0562P	TPC GROUP LLC	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	346.7	§117.300 - §117.356 §101.350 - §101.363
RN100633650	HG1575W	LYONDELL CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	335.9	§117.300 - §117.356 §101.350 - §101.363
RN100222041	HG9954A	PASADENA COGENERATION LP	HARRIS	4911	ELECTRIC SERVICES	323.2	§117.300 - §117.356 §101.350 - §101.363
RN100210863	HG1174V	ALTURA COGEN LLC	HARRIS	4931	ELECTRIC AND OTHER SERVICES COMBINED	319.5	§117.300 - §117.356 §101.350 - §101.363
RN100233998	HG0071Q	AIR LIQUIDE AMERICA CORP	HARRIS	2813	INDUSTRIAL GASES	318.3	§117.300 - §117.356 §101.350 - §101.363
RN100542224	HG3307M	STYROLUTION AMERICA LLC	HARRIS	2865	CYCLIC CRUDES, INTERMEDIATES, ORGANIC DYES	317.5	§117.300 - §117.356 §101.350 - §101.363
RN100223205	HG0632T	ROHM AND HAAS TEXAS	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	308.9	§117.300 - §117.356 §101.350 - §101.363
RN103934493	GBA004D	SOUTH HOUSTON GREEN POWER	GALVESTON	4931	ELECTRIC AND OTHER SERVICES COMBINED	286.1	§117.300 - §117.356 §101.350 - §101.363
RN100238682	BL0038U	ASCEND PERFORMANCE MATERIALS	BRAZORIA	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	282.6	§117.300 - §117.356 §101.350 - §101.363
RN100220276	HX2342B	EIF CHANNELVIEW COGENERATION	HARRIS	4911	ELECTRIC SERVICES	281.3	§117.300 - §117.356 §101.350 - §101.363
RN100222033	HX2762V	DEER PARK ENERGY CENTER LP	HARRIS	4931	ELECTRIC AND OTHER SERVICES COMBINED	277.3	§117.300 - §117.356 §101.350 - §101.363
RN102574803	HG0229F	EXXONMOBIL CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	267.4	§117.300 - §117.356 §101.350 - §101.363
RN103919817	HG0310V	CHEVRON PHILLIPS	HARRIS	2869	INDUSTRIAL ORGANIC	250.3	§117.300 - §117.356 §101.350 - §101.363
RN100217363	HG0194W	OXYVINYLS LP	HARRIS	2812	ALKALIES AND CHLORINE	206.1	§117.300 - §117.356 §101.350 - §101.363
RN100224245	GB0153Q	TEXAS CITY COGENERATION LP	GALVESTON	4911	ELECTRIC SERVICES	195.7	§117.300 - §117.356 §101.350 - §101.363
RN100213107	HX2690V	CHANNEL ENERGY CENTER LP	HARRIS	4911	ELECTRIC SERVICES	183.1	§117.300 - §117.356 §101.350 - §101.363
RN100226067	CI0184T	BAYTOWN ENERGY CENTER LP	CHAMBERS	4911	ELECTRIC SERVICES	173.7	§117.300 - §117.356 §101.350 - §101.363
RN100226877	MQ0009F	ENTERGY TEXAS INC	MONTGOMERY	4911	ELECTRIC SERVICES	168.4	§117.1200 - §117.1256 §101.350 - §101.363
RN102576063	HG0035U	FLINT HILLS HOUSTON CHEMICAL	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	144.5	§117.300 - §117.356 §101.350 - §101.363

RN100210608	GB0055R	MARATHON PETROLEUM	GALVESTON	2911	PETROLEUM REFINING	140.3	§117.300 - §117.356 §101.350 - §101.363
RN100219310	HG0130C	VALERO REFINING TEXAS LP	HARRIS	2911	PETROLEUM REFINING	136.2	§117.300 - §117.356 §101.350 - §101.363
RN100542901	HG4955K	NRG TEXAS POWER LLC	HARRIS	4911	ELECTRIC SERVICES	116.3	§117.1200 - §117.1256 §101.350 - §101.363
RN100211523	HGA010J	ALBEMARLE CORPORATION	HARRIS	2819	INDUSTRIAL INORGANIC CHEMICALS	112.6	§117.300 - §117.356 §101.350 - §101.363
RN100216092	FG0595L	BRAZOS VALLEY ENERGY LP	FORT BEND	4911	ELECTRIC SERVICES	111	§117.1200 - §117.1256 §101.350 - §101.363
RN100214931	HG0473P	ATLANTIC COFFEE	HARRIS	2095	ROASTED COFFEE	106.2	§117.300 - §117.356 §101.350 - §101.363
RN100217413	HG0114A	WYMAN GORDON FORGINGS LP	HARRIS	3462	IRON AND STEEL FORGINGS	105.3	§117.300 - §117.356 §101.350 - §101.363
RN102184173	HG0633R	CLEAN HARBORS DEER PARK LLC	HARRIS	4953	REFUSE SYSTEMS	105.3	§117.300 - §117.356 §101.350 - §101.363
RN104150123	HGA005E	ARKEMA INC	HARRIS	2869	INDUSTRIAL ORGANIC	104.9	§117.300 - §117.356 §101.350 - §101.363
RN102523107	HG0537O	LYONDELL CHEMICAL COMPANY	HARRIS	2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	103.5	§117.300 - §117.356 §101.350 - §101.363
RN100229905	HG0665E	INEOS USA LLC	HARRIS	2821	PLASTICS MATERIALS AND SYNTHETIC RESINS	102.7	§117.300 - §117.356 §101.350 - §101.363

7.2 *Example 3 (30 TAC 117.305)*

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 117	CONTROL OF AIR POLLUTION FROM NITROGEN COMPOUNDS
SUBCHAPTER B	**COMBUSTION CONTROL AT MAJOR INDUSTRIAL, COMMERCIAL, AND INSTITUTIONAL SOURCES IN OZONE NONATTAINMENT AREAS**
DIVISION 3	HOUSTON-GALVESTON-BRAZORIA OZONE NONATTAINMENT AREA MAJOR SOURCES
RULE §117.305	**Emission Specifications for Reasonably Available Control Technology (RACT)**

(a) No person shall allow the discharge of air contaminants into the atmosphere to exceed the emission specifications of this section, except as provided in §§117.315, 117.323, or 117.9800 of this title (relating to Alternative Plant-Wide Emission Specifications; Source Cap; and Use of Emission Credits for Compliance).

(1) For purposes of this subchapter, the lower of any permit nitrogen oxides (NO_X) emission limit in effect on June 9, 1993, under a permit issued in accordance with Chapter 116 of this title (relating to Control of Air Pollution by Permits for New Construction or Modification) and the emission specifications of subsections (b) - (d) of this section apply, except that:

(A) gas-fired boilers and process heaters operating under a permit issued after March 3, 1982, with a NO_X emission limit of 0.12 pounds per million British thermal units (lb/MMBtu) heat input, are limited to that rate for the purposes of this subchapter; and

…

(b) For each boiler and process heater with a maximum rated capacity greater than or equal to 100.0 MMBtu/hr of heat input, the applicable NO_X emission specification is as follows:

(1) gas-fired boilers, as follows:

(A) low heat release boilers with no preheated air or preheated air less than 200 degrees Fahrenheit, 0.10 lb/MMBtu of heat input;

(B) low heat release boilers with preheated air greater than or equal to 200 degrees Fahrenheit and less than 400 degrees Fahrenheit, 0.15 lb/MMBtu of heat input;

(C) low heat release boilers with preheated air greater than or equal to 400 degrees Fahrenheit, 0.20 lb/MMBtu of heat input;

(D) high heat release boilers with no preheated air or preheated air less than 250 degrees Fahrenheit, 0.20 lb/MMBtu of heat input;

(E) high heat release boilers with preheated air greater than or equal to 250 degrees Fahrenheit and less than 500 degrees Fahrenheit, 0.24 lb/MMBtu of heat input; or

(F) high heat release boilers with preheated air greater than or equal to 500 degrees Fahrenheit, 0.28 lb/MMBtu of heat input;

(2) gas-fired process heaters, based on either air preheat temperature or firebox temperature, as follows:

(A) based on air preheat temperature:

(i) process heaters with preheated air less than 200 degrees Fahrenheit, 0.10 lb/MMBtu of heat input;

(ii) process heaters with preheated air greater than or equal to 200 degrees Fahrenheit and less than 400 degrees Fahrenheit, 0.13 lb/MMBtu of heat input; or

(iii) process heaters with preheated air greater than or equal to 400 degrees Fahrenheit, 0.18 lb/MMBtu of heat input; or

(B) based on firebox temperature:

(i) process heaters with a firebox temperature less than 1,400 degrees Fahrenheit, 0.10 lb/MMBtu of heat input;

(ii) process heaters with a firebox temperature greater than or equal to 1,400 degrees Fahrenheit and less than 1,800 degrees Fahrenheit, 0.125 lb/MMBtu of heat input; or

(iii) process heaters with a firebox temperature greater than or equal to 1,800 degrees Fahrenheit, 0.15 lb/MMBtu of heat input;

Source Note: The provisions of this §117.305 adopted to be effective June 14, 2007, 32 TexReg 3206

As the highlighted requirements for NOx for gas-fired equipment greater than 100 million Btu/hr heat input show, the NOx limits, depending on the type of equipment (i.e., boiler or heater) and the types of air-preheat temperature or firebox temperature, the NOx limits can range from 0.10 lb/MMBtu to as high as 0.28 lb/MMBtu. For units permitted after 1982 the limit is capped at 0.12 lb/MMBtu.

In its analysis, neither TCEQ nor EPA discusses how many such combustion devices are present in the HGB area and whether they were permitted before or after 1982. And, what their applicable NOx limits are, given the various potential limits in 117.305 which can range from 0.1 lb/MMBtu to 0.28 lb/MMBtu as noted.

In any case, even 0.10 lb/MMBtu, the lowest applicable limit is still not current RACT for gas-fired combustion equipment. This is readily verified by looking at permit limits for such equipment that EPA can readily verify, such as by reviewing the RACT/BACT/LAER Clearinghouse (RBLC) database. While the RBLC database contains equipment that have undergone BACT review, I note that EPA has relied on the RBLC database in its TSD for this rule to determine in this database contains limits that may apply as RACT.[26] It is appropriate to rely on the RBLC (but not exclusively so) because there is no question that limits in the RBLC are technically feasible, one of the requirements of RACT. And, the age and prevalence of limits in the RBLC are strong indicators of the levels that can be readily achieved, which is also indicative of RACT.

I summarize my review of the RBLC relating to gas-fired combustion equipment in the next section.

7.3 Summary of EPA RBLC Review (accessed 3/28/2021)

I searched EPA's RBLC[27] from 1/1/2016 through current (i.e., the last 5 years or so), for boilers and heaters using natural gas or gaseous fuels greater than 100 MMBtu/hr firing rate: The process codes are 12.310 (Industrial) and 13.310 (Commercial/Institutional). The results of the searches are voluminous and I am attaching the output from the 12.310 search in Attachment C to this comment report.

I have highlighted in Attachment C, numerous instances of NOx limits from gas fired units that are lower (and often significantly lower) than 0.1 lb/MMBtu, the lowest value in current rule 117.305 as discussed in the previous section. In fact, the RBLC search shows that much lower

[26] TSD, Appendix A discussion for phosphatic fertilizer plants, showing the results of the RBLC search on p. 25-27.

[27] https://cfpub.epa.gov/rblc/index.cfm?action=Search.BasicSearch&lang=en

limits apply to equipment that is not just 100 MMBtu/hr or greater but also to equipment that have smaller heat input sizes.

Values in the RBLC are as low as 0.01 lb/MMBtu for NOx, which is not inconsistent with levels that can be achieved by current low NOx and ultra low-NOx burner technologies including internal flue gas recirculation. Certainly many limits are around 0.05 lb/MMBtu as I have marked in red box highlights in Attachment C. These are readily achieved by low-NOx burner technologies.

Thus, EPA's approval of 117.305 in its current form is improper because it does not represent current RACT in my opinion.

Attachment A – Resume

RANAJIT (RON) SAHU, Ph.D, QEP, CEM (Nevada)

CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

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EXPERIENCE SUMMARY

Dr. Sahu has over thirty one 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.

He has over twenty eight years of project management experience and has successfully managed and executed numerous projects in this time period. 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.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past twenty six years include various trade associations as well as individual companies such as steel mills, petroleum refineries, chemical plants, cement manufacturers, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, land development companies, and various entities in the public sector including EPA, the US Dept. of Justice, several states (including Oregon, New Mexico, Pennsylvania, and others), various agencies such as the California DTSC, and various municipalities. Dr. Sahu has performed projects in all 50 states, numerous local jurisdictions and internationally.

In addition to consulting, for approximately twenty years, Dr. Sahu taught numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management). He also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing 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 with project management, environmental consulting, project management, as well as regulatory and engineering support consulting services.

1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for** Air Quality/Geosciences/Hazardous Waste Groups, Pasadena. Responsible for the management of a group of approximately 24 air quality and environmental professionals, 15 geoscience, and 10 hazardous waste professionals providing full-service consulting, project management, regulatory compliance and A/E design assistance in all areas.

Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.

1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department. Responsibilities included multimedia regulatory compliance and permitting (including hazardous and nuclear materials), air pollution engineering (emissions from stationary and mobile sources, control of criteria and air toxics, dispersion modeling, risk assessment, visibility analysis, odor analysis), supervisory functions and project management.

1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department. Responsibilities included permitting, tracking regulatory issues, technical analysis, and supervisory functions on numerous air, water, and hazardous waste projects. Responsibilities also include client and agency interfacing, project cost and schedule control, and reporting to internal and external upper management regarding project status.

1989-1990 Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.

1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1984 M. S., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

“Thermodynamics and Heat Transfer,” Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

"Advanced Hazardous Waste Management" University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

"Environmental Risk Assessment," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1998.

"Hazardous Waste Remediation" Loyola Marymount University, Dept. of Civil Engineering. Various years since 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

"Environmental Planning and Management," 5 week program for visiting Chinese delegation, 1994.

"Environmental Planning and Management," 1 day program for visiting Russian delegation, 1995.

"Air Pollution Planning and Management," IEP, UCR, Spring 1996.

"Environmental Issues and Air Pollution," IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-mid-1990s.

Air and Waste Management Association, West Coast Section, 1989-mid-2000s.

PROFESSIONAL CERTIFICATIONS

EIT, California (#XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, since 2000.

CEM, State of Nevada (#EM-1699). Expiration 10/07/2021.

PUBLICATIONS (PARTIAL LIST)

"Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).

"Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).

"On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).

"Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).

"Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).

"A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).

"Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R. Gavalas, *Combust. Flame*, **77**, 337-346 (1989).

"Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).

"Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.

"Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).

"HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).

"Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).

"Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).

"NOx Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

"From Purchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada," with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.

"The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants," with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

"Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).

"Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

Annex A

Expert Litigation Support

A. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

1. In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled "Hitting the Ethanol Blend Wall – Examining the Science on E15."

B. Matters for which Dr. Sahu has provided affidavits and expert reports include:

2. Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.

3. Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

4. Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

5. Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).

6. Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).

7. Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.

8. Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc*., 5:04-cv-00034-KSF (Eastern District of Kentucky).

9. Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.

10. Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.

11. Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.

12. Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.

13. Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo's eight new proposed PRB-fired PC boilers located at seven TX sites.

14. Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).

15. Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.

16. Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

17. Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.

18. Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with *General Power Products, LLC v MTD Products Inc*., 1:06 CVA 0143 (Southern District of Ohio, Western Division) .

19. Expert Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.

20. Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.

21. Affidavits (May 2010/June 2010 in the Office of Administrative Hearings))/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).

22. Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).

23. Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.us

24. Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.

25. Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone's proposed Unit 3 in Texas.

26. Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*

27. Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper's proposed Pee Dee plant in South Carolina).

28. Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.

29. Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

30. Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

31. Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

32. Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

33. Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

34. Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.

35. Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (Eastern District of Michigan).

36. Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.

37. Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (District of Colorado).

38. Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

39. Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

40. Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. Public Service Company of New Mexico* (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE) (District of New Mexico).

41. Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

42. Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

43. Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant*

Generation Company LLC, Case No. 5:10-cv-00156-DF-CMC (Eastern District of Texas, Texarkana Division).

44. Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

45. Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.

46. Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

47. Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority,* Civil Action No. 4:11-cv-00791 (Southern District of Texas, Houston Division).

48. Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

49. Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

50. Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.,* Civil Action No. A-08-CA-648-LY (Western District of Texas, Austin Division).

51. Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.,* Case No. 3:10-cv-747 (TJM/DEP) (Northern District of New York).

52. Declaration (October 2011) on behalf of the Plaintiffs in the matter of *American Nurses Association et. al. (Plaintiffs), v. US EPA (Defendant)*, Case No. 1:08-cv-02198-RMC (US District Court for the District of Columbia).

53. Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association,* Case No. 11-417-MJP (Western District of Washington).

54. Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

55. Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency,* Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).

56. Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).

57. Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality,* Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261st Judicial District).

58. Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.,* Civil Action No. 07-CV-5298 (JKG) (Eastern District of Pennsylvania).

59. Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project.

60. Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.

61. Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.

62. Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.

63. Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

64. Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.

65. Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

66. Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.

67. Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

68. Declaration (April 2013) on behalf of Petitioners in the matter of *Sierra Club, et al., (Petitioners) v Environmental Protection Agency et al. (Resppondents),* Case No., 13-1112, (Court of Appeals, District of Columbia Circuit).

69. Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

70. Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of *A. J. Acosta Company, Inc., v. County of San Bernardino*, Case No. CIVSS803651.

71. Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.

72. Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.

73. Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

74. Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.

75. Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).

76. Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States*, Civil Action No. 13-1820 RC (District Court for the District of Columbia).

77. Declaration (April 2014) on behalf of Respondent-Intervenors in the matter of *Mexichem Specialty Resins Inc., et al., (Petitioners) v Environmental Protection Agency et al.,* Case No., 12-1260 (and Consolidated Case Nos. 12-1263, 12-1265, 12-1266, and 12-1267), (Court of Appeals, District of Columbia Circuit).

78. Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).

79. Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).

80. Direct Prefiled Testimony (August 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of Consumers Energy Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17317 (Michigan Public Service Commission).

81. Declaration (July 2014) on behalf of Public Health Intervenors in the matter of *EME Homer City Generation v. US EPA* (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).

82. Expert Report (September 2014), Rebuttal Expert Report (December 2014) and Supplemental Expert Report (March 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

83. Expert Report (November 2014) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

84. *Declaration (January 2015) relating to Startup/Shutdown in the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.*

85. Pre-filed Direct Testimony (March 2015), Supplemental Testimony (May 2015), and Surrebuttal Testimony (December 2015) on behalf of Friends of the Columbia Gorge in the matter of the Application for a Site Certificate for the Troutdale Energy Center before the Oregon Energy Facility Siting Council.

86. Brief of Amici Curiae Experts in Air Pollution Control and Air Quality Regulation in Support of the Respondents, On Writs of Certiorari to the US Court of Appeals for the District of Columbia, No. 14-46, 47, 48. *Michigan et. al., (Petitioners) v. EPA et. al., Utility Air Regulatory Group (Petitioners) v. EPA et. al., National Mining Association et. al., (Petitioner) v. EPA et. al.,* (Supreme Court of the United States).

87. Expert Report (March 2015) and Rebuttal Expert Report (January 2016) on behalf of Plaintiffs in the matter of *Conservation Law Foundation v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

88. Declaration (April 2015) relating to various Technical Corrections for the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.

89. Direct Prefiled Testimony (May 2015) on behalf of the Michigan Environmental Council, the Natural Resources Defense Council, and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Increase its Rates, Amend its Rate Schedules and Rules Governing the Distribution and Supply of Electric Energy and for Miscellaneous Accounting Authority, Case No. U-17767 (Michigan Public Service Commission).

90. Expert Report (July 2015) and Rebuttal Expert Report (July 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

91. Declaration (August 2015, Docket No. 1570376) in support of "Opposition of Respondent-Intervenors American Lung Association, et. al., to Tri-State Generation's Emergency Motion;" Declaration (September 2015, Docket No. 1574820) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors for Remand Without Vacatur;" Declaration (October 2015) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors to State and Certain Industry Petitioners' Motion to Govern, *White Stallion Energy Center, LLC v. US EPA*, Case No. 12-1100 (US Court of Appeals for the District of Columbia).

92. Declaration (September 2015) in support of the Draft Title V Permit for Dickerson Generating Station (Proposed Permit No 24-031-0019) on behalf of the Environmental Integrity Project.

93. Expert Report (Liability Phase) (December 2015) and Rebuttal Expert Report (February 2016) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., Environmental Law and Policy Center, and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

94. Declaration (December 2015) in support of the Petition to Object to the Title V Permit for Morgantown Generating Station (Proposed Permit No 24-017-0014) on behalf of the Environmental Integrity Project.

95. Expert Report (November 2015) on behalf of Appellants in the matter of *Sierra Club, et al. v. Craig W. Butler, Director of Ohio Environmental Protection Agency et al.,* ERAC Case No. 14-256814.

96. Affidavit (January 2016) on behalf of Bridgewatch Detroit in the matter of *Bridgewatch Detroit v. Waterfront Petroleum Terminal Co., and Waterfront Terminal Holdings, LLC.*, in the Circuit Court for the County of Wayne, State of Michigan.

97. Expert Report (February 2016) and Rebuttal Expert Report (July 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

98. Direct Testimony (May 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

99. Declaration (June 2016) relating to deficiencies in air quality analysis for the proposed Millenium Bulk Terminal, Port of Longview, Washington.

100. Declaration (December 2016) relating to EPA's refusal to set limits on PM emissions from coal-fired power plants that reflect pollution reductions achievable with fabric filters on behalf of Environmental Integrity Project, Clean Air Council, Chesapeake Climate Action Network, Downwinders at Risk represented by Earthjustice in the matter of *ARIPPA v EPA, Case No. 15-1180.* (D.C. Circuit Court of Appeals).

101. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

102. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Backus Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

103. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Drakulic Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

104. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Deutsch Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

105. Affidavit (February 2017) pertaining to deficiencies water discharge compliance issues at the Wood River Refinery in the matter of *People of the State of Illinois (Plaintiff) v. Phillips 66 Company, ConocoPhillips Company, WRB Refining LP (Defendants)*, Case No. 16-CH-656, (Circuit Court for the Third Judicial Circuit, Madison County, Illinois).

106. Expert Report (March 2017) on behalf of the Plaintiff pertaining to non-degradation analysis for waste water discharges from a power plant in the matter of *Sierra Club (Plaintiff) v. Pennsylvania Department of Environmental Protection (PADEP) and Lackawanna Energy Center*, Docket No. 2016-047-L (consolidated), (Pennsylvania Environmental Hearing Board).

107. Expert Report (March 2017) on behalf of the Plaintiff pertaining to air emissions from the Heritage incinerator in East Liverpool, Ohio in the matter of *Save our County (Plaintiff) v. Heritage Thermal Services, Inc. (Defendant), Case No. 4:16-CV-1544-BYP*, (US District Court for the Northern District of Ohio, Eastern Division).

108. Rebuttal Expert Report (June 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight (Plaintiffs) v Coyote Creek Mining Company LLC (Defendant),* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

109. Expert Affidavit (August 2017) and Penalty/Remedy Expert Affidavit (October 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant,)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

110. Expert Report (August 2017) on behalf of Appellant in the matter of *Patricia Ann Troiano (Appellant) v. Upper Burrell Township Zoning Hearing Board (Appellee)*, Court of Common Pleas of Westmoreland County, Pennsylvania, Civil Division.

111. Expert Report (October 2017), Supplemental Expert Report (October 2017), and Rebuttal Expert Report (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

112. Declaration (December 2017) on behalf of the Environmental Integrity Project in the matter of permit issuance for ATI Flat Rolled Products Holdings, Breckenridge, PA to the Allegheny County Health Department.

113. Expert Report (Harm Phase) (January 2018), Rebuttal Expert Report (Harm Phase) (May 2018) and Supplemental Expert Report (Harm Phase) (April 2019) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

114. Declaration (February 2018) on behalf of the Chesapeake Bay Foundation, et. al., in the matter of the Section 126 Petition filed by the state of Maryland in *State of Maryland v. Pruitt (Defendant)*, Civil Action No. JKB-17-2939 (Consolidated with No. JKB-17-2873) (US District Court for the District of Maryland).

115. Direct Pre-filed Testimony (March 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of *NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC*, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

116. Expert Affidavit (April 2018) and Second Expert Affidavit (May 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

117. Direct Pre-filed Testimony and Affidavit (December 2018) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

118. Expert Report (February 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

119. Declaration (March 2019) on behalf of Earthjustice in the matter of comments on the renewal of the Title V Federal Operating Permit for Valero Houston refinery.

120. Expert Report (March 2019) on behalf of Plaintiffs for Class Certification in the matter of *Resendez et al v Precision Castparts Corporation* in the Circuit Court for the State of Oregon, County of Multnomah, Case No. 16cv16164.

121. Expert Report (June 2019), Affidavit (July 2019) and Rebuttal Expert Report (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellees) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

122. Affidavit/Expert Report (August 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

123. Expert Report (October 2019) relating to the appeal of air permit (Plan Approval) on behalf of Appellants in the matter of *Clean Air Council and Environmental Integrity Project (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection and Sunoco Partners Marketing and Terminals L.P.*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-057-L.

124. Expert Report (December 2019), Affidavit (March 2020), and Supplemental Expert Report (July 2020) on behalf of Earthjustice in the matter of *Objection to the Issuance of PSD/NSR and Title V*

permits for Riverview Energy Corporation, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

125. Affidavit (December 2019) on behalf of Plaintiff-Intervenor (Surfrider Foundation) in the matter of *United States and the State of Indiana (Plaintiffs), Surfrider Foundation (Plaintiff-Intervenor), and City of Chicago (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant),* Civil Action No. 2:18-cv-00127 (US District Court for the Northern District of Indiana, Hammond Division).

126. Declarations (January 2020, February 2020, May 2020, July 2020, and August 2020) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

127. Expert Report (April 2020) on behalf of the plaintiff in the matter of Orion Engineered Carbons, GmbH (Plaintiff) vs. Evonik Operations, GmbH (formerly Evonik Degussa GmbH) (Respondent), before the German Arbitration Institute, Case No. DIS-SV-2019-00216.

128. Expert Independent Evaluation Report (June 2020) for *PacifiCorp's Decommissioning Costs Study Reports dated January 15, 2020 and March 13, 2020 relating to the closures of the Hunter, Huntington, Dave Johnston, Jim Bridger, Naughton, Wyodak, Hayden, and Colstrip (Units 3&4) plants*, prepared for the Oregon Public Utility Commission (Oregon PUC).

129. Direct Pre-filed Testimony (July 2020) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

130. Expert Report (August 2020) and Rebuttal Expert Report (September 2020) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware Operating – NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

131. Expert Report (July 2020) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

132. Expert Report (August 2020) and Supplemental Expert Report (February 2021) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

133. Expert Report (August 2020) and Supplemental Expert Report (December 2020) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

134. Pre-filed Direct Testimony (October 2020) and Sur-rebuttal Testimony (November 2020) on behalf of petitioners (Ten Persons Group, including citizens, the Town of Braintree, the Town of Hingham, and the City of Quincy) in the matter of Algonquin Gas Transmission LLC, Weymouth MA, No. X266786 Air Quality Plan Approval, before the Commonwealth of Massachusetts, Department of Environmental Protection, the Office of Appeals and Dispute Resolution, OADR Docket Nos. 2019-008, 2019-009, 2019010, 2019-011, 2019-012 and 2019-013.

135. Expert Report (November 2020) on behalf of Protect PT in the matter of *Protect PT v. Commonwealth of Pennsylvania Department of Environmental Protection and Apex Energy (PA)*

LLC, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2018-080-R (consolidated with 2019-101-R)(the "Drakulic Appeal").

136. Expert Report (December 2020) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (Defendants)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

137. Pre-filed Testimony (January 2021) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

C. Occasions where Dr. Sahu has provided oral testimony <u>in depositions, at trial or in similar proceedings</u> include the following:

138. Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.

139. Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.

140. Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

141. Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

142. Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et* al. *v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).

143. Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia DEP.

144. Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.

145. Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.

146. Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.

147. Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.

148. Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

149. Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al*.

150. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coleto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

151. Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

152. Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

153. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).

154. Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

155. Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

156. Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

157. Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

158. Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

159. Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

160. Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

161. Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

162. Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

163. Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

164. Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

165. Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).

166. Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

167. Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

168. Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

169. Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

170. Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

171. Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

172. Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

173. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

174. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

175. Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

176. Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

177. Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

178. Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the *US Federal Trade Commission (FTC) v. ECM Biofilms* (FTC Docket #9358).

179. Deposition (February 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

180. Oral Testimony at Hearing (April 2015) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New

York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

181. Deposition (August 2015) on behalf of Plaintiff in the matter of *Conservation Law Foundation (Plaintiff) v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

182. Testimony at Hearing (August 2015) on behalf of the Sierra Club in the matter of *Amendments to 35 Illinois Administrative Code Parts 214, 217, and 225* before the Illinois Pollution Control Board, R15-21.

183. Deposition (May 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

184. Trial Testimony (October 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

185. Deposition (April 2016) on behalf of the Plaintiffs in *UNatural Resources Defense Council, Respiratory Health Association, and Sierra Club (Plaintiffs) v. Illinois Power Resources LLC and Illinois Power Resources Generation LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (Central District of Illinois, Peoria Division).

186. Trial Testimony at Hearing (July 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

187. Trial Testimony (December 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

188. Trial Testimony (July-August 2016) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

189. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

190. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Backus Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

191. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Drakulic Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

192. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Deutsch Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

193. Deposition Testimony (July 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight v Coyote Creek Mining Company LLC (Defendant)* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

194. Deposition Testimony (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

195. Deposition Testimony (December 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

196. Deposition Testimony (January 2018) in the matter of National Parks Conservation Association (NPCA) v. State of Washington Department of Ecology and British Petroleum (BP) before the Washington Pollution Control Hearing Board, Case No. 17-055.

197. Trial Testimony (January 2018) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

198. Trial Testimony (April 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

199. Deposition (June 2018) (harm Phase) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

200. Trial Testimony (July 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

201. Deposition (January 2019) and Trial Testimony (January 2019) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

202. Deposition (February 2019) and Trial Testimony (March 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

203. Deposition (June 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

204. Deposition (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellees) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

205. Deposition (December 2019) on behalf of the Plaintiffs in the matter of David Kovac, individually and on behalf of wrongful death class of Irene Kovac v. BP Corporation North America Inc., Circuit Court of Jackson County, Missouri (Independence), Case No. 1816-CV12417.

206. Deposition (February 2020) and testimony at Hearing (August 2020, virtual) on behalf of Earthjustice in the matter of *Objection to the Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation*, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

207. Hearing (July 14-15, 2020, virtual) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

208. Hearing (September 2020, virtual) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware* Operating – *NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

209. Deposition (December 2020, March 4-5, 2021, all virtual) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

210. Hearing (September 2020, virtual) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

211. Deposition (December 2020, virtual and Hearing February 2021, virtual) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

212. Deposition (January 2021, virtual) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

213. Deposition (February 2021) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (*Defendants*)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

214.

Attachment B – Monitored Ozone Values in the HGB (2019, 2020 Ozone Seasons)

Monitoring Site	May-19																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Houston East C1/G316	31	31	22	50	53	55	NV	NA	NV	38	15	30	58	58	51	51	36	25	30	21	23	23	22	35	34	45	40	23	37	35	42
Houston Aldine C8/AF108/X150	33	38	22	NV	66	62	38	31	47	46	21	36	51	64	64	59	41	25	38	25	26	27	27	42	41	52	46	28	38	47	59
Channelview C15/AH115	28	32	22	48	45	46	38	29	48	48	20	30	50	57	49	49	35	25	28	18	23	23	24	36	35	44	40	22	35	27	43
Northwest Harris Co. C26/A110/X154	31	35	28	43	60	58	44	35	42	36	17	36	45	60	76	61	35	25	36	25	26	28	28	39	35	41	40	27	35	42	40
Hou.DeerPrk2 C35/235/1001/AFH139FP239	32	33	27	54	49	53	46	35	50	53	21	31	58	55	50	51	38	27	26	20	24	25	27	38	38	45	39	25	38	32	40
Seabrook Friendship Park C45	31	32	27	47	43	49	43	34	49	48	22	30	51	52	48	48	39	27	20	18	22	24	26	35	34	40	37	25	37	30	33
Houston Bayland Park C53/A146	34	38	NV	NA	NA	NA	NV	41	51	49	22	45	80	69	60	58	37	29	34	22	26	27	27	38	36	45	45	26	38	44	42
Conroe Relocated C78/A321	42	41	26	45	55	62	43	NV	40	40	25	37	47	57	57	61	48	29	43	38	32	37	36	48	48	54	50	36	46	37	42
Manvel Croix Park C84	31	33	26	59	47	47	NV	31	NA	NA	NA	NA	NA	NV	56	50	31	27	30	21	23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Clinton C403/C304/AH113	23	30	20	51	48	47	37	27	40	44	16	30	56	54	45	47	29	21	26	16	20	19	20	31	31	41	37	20	31	30	43
Houston North Wayside C405	29	32	20	48	55	53	35	28	NV	39	18	31	46	54	53	50	35	23	30	20	22	23	23	36	34	44	39	22	34	35	48
Houston Monroe C406	25	28	21	48	43	44	NV	NA	NV	43	13	29	51	49	48	51	32	27	27	19	23	23	24	33	32	40	39	25	37	34	39
Lang C408	31	33	22	49	55	53	44	30	44	33	19	37	51	65	59	55	34	25	36	22	24	26	26	36	35	42	43	24	36	44	44
Houston Croquet C409	31	33	26	53	49	49	47	33	46	45	17	41	66	57	53	51	33	26	28	19	23	24	23	33	32	39	40	23	35	34	34
Houston Westhollow C410/C3003	33	35	29	51	53	51	50	34	56	46	17	40	77	69	59	54	33	25	34	22	24	27	25	36	33	41	38	24	37	42	42
Park Place C416	31	33	24	56	52	53	47	32	47	50	14	35	66	57	49	52	33	26	29	19	23	24	23	34	32	40	40	24	36	37	43
Baytown Wetlands Center C552	24	26	18	36	32	39	24	19	30	39	11	24	41	43	40	40	29	20	13	11	14	15	18	24	24	32	32	17	28	22	22
Crosby Library C553	25	25	19	31	38	38	27	25	35	35	12	24	38	49	45	43	29	22	25	15	19	20	20	29	29	36	36	19	33	31	36
West Houston C554	54	56	57	58	54	54	53	56	57	56	55	55	53	53	57	56	55	56	55	58	56	56	57	58	56	54	54	53	54	56	NV
La Porte Sylvan Beach C556	NA	18	20	34	30	35	29	24	29	29	12	18	34	35	36	38	31	19	13	12	13	17	18	25	23	28	27	18	26	22	24
Tom Bass C558	32	34	28	59	50	52	47	36	48	53	20	40	63	56	52	54	34	28	29	21	29	29	27	36	34	41	41	29	40	39	NV
Katy Park C559	NV	34	30	46	52	51	48	34	49	37	13	39	67	74	62	52	33	24	33	23	24	27	26	37	35	42	39	24	33	41	40
Atascocita C560	25	26	17	32	43	42	29	22	36	35	13	22	37	45	41	41	32	19	28	17	18	20	20	30	31	39	33	19	28	31	37
Meyer Park C561	32	34	21	40	63	59	38	30	44	38	18	34	44	58	66	57	36	24	35	24	25	27	28	39	36	44	42	26	37	45	44
Huffman Wolf Road C563	21	20	14	22	29	29	21	18	NV	NV	11	18	25	35	29	29	22	18	23	15	17	17	17	23	22	26	26	17	24	24	25
HRM-3 Haden Road C603/A114	29	33	23	51	52	52	37	NV	47	50	17	31	60	58	53	52	37	24	29	20	24	25	25	39	38	46	41	24	34	36	41
Wallisville Road C617	33	34	27	43	45	48	40	34	51	53	22	33	51	59	49	51	37	29	25	20	23	24	24	33	34	42	42	25	38	34	38
Danciger C618	NA	NA	NV	52	48	42	45	35	NV	NA	NA	NA	NA	NV	54	43	NA	NV	25	19	23	23	25	33	27	37	34	24	33	27	26
Texas City 34th St. C620	36	35	33	65	50	NV	49	39	59	NV	36	35	54	61	57	57	48	34	25	NV	NV	28	33	38	40	45	44	29	42	31	38
UH Moody Tower C695	34	36	27	60	56	57	49	34	NV	NV	NV	NA	72	66	53	55	36	28	32	22	26	26	25	37	35	43	42	25	40	42	47
UH WG Jones Forest C698	38	39	24	45	61	67	42	33	41	42	23	38	48	60	62	65	49	29	43	36	31	35	35	51	47	56	49	33	43	46	47
UH West Liberty C699	32	33	NV	NA	NA	NA	34	30	44	44	17	30	42	59	49	48	33	27	32	19	24	23	23	32	32	40	42	24	39	35	36
Lynchburg Ferry C1015/A165	29	33	25	36	41	47	41	33	48	51	18	26	52	54	48	48	36	27	24	18	24	24	25	36	34	41	40	23	37	33	34
Lake Jackson C1016	32	30	26	52	46	47	50	37	53	54	23	45	54	55	56	48	35	30	20	19	24	25	30	35	31	40	40	26	38	24	27
Baytown Garth C1017	NV	44	36	54	57	64	53	45	NV	NA	NA	NA	NA	NA	NV	49	37	30	27	21	25	26	27	35	35	43	42	27	40	37	41
Galveston 99th St. C1034/A320/X183	33	32	39	70	46	NV	47	39	56	59	46	32	48	58	56	55	47	34	26	20	25	27	33	36	41	44	44	NV	NA	NV	34
UH Smith Point C1606	34	38	NV	NV	45	51	43	NV	NV	NA	NA	NA	49	56	53	54	46	32	25	NV	NA	NA	NA	NA	NA	NV	NA	NV	40	NV	NA
Oyster Creek C1607	33	29	29	53	45	51	49	NV	NV	31	14	25	33	53	NV	47	37	29	18	16	19	23	28	32	33	37	37	26	38	24	NV

Monitoring Site	Jun-19																													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Houston East C1/G316	65	40	57	34	11	62	56	55	88	36	52	65	53	64	22	31	76	58	27	18	15	19	21	40	17	19	22	39	32	38
Houston Aldine C8/AF108/X150	81	48	72	43	17	62	59	56	72	42	58	70	64	71	22	40	81	61	35	21	20	21	25	47	22	19	28	55	34	50
Channelview C15/AH115	71	47	45	30	18	56	57	NV	NV	42	50	62	59	67	21	37	76	58	30	19	14	19	23	43	17	18	29	47	33	58
Northwest Harris Co. C26/A110/X154	42	36	58	42	17	48	54	48	63	41	54	56	54	66	25	NV	NV	49	27	21	22	22	27	51	24	23	22	37	30	34
Hou.DeerPrk2 C35/235/1001/AFH139FP239	63	37	48	32	19	60	59	60	74	45	68	78	66	67	22	37	65	57	25	21	17	22	23	47	21	23	30	32	34	45
Seabrook Friendship Park C45	56	34	37	28	21	43	56	63	57	43	59	67	63	63	20	37	59	46	22	17	16	21	22	47	23	20	27	33	34	56
Houston Bayland Park C53/A146	46	33	44	30	20	56	59	61	83	54	78	91	80	68	25	43	70	NV	NV	19	22	24	24	50	22	22	22	37	35	40
Conroe Relocated C78/A321	41	42	61	51	21	47	51	48	43	40	48	55	50	83	28	43	60	54	36	27	32	29	31	55	33	26	32	38	32	49
Manvel Croix Park C84	NA	NA	NA	NA	NV	52	52	59	62	54	80	90	79	61	18	38	52	46	21	17	16	19	20	46	20	17	NA	NV	31	28
Clinton C403/C304/AH113	55	34	45	26	15	53	51	53	92	44	58	73	62	54	NA	NA	NV	40	20	13	14	17	21	40	13	17	15	27	32	31
Houston North Wayside C405	66	38	59	32	14	50	49	49	73	39	49	62	53	60	16	31	67	50	24	15	14	16	19	38	14	17	21	36	28	37
Houston Monroe C406	44	30	41	27	17	54	55	58	69	41	67	81	71	55	19	37	55	49	22	16	15	19	20	43	20	18	24	28	32	32
Lang C408	55	37	51	33	15	52	54	51	88	41	60	74	62	64	23	40	75	51	31	21	20	21	24	43	22	16	21	42	30	41
Houston Croquet C409	33	25	35	23	16	48	50	53	68	47	83	84	75	58	20	34	61	46	21	15	17	18	18	42	20	NV	18	28	30	33
Houston Westhollow C410/C3003	39	34	41	27	19	48	52	56	76	47	67	70	65	61	24	43	55	49	22	18	16	19	NV	47	22	21	21	32	30	36
Park Place C416	49	33	46	30	14	56	56	57	88	49	68	82	72	61	21	35	65	NV	NV	17	17	21	23	45	20	20	21	31	37	36
Baytown Wetlands Center C552	44	30	25	19	12	40	NV	NA	NA	NA	NV	50	48	52	16	23	55	37	14	10	9	13	12	23	8	10	12	16	16	38
Crosby Library C553	50	49	41	28	13	54	37	42	49	35	40	47	42	59	19	29	56	54	28	19	14	18	17	34	16	15	23	45	22	48
West Houston C554	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	55	56	21	36	48	42	20	16	16	19	21	43	19	NV	NV	NV	NA	NA
La Porte Sylvan Beach C556	37	24	24	19	15	30	37	42	35	28	39	45	51	51	17	28	46	32	13	12	12	18	18	35	17	15	NV	29	32	52
Tom Bass C558	NV	NA	NA	NA	26	55	55	60	73	54	79	91	80	62	33	39	60	52	28	23	25	NA	NV	38	26	24	27	30	35	35
Katy Park C559	41	33	43	28	19	41	49	55	71	41	60	58	58	65	23	41	51	47	21	17	16	14	17	47	22	21	22	30	31	35
Atascocita C560	53	40	46	29	12	39	38	35	39	28	35	43	39	59	30	32	56	43	26	15	13	15	18	38	15	12	23	38	22	38
Meyer Park C561	56	39	63	45	16	43	48	45	60	NA	NA	NV	53	68	23	37	63	47	28	20	23	22	24	48	23	22	21	39	27	40
Huffman Wolf Road C563	29	36	30	21	13	33	30	27	28	25	27	31	27	40	14	24	36	35	24	18	13	15	16	27	15	13	17	25	19	32
HRM-3 Haden Road C603/A114	69	41	52	32	14	59	55	54	86	40	53	64	56	59	19	33	75	57	27	18	15	19	24	42	15	NV	26	39	31	41
Wallisville Road C617	56	53	37	28	22	65	57	53	62	42	52	58	53	66	22	38	76	61	28	NA	NV	25	27	46	21	22	26	48	33	57
Danciger C618	23	20	24	18	19	43	36	52	57	60	53	57	73	55	19	40	50	42	18	19	17	21	18	47	22	20	20	23	28	30
Texas City 34th St. C620	46	31	42	28	24	51	54	73	74	47	72	83	77	68	23	44	59	51	25	20	20	26	26	55	26	23	30	38	35	47
UH Moody Tower C695	52	36	50	32	16	62	59	59	93	49	69	83	75	65	23	39	77	58	26	19	18	22	25	48	23	22	25	37	38	40
UH WG Jones Forest C698	59	48	71	55	20	49	55	51	51	43	53	60	55	83	28	NV	64	NV	35	26	30	28	30	59	32	27	29	36	31	52
UH West Liberty C699	40	57	43	28	18	57	49	43	44	40	43	51	46	65	21	38	58	55	37	NV	18	21	25	43	23	19	25	46	31	51
Lynchburg Ferry C1015/A165	70	44	38	NV	NV	58	55	48	69	32	49	58	61	66	22	38	77	53	27	21	17	22	25	46	18	19	26	47	31	59
Lake Jackson C1016	23	21	22	20	22	38	35	50	48	63	54	57	68	59	20	42	47	41	18	17	17	21	18	49	25	22	24	26	29	31
Baytown Garth C1017	57	55	39	30	23	68	58	53	63	42	49	56	52	67	24	40	76	63	30	22	19	25	28	50	24	23	28	50	36	58
Galveston 99th St. C1034/A320/X183	43	24	38	28	25	53	43	81	73	44	72	73	81	70	21	45	51	48	29	17	20	25	23	55	29	26	29	38	40	42
UH Smith Point C1606	NV	NV	NA	NA	NV	NA	NA	NV	NA	NV	NV	NV	NV	NA	NA	NA	NA	NV	26	NV	NA	NA	NV	NV	NA	NA	NV	NV	NV	56
Oyster Creek C1607	NV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	32	15	12	NA	NA	NA	NA	NA	NA	NV	29	31	33

Monitoring Site	Jul-19																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Houston East C1/G316	43	28	25	18	24	42	38	29	31	57	39	43	33	39	26	26	25	24	22	24	26	23	28	36	NV	NV	46	23	19	30	54
Houston Aldine C8/AF108/X150	52	33	30	24	33	47	42	38	45	66	39	NV	37	40	27	30	30	32	30	29	33	36	37	51	54	64	55	28	24	34	52
Channelview C15/AH115	45	28	23	21	25	61	45	30	31	56	39	48	33	41	26	27	23	23	23	25	30	24	33	41	48	57	44	23	22	32	39
Northwest Harris Co. C26/A110/X154	43	31	29	22	27	36	28	30	32	36	40	47	35	36	29	27	28	30	29	30	26	26	37	49	51	60	54	21	23	27	42
Hou.DeerPrk2 C35/235/1001/AFH139FP239	43	28	25	19	21	37	32	23	27	44	50	49	36	40	28	26	22	24	23	23	26	25	36	47	64	59	47	25	22	31	47
Seabrook Friendship Park C45	41	24	23	18	17	35	33	22	23	33	46	44	34	34	23	20	20	19	20	19	24	24	30	40	51	47	37	21	19	24	37
Houston Bayland Park C53/A146	44	29	NV	21	23	34	35	29	33	49	59	59	42	40	27	24	28	27	25	27	28	NV	43	60	74	73	56	28	23	31	53
Conroe Relocated C78/A321	56	35	43	31	47	51	34	39	48	42	33	47	35	33	30	35	NV	43	44	43	28	32	38	47	46	51	45	29	28	27	32
Manvel Croix Park C84	36	19	16	NV	NV	NV	30	25	27	42	NA	NV	42	36	24	19	23	24	20	22	22	23	39	55	79	57	44	24	18	26	37
Clinton C403/C304/AH113	33	21	18	17	19	31	30	22	25	53	47	49	37	39	22	22	21	21	18	22	24	20	36	44	59	62	45	23	15	24	46
Houston North Wayside C405	41	25	22	18	24	37	35	26	30	54	39	43	32	33	20	23	23	23	22	23	25	24	32	40	45	55	47	22	18	25	49
Houston Monroe C406	37	22	23	18	20	31	29	23	25	39	52	49	40	37	24	24	23	21	19	21	22	22	31	45	69	53	43	25	20	NV	39
Lang C408	42	30	26	20	25	40	35	31	39	53	45	47	36	39	29	24	28	27	26	27	28	26	34	50	60	64	59	25	20	28	56
Houston Croquet C409	39	23	22	17	19	28	29	22	24	43	54	53	37	36	23	21	25	23	21	24	24	24	37	54	77	60	49	24	18	29	42
Houston Westhollow C410/C3003	39	28	26	21	23	37	31	25	28	NV	53	52	36	NV	25	25	25	24	23	26	27	23	41	58	73	76	64	24	21	NV	49
Park Place C416	40	24	25	20	24	34	33	26	29	48	54	51	40	40	27	26	27	24	23	24	25	23	34	45	69	61	48	26	20	30	47
Baytown Wetlands Center C552	24	15	10	9	10	24	19	13	14	31	22	32	22	28	12	11	13	18	20	23	27	22	34	45	54	54	38	22	19	30	36
Crosby Library C553	41	26	20	17	27	54	37	29	32	41	34	45	31	40	26	27	27	26	26	27	32	29	31	40	47	59	39	26	24	31	34
West Houston C554	NA	NV	28	30	21	37	26	29	24	NV	NV	44	24	33	17	NV	27	24	23	25	NV	19	37	42	NV	46	54	35	23	24	51
La Porte Sylvan Beach C556	38	22	22	17	16	32	30	21	21	32	38	42	31	34	21	18	19	18	19	19	24	22	28	39	44	42	34	21	16	27	32
Tom Bass C558	41	27	28	22	24	32	30	27	27	41	59	48	43	40	24	26	23	25	24	24	28	27	38	51	82	59	45	31	23	31	45
Katy Park C559	36	26	25	18	18	26	28	24	24	32	40	43	35	36	26	22	23	23	23	25	26	25	42	57	70	81	53	NV	NV	NV	NA
Atascocita C560	41	23	20	15	26	43	31	29	31	43	25	33	23	27	19	22	21	20	28	29	28	25	30	40	41	54	45	23	22	27	39
Meyer Park C561	45	27	25	21	29	41	31	32	37	46	38	44	32	33	26	27	27	32	30	31	26	27	38	53	54	63	56	22	21	26	43
Huffman Wolf Road C563	29	19	18	15	25	37	26	24	26	27	21	28	18	19	16	20	19	20	NV	NA	NA	NV	36	43	47	64	47	33	33	34	37
HRM-3 Haden Road C603/A114	42	26	22	NV	NV	41	NV	27	29	52	36	43	32	36	25	19	25	25	22	23	26	NV	33	42	55	60	40	22	19	30	47
Wallisville Road C617	NV	NV	25	24	28	52	50	32	34	56	38	48	33	39	29	25	28	26	27	28	33	28	36	44	51	61	45	26	25	36	46
Danciger C618	34	23	20	16	15	25	25	19	20	25	48	56	37	35	20	19	19	19	17	18	22	21	45	66	66	57	41	17	17	26	28
Texas City 34th St. C620	43	29	28	23	20	35	35	24	24	33	61	58	46	38	29	25	25	24	24	23	27	29	42	48	65	52	43	25	23	24	41
UH Moody Tower C695	42	27	28	21	26	36	38	28	32	55	53	54	42	41	28	29	28	27	25	25	27	29	39	50	67	70	53	28	23	31	54
UH WG Jones Forest C698	57	40	39	28	41	50	35	39	49	42	39	50	37	35	31	35	38	41	43	40	31	31	41	51	51	57	50	26	27	28	41
UH West Liberty C699	42	29	23	22	35	53	42	37	40	42	32	45	27	32	26	29	27	30	28	29	30	27	32	40	44	61	41	28	30	31	33
Lynchburg Ferry C1015/A165	42	29	22	20	20	50	38	24	25	52	30	38	27	36	26	25	22	21	23	23	25	23	28	38	47	53	42	23	21	30	40
Lake Jackson C1016	37	23	19	17	15	24	26	17	18	19	59	60	38	35	22	21	19	19	17	18	20	21	47	52	63	NV	NA	NA	NV	21	30
Baytown Garth C1017	44	29	25	23	27	53	52	34	34	57	37	47	33	38	28	24	27	26	26	26	32	29	35	43	49	60	44	25	24	36	43
Galveston 99th St. C1034/A320/X183	40	27	25	21	20	32	32	20	19	25	66	52	45	34	29	22	22	21	22	20	25	26	35	46	59	48	39	24	20	20	34
UH Smith Point C1606	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	37
Oyster Creek C1607	39	25	23	17	15	26	29	17	18	20	55	62	40	30	24	20	19	NV	17	17	21	21	46	49	58	50	37	19	18	21	31

Monitoring Site	Aug-19																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Houston East C1/G316	53	**57**	**55**	36	37	30	25	27	27	25	28	33	38	54	**74**	NV	19	18	20	22	24	25	16	38	23	NV	27	43	49	38	48
Houston Aldine C8/AF108/X150	**55**	**64**	**55**	50	**60**	41	33	38	35	31	36	46	51	54	**69**	**68**	NV	NA	NA	NV	33	33	25	45	23	25	34	34	**65**	50	**56**
Channelview C15/AH115	44	51	**55**	42	52	33	28	30	31	27	29	35	45	51	**57**	**59**	26	21	24	24	28	25	22	39	26	24	35	35	43	38	47
Northwest Harris Co. C26/A110/X154	46	46	35	39	38	36	26	31	30	26	30	33	34	33	47	**55**	29	23	32	21	31	50	30	45	26	28	33	40	**70**	54	53
Hou.DeerPrk2 C35/235/1001/AFH139FP239	46	**67**	**64**	35	35	31	22	29	29	25	29	31	33	**59**	**107**	**62**	22	18	22	NV	25	29	22	37	29	24	29	44	44	43	52
Seabrook Friendship Park C45	34	47	48	29	29	25	19	27	25	18	23	25	27	45	**90**	53	19	15	18	21	21	24	24	30	25	20	25	28	37	44	46
Houston Bayland Park C53/A146	**73**	**69**	**60**	38	42	32	25	34	33	28	28	36	38	52	**73**	51	25	21	24	26	29	35	29	49	26	26	27	47	NV	37	**76**
Conroe Relocated C78/A321	40	44	35	39	39	47	39	34	44	39	36	47	41	33	41	51	34	29	45	35	40	35	27	29	28	37	48	31	52	42	49
Manvel Croix Park C84	38	47	44	32	28	24	18	25	23	19	23	25	25	41	**63**	36	19	16	18	19	21	26	22	36	23	21	21	32	44	29	**56**
Clinton C403/C304/AH113	**57**	**60**	**57**	35	NV	26	19	23	20	21	25	24	30	51	**78**	48	18	17	19	18	21	26	17	36	23	18	16	39	46	35	46
Houston North Wayside C405	49	51	50	39	44	31	23	26	24	23	28	34	41	46	**64**	**56**	21	17	22	20	27	31	16	39	21	20	25	32	54	40	47
Houston Monroe C406	49	**58**	53	32	31	25	19	25	23	21	26	NV	NV	NV	**82**	49	20	19	20	21	21	28	21	35	24	21	22	40	50	32	**61**
Lang C408	**60**	**67**	52	39	45	33	27	31	33	33	28	38	41	48	**64**	54	25	21	27	24	32	36	24	49	23	27	31	38	**69**	42	**63**
Houston Croquet C409	**56**	**57**	51	32	33	25	19	25	23	20	23	27	27	45	**65**	40	20	16	18	20	22	28	25	39	23	22	21	37	50	30	**65**
Houston Westhollow C410/C3003	**72**	**62**	49	37	35	29	22	27	26	24	28	27	33	44	**60**	43	24	20	25	21	25	34	31	46	23	24	27	40	**60**	38	**67**
Park Place C416	**59**	**70**	**61**	34	36	29	21	27	25	22	28	29	31	**56**	**86**	**55**	22	18	23	24	26	29	24	41	25	23	24	49	**61**	36	**58**
Sheldon C551	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	29
Baytown Wetlands Center C552	35	**57**	**60**	33	39	31	21	27	27	20	26	29	32	54	**67**	49	20	14	17	20	24	23	22	29	29	20	27	33	31	33	46
Crosby Library C553	36	45	47	39	43	39	31	30	30	29	34	41	49	39	41	49	26	20	28	28	34	25	25	34	25	26	39	24	43	35	40
West Houston C554	45	**57**	41	33	35	29	19	50	49	20	34	33	31	33	**65**	NV	NA	NA	NV	15	NV	NA	NA	NA	NA	NA	NV	38	**62**	38	**61**
La Porte Sylvan Beach C556	30	42	47	26	29	25	17	23	22	16	21	23	23	49	**72**	49	18	14	15	18	20	22	23	26	23	16	21	26	31	38	41
Mercer Arboretum C557	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	22	31	29	25	33	18	27	37	23	45	46	43
Tom Bass C558	52	**56**	53	35	35	NV	NA	NV	24	21	24	27	27	48	**74**	44	21	18	21	22	23	30	24	39	24	23	24	40	53	31	**62**
Katy Park C559	NA	NA	NA	NA	NA	NV	22	27	25	22	25	27	32	39	**55**	44	24	21	24	21	25	37	33	45	22	25	25	38	**56**	37	**59**
Atascocita C560	41	43	43	44	49	37	31	31	28	29	32	43	45	33	NV	NV	27	23	30	28	35	29	27	34	26	29	41	17	46	44	45
Meyer Park C561	49	51	44	43	44	32	26	28	30	33	31	39	43	36	50	**58**	26	23	33	22	35	44	25	47	22	28	36	34	**67**	**61**	**55**
Bunker Hill Village C562	NA	NA	NA	NA	NA	NA	NV	24	26	27	24	29	33	40	**55**	33	17	15	17	16	23	28	23	39	17	23	24	33	54	29	**58**
Huffman Wolf Road C563	43	44	42	46	42	46	40	39	41	40	38	51	51	39	42	52	33	28	37	40	40	28	30	34	30	34	46	26	49	39	45
HRM-3 Haden Road C603/A114	50	**60**	54	36	40	28	24	NV	NV	24	28	33	41	53	NV	NV	22	NV	NV	24	24	28	18	40	26	23	31	49	44	40	48
Wallisville Road C617	41	**55**	54	42	49	39	29	NA	NA	NA	NA	NA	NV	42	43	50	24	21	24	26	31	25	27	37	32	28	35	35	38	35	48
Danciger C618	32	35	36	30	18	24	NV	NV	23	20	25	24	24	28	NV	NV	21	NA	NA	NV	9	14	12	16	10	13	10	12	NV	NV	43
Texas City 34th St. C620	40	47	51	35	30	25	NV	28	25	NA	NA	NV	NA	NA	NA	NA	NA	NA	NV	19	20	27	26	29	28	19	25	31	42	47	50
UH Moody Tower C695	**66**	**67**	**63**	37	43	33	23	29	27	24	28	34	39	**58**	**88**	**61**	24	20	26	26	29	33	26	45	26	25	28	54	**67**	40	**66**
UH WG Jones Forest C698	45	49	NV	24	NV	46	36	35	38	39	39	45	43	36	49	**60**	33	29	42	30	41	39	33	33	30	35	47	35	**60**	53	**56**
UH West Liberty C699	37	37	38	40	33	37	33	33	38	32	34	44	45	32	34	46	29	21	30	28	32	25	24	28	26	29	39	21	39	32	39
Lynchburg Ferry C1015/A165	40	**60**	**58**	33	40	32	22	28	29	22	26	28	34	48	**68**	**55**	22	18	22	24	26	24	23	34	27	24	32	41	37	36	44
Lake Jackson C1016	28	32	NV	NV	19	17	14	23	20	15	20	19	17	21	30	23	16	15	15	16	18	NV	22	26	19	NV	15	22	34	24	39
Baytown Garth C1017	39	54	51	40	47	37	27	31	32	26	32	38	49	NV	NV	52	25	20	24	27	34	26	28	37	32	NA	NV	NV	40	37	49
Galveston 99th St. C1034/A320/X183	39	38	36	31	26	21	16	23	21	17	23	22	19	30	**81**	43	19	21	19	22	25	NV	28	29	27	18	20	28	41	50	**55**
UH Smith Point C1606	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	NV	NA	NA	NV	19	19	NV	NV	27	29	32	32	21	26	31	37	45	49
Oyster Creek C1607	28	30	34	25	22	19	15	23	21	16	21	19	18	22	33	25	16	17	16	20	20	24	26	26	23	19	16	22	34	37	42

Monitoring Site	Sep-19																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Houston East C1/G316	42	32	33	46	66	70	51	36	47	44	27	36	49	49	41	26	28	24	18	30	31	29	29	41	44	56	25	35	34	27
Houston Aldine C8/AF108/X150	45	36	29	51	93	85	63	49	58	49	36	49	53	57	44	38	35	25	27	38	42	35	35	57	53	67	27	45	43	35
Channelview C15/AH115	43	31	30	48	65	62	62	45	48	43	27	34	47	49	42	29	30	27	21	32	30	28	28	37	40	52	25	35	33	26
Northwest Harris Co. C26/A110/X154	44	35	30	45	86	73	44	40	53	45	46	58	48	53	38	38	30	24	25	28	43	33	42	65	53	73	30	39	38	33
Hou.DeerPrk2 C35/235/1001/AFH139FP239	50	38	46	49	61	62	44	33	48	42	27	35	51	54	42	31	31	NA	NA	NV	35	31	31	43	46	47	34	39	37	31
Seabrook Friendship Park C45	45	32	39	43	51	74	43	35	47	42	NA	NV	46	51	43	36	35	32	25	37	29	29	27	38	40	38	34	35	34	29
Houston Bayland Park C53/A146	57	43	50	68	73	72	47	37	53	50	38	49	69	65	57	39	30	35	31	33	39	33	34	53	45	71	31	35	34	26
Conroe Relocated C78/A321	43	36	27	41	63	67	61	58	63	47	38	39	43	49	38	37	30	27	29	35	34	39	38	50	62	47	39	46	42	36
Manvel Croix Park C84	59	44	44	48	58	54	36	31	47	41	28	36	57	61	46	35	33	30	19	33	32	30	27	43	36	45	25	31	29	23
Clinton C403/C304/AH113	43	33	37	49	59	63	43	33	40	38	27	36	51	51	43	NV	30	24	19	NV	32	29	25	38	37	55	23	32	33	26
Houston North Wayside C405	39	31	26	46	74	73	51	39	47	44	29	37	44	48	39	29	27	15	16	25	32	28	28	43	45	58	17	35	34	27
Houston Monroe C406	54	40	45	47	57	61	41	33	44	40	30	38	55	59	45	34	35	31	21	32	35	28	27	41	39	49	26	30	30	25
Lang C408	49	37	31	50	79	75	48	37	47	43	35	42	50	55	41	32	28	24	24	26	36	29	33	NV	46	71	24	33	33	27
Houston Croquet C409	52	38	50	51	60	57	39	32	46	41	30	39	60	58	48	35	28	30	25	29	32	29	30	44	38	48	26	31	29	23
Houston Westhollow C410/C3003	53	42	NV	62	70	65	39	35	46	45	36	43	63	61	50	39	29	34	29	33	35	30	34	49	43	67	31	35	32	26
Park Place C416	51	39	47	52	64	68	46	36	47	44	32	40	60	58	51	35	35	30	21	33	35	31	32	46	42	56	26	34	35	28
Sheldon C551	33	27	23	47	65	61	25	22	23	20	10	16	23	21	17	16	15	NV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Baytown Wetlands Center C552	43	32	44	47	52	64	53	40	50	42	23	30	50	51	42	32	33	29	23	33	28	27	29	36	38	39	34	34	34	27
Crosby Library C553	39	31	27	50	62	64	74	53	51	45	27	37	40	48	37	34	NV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV
West Houston C554	49	39	37	53	76	69	40	36	47	42	39	46	55	57	43	38	28	28	26	31	36	30	34	53	43	78	29	34	32	26
La Porte Sylvan Beach C556	36	27	33	38	46	63	41	33	44	38	23	28	43	43	35	30	31	26	23	33	26	22	21	32	37	33	32	32	32	27
Mercer Arboretum C557	36	29	22	36	72	67	52	44	50	39	28	36	38	42	31	28	22	12	17	21	30	28	25	42	45	45	18	33	31	28
Tom Bass C558	57	42	48	50	60	59	40	34	47	42	32	41	60	61	47	34	31	28	21	31	32	27	28	44	36	49	26	30	28	24
Katy Park C559	51	42	44	57	74	65	38	34	48	46	39	39	59	58	44	42	32	34	26	29	33	31	34	50	40	68	29	33	32	25
Atascocita C560	36	NV	NA	NA	NA	NA	NA	NA	NA	NA	NV	28	31	32	26	26	24	16	15	24	22	23	19	31	37	37	17	27	26	21
Meyer Park C561	44	36	28	45	90	80	51	42	51	43	38	52	47	52	39	37	27	19	23	27	40	32	40	63	56	70	26	42	41	34
Bunker Hill Village C562	46	36	37	53	68	65	39	32	42	37	30	35	53	53	42	31	20	22	17	22	27	20	21	31	32	60	19	23	24	19
Huffman Wolf Road C563	43	34	30	45	64	64	77	56	54	48	32	40	47	50	40	36	33	31	31	37	31	33	31	42	51	53	33	38	36	31
HRM-3 Haden Road C603/A114	46	34	37	51	63	69	55	39	49	46	30	39	52	54	45	32	30	27	21	32	34	NV	30	41	43	55	27	37	34	28
Wallisville Road C617	41	32	33	52	57	59	68	47	51	44	28	35	49	51	43	36	38	34	29	40	33	33	32	39	41	48	35	36	34	29
Danciger C618	61	48	38	45	54	51	30	29	47	43	30	37	53	61	49	42	35	28	NV	38	35	30	NV	50	34	42	31	33	28	24
Texas City 34th St. C620	60	41	40	50	60	72	43	41	52	46	31	41	59	59	53	43	40	36	27	43	37	33	34	45	43	42	38	40	39	33
UH Moody Tower C695	52	40	45	60	71	74	49	39	47	47	34	42	61	59	52	37	34	33	27	34	37	32	34	49	45	67	28	35	35	28
UH WG Jones Forest C698	46	37	29	43	78	72	57	56	62	54	41	NV	47	51	41	39	32	25	27	34	37	41	42	59	67	58	38	49	46	41
UH West Liberty C699	38	29	27	40	56	56	72	49	48	41	28	34	44	45	36	31	27	29	27	32	28	27	25	29	41	44	29	31	28	24
Lynchburg Ferry C1015/A165	40	32	36	48	59	60	57	41	50	42	25	34	48	49	41	31	32	29	24	31	27	27	31	37	41	41	29	34	30	26
Lake Jackson C1016	55	40	29	40	48	45	23	28	42	39	25	31	52	57	41	36	34	33	17	36	33	29	25	41	34	34	27	32	29	27
Baytown Garth C1017	43	34	35	54	60	62	70	48	52	46	29	37	52	53	44	36	39	33	30	40	33	33	31	41	41	48	34	37	35	30
Galveston 99th St. C1034/A320/X183	64	45	35	51	58	65	42	46	52	48	33	40	61	58	53	42	40	39	26	43	36	32	40	43	NV	42	38	41	39	35
UH Smith Point C1606	54	37	38	46	57	70	48	42	52	46	32	37	NV	56	48	38	38	37	31	42	34	34	33	41	42	NV	NV	38	37	NA
Oyster Creek C1607	62	45	32	48	47	44	27	38	45	40	27	31	54	61	49	36	34	32	18	35	31	27	26	38	35	35	30	NV	28	28

Monitoring Site	May-20																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Houston East C1/G316	**58**	52	48	42	**59**	47	**61**	45	39	50	**57**	50	45	42	30	54	49	**86**	46	41	40	27	30	41	52	**56**	**57**	38	36	48	46
Houston Aldine C8/AF108/X150	**63**	52	48	42	43	48	**64**	41	43	47	**64**	49	44	37	26	48	46	**74**	47	40	38	25	28	35	47	53	48	41	41	42	41
Channelview C15/AH115	54	49	47	41	**56**	43	**56**	44	40	45	50	47	42	40	29	54	47	**81**	47	40	37	24	28	42	54	**57**	NV	32	39	41	49
Northwest Harris Co. C26/A110/X154	**65**	53	52	NV	NV	51	**64**	43	44	47	**74**	52	48	46	35	45	47	**62**	NV	44	44	32	34	42	42	51	51	47	41	41	39
Hou.DeerPrk2 C35/235/1001/AFH139FP239	**60**	52	47	40	54	54	**62**	46	45	**57**	54	51	43	47	38	52	50	**81**	41	39	39	26	29	48	54	**59**	53	38	45	52	49
Seabrook Friendship Park C45	54	46	39	32	35	52	**55**	42	44	52	51	44	38	43	34	46	47	**75**	36	31	34	22	25	45	47	53	44	37	40	46	38
Houston Bayland Park C53/A146	**63**	52	47	39	51	**62**	**64**	46	49	**59**	**60**	51	45	53	39	50	49	**67**	41	39	39	26	27	46	46	54	52	41	49	**57**	48
Conroe Relocated C78/A321	**75**	**62**	**56**	**56**	35	48	**69**	43	43	42	**60**	**55**	**55**	42	35	39	45	**59**	49	54	52	38	39	44	45	47	51	48	39	38	37
Manvel Croix Park C84	**55**	51	46	38	39	54	**58**	NV	49	**63**	NV	47	41	45	35	48	49	**65**	38	34	33	25	25	41	45	53	47	36	53	**57**	37
Clinton C403/C304/AH113	51	47	45	36	49	50	54	37	43	53	52	40	38	44	NV	NA	NA	**71**	35	32	34	24	26	40	46	48	45	33	43	50	45
Houston North Wayside C405	53	46	42	36	45	40	54	NV	36	42	53	44	39	36	24	43	40	**64**	39	35	35	23	26	34	43	45	47	36	37	38	42
Houston Monroe C406	50	44	43	35	41	50	NV	44	41	**55**	52	45	37	44	30	NA	NA	NV	38	33	33	23	23	43	46	54	47	NV	NV	52	41
Lang C408	**59**	51	46	32	43	48	NV	41	42	51	**62**	48	43	45	32	46	46	**67**	42	43	39	27	28	40	44	51	51	44	40	47	49
Houston Croquet C409	52	48	43	34	44	**59**	**56**	42	44	**61**	52	46	40	46	29	46	46	**64**	36	34	35	25	25	42	43	52	48	36	45	**57**	41
Houston Westhollow C410/C3003	**59**	48	47	40	42	**56**	**58**	42	45	**56**	**58**	49	39	49	39	46	46	**61**	39	38	38	25	28	46	43	53	51	43	NV	53	47
Park Place C416	**56**	48	44	34	46	52	NV	42	42	**56**	53	46	40	45	32	47	46	52	40	36	35	24	24	42	46	53	49	36	43	52	44
Sheldon C551	**55**	49	46	41	46	45	**56**	42	41	44	53	47	41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	26	29
Baytown Wetlands Center C552	**59**	49	44	36	44	50	**57**	45	43	53	54	49	43	42	31	52	48	**85**	41	36	35	23	25	41	53	**56**	48	33	39	43	48
Crosby Library C553	**57**	48	45	39	43	42	54	39	38	39	50	44	39	32	24	29	NV	50	NV	NV	NV	25	23	34	50	50	**57**	35	34	36	47
West Houston C554	43	30	26	19	23	39	48	28	36	38	47	39	NV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
La Porte Sylvan Beach C556	**56**	46	41	34	38	50	**58**	45	44	53	**55**	49	43	43	37	48	49	**79**	38	31	38	24	25	46	50	**55**	49	41	39	42	43
Mercer Arboretum C557	**62**	52	47	44	38	44	**62**	39	40	43	**61**	50	48	35	29	42	40	**61**	46	47	44	29	34	35	40	46	49	46	35	36	32
Tom Bass C558	**55**	49	45	38	41	**59**	**58**	43	45	**63**	**55**	47	40	46	33	48	48	**67**	38	35	35	25	25	43	46	54	47	36	49	**57**	39
Katy Park C559	**57**	48	46	37	38	**57**	**57**	40	47	**55**	**57**	47	39	46	36	45	45	**56**	37	36	36	25	28	41	41	48	48	42	41	50	43
Atascocita C560	**59**	52	48	45	40	42	**58**	41	39	41	**55**	49	46	39	30	46	41	**67**	49	46	42	28	34	39	45	48	52	43	36	37	43
Meyer Park C561	**65**	54	49	46	34	50	**63**	41	44	47	**70**	51	48	41	33	44	43	**61**	44	46	43	30	32	39	40	49	48	48	39	40	37
Bunker Hill Village C562	**57**	45	43	36	41	51	**56**	38	43	52	**56**	46	37	46	30	41	44	**59**	37	38	36	24	25	34	39	48	45	38	44	47	40
Huffman Wolf Road C563	**66**	**56**	53	50	44	NV	**60**	46	42	43	**56**	51	49	35	33	**55**	44	**71**	**60**	53	45	33	32	43	52	49	**62**	47	41	40	41
HRM-3 Haden Road C603/A114	54	46	44	38	54	47	**56**	40	41	48	52	44	40	38	27	50	45	**79**	43	37	35	23	26	38	50	NA	NA	NV	40	44	47
Wallisville Road C617	**62**	53	48	42	**56**	50	**61**	47	44	51	54	51	46	44	34	**60**	50	**81**	51	44	41	30	30	49	**62**	**65**	**65**	42	43	47	**58**
Texas City 34th St. C620	**59**	52	48	38	NV	NV	**65**	54	**55**	**65**	**62**	**55**	46	54	42	**55**	**57**	**88**	43	36	41	27	29	52	**56**	**63**	**55**	46	53	**65**	48
UH Moody Tower C695	**60**	53	48	43	52	**56**	**62**	46	47	**56**	**59**	50	44	48	36	53	51	**77**	44	41	39	NV	28	44	51	**59**	**57**	NV	48	**57**	52
UH WG Jones Forest C698	**71**	**60**	53	54	37	50	**70**	43	44	45	**62**	**56**	54	41	36	42	48	**62**	49	51	53	36	41	45	44	48	53	47	40	39	38
UH West Liberty C699	**60**	51	48	45	40	43	**55**	42	39	39	52	46	43	31	26	54	41	**63**	**56**	46	39	28	25	42	52	48	**60**	44	38	38	40
Lynchburg Ferry C1015/A165	**55**	50	45	36	52	47	**58**	45	41	49	51	48	42	40	29	49	43	**76**	42	33	37	24	27	44	49	52	52	NV	33	41	51
Lake Jackson C1016	**56**	50	47	34	30	**57**	**62**	50	51	**65**	54	48	40	49	41	51	45	**56**	35	33	36	22	26	43	47	50	50	39	**60**	**57**	29
Baytown Garth C1017	**61**	52	47	41	54	49	**59**	46	42	49	53	50	45	42	34	**58**	48	**81**	49	44	41	30	29	47	**59**	**62**	**62**	41	41	45	**58**
Galveston 99th St. C1034/A320/X183	**58**	52	49	37	33	**57**	**61**	52	46	**62**	**59**	52	48	51	42	**57**	52	**76**	48	38	39	25	27	47	**57**	**62**	52	47	**61**	54	41
UH Smith Point C1606	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	44	48	**55**	46
Oyster Creek C1607	52	50	47	36	34	54	**59**	50	NV	NV	53	48	NV	49	45	53	46	**58**	44	37	40	28	31	49	52	53	NV	52	**68**	**62**	41
UH Launch Trailer C1611	**59**	51	47	41	50	52	**59**	45	44	54	**57**	48	43	46	34	NV	50	**75**	43	40	38	27	27	41	50	**57**	**56**	40	44	53	48

Monitoring Site	Jun-20																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Houston East C1/G316	43	66	30	33	40	34	24	42	33	43	44	50	51	62	41	65	56	50	34	26	19	21	29	40	25	16	18	19	19	23
Houston Aldine C8/AF108/X150	43	64	37	42	46	33	24	44	37	NV	49	57	55	58	46	75	63	55	32	28	21	20	25	40	26	14	20	19	18	19
Channelview C15/AH115	39	59	24	34	31	33	23	45	33	43	42	50	52	54	36	59	57	49	32	27	19	24	27	42	22	12	16	17	15	21
Northwest Harris Co. C26/A110/X154	49	71	40	40	69	36	27	43	38	47	50	59	56	59	60	84	63	58	34	35	22	17	25	38	NV	19	23	21	22	24
Hou.DeerPrk2 C35/235/1001/AFH139FP239	55	58	27	32	33	40	27	43	30	51	51	58	62	57	37	63	54	49	37	24	17	30	30	40	23	18	18	18	19	NV
Seabrook Friendship Park C45	49	51	24	25	28	34	25	35	22	42	46	50	57	50	31	NV	49	43	31	21	17	30	28	34	22	17	16	15	17	17
Houston Bayland Park C53/A146	62	61	31	32	44	46	29	40	35	64	59	63	59	66	NV	NA	NV	46	27	21	17	NV	NV	NV	20	14	16	16	16	17
Conroe Relocated C78/A321	36	48	42	48	42	34	27	38	49	NV	47	55	55	54	41	68	79	67	41	36	27	21	31	37	34	20	30	24	28	31
Manvel Croix Park C84	54	54	27	24	37	48	31	35	26	61	63	67	65	61	40	54	51	NV	26	20	17	34	27	36	23	17	16	18	19	21
Clinton C403/C304/AH113	50	61	24	24	36	38	25	33	26	50	47	55	56	61	38	59	48	42	31	24	19	20	28	34	22	14	16	19	NV	20
Houston North Wayside C405	36	61	NV	33	40	31	24	39	32	36	43	49	48	56	40	65	55	47	26	25	17	NV	NV	34	21	12	16	16	15	19
Houston Monroe C406	50	51	26	23	33	38	27	35	25	50	49	54	55	54	36	60	49	43	27	21	16	NV	28	37	21	15	16	16	17	20
Lang C408	57	73	35	41	55	41	28	44	43	53	50	58	56	66	50	73	61	51	30	31	21	19	29	42	24	17	19	18	19	22
Houston Croquet C409	56	53	28	25	40	43	28	40	28	57	56	60	57	60	42	56	55	44	26	19	16	26	25	35	22	16	16	16	17	18
Houston Westhollow C410/C3003	58	61	33	36	48	45	29	40	32	52	56	62	57	65	47	58	54	48	29	26	21	23	32	41	28	19	18	18	19	21
Park Place C416	53	56	29	27	35	40	26	39	28	52	50	55	56	56	39	62	52	45	29	21	17	25	28	NV	23	16	17	18	18	22
Sheldon C551	21	34	13	22	19	17	10	24	19	27	30	39	39	37	21	40	43	36	20	16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Baytown Wetlands Center C552	39	52	21	27	23	32	22	39	22	42	45	52	56	50	30	55	55	46	31	23	17	25	29	37	20	15	16	14	16	16
Crosby Library C553	33	53	24	45	30	28	20	45	32	39	40	48	48	49	33	54	61	48	28	26	19	20	22	41	22	12	15	15	17	20
West Houston C554	NA	NV	34	35	57	43	27	40	29	50	54	60	57	65	49	61	53	48	28	27	18	18	24	37	26	15	17	16	17	19
La Porte Sylvan Beach C556	49	49	24	26	26	31	23	38	22	41	43	49	55	50	31	48	47	41	28	18	13	26	26	31	18	14	11	8	9	11
Mercer Arboretum C557	34	56	35	50	48	32	22	37	47	42	42	52	50	52	40	71	65	56	36	29	19	12	23	32	24	13	19	16	19	21
Tom Bass C558	53	52	26	24	36	44	29	37	26	56	61	63	61	57	39	57	50	43	26	19	16	29	27	35	22	16	15	17	18	20
Katy Park C559	61	65	31	28	52	42	26	42	29	47	53	63	58	66	48	57	52	44	27	28	18	19	23	37	26	15	15	15	16	18
Atascocita C560	37	54	33	42	41	30	23	42	39	38	38	44	44	46	34	60	59	50	30	27	18	19	25	36	25	14	16	14	16	19
Meyer Park C561	42	61	35	44	58	35	26	40	42	50	48	56	54	57	50	80	62	53	33	34	20	15	24	32	25	14	18	17	18	22
Bunker Hill Village C562	52	60	30	31	43	38	25	30	32	53	50	57	52	63	41	57	51	43	25	19	15	12	21	31	19	12	13	12	13	17
Huffman Wolf Road C563	35	58	32	52	35	34	26	38	44	45	45	53	53	54	39	60	72	56	37	32	26	26	32	45	31	20	24	24	24	28
HRM-3 Haden Road C603/A114	43	60	23	32	35	35	24	40	31	45	46	53	NV	NA	NV	59	53	47	35	26	18	21	26	39	22	15	16	16	16	20
Wallisville Road C617	44	62	26	45	31	37	26	51	31	45	47	55	58	55	37	60	61	53	35	28	21	30	33	47	28	NA	NA	NA	NA	NA
Texas City 34th St. C620	64	61	32	25	36	58	30	NV	NA	NV	63	67	80	68	NV	NV	65	60	42	NV	NA	NV	48	48	28	23	23	21	22	NV
UH Moody Tower C695	56	64	34	NV	42	43	30	43	32	55	55	59	58	64	43	68	55	50	32	25	20	30	30	43	NV	18	19	20	20	23
UH WG Jones Forest C698	38	57	46	47	48	34	27	41	44	NV	48	57	56	56	43	78	75	67	45	40	25	19	29	36	NV	19	27	21	25	29
UH West Liberty C699	34	55	26	43	28	29	21	35	36	40	40	48	48	50	33	NV	61	50	32	27	21	23	30	44	26	16	20	19	19	23
Lynchburg Ferry C1015/A165	33	55	23	31	27	31	19	42	28	39	44	50	53	53	33	57	55	48	32	23	17	23	29	37	23	15	16	17	18	21
Lake Jackson C1016	53	51	24	17	25	50	35	38	20	70	59	58	63	58	32	52	47	37	27	16	15	24	28	30	23	17	14	15	16	17
Baytown Garth C1017	41	60	27	44	32	36	25	51	27	43	45	53	57	55	38	59	59	52	35	28	21	29	33	46	29	NV	23	21	21	24
Galveston 99th St. C1034/A320/X183	61	57	29	23	31	57	25	37	25	46	58	65	62	58	50	55	52	48	32	25	21	41	41	40	26	NV	18	17	19	18
UH Smith Point C1606	57	56	30	30	27	43	24	39	28	46	51	55	64	NV	42	56	60	49	35	26	22	38	34	39	25	18	20	19	21	NV
Oyster Creek C1607	67	NV	30	22	29	59	41	39	27	73	65	68	68	64	38	56	56	50	33	26	22	35	41	39	31	24	21	22	23	23
UH Launch Trailer C1611	51	61	NV	32	40	39	28	42	31	49	51	55	54	61	41	65	54	49	30	23	20	26	30	41	25	17	18	18	20	NV

Monitoring Site	POC	Jul-20																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Houston East C1/G316	2	22	36	41	52	35	19	17	21	25	30	37	35	43	26	27	46	37	29	44	23	22	25	27	23	21	28	34	21	24	21	30
Houston Aldine C8/AF108/X150	2	23	40	31	43	28	22	17	24	27	NV	34	27	45	29	29	42	35	32	42	26	28	29	27	26	21	25	30	19	24	20	27
Channelview C15/AH115	3	21	38	43	53	37	18	18	22	24	28	37	38	38	26	26	48	30	25	38	24	22	26	26	25	21	25	27	21	24	22	31
Northwest Harris Co. C26/A110/X154	2	25	NV	28	29	25	22	24	24	27	35	26	25	36	29	29	37	50	43	54	36	41	34	35	29	25	27	36	25	28	22	27
Hou.DeerPrk2 C35/235/1001/AFH139FP239	1	22	29	41	42	32	20	20	22	22	25	27	31	29	23	25	37	36	28	42	28	26	28	35	29	26	29	36	25	24	22	24
Seabrook Friendship Park C45	1	17	24	35	35	24	16	16	18	18	20	23	24	21	20	20	31	30	25	36	27	22	24	32	23	23	27	29	17	19	18	20
Houston Bayland Park C53/A146	1	17	23	25	32	24	16	17	13	NV	28	28	27	30	22	25	34	34	28	47	28	28	24	38	31	24	24	45	22	26	20	26
Conroe Relocated C78/A321	1	31	33	31	37	27	33	22	36	39	42	31	30	51	46	43	44	37	30	39	29	27	NV	29	23	23	24	29	33	32	27	29
Manvel Croix Park C84	1	18	22	28	31	23	16	16	17	21	22	19	22	20	18	19	23	27	26	39	28	23	22	43	NV	25	23	42	22	21	17	19
Clinton C403/C304/AH113	3	19	27	36	43	31	16	14	17	21	26	33	31	31	21	21	34	33	28	43	27	25	21	32	28	23	28	37	18	16	17	22
Houston North Wayside C405	1	18	35	32	43	28	17	15	19	23	32	35	31	41	24	24	42	35	30	40	22	24	21	NV	23	20	23	27	NV	NV	16	22
Houston Monroe C406	1	18	24	33	37	29	16	15	17	20	21	25	26	23	19	19	29	29	26	39	25	24	24	35	28	23	27	38	21	20	NV	NV
Lang C408	2	24	30	31	37	26	19	20	26	23	39	31	26	39	29	33	39	37	33	50	26	29	27	33	28	24	25	40	22	27	24	24
Houston Croquet C409	2	17	24	29	32	24	16	16	17	18	21	26	24	24	18	20	29	30	26	41	28	25	22	37	29	23	22	43	21	21	15	20
Houston Westhollow C410/C3003	1	20	25	28	30	26	19	19	21	23	28	26	26	30	23	22	32	37	34	49	32	31	27	41	33	27	26	43	23	27	18	25
Park Place C416	1	20	27	35	40	30	18	16	19	24	26	33	32	28	21	22	36	31	29	43	27	28	25	34	28	24	27	42	20	23	18	24
Baytown Wetlands Center C552	1 [N]	16	23	46	49	30	15	15	16	17	20	25	27	24	20	20	39	25	20	34	22	20	21	25	23	20	24	26	18	18	16	21
Crosby Library C553	1 [N]	21	38	34	40	31	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
West Houston C554	1 [N]	18	22	26	27	21	16	17	19	21	26	25	20	27	22	22	32	38	34	49	31	30	23	37	30	25	25	42	20	24	16	22
La Porte Sylvan Beach C556	1 [N]	11	16	32	31	19	10	11	12	12	12	16	17	15	14	14	24	23	17	27	19	17	16	21	17	16	18	19	16	15	12	14
Mercer Arboretum C557	1 [N]	24	29	26	35	22	18	22	27	26	41	34	28	47	33	37	45	36	29	39	26	26	30	26	23	17	18	26	20	24	24	24
Tom Bass C558	1 [N]	18	21	29	33	26	16	16	17	22	22	24	25	21	19	19	26	28	23	38	26	23	22	38	29	22	23	44	20	20	16	18
Katy Park C559	1 [N]	18	21	24	22	23	16	16	17	19	21	22	20	23	19	20	26	38	35	48	35	30	22	39	31	24	25	39	20	21	15	23
Atascocita C560	1 [N]	18	36	26	39	25	18	16	20	24	33	31	27	42	29	29	41	28	23	31	23	24	25	21	21	16	17	20	18	19	18	22
Meyer Park C561	1 [N]	22	28	26	31	22	16	19	22	28	37	28	25	42	34	29	40	41	37	44	29	32	29	30	26	20	22	31	21	24	17	23
Bunker Hill Village C562	1 [N]	16	22	23	28	20	15	16	18	17	30	24	23	31	22	23	31	30	26	43	22	22	18	31	25	19	13	33	14	18	15	18
Huffman Wolf Road C563	1 [N]	31	47	35	44	35	29	26	33	33	44	41	39	52	40	38	53	32	26	39	29	26	28	28	27	24	25	29	31	32	31	34
HRM-3 Haden Road C603/A114	1 [N]	19	32	39	49	33	17	16	20	22	28	35	34	37	22	23	43	30	25	39	20	19	23	28	25	20	25	34	19	21	19	26
Wallisville Road C617	1 [N]	NA	NA	NA	NA	NA	NA	NA	NA	NV	33	47	47	42	28	26	52	NV	NA	NA	NA	NV	NV	31	30	25	29	34	27	26	25	35
Texas City 34th St. C620	1 [N]	20	25	27	35	27	17	18	20	21	20	21	23	21	20	21	32	33	33	41	32	29	30	44	31	30	32	34	26	24	19	21
UH Moody Tower C695	1 [N]	22	33	NV	44	33	20	18	21	25	29	37	32	35	24	25	40	NV	32	46	29	29	27	36	30	25	28	44	24	27	19	28
UH WG Jones Forest C698	1 [N]	NA	NV	30	35	24	29	23	30	36	41	30	29	49	43	36	44	41	34	42	31	31	38	31	26	NV	24	33	29	31	24	28
UH West Liberty C699	1 [N]	26	40	32	40	32	23	22	27	28	40	35	34	44	33	32	49	28	19	35	26	21	22	25	23	21	22	25	28	29	28	31
Lynchburg Ferry C1015/A165	1	21	27	41	49	34	18	19	21	21	22	34	36	29	24	25	45	27	22	34	24	20	22	27	27	22	25	32	20	22	22	25
Lake Jackson C1016	1	16	18	16	23	21	13	14	15	17	16	12	14	15	16	17	17	21	29	36	NV	NA	NA	NV	27	26	24	20	20	17	14	16
Baytown Garth C1017	1	25	36	48	**60**	43	23	24	26	25	35	49	48	45	30	29	54	32	23	42	30	26	28	NV	NV	26	31	34	28	29	27	37
Galveston 99th St. C1034/A320/X183	1	17	19	19	24	21	14	15	16	16	13	14	14	15	NV	NA	NV	26	33	34	NV	NV	28	NV	NV	NA	NA	NA	NA	NV	17	19
UH Smith Point C1606	1 [N]	20	24	30	41	NV	NV	17	19	21	19	25	21	22	19	21	33	31	29	39	29	27	26	37	28	25	30	32	NV	NA	NA	NA
Oyster Creek C1607	1 [N]	22	26	23	28	29	20	20	22	23	21	19	21	21	23	24	25	29	31	42	32	32	28	NV	NA	NA	NA	NV	25	25	18	20
UH Launch Trailer C1611	1 [N]	21	33	34	43	32	20	18	21	25	28	36	31	35	24	24	39	32	30	43	23	27	26	31	27	23	27	41	23	26	19	27

Monitoring Site	POC	Aug-20																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Houston East C1/G316	2	32	60	61	62	50	53	57	38	23	23	23	29	32	30	42	55	54	67	47	54	73	60	56	30	NV	NA	NV	23	28	23	20
Houston Aldine C8/AF108/X150	2	38	49	55	62	56	59	66	42	24	NV	29	39	40	40	47	46	53	63	45	55	68	62	53	34	NV	20	41	28	35	29	27
Channelview C15/AH115	3	40	51	55	67	47	53	59	38	22	20	22	30	33	30	36	49	46	58	42	46	69	56	53	29	NV	NA	NV	23	27	21	18
Northwest Harris Co. C26/A110/X154	2	44	37	52	57	52	58	63	45	24	31	30	27	32	29	34	NV	NA	NA	NA	NA	NV	51	52	43	31	22	35	31	30	28	25
Hou.DeerPrk2 C35/235/1001/AFH139FP239	1	41	66	67	61	51	53	61	35	22	22	24	26	26	25	28	57	63	81	65	62	74	62	62	40	NV	NA	NA	25	27	24	19
Seabrook Friendship Park C45	1	38	58	74	47	40	42	53	29	15	16	18	18	21	20	21	52	51	64	50	49	55	50	51	31	NV	NA	NA	NV	20	18	14
Houston Bayland Park C53/A146	1	39	55	61	55	43	47	50	35	19	24	21	28	23	28	37	44	73	84	61	73	62	57	66	41	NV	27	39	21	26	24	18
Conroe Relocated C78/A321	1	50	43	50	52	66	77	77	59	28	42	41	40	47	43	44	41	54	61	38	47	61	53	49	40	27	19	41	34	36	34	36
Manvel Croix Park C84	1	31	58	50	47	43	44	46	28	20	20	21	21	21	21	22	30	68	98	70	70	52	53	61	48	NV	25	38	18	20	21	19
Clinton C403/C304/AH113	3	37	NV	NV	NV	43	43	51	32	22	20	22	25	25	26	37	56	58	72	56	61	71	57	58	37	NV	NA	NV	13	23	23	18
Houston North Wayside C405	1	30	51	52	57	48	51	54	35	19	22	23	31	32	31	43	45	51	59	41	47	62	56	49	28	NV	NA	NV	20	28	24	19
Houston Monroe C406	1	32	50	61	51	42	40	43	30	20	19	20	22	21	21	24	38	58	80	62	67	60	55	57	38	NV	NA	NV	NV	20	19	17
Lang C408	2	39	50	60	58	52	53	55	41	22	27	30	36	33	33	40	48	61	70	50	61	69	57	55	35	NV	NA	NV	26	33	28	21
Houston Croquet C409	2	33	49	53	46	38	42	43	31	18	22	19	23	19	24	31	36	65	81	57	69	55	52	63	43	NV	NA	NV	20	22	22	18
Houston Westhollow C410/C3003	1	38	47	56	53	47	47	50	34	23	24	24	29	26	28	32	40	NV	74	57	66	52	51	56	43	NV	NA	NV	19	20	21	17
Park Place C416	1	38	67	67	56	44	45	48	34	21	22	22	25	26	26	34	47	62	80	59	67	66	56	64	38	NV	NA	NV	23	25	24	21
Baytown Wetlands Center C552	1 [N]	44	44	66	57	40	44	51	32	18	18	19	21	24	23	25	51	44	63	48	50	65	51	52	27	NV	NA	NA	NA	NA	NA	NA
West Houston C554	1 [N]	35	37	45	51	42	44	47	35	18	23	23	26	24	25	28	37	62	69	51	60	54	48	55	42	33	24	34	24	25	25	20
La Porte Sylvan Beach C556	1 [N]	41	44	67	45	34	40	47	27	16	13	15	16	17	18	18	44	42	60	44	44	52	48	47	27	NV	NA	NA	NA	NA	NA	NA
Mercer Arboretum C557	1 [N]	36	36	43	50	54	62	69	43	21	29	32	36	39	36	41	37	44	54	36	43	58	51	44	33	23	16	32	27	29	25	22
Tom Bass C558	1 [N]	30	56	56	47	41	43	45	28	19	19	21	20	21	20	23	35	63	87	65	71	55	52	58	43	33	23	39	18	21	20	19
Katy Park C559	1 [N]	31	38	45	48	39	49	49	30	18	20	21	23	19	21	25	35	59	66	49	58	49	46	56	46	34	26	32	23	24	23	18
Atascocita C560	1 [N]	27	37	39	48	50	56	61	38	19	25	25	31	35	34	38	36	40	48	32	41	56	51	42	25	18	14	36	24	29	22	19
Meyer Park C561	1 [N]	37	36	49	51	54	55	58	40	20	28	30	34	35	33	37	45	50	60	41	50	62	50	49	38	27	19	34	27	29	27	24
Bunker Hill Village C562	1 [N]	25	40	52	47	42	41	43	31	16	21	22	26	24	25	30	37	61	69	51	61	55	46	50	34	31	23	34	18	21	20	16
Huffman Wolf Road C563	1 [N]	36	39	46	58	68	58	63	51	30	36	37	43	50	46	46	41	40	55	38	47	58	56	47	33	24	20	43	36	39	31	27
HRM-3 Haden Road C603/A114	1 [N]	28	54	52	58	46	47	52	32	20	19	22	28	30	28	38	50	50	61	47	50	71	57	53	31	23	22	50	21	26	20	16
Wallisville Road C617	1 [N]	53	48	66	74	56	51	54	39	25	24	28	35	36	37	45	51	45	62	45	50	71	58	55	33	24	24	51	27	31	28	19
Texas City 34th St. C620	1 [N]	49	71	58	49	47	46	57	34	21	20	21	20	21	23	25	39	69	78	71	61	61	61	63	44	26	26	36	19	22	22	17
UH Moody Tower C695	1 [N]	45	69	68	61	48	49	52	37	22	24	25	30	28	30	40	54	67	80	60	67	71	62	63	40	32	27	46	24	27	26	22
UH WG Jones Forest C698	1 [N]	48	41	52	52	60	76	81	57	27	38	7	39	42	40	43	42	56	67	42	52	65	NV	50	40	NV	19	NV	34	36	32	32
UH West Liberty C699	1 [N]	33	36	42	55	63	52	54	44	25	27	33	36	43	39	38	35	34	50	34	42	53	52	43	29	19	16	NV	32	34	26	21
Lynchburg Ferry C1015/A165	1	31	51	63	61	47	48	55	35	20	19	21	23	27	26	31	50	42	59	38	45	72	57	52	28	NV	NA	NA	NV	20	19	17
Lake Jackson C1016	1	28	48	34	38	38	37	39	17	16	16	16	13	12	14	15	23	52	73	73	59	40	40	48	41	NV	NA	NV	14	17	17	14
Baytown Garth C1017	1	53	48	66	76	59	53	56	40	26	26	30	37	39	39	47	53	45	61	45	50	71	59	57	35	NV	NA	NV	30	34	31	22
Galveston 99th St. C1034/A320/X183	1	54	69	43	40	41	43	57	39	19	19	18	17	16	17	17	28	67	65	83	NV	56	53	59	42	NV	NA	NA	NV	20	18	NV
UH Smith Point C1606	1 [N]	NV	60	89	NV	45	49	54	40	23	20	20	NV	21	25	28	52	65	66	51	57	59	55	60	NV	NA	NA	NA	NA	NA	NA	NA
Oyster Creek C1607	1 [N]	37	61	46	NV	45	45	47	28	22	22	22	19	20	22	22	27	69	79	93	69	56	53	62	47	NV	NA	NA	NA	NA	NA	NA
UH Launch Trailer C1611	1 [N]	43	66	65	59	47	48	51	36	NV	23	24	30	27	29	41	52	63	75	56	NV	75	59	58	34	28	23	45	24	26	25	22

Monitoring Site	POC	Sep-20																													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Houston East C1/G316	2	21	16	24	18	36	48	35	31	32	23	35	34	21	19	25	33	22	40	37	28	19	23	16	11	54	**55**	36	27	32	52
Houston Aldine C8/AF108/X150	2	18	15	21	13	19	29	25	20	20	18	22	26	15	16	23	NV	NV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	52
Channelview C15/AH115	3	19	17	23	15	32	41	42	31	29	24	36	32	22	22	29	33	26	43	40	26	17	19	19	17	43	49	37	31	36	48
Northwest Harris Co. C26/A110/X154	2	24	21	33	21	33	41	39	34	34	32	33	37	22	26	32	36	32	51	47	30	NV	20	24	19	34	51	34	34	36	50
Hou.DeerPrk2 C35/235/1001/AFH139FP239	1	21	18	24	18	42	**61**	43	36	35	32	47	39	31	27	35	41	34	51	45	27	23	29	21	18	51	52	38	33	41	**56**
Seabrook Friendship Park C45	1	17	15	17	15	35	41	38	31	30	28	38	33	23	25	30	45	27	43	38	21	20	24	14	NV	35	40	29	26	33	NV
Houston Bayland Park C53/A146	1	20	19	29	24	54	**59**	34	32	26	36	48	50	32	30	42	45	37	**56**	51	32	20	22	23	20	**59**	54	34	37	28	51
Conroe Relocated C78/A321	1	33	28	38	19	26	38	45	49	43	30	27	38	24	26	31	35	33	50	46	30	22	21	21	18	42	**61**	46	37	41	**58**
Manvel Croix Park C84	1	20	16	20	22	41	43	30	29	24	38	54	47	38	32	46	49	36	**55**	47	29	24	23	25	20	**60**	47	32	35	NV	50
Clinton C403/C304/AH113	3	19	14	23	18	38	50	32	29	27	24	38	37	25	25	34	39	29	48	42	29	19	26	18	13	54	50	34	31	37	45
Houston North Wayside C405	1	18	16	22	19	29	36	36	30	30	23	35	35	20	24	31	34	25	42	39	28	17	19	16	12	43	52	32	28	33	44
Houston Monroe C406	1	18	14	17	17	36	**57**	30	28	23	22	36	34	28	22	33	36	28	43	37	24	NV	25	20	16	51	47	32	28	37	48
Lang C408	2	22	20	31	26	37	53	38	32	26	30	36	41	28	26	36	39	31	49	46	30	20	21	22	19	**56**	**57**	37	30	36	53
Houston Croquet C409	2	19	16	22	23	47	54	33	30	25	34	47	45	30	32	41	44	34	51	46	28	22	25	22	17	49	48	31	32	34	45
Houston Westhollow C410/C3003	1	18	13	24	25	42	44	32	28	25	32	39	42	28	29	37	38	32	53	47	23	13	17	19	13	44	45	28	30	33	45
Park Place C416	1	20	17	24	24	47	**67**	35	34	29	26	46	42	29	27	37	42	30	47	43	29	20	26	20	14	**63**	53	34	NV	39	51
Sheldon C551	1[N]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	28	30	24	45	39	28	17	19	19	17	37	52	35	32	37	46
Baytown Wetlands Center C552	1[N]	NV	14	19	15	32	39	43	33	29	29	36	33	20	25	28	34	28	47	41	27	NV	NA	NV	14	30	40	24	27	32	47
Crosby Library C553	1[N]	NA	NA	NA	NA	NV	31	50	33	NV	50	30	29	17	18	25	29	24	44	37	24	15	17	16	15	32	**58**	35	29	34	52
West Houston C554	1[N]	19	17	30	27	40	41	37	29	27	31	37	41	27	28	35	37	32	52	47	29	17	22	23	18	44	51	31	35	39	52
La Porte Sylvan Beach C556	1[N]	NV	10	13	12	28	32	38	31	28	24	33	30	18	19	24	40	23	39	36	24	NV	NA	NA	NA	NV	38	28	26	33	51
Mercer Arboretum C557	1[N]	21	20	29	19	24	31	36	33	30	25	25	31	20	20	26	30	24	42	38	25	16	17	16	15	37	53	33	29	35	52
Tom Bass C558	1[N]	18	14	19	20	38	52	29	29	24	32	44	42	30	27	38	41	30	49	42	28	21	23	21	19	52	47	30	31	40	50
Katy Park C559	1[N]	20	16	30	25	41	39	32	29	28	24	32	38	25	27	34	35	31	52	48	30	18	21	24	18	34	48	30	35	37	47
Atascocita C560	1[N]	19	18	22	13	20	29	34	35	29	21	24	28	16	18	24	26	22	41	34	25	18	18	14	14	34	53	32	26	32	49
Meyer Park C561	1[N]	24	18	31	22	27	38	38	33	30	26	32	34	22	23	30	34	27	47	43	28	18	18	19	18	40	53	36	32	36	52
Bunker Hill Village C562	1[N]	17	14	26	17	34	43	25	23	18	28	32	37	25	26	34	37	30	49	44	27	14	15	18	16	45	46	29	32	35	45
Huffman Wolf Road C563	1[N]	29	27	29	21	23	30	49	36	32	29	37	36	23	24	32	34	29	50	42	29	21	24	20	19	31	**63**	43	33	38	**58**
HRM-3 Haden Road C603/A114	1[N]	17	15	21	20	33	45	34	29	29	22	33	32	22	20	27	32	24	42	37	26	16	22	18	15	**55**	50	34	29	34	50
Wallisville Road C617	1[N]	21	19	29	17	36	46	46	33	31	36	40	35	25	26	31	35	29	49	43	29	23	26	21	21	40	54	35	34	38	**57**
Texas City 34th St. C620	1[N]	20	17	20	21	40	49	50	42	36	35	**58**	41	33	29	36	**55**	42	**56**	46	34	33	32	25	21	45	47	36	39	44	**57**
UH Moody Tower C695	1[N]	22	19	26	24	49	**60**	37	35	29	31	45	44	28	29	39	41	31	50	44	29	19	24	22	20	**61**	**57**	35	33	41	NV
UH WG Jones Forest C698	1[N]	30	24	36	23	29	40	42	46	45	33	32	37	24	26	33	NV	32	50	46	31	20	21	22	21	43	**59**	42	36	42	**57**
UH West Liberty C699	1[N]	21	22	27	19	21	26	46	30	26	30	34	32	20	21	27	29	NV	44	38	25	17	21	17	17	NV	NA	NA	NV	34	**55**
Lynchburg Ferry C1015/A165	1	19	17	21	15	31	38	37	29	30	19	24	24	20	15	21	26	25	43	38	20	21	24	14	10	36	40	35	23	29	46
Lake Jackson C1016	1	16	12	15	16	29	36	31	22	23	24	**55**	49	31	NV	49	43	39	54	49	29	23	20	23	NV	40	39	28	40	NV	39
Baytown Garth C1017	1	23	22	31	20	38	48	49	34	34	38	42	38	27	29	33	37	32	50	44	30	24	29	21	21	42	**56**	39	35	38	**57**
Galveston 99th St. C1034/A320/X183	1	16	16	17	18	33	48	48	41	35	36	54	44	33	26	32	44	NV	**57**	44	33	33	32	24	22	48	47	37	39	NV	**58**
UH Smith Point C1606	1[N]	NA	NV	20	NV	36	47	49	39	33	34	43	34	28	26	31	36	33	51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NV	53
Oyster Creek C1607	1[N]	NV	18	22	21	37	44	45	38	35	37	**70**	51	41	39	51	52	51	**59**	51	35	35	32	33	29	51	50	40	43	51	**61**
UH Launch Trailer C1611	1[N]	22	18	16	22	44	**56**	35	32	27	28	42	41	25	26	36	38	27	46	NA	NA	19	23	20	17	**58**	**56**	34	31	38	50

Attachment C – EPA RBLC Report

(Accessed March 28, 2021)

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Report Date: 03/29/2021 Control Technology Determinations (Freeform)

Facility Information: LION OIL COMPANY

RBLC ID:	*AR-0167
+Facility Name:	LION OIL COMPANY
Date determination entered in RBLC:	01/12/2021
Permit Type:	U: Unspecified
Facility Description:	Lion Oil Co. owns and operates a petroleum refinery located in El Dorado, Union County, Arkansas.
Permit Notes:	This modification permits the installation of backup thermal oxidizers as SN-878 to provide emissions control for vessel purging and other potential release activities during facility turnarounds/outages, adds Maintenance, Startup, and Shutdown (MSS) limits and conditions for #7 FCCU Catalyst Regenerator Stack (SN-809), Refinery Boilers (SN-821), and various boilers and heaters (SN-803, 804, 805, 805N, 808, 810, 811, and 842), and add MSS-specific secondary Best Available Control Technology (BACT) limits for various boilers and heaters (SN-803, 804, 805, 805N, 808, 810, 811, and 842).

Process Information: LION OIL COMPANY

0.059 lb/MMBtu

+Process Name:	SN-804 - #4 Atmospheric Furnace
+Process Type:	11.310
Primary Fuel:	Natural Gas
Throughput:	280.00
Throughput Unit:	MMBtu/hr
Process Notes:	SN-804 is a 280 MMBTU/hr source used to heat the bottoms from the pre-flash column in order to separate them into naphtha, kerosene, diesel, and gas oil. The furnace is fuelled by NSPS Subpart J quality gas. As a result of the refinery expansion permit revision, this source has undergone PSD review for PM10, NOx, and CO. BACT for this source is good combustion practice and next generation ultra-low NOx burners. This source is equipped with a CEMS for monitoring NOx emissions.

Pollutant Information: LION OIL COMPANY - SN-804 - #4 Atmospheric Furnace

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	16.4000
Emission Limit 1 Unit:	LB/HR

Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	14.6000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LION OIL COMPANY

0.054 lb/MMBtu

+Process Name:	SN-811 - #9 Reformer Furnace
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	170.00
Throughput Unit:	MMBtu/hr
Process Notes:	SN-811 is a 170 MMBtu/hr furnace (nominal design) used to heat the #9 Unit Stripper bottoms. It is fueled by NSPS Subpart J quality gas. It was installed in 1980. BACT for this source is good combustion practice. This source is equipped with a CEMS for monitoring NOx emissions

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Pollutant Information: LION OIL COMPANY - SN-811 - #9 Reformer Furnace

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+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	9.1000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LION OIL COMPANY

+Process Name:	SN-803 - #4 Pre-Flash Column Reboiler
+Process Type:	13.310
Primary Fuel:	Natural Gas

0.048 lb/MMBtu

Throughput:	40.00
Throughput Unit:	MMBtu/hr
Process Notes:	SN-803 is a 40 MMBtu/hr reboiler (nominal design) used to maintain the temperature in the pre-flash column in order to separate crude oil into gasoline and naphtha. The reboiler is fueled by NSPS Subpart J quality gas. It was installed in 1979 and will be retrofitted with next generation, ultra-low NOx burners. As a result of the refinery expansion permit revision, this source has undergone PSD review for PM10. BACT for this source is good combustion practice.

Pollutant Information: LION OIL COMPANY - SN-803 - #4 Pre-Flash Column Reboiler

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	1.9000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LION OIL COMPANY

+Process Name:	SN-805 - #4 Pre-Flash Reboiler
+Process Type:	13.310
Primary Fuel:	Natural Gas
Throughput:	75.00
Throughput Unit:	MMBtu/hr
Process Notes:	SN-805 is a 75 MM Btu/hr reboiler (nominal design). It was installed in 1996 and will be retrofitted with next generation, ultra-low NOx burners. On May 17, 2000, this source was tested for NOx emissions using EPA Reference Method 7E pursuant to §19.702 of Regulation 19, and 40 C.F.R., Part 52, Subpart E. The test results submitted to the Department demonstrated compliance. As a result of the refinery expansion permit revision, this source has undergone PSD review for PM10. BACT for this source is good combustion practice.

0.047 lb/MMBtu

Pollutant Information: LION OIL COMPANY - SN-805 - #4 Pre-Flash Reboiler

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	3.5000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0

Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: LION OIL COMPANY

+Process Name:	SN-808 - #7 FCCU Furnace
+Process Type:	13.310
Primary Fuel:	Natural Gas
Throughput:	56.00
Throughput Unit:	MMBtu/hr
Process Notes:	SN-808 is a 56 MMBtu/hr furnace (nominal design) used to heat gas oil. It is fueled by NSPS Subpart J quality gas. It was installed in 1979. BACT for this source is good combustion practice.

0.05 lb/MMBtu

Pollutant Information: LION OIL COMPANY - SN-808 - #7 FCCU Furnace

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+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.8000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LION OIL COMPANY

+Process Name:	SN-810 - #9 Hydrotreater Furnace/Reboiler
+Process Type:	13.310
Primary Fuel:	Natural Gas
Throughput:	70.00
Throughput Unit:	MMBtu/hr
Process Notes:	SN-810 is a 70 MMBtu/hr furnace (nominal design) used to heat naphtha. It is fueled NSPS Subpart J quality gas. It was installed in 1958. This source was declared subject to NSPS Subpart J as a result of the Consent Decree (CIV. No. 03-1028) between Lion Oil, ADEQ, and the US EPA.

Pollutant Information: LION OIL COMPANY - SN-810 - #9 Hydrotreater Furnace/Reboiler

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+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	12.7000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE

Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LION OIL COMPANY

+Process Name:	SN-842 - #12 Unit Distillate Hydrotreater
+Process Type:	13.310
Primary Fuel:	Natural Gas
Throughput:	50.00
Throughput Unit:	MMBtu/hr
Process Notes:	SN-842 is a 50.0 MMBtu/hr furnace (nominal design). It is fueled by NSPS Subpart J quality gas. It was installed in 1993. BACT for this source is good combustion practice.

Pollutant Information: LION OIL COMPANY - SN-842 - #12 Unit Distillate Hydrotreater

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	5.3000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LION OIL COMPANY

+Process Name:	SN-805N - #4 Vacuum Furnace
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	142.20
Throughput Unit:	MMBtu/hr
Process Notes:	SN-805N is a 142.2 MMBTU/hr (annual) source. The furnace will be fueled by NSPS Subpart J quality gas. As a result of the refinery expansion permit revision, this source has undergone PSD review for PM10, NOx, and CO. BACT for this source is good combustion practice and next generation ultra low NOx burners.

0.046 lb/MMBtu

Pollutant Information: LION OIL COMPANY - SN-805N - #4 Vacuum Furnace

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	6.5000
Emission Limit 1 Unit:	LB/HR

Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	7.4000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3-HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: MONT BELVIEU NGL FRACTIONATION UNIT

RBLC ID:	TX-0886
+Facility Name:	MONT BELVIEU NGL FRACTIONATION UNIT
Date determination entered in RBLC:	02/10/2020
Permit Type:	B: Add new process to existing facility
Facility Description:	Oneok proposes to authorize an additional E/P Splitter (EP-2) and two additional fractionation units (Frac-5 and Frac-6) at its site. The E/P Splitter will separate ethane from propane and heavier materials in a mixed ethane-propane feed. Both fractionation units will treat and fractionate a demethanized natural gas liquids mixture (Y-grade) into ethane, propane, isobutane, normal butane, and natural gasoline. Emissions from production operations as well as emissions from planned maintenance, startup, and shutdown activities are included with this project.
Permit Notes:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	HOT OIL HEATERS
+Process Type:	12.310
Primary Fuel:	SWEET NATURAL GAS
Throughput:	150.00
Throughput Unit:	MMBTU/H
Process Notes:	EPNs: H-EP2, H-61500, H-61501, H-71500, H-71501

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - HOT OIL HEATERS

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0100
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0.0060
Emission Limit 2 Unit:	LB/MMBTU
Emission Limit 2 Avg. Time/Condition:	ANNUAL

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0020
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	HOT OIL HEATERS MSS
+Process Type:	12.310
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	BURNER CLEANING

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - HOT OIL HEATERS MSS

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0500
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	PROCESS VENTS
+Process Type:	50.002
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - PROCESS VENTS

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	COOLING TOWER
+Process Type:	99.009
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - COOLING TOWER

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.7000
Emission Limit 1 Unit:	LB/MMGAL
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0.3000
Emission Limit 2 Unit:	LB/MMGAL
Emission Limit 2 Avg. Time/Condition:	ANNUAL

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	TRUCK LOADING

+Process Type:	42.010
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - TRUCK LOADING

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	PRESSURIZED LOADING
+Process Type:	50.999
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - PRESSURIZED LOADING

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	EQUIPMENT LEAK FUGITIVES
+Process Type:	50.002
Primary Fuel:	
Throughput:	0

Throughput Unit:
Process Notes:

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - EQUIPMENT LEAK FUGITIVES

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	EMERGENCY DIESEL ENGINE
+Process Type:	17.210
Primary Fuel:	Ultra-low sulfur diesel
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - EMERGENCY DIESEL ENGINE

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg. Time/Condition:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	MSS FLARE
+Process Type:	19.390
Primary Fuel:	NATURAL GAS
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - MSS FLARE

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MONT BELVIEU NGL FRACTIONATION UNIT

+Process Name:	EQUIPMENT MSS
+Process Type:	50.002
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	MSS Process Vessel and Equipment Depressure, Purge, and Degas

Pollutant Information: MONT BELVIEU NGL FRACTIONATION UNIT - EQUIPMENT MSS

+Pollutant Name	Volatile Organic Compounds (VOC)

Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: PLAQUEMINE ETHYLENE PLANT 1

RBLC ID:	*LA-0352
+Facility Name:	PLAQUEMINE ETHYLENE PLANT 1
Date determination entered in RBLC:	04/03/2020
Permit Type:	C: Modify process at existing facility
Facility Description:	An ethylene production plant
Permit Notes:	

Process Information: PLAQUEMINE ETHYLENE PLANT 1

+Process Name:	Cracking Heater H (EP-8, EQT0426)
+Process Type:	12.310
Primary Fuel:	
Throughput:	191.28
Throughput Unit:	mm btu/hr
Process Notes:	

Pollutant Information: PLAQUEMINE ETHYLENE PLANT 1 - Cracking Heater H (EP-8, EQT0426)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0840
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0840
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0425
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO_2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NO_x)
Emission Limit 1:	0.0100
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	30 DAY ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	30 DAY ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg.
Time/Condition:

Process Information: PLAQUEMINE ETHYLENE PLANT 1

+Process Name:	BP Steam Boiler Packages (EU-2/EU-2, EQT0266/EQT0267)
+Process Type:	12.310
Primary Fuel:	natural gas
Throughput:	180.13
Throughput Unit:	mm btu/hr (each)
Process Notes:	

Pollutant Information: PLAQUEMINE ETHYLENE PLANT 1 - BP Steam Boiler Packages (EU-2/EU-2, EQT0266/EQT0267)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0210
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	30 DAY ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Report Date: 03/29/2021 Control Technology Determinations (Freeform)

Facility Information: INDECK NILES, LLC

RBLC ID:	*MI-0445
+Facility Name:	INDECK NILES, LLC
Date determination entered in RBLC:	12/22/2020
Permit Type:	A: New/Greenfield Facility
Facility Description:	Natural gas combined cycle power plant
Permit Notes:	

Process Information: INDECK NILES, LLC

+Process Name:	FGCTGHRSG
+Process Type:	15.210
Primary Fuel:	Natural gas

Throughput:	3421.00
Throughput Unit:	MMBTU/H
Process Notes:	3421 MMBTU/H for each turbine 740 MMBTU/H for each duct burner for a combined throughput of 4161 MMBTU/H or 8322 MMBTU/H for both trains. Two combined-cycle natural gas-fired combustion turbine generators (CTGs) with Heat Recovery Steam Generators (HRSG) (EUCTGHRSG1 & EUCTGHRSG2 in FGCTGHRSG). The total hours for startup and shutdown for each train shall not exceed 500 hours per 12-month rolling time period.

Pollutant Information: INDECK NILES, LLC - FGCTGHRSG

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	4.0000
Emission Limit 1 Unit:	PPM
Emission Limit 1 Avg. Time/Condition:	PPMVD @15% O2. 24HR ROLL AVG EXCEPT SS
Emission Limit 2:	24.7000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	24-HR ROLL AVG EXCEPT SS

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPM
Emission Limit 1 Avg. Time/Condition:	PPMVD @15% O2. 24HR ROLL AVG EXCEPT SS
Emission Limit 2:	15.0000
Emission Limit 2 Unit:	PPM
Emission Limit 2 Avg. Time/Condition:	30 DAY ROLL AVG DET. EACH OPERATING DAY

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	9.9000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY; EACH CTGHRSG
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	19.8000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY; EACH CTGHRSG

Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 19.8000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: HOURLY; EACH CTGHRSG
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 4.0000
Emission Limit 1 Unit: PPM
Emission Limit 1 Avg. Time/Condition: PPMVD@15%O2, HOURLY; EACH
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 4.6000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: HOURLY; EACH CTGHRSG
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 11.7000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: HOURLY; EACH CTGHRSG
Emission Limit 2: 0.0600
Emission Limit 2 Unit: LB/MMBTU
Emission Limit 2 Avg. Time/Condition: HOURLY; EACH CTGHRSG

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 1911481.0000
Emission Limit 1 Unit: T/YR

Emission Limit 1 Avg. Time/Condition:	12-MO ROLLING TIME PERIOD; EACH CTGHRSG
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDECK NILES, LLC

+Process Name:	EUAUXBOILER
+Process Type:	12.310
Primary Fuel:	Natural gas
Throughput:	182.00
Throughput Unit:	MMBTU/H
Process Notes:	One natural gas-fired auxiliary boiler rated at 182 MMBTU/H fuel heat input (EUAUXBOILER).

Pollutant Information: INDECK NILES, LLC - EUAUXBOILER

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0400
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0400
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	30-DAY ROLLING AVERAGE TIME PERIOD
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0050
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 1.3600
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 1.3600
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0040
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.6000
Emission Limit 1 Unit: LB/MMSCF
Emission Limit 1 Avg.
Time/Condition: BASED UPON FUEL RECEIPT RECORDS
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 93346.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: 12-MO ROLLING TIME PERIOD

Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDECK NILES, LLC

+Process Name:	FGFUELHTR (2 fuel pre-heaters)
+Process Type:	13.310
Primary Fuel:	Natural gas
Throughput:	27.00
Throughput Unit:	MMBTU/H
Process Notes:	Two natural gas-fired dew point heaters for warming the natural gas fuel (EUFUELHTR1 & EUFUELHTR2 in FGFUELHTR). The total combined heat input during operating shall not exceed 27 MMBTU/hr as well. The CO2e limit is for both units combined; however the other limits are per unit.

Pollutant Information: INDECK NILES, LLC - FGFUELHTR (2 fuel pre-heaters)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	1.1100
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY; EACH FUEL HEATER
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

0.048 lb/MMBtu

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	1.3200
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY; EACH FUEL HEATER
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0020
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	HOURLY; EACH FUEL HEATER
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.1000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY; EACH FUEL HEATER
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.1000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY; EACH FUEL HEATER
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY; EACH FUEL HEATER
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 2000.0000
Emission Limit 1 Unit: GR/MMSCF
Emission Limit 1 Avg.
Time/Condition: BASED UPON FUEL RECEIPT RECORDS
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 13848.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: 12-MO ROLLING TIME PERIOD

Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDECK NILES, LLC

+Process Name:	EUEMENGINE (diesel fuel emergency engine)
+Process Type:	17.110
Primary Fuel:	diesel fuel
Throughput:	22.68
Throughput Unit:	MMBTU/H
Process Notes:	A 2,922 horsepower (HP) (2,179 kilowatts (kW)) natural gas-fueled emergency engine (EUEMENGINE) manufactured in 2011 or later and a displacement of

Pollutant Information: INDECK NILES, LLC - EUEMENGINE (diesel fuel emergency engine)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	3.5000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	6.4000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.2000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	1.5800
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	1.5800
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	15.0000
Emission Limit 1 Unit:	PPM
Emission Limit 1 Avg. Time/Condition:	FUEL SUPPLIER CERT. RECORDS OR TEST DATA
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	928.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	12-MO ROLLING TIME PERIOD
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDECK NILES, LLC

+Process Name:	EUFPENGINE (Emergency engine-diesel fire pump
+Process Type:	17.210
Primary Fuel:	diesel fuel
Throughput:	1.66

Throughput Unit: MMBTU/H
Process Notes: A 260 brake horsepower (bhp) diesel-fueled emergency engine manufactured in 2011 or later and a displacement of

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Pollutant Information: INDECK NILES, LLC - EUFPENGINE (Emergency engine-diesel fire pump

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+Pollutant Name Carbon Monoxide
Emission Limit 1: 2.6000
Emission Limit 1 Unit: G/BHP-H
Emission Limit 1 Avg. Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 3.0000
Emission Limit 1 Unit: G/BHP-H
Emission Limit 1 Avg. Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, filterable (FPM)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: G/BHP-H
Emission Limit 1 Avg. Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.5700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)

Emission Limit 1:	0.5700
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO_2)
Emission Limit 1:	15.0000
Emission Limit 1 Unit:	PPM
Emission Limit 1 Avg. Time/Condition:	FUEL SUPPLIER CERT. RECORDS OR TEST DATA
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO_2e)
Emission Limit 1:	13.5800
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	12-MO ROLLING TIME PERIOD
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: NORTHSTAR BLUESCOPE STEEL, LLC

RBLC ID:	*OH-0381
+Facility Name:	NORTHSTAR BLUESCOPE STEEL, LLC
Date determination entered in RBLC:	12/24/2019
Permit Type:	B: Add new process to existing facility
Facility Description:	Steel Mill
Permit Notes:	Initial installation PTI for expansion of mini mill operations resulting in increased facility production capacity including modification of existing operations and installation of the following new units: Electric Arc Furnace (EAF), twin-station Ladle Metallurgy Facility (LMF), casting operations, and support systems including cooling towers, natural gas

fired ladles/tundish heaters & dryers, tunnel furnace, dust handling system, storage silos, limestone receiving, scrap handling/storage, & alloy handling/storage.

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Plant Roadways & Parking Areas (F005)
+Process Type:	99.140
Primary Fuel:	
Throughput:	686399.00
Throughput Unit:	MI/YR
Process Notes:	Plant Roadways and Parking Areas. 0.88 miles unpaved and 12.94 miles paved. 27,636 unpaved VMT and 658,763 paved VMT

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Plant Roadways & Parking Areas (F005)

+Pollutant Name	Particulate matter, fugitive
Emission Limit 1:	16.7400
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	3.5500
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0.7500
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	North Alloy Storage and Handling (F006)
+Process Type:	81.290
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	North Alloy Storage and Handling (Scrap Storage Piles)

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - North Alloy Storage and Handling (F006)

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0024
Emission Limit 1 Unit:	GR/DSCF
Emission Limit 1 Avg. Time/Condition:	SEE NOTES
Emission Limit 2:	0.6800
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	SEE NOTES

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0024
Emission Limit 1 Unit:	GR/DSCF
Emission Limit 1 Avg. Time/Condition:	SEE NOTES
Emission Limit 2:	0.6800
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	SEE NOTES

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0024
Emission Limit 1 Unit:	GR/DSCF
Emission Limit 1 Avg. Time/Condition:	SEE NOTES

Emission Limit 2:	0.6800
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	SEE NOTES

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	5.0000
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	OPACITY AS A 6 MINUTE AVERAGE. SEE NOTE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Limestone Receiving #2 (F007)
+Process Type:	81.290
Primary Fuel:	
Throughput:	262800.00
Throughput Unit:	T/YR
Process Notes:	

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Limestone Receiving #2 (F007)

+Pollutant Name	Particulate matter, fugitive
Emission Limit 1:	1.1600
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	1.1600
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)

Emission Limit 1:	1.1600
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Scrap Unloading (F008)
+Process Type:	81.290
Primary Fuel:	
Throughput:	4070000.00
Throughput Unit:	T/YR
Process Notes:	Scrap unloading, transfer, and storage

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Scrap Unloading (F008)

+Pollutant Name	Particulate matter, fugitive
Emission Limit 1:	3.4600
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	1.6300
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0.2000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Tunnel Furnace (P001)
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	112.00
Throughput Unit:	MMBTU/H
Process Notes:	Raises and equalizes the temperature of the steel slabs to a level suitable for hot rolling.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Tunnel Furnace (P001)

0.07 lb/MMBtu

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	7.8400
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	34.3400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	7.8400

Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 34.3400
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD.

+Pollutant Name Particulate matter, filterable (FPM)
Emission Limit 1: 1.1200
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 4.9100
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 1.1200
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 4.9100
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 1.1200
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 4.9100
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.6200
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 2.7200
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name: Sulfur Dioxide (SO_2)
Emission Limit 1: 0.0700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.3100
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name: Carbon Dioxide Equivalent (CO_2e)
Emission Limit 1: 13087.2000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 53321.9400
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name: Finishing Mill (P003)
+Process Type: 81.290
Primary Fuel:
Throughput: 0
Throughput Unit:
Process Notes: Finish Mill (hot rolling mill).

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Finishing Mill (P003)

+Pollutant Name: Particulate matter, filterable (FPM)
Emission Limit 1: 2.2000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 9.6400
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name: Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 2.2000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 9.6400

Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	2.2000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.6400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Contact Cooling Towers (P014)
+Process Type:	99.009
Primary Fuel:	
Throughput:	6.41
Throughput Unit:	MMGAL/H
Process Notes:	5 Cooling Towers with drift eliminators as follows: Meltshop Cooling Tower (501) Caster Non-Contact Cooling Tower (6 Cell) Caster Contact Cooling Tower (503) Mill Contact Cooling Tower (505) Laminar Flow Cooling Tower (506)

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Contact Cooling Towers (P014)

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	8.7000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	6.9500
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0.0200
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Tunnel Furnace #2 (P018)
+Process Type:	13.310
Primary Fuel:	Natural Gas
Throughput:	88.00
Throughput Unit:	MMBTU/H
Process Notes:	Raises and equalizes the temperature of the steel slabs to a level suitable for hot rolling.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Tunnel Furnace #2 (P018)

0.07 lb/MMBtu

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	6.1600
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	26.9800
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	6.1600
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	26.9800
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.8800

Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 3.8500
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.8800
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 3.8500
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.8800
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 3.8500
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.4800
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 2.1000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0500
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.2200
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	10283.0600
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	45039.5400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Contact Cooling Towers - Melt Shop 2 (P027)
+Process Type:	99.009
Primary Fuel:	
Throughput:	2.70
Throughput Unit:	MMGAL/H
Process Notes:	5 Cooling Towers with drift eliminators as follows: Meltshop 2 Cooling Tower (non-contact) Caster Mold Water Cooling Tower Tunnel Furnace Cooling Tower Caster Non-Contact 2 Cooling Tower Caster Contact 2 Cooling Tower

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Contact Cooling Towers - Melt Shop 2 (P027)

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	1.1700
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	0.9300
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Tundish Dryer #2 (P030)
+Process Type:	19.600
Primary Fuel:	Natural Gas
Throughput:	1.20
Throughput Unit:	MMBTU/H
Process Notes:	

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Tundish Dryer #2 (P030)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.1200
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.5300
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0200
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.0900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0040
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.0200
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0040
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.0200

Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0040
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0200
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0100
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0300
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0010
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0040
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 140.2200
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 614.1800
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name: Baghouse Dust Handling Melt Shop 2 (P031)

+Process Type: 81.290
Primary Fuel:
Throughput: 0
Throughput Unit:
Process Notes:

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Baghouse Dust Handling Melt Shop 2 (P031)

+Pollutant Name Particulate matter, filterable (FPM)
Emission Limit 1: 0.0300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.1500
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0100
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0800
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0100
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0800
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Visible Emissions (VE)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:

Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	LMF Silo #2 & Lime/Carbon Silo: P032,P033,P034
+Process Type:	81.290
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	Consists of 3 emission units: Lime & Carbon Silos #3 (P032) Lime & Carbon Silos #4 (P033) Limestone Silo #2 (P034) All limits per each unit.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - LMF Silo #2 & Lime/Carbon Silo: P032,P033,P034

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0200
Emission Limit 1 Unit:	GR/DSCF
Emission Limit 1 Avg. Time/Condition:	SEE NOTES
Emission Limit 2:	0.5700
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.
+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	0.0200
Emission Limit 1 Unit:	GR/DSCF
Emission Limit 1 Avg. Time/Condition:	SEE NOTES
Emission Limit 2:	0.5700
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.
+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0.0200
Emission Limit 1 Unit:	GR/DSCF
Emission Limit 1 Avg. Time/Condition:	SEE NOTES
Emission Limit 2:	0.5700
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.
+Pollutant Name	Visible Emissions (VE)

Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Ladle Preheaters and Dryers (P021-023, P025-026)
+Process Type:	19.600
Primary Fuel:	Natural Gas
Throughput:	16.00
Throughput Unit:	MMBTU/H
Process Notes:	Consists of the 5 following units: Ladle Preheat #5 (P021) Ladle Preheat #6 (P022) Ladle Dryer #5 (P023) Ladle Dryer #3 (P025) Ladle Dryer #4(P026) All limits and throughputs are for each unit.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Ladle Preheaters and Dryers (P021-023, P025-026)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	1.6000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	7.0100
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.3200
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	1.4000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0500
Emission Limit 1 Unit:	LB/H

Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.2200
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0500
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.2200
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0500
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.2200
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0900
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.3900
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0100
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.0400
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD

+Pollutant Name Carbon Dioxide Equivalent (CO2e)

Emission Limit 1:	1869.6500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	8189.0300
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Electric Arc Furnace #2 (P905)
+Process Type:	81.210
Primary Fuel:	
Throughput:	250.00
Throughput Unit:	T/H
Process Notes:	EAF 2 (P905) direct evacuation control (DEC) and LMF 3/4 (P906) DEC vents to baghouse 2. Canopy hood captures emissions from P905, P906 and Caster 2 (P907) and vents to baghouse 2.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Electric Arc Furnace #2 (P905)

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	19.9300
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905, P906 AND P907. SEE NOTES
Emission Limit 2:	87.6900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	26.5700
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905, P906 AND P907. SEE NOTES
Emission Limit 2:	116.3800
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	26.5700
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905, P906 AND P907. SEE NOTES

Emission Limit 2:	116.3800
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	87.5000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	575.9000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	105.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	828.5000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	500.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	11603.5700
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	87.5000
Emission Limit 1 Unit:	LB/H

Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	712.2500
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	73000.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	594220.0000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Particulate matter, fugitive
Emission Limit 1:	20.9600
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Twin-Station Ladle Metallurgy Facility (LMF 3/4) (P906)
+Process Type:	81.220
Primary Fuel:	
Throughput:	250.00
Throughput Unit:	T/H
Process Notes:	EAF 2 (P905) direct evacuation control (DEC) and LMF 3/4 (P906) DEC vents to baghouse 2. Canopy hood captures emissions from P905, P906 and Caster 2 (P907) and vents to baghouse 2.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Twin-Station Ladle Metallurgy Facility (LMF 3/4) (P906)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	73000.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	594220.0000

Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Carbon Monoxide
Emission Limit 1: 500.0000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2: 11603.5700
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 105.0000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2: 828.5000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Particulate matter, filterable (FPM)
Emission Limit 1: 19.9300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905, P906 AND P907. SEE NOTES
Emission Limit 2: 87.6900
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Particulate matter, fugitive
Emission Limit 1: 20.9600
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 26.5700
Emission Limit 1 Unit: LB/H

Emission Limit 1 Avg.
Time/Condition: COMBINED P905, P906 AND P907. SEE NOTES
Emission Limit 2: 116.3800
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Particulate matter, total < 2.5 μ (TPM2.5)
Emission Limit 1: 26.5700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905, P906 AND P907. SEE NOTES
Emission Limit 2: 116.3800
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 87.5000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2: 575.9000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Visible Emissions (VE)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 87.5000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2: 712.2500
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Caster #2 (P907)
+Process Type:	81.230
Primary Fuel:	
Throughput:	250.00
Throughput Unit:	T/H
Process Notes:	EAF 2 (P905) direct evacuation control (DEC) and LMF 3/4 (P906) DEC vents to baghouse 2. Canopy hood captures emissions from P905, P906 and Caster 2 (P907) and vents to baghouse 2.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Caster #2 (P907)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	73000.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	594220.0000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	500.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	11603.5700
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	105.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	828.5000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	19.9300
Emission Limit 1 Unit:	LB/H

Emission Limit 1 Avg.
Time/Condition: COMBINED P905, P906 AND P907. SEE NOTES
Emission Limit 2: 87.6900
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Particulate matter, fugitive
Emission Limit 1: 20.9600
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 μ (TPM10)
Emission Limit 1: 26.5700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905, P906 AND P907. SEE NOTES
Emission Limit 2: 116.3800
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Particulate matter, total < 2.5 μ (TPM2.5)
Emission Limit 1: 26.5700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905, P906 AND P907. SEE NOTES
Emission Limit 2: 116.3800
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 87.5000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2: 575.9000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

+Pollutant Name Visible Emissions (VE)

Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	87.5000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	COMBINED P905 AND P906. SEE NOTES.
Emission Limit 2:	712.2500
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING, 12-MONTH PERIOD. SEE NOTES.

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Shuttle Cars #1 and #2 (P019 and P020)
+Process Type:	19.600
Primary Fuel:	Natural Gas
Throughput:	30.00
Throughput Unit:	MMBTU/H
Process Notes:	Consists of the 2 following units: Shuttle Car #1 (P019) Shuttle Car #2 (P020) All limits and throughputs are for each unit.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Shuttle Cars #1 and #2 (P019 and P020)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.1000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.2000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12-MONTH PERIOD.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.1000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	

Emission Limit 2: 9.2000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Particulate matter, total (TPM)
Emission Limit 1: 0.3000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 1.3100
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.3000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 1.3100
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.3000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 1.3100
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.1700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.7400
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0200
Emission Limit 1 Unit: LB/H

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.0900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12-MONTH PERIOD.

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	3505.5900
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	15354.4300
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12-MONTH PERIOD.

Process Information: NORTHSTAR BLUESCOPE STEEL, LLC

+Process Name:	Tundish Preheaters #3 and #4 (P028 and P029)
+Process Type:	19.600
Primary Fuel:	Natural Gas
Throughput:	9.50
Throughput Unit:	mmbtu/hr
Process Notes:	All limits and throughputs are for each unit.

Pollutant Information: NORTHSTAR BLUESCOPE STEEL, LLC - Tundish Preheaters #3 and #4 (P028 and P029)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.9500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	4.1600
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12-MONTH PERIOD.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.1900
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.8300
Emission Limit 2 Unit:	T/YR

Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Particulate matter, total (TPM)
Emission Limit 1: 0.0300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.1300
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.1300
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.1300
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0500
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.2200
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12-MONTH PERIOD.

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0100
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:

Emission Limit 2:	0.0400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12-MONTH PERIOD.

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1110.1000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	4862.2400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12-MONTH PERIOD.

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
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Facility Information: LEHIGH CEMENT COMPANY LLC

RBLC ID:	IN-0312
+Facility Name:	LEHIGH CEMENT COMPANY LLC
Date determination entered in RBLC:	07/10/2019
Permit Type:	B: Add new process to existing facility
Facility Description:	Portland Cement Plant
Permit Notes:	

Process Information: LEHIGH CEMENT COMPANY LLC

+Process Name:	Kiln
+Process Type:	90.028
Primary Fuel:	natural gas, coal, coke, Fuel oils
Throughput:	7716.00
Throughput Unit:	tons clinker/day
Process Notes:	

Pollutant Information: LEHIGH CEMENT COMPANY LLC - Kiln

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	1.5000
Emission Limit 1 Unit:	LB/TON CLINKER
Emission Limit 1 Avg. Time/Condition:	30-DAY ROLLING AVERAGE

Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	1.4000
Emission Limit 1 Unit:	LB/TON CLINKER
Emission Limit 1 Avg. Time/Condition:	12-MONTH ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.1200
Emission Limit 1 Unit:	LB/TON CLINKER
Emission Limit 1 Avg. Time/Condition:	12-MONTH ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0.9700
Emission Limit 1 Unit:	TON CO2E/TON CLINKER
Emission Limit 1 Avg. Time/Condition:	12-MONTH ROLLING AVERAGE BASIS
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LEHIGH CEMENT COMPANY LLC

+Process Name:	Finish Mill Air Heaters
+Process Type:	12.310
Primary Fuel:	natural gas
Throughput:	16.70
Throughput Unit:	MMBtu/hr (each)
Process Notes:	

Pollutant Information: LEHIGH CEMENT COMPANY LLC - Finish Mill Air Heaters

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+Pollutant Name	Nitrogen Oxides (NOx)

0.05 lb/MMBtu

Emission Limit 1:	50.0000
Emission Limit 1 Unit:	LB/MMCF NATURAL GAS
Emission Limit 1 Avg. Time/Condition:	NA
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0500
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	-
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	--
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	8657.0000
Emission Limit 1 Unit:	TONS/YEAR
Emission Limit 1 Avg. Time/Condition:	--
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LEHIGH CEMENT COMPANY LLC

+Process Name:	spark ignition engine
+Process Type:	17.230
Primary Fuel:	natural gas
Throughput:	750.00
Throughput Unit:	kW
Process Notes:	

Pollutant Information: LEHIGH CEMENT COMPANY LLC - spark ignition engine

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	G/HP-H
Emission Limit 1 Avg. Time/Condition:	--
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Carbon Monoxide
Emission Limit 1:	4.0000
Emission Limit 1 Unit:	G/HP-H
Emission Limit 1 Avg. Time/Condition:	--
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	1.0000
Emission Limit 1 Unit:	G/HP-H
Emission Limit 1 Avg. Time/Condition:	--
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	206.0900
Emission Limit 1 Unit:	TONS/YEAR
Emission Limit 1 Avg. Time/Condition:	--
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LEHIGH CEMENT COMPANY LLC

+Process Name:	Diesel tanks
+Process Type:	42.009

Primary Fuel:	Diesel
Throughput:	1400.00
Throughput Unit:	GALLONS (EACH)
Process Notes:	

Pollutant Information: LEHIGH CEMENT COMPANY LLC - Diesel tanks

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LEHIGH CEMENT COMPANY LLC

+Process Name:	Gasoline tank
+Process Type:	42.009
Primary Fuel:	gasoline
Throughput:	500.00
Throughput Unit:	gallons
Process Notes:	

Pollutant Information: LEHIGH CEMENT COMPANY LLC - Gasoline tank

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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Facility Information: CHICKAHOMINY POWER LLC

RBLC ID:	*VA-0332
+Facility Name:	CHICKAHOMINY POWER LLC
Date determination entered in RBLC:	08/07/2019
Permit Type:	A: New/Greenfield Facility
Facility Description:	Natural gas-fired combined cycle power plant, three 1 x1 configuration, 310 MW each, no duct firing, air cooled with two 84 MMBtu/hr natural gas-fired auxiliary boilers, three fuel gas heaters, an emergency generator, fire water pump, and circuit breakers.
Permit Notes:	The proposed project will be a new combined-cycle electrical power generating facility utilizing three power blocks consisting of a combustion turbine with a heat recovery steam generator (HRSG) and a reheat condensing steam turbine generator (three 1 x 1 configuration). The turbine model proposed is a MHPS M501JAC turbine. The project will have a nominal net generating capacity of 1,650 MW. The proposed fuel for the turbines is pipeline-quality natural gas. Emissions from the turbines will be controlled by the use of low carbon fuels and high efficiency design (for GHG), clean fuels and GCPs (for PM, PM10 and PM2.5), SCR and dry low NOx burners (for NOx), and oxidation catalyst (for CO and VOC). Other equipment at the site, including two natural gas-fired auxiliary boilers, three fuel gas heaters, a diesel-fired emergency fire water pump, and a diesel-fired emergency generator, are also proposed and will be subject to emission controls. Natural gas piping components and electrical circuit breakers potentially emit GHG pollutants (expressed as carbon dioxide equivalents, or CO2e) and they will also be covered in the permit. This facility is not proposing duct firing in the HRSGs and is proposing air-cooled turbines that will not require cooling towers.

Process Information: CHICKAHOMINY POWER LLC

+Process Name:	Three (3) Mitsubishi Hitachi Power Systems combustion turbine generators
+Process Type:	15.210
Primary Fuel:	natural gas
Throughput:	35000.00
Throughput Unit:	MMCF/YR
Process Notes:	One on one configuration: 4,066 MMBtu/hr combustion turbine. Emission limits reflect the operation of each of the three turbines.

Pollutant Information: CHICKAHOMINY POWER LLC - Three (3) Mitsubishi Hitachi Power Systems combustion turbine generators

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPMVD 15% O2

Emission Limit 1 Avg.
Time/Condition: 1 HR AVG
Emission Limit 2: 128.4000
Emission Limit 2 Unit: TONS/YR
Emission Limit 2 Avg.
Time/Condition: 12-MO ROLLING AVG

+Pollutant Name Carbon Monoxide
Emission Limit 1: 1.0000
Emission Limit 1 Unit: PPMVD @ 15% O2
Emission Limit 1 Avg.
Time/Condition: 3 HR AVG
Emission Limit 2: 94.3000
Emission Limit 2 Unit: TONS/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING AVG

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.7000
Emission Limit 1 Unit: PPMVD @ 15% O2
Emission Limit 1 Avg.
Time/Condition: 3 HR AVG
Emission Limit 2: 68.1000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING AVG

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0011
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: 3 HR AVG
Emission Limit 2: 20.4000
Emission Limit 2 Unit: TONS/YR
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0.0012
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: 3 HR AVG
Emission Limit 2: 21.4000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING AVG

+Pollutant Name Particulate matter, filterable (FPM)

Emission Limit 1:	0.0052
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	AVG. OF 3 TEST RUNS
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0052
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	AVG OF 3 TEST RUNS
Emission Limit 2:	12.3000
Emission Limit 2 Unit:	LB/HR
Emission Limit 2 Avg. Time/Condition:	AVG OF 3 TEST RUNS

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0052
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	AVG OF 3 TEST RUNS
Emission Limit 2:	12.3000
Emission Limit 2 Unit:	LB/HR
Emission Limit 2 Avg. Time/Condition:	AVG OF 3 TEST RUNS

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	812.0000
Emission Limit 1 Unit:	LB/CO2E/MW-HR
Emission Limit 1 Avg. Time/Condition:	12 MO ROLLING TOTAL
Emission Limit 2:	6452.0000
Emission Limit 2 Unit:	BTU/KW-HR NET HHV
Emission Limit 2 Avg. Time/Condition:	INITIAL HEAR RATE TEST

Process Information: CHICKAHOMINY POWER LLC

+Process Name:	Three (3) Mitsubishi Hitachi Power Systems Combustion
+Process Type:	15.210
Primary Fuel:	natural gas
Throughput:	35000.00
Throughput Unit:	MMCF/YR
Process Notes:	Alternative operating scenario: during periods of tuning

Pollutant Information: CHICKAHOMINY POWER LLC - Three (3) Mitsubishi Hitachi Power Systems Combustion

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	703.0000
Emission Limit 1 Unit:	LB/TURBINE/CAL. DAY
Emission Limit 1 Avg. Time/Condition:	24 HR TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	214.0000
Emission Limit 1 Unit:	LB/TURBINE/DAY
Emission Limit 1 Avg. Time/Condition:	24 HR TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CHICKAHOMINY POWER LLC

+Process Name:	Three (3) Mitsubishi Hitachi Power Systems combustion turbine generators
+Process Type:	15.210
Primary Fuel:	natural gas
Throughput:	35000.00
Throughput Unit:	MMCF/YR
Process Notes:	Startup and Shutdown

Pollutant Information: CHICKAHOMINY POWER LLC - Three (3) Mitsubishi Hitachi Power Systems combustion turbine generators

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	60.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START-42 MINUTES OR LESS
Emission Limit 2:	0
Emission Limit 2 Unit:	LB/TURBINE/EVENT
Emission Limit 2 Avg. Time/Condition:	COLD START-42 MINUTES OR LESS

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	444.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START 42 MIN OR LESS
Emission Limit 2:	396.0000
Emission Limit 2 Unit:	LB/TURBINE/EVENT
Emission Limit 2 Avg. Time/Condition:	WARM START 42 MIN OR LESS

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	216.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START 42 MIN OR LESS
Emission Limit 2:	216.0000
Emission Limit 2 Unit:	LB/TURBINE/EVENT
Emission Limit 2 Avg. Time/Condition:	WARM START 42 MIN OR LESS

Process Information: CHICKAHOMINY POWER LLC

+Process Name:	Two (2) Auxiliary Boilers
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	721.00
Throughput Unit:	MMCF/YR
Process Notes:	

Pollutant Information: CHICKAHOMINY POWER LLC - Two (2) Auxiliary Boilers

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+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0110
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	CORRECTED TO 3% O2
Emission Limit 2:	1.0000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0370
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	

Emission Limit 2: 3.2000
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.6000
Emission Limit 1 Unit: LB/HR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 2.6000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: 12 MO ROLLING AVG

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.6000
Emission Limit 1 Unit: LB/HR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 2.6000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: 12 MO ROLLING AVG

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0011
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.5000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: 12 MO ROLLING TOTAL

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0050
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 1.9000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: 12 MO ROLLING AVG

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 43827.0000
Emission Limit 1 Unit: T/YR

Emission Limit 1 Avg. Time/Condition: 12 MO ROLLING TOTAL
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: CHICKAHOMINY POWER LLC

+Process Name: Three (3) Fuel Gas Heaters
+Process Type: 19.600
Primary Fuel: Natural Gas
Throughput: 103.00
Throughput Unit: MMCF/YR
Process Notes:

Pollutant Information: CHICKAHOMINY POWER LLC - Three (3) Fuel Gas Heaters

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+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0.0110
Emission Limit 1 Unit: LBS/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.6000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: 12 MO ROLLING TOTAL

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0.0370
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.5000
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 μ (TPM10)
Emission Limit 1: 0.4000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.5000
Emission Limit 1 Unit: T/YR (EACH)
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.3000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition: 12 MO ROLLING AVG
Emission Limit 2: 0.0050
Emission Limit 2 Unit: LB/MMBTU
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 6261.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:

Emission Limit 2 Avg. Time/Condition:

Process Information: CHICKAHOMINY POWER LLC

+Process Name:	Emergency Diesel Generator - 300 kW
+Process Type:	17.110
Primary Fuel:	Ultra Low Sulfur Diesel
Throughput:	500.00
Throughput Unit:	H/YR
Process Notes:	

Pollutant Information: CHICKAHOMINY POWER LLC - Emergency Diesel Generator - 300 kW

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	4.8000
Emission Limit 1 Unit:	G/HP-H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	11.7000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING AVG

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	G/HP-H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	G/HP-HR

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.6000
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	6.4000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING AVG

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0.0015
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0.0001
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1203.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	12 MO ROLLING TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CHICKAHOMINY POWER LLC

+Process Name:	Emegency Fire Water Pump
+Process Type:	17.210
Primary Fuel:	Ultra Low Sulfur Diesel
Throughput:	500.00
Throughput Unit:	HR/YR
Process Notes:	

Pollutant Information: CHICKAHOMINY POWER LLC - Emegency Fire Water Pump

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	3.0000
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.7000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0

Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.6000
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.6000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.1100
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0.0015
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0.0001
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	106.0000
Emission Limit 1 Unit:	T/YR

Emission Limit 1 Avg. Time/Condition:	12 MO ROLLING TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CHICKAHOMINY POWER LLC

+Process Name:	Circuit Breakers
+Process Type:	99.999
Primary Fuel:	
Throughput:	0.50
Throughput Unit:	%
Process Notes:	Total capacity of 22,800 lbs of SF 6 Annual Leakage Rate

Pollutant Information: CHICKAHOMINY POWER LLC - Circuit Breakers

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CHICKAHOMINY POWER LLC

+Process Name:	Equipment Leaks from Natural Gas Components
+Process Type:	99.999
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	Workpractice requirements

Pollutant Information: CHICKAHOMINY POWER LLC - Equipment Leaks from Natural Gas Components

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0

Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

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**NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".**

Facility Information: BIG RIVER STEEL LLC

RBLC ID:	AR-0163
+Facility Name:	BIG RIVER STEEL LLC
Date determination entered in RBLC:	07/13/2020
Permit Type:	Both B: (Add new process to existing facility) &C: (Modify process at existing facility)
Facility Description:	THE FACILITY WILL CONSIST OF TWO ELECTRIC ARC FURNACES TO MELT SCRAP IRON AND STEEL, LADLE METALLURGY FURNACES (LMF) TO ADJUST THE CHEMISTRY, A RH DEGASSER AND BOILER FOR FURTHER REFINEMENT, AND CASTERS.
Permit Notes:	

Process Information: BIG RIVER STEEL LLC

+Process Name:	Lime Injector Burners
+Process Type:	17.130
Primary Fuel:	Natural Gas
Throughput:	0
Throughput Unit:	
Process Notes:	Each EAF is equipped with a natural gas fired lime injection burner each rated at 18.5 MMBtu/hr and assigned SN-01A and SN-02A, respectively.

Pollutant Information: BIG RIVER STEEL LLC - Lime Injector Burners

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Visible Emissions (VE)
Emission Limit 1: 5.0000
Emission Limit 1 Unit: %
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0.0824
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0.0950
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:

Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	117.0000
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Methane
Emission Limit 1:	0.0022
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrous Oxide (N2O)
Emission Limit 1:	0.0002
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: BIG RIVER STEEL LLC

+Process Name:	Steel Casters
+Process Type:	81.230
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	The liquid steel proceeds from the LMF to the RH Degasser, SN-03, or to the Casters, SN-14 and SN-15 depending on the type of steel being produced.

Pollutant Information: BIG RIVER STEEL LLC - Steel Casters

+Pollutant Name	Particulate matter, filterable (FPM)

Emission Limit 1:	0.0620
Emission Limit 1 Unit:	LB/TON LIQUID STEEL
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0620
Emission Limit 1 Unit:	LB/TON LIQUID STEEL
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0620
Emission Limit 1 Unit:	LB/TON LIQUID STEEL
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: BIG RIVER STEEL LLC

+Process Name:	Tunnel Furnaces
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	234.00
Throughput Unit:	
Process Notes:	2 TUNNEL FURNCE SECTIONS 234 MMBTU/HR AND 192 MMBTU/HR MADE UP OF A SERIES OF INDIVIDUAL 3 MMBTU BURNERS. Also includes the Tunnel Furnace Shuttle Zone.

Pollutant Information: BIG RIVER STEEL LLC - Tunnel Furnaces

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	

Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 μ (TPM10)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 μ (TPM2.5)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Visible Emissions (VE)
Emission Limit 1: 5.0000
Emission Limit 1 Unit: %
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0006
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0054
Emission Limit 1 Unit: LB/MMBTU

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0824
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.1000
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	117.0000
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Methane
Emission Limit 1:	0.0022
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrous Oxide (N2O)

Emission Limit 1:	0.0002
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: BIG RIVER STEEL LLC

+Process Name:	Emergency Engines
+Process Type:	17.110
Primary Fuel:	Diesel
Throughput:	0
Throughput Unit:	
Process Notes:	The emergency generators are diesel fired generators which provide electrical power in the event of power failure.

Pollutant Information: BIG RIVER STEEL LLC - Emergency Engines

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.2000
Emission Limit 1 Unit:	G/KW-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.2000
Emission Limit 1 Unit:	G/KW-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.2000
Emission Limit 1 Unit:	G/KW-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0

Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	20.0000
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO_2)
Emission Limit 1:	0.0015
Emission Limit 1 Unit:	% SULFUR FUEL
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	1.5500
Emission Limit 1 Unit:	G/KW-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	3.5000
Emission Limit 1 Unit:	G/KW-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NO_x)
Emission Limit 1:	4.8600
Emission Limit 1 Unit:	G/KW-HR

Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	163.0000
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Methane
Emission Limit 1:	0.0061
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrous Oxide (N2O)
Emission Limit 1:	0.0013
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: BIG RIVER STEEL LLC

+Process Name:	EAF I/II Lime Injection System
+Process Type:	81.290
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	EAF I/II Lime Injection System, SN-103, accounts for the emissions from the transport and storage of the various types of lime for injection into EAF I and II.

Pollutant Information: BIG RIVER STEEL LLC - EAF I/II Lime Injection System

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.1000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.4000
Emission Limit 2 Unit:	TPY
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.1000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.4000
Emission Limit 2 Unit:	TPY
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.1000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.4000
Emission Limit 2 Unit:	TPY
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	5.0000
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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Required fields are denoted by "+".

Facility Information: PETMIN USA INCORPORATED

RBLC ID:	OH-0379
+Facility Name:	PETMIN USA INCORPORATED
Date determination entered in RBLC:	04/02/2019
Permit Type:	A: New/Greenfield Facility
Facility Description:	Merchant Pig Iron Production
Permit Notes:	Initial PTI to convert iron ore pellets to merchant pig iron, including the installation of a process gas heater, electric arc furnace, startup boiler, black start generator, emergency generators, ladle preheaters, quenching & wastewater treatment, material handling and roadways.

Process Information: PETMIN USA INCORPORATED

+Process Name:	Startup boiler (B001)
+Process Type:	13.310
Primary Fuel:	Natural gas
Throughput:	15.17
Throughput Unit:	MMBTU/H
Process Notes:	Startup boiler, natural gas fired with maximum heat input of 15.17 MMBtu/hr.

Pollutant Information: PETMIN USA INCORPORATED - Startup boiler (B001)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.1130
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	0.4900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD. SEE NOTES.

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.1130
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	0.4900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD. SEE NOTES.

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1784.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	7814.0000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.6340
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	2.7800
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

0.04 lb/MMBtu

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: PETMIN USA INCORPORATED

+Process Name:	Plant Roadways (F001)
+Process Type:	99.150
Primary Fuel:	
Throughput:	4195.00
Throughput Unit:	MI/YR
Process Notes:	Unpaved plant roadways and parking areas

Pollutant Information: PETMIN USA INCORPORATED - Plant Roadways (F001)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.2100
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0

Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0200
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: PETMIN USA INCORPORATED

+Process Name:	Process gas heater (P001)
+Process Type:	12.310
Primary Fuel:	Natural gas
Throughput:	218.90
Throughput Unit:	MMBTU/H
Process Notes:	Process gas preheater, natural gas, indirect fired with maximum heat input of 218.9 MMBtu/hr, emissions are vented to a stack.

Pollutant Information: PETMIN USA INCORPORATED - Process gas heater (P001)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	1.6300
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	7.1400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD. SEE NOTES.

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)

Emission Limit 1:	1.6300
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	7.1400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD. SEE NOTES.

0.064 lb/MMBtu

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	14.0100
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	61.3600
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	25830.2000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	113136.0000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD. SEE NOTES.

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: PETMIN USA INCORPORATED

+Process Name:	Black Start Generator (P007)
+Process Type:	17.210
Primary Fuel:	Diesel fuel
Throughput:	158.00
Throughput Unit:	HP
Process Notes:	Black start generator, 158 HP diesel engine.

Pollutant Information: PETMIN USA INCORPORATED - Black Start Generator (P007)

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	5.2200
Emission Limit 1 Unit:	X10-3 LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	2.6100
Emission Limit 2 Unit:	X10-4 T/YR
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	5.2200
Emission Limit 1 Unit:	X10-3 LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	2.6100
Emission Limit 2 Unit:	X10-4 T/YR
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.1040
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	5.2000
Emission Limit 2 Unit:	X10-3 T/YR
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	181.7000
Emission Limit 1 Unit:	LB/H

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.0900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	

Process Information: PETMIN USA INCORPORATED

+Process Name:	Quenching & wastewater treatment (P008)
+Process Type:	81.900
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	Quenching & wastewater treatment, equipped with a flare.

Pollutant Information: PETMIN USA INCORPORATED - Quenching & wastewater treatment (P008)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0257
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	0.1130
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD. SEE NOTES.
+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0257
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	0.1130
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD. SEE NOTES.
+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.2350
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	1.0300
Emission Limit 2 Unit:	T/YR

Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

+Pollutant Name	Carbon Dioxide Equivalent (CO_2e)
Emission Limit 1:	405.7200
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	1777.0000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

Process Information: PETMIN USA INCORPORATED

+Process Name:	Electric Arc Furnace (EAF) (P901)
+Process Type:	81.900
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	Electric Arc Furnace, including smelting, tapping, pouring, and casting.

Pollutant Information: PETMIN USA INCORPORATED - Electric Arc Furnace (EAF) (P901)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0740
Emission Limit 1 Unit:	LB/T
Emission Limit 1 Avg. Time/Condition:	OF MERCHANT PIG IRON (MPI) PRODUCED
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0061
Emission Limit 1 Unit:	LB/T
Emission Limit 1 Avg. Time/Condition:	OF MERCHANT PIG IRON (MPI) PRODUCED
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	1.4000
Emission Limit 1 Unit:	LB/T

Emission Limit 1 Avg. Time/Condition:	OF MERCHANT PIG IRON (MPI) PRODUCED
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	186.4100
Emission Limit 1 Unit:	LB/T
Emission Limit 1 Avg. Time/Condition:	OF MERCHANT PIG IRON (MPI) PRODUCED
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: PETMIN USA INCORPORATED

+Process Name:	Material Handling (P902)
+Process Type:	81.900
Primary Fuel:	
Throughput:	788000.00
Throughput Unit:	T/YR
Process Notes:	Raw materials handling, including screening and transfer via conveyor system.

Pollutant Information: PETMIN USA INCORPORATED - Material Handling (P902)

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: PETMIN USA INCORPORATED

+Process Name:	Emergency Generators (P005 and P006)
+Process Type:	17.110
Primary Fuel:	Diesel fuel
Throughput:	3131.00
Throughput Unit:	HP
Process Notes:	Two identical Emergency generators, 3131 HP diesel engines. Throughputs and limits are for one generator, except as noted.

Pollutant Information: PETMIN USA INCORPORATED - Emergency Generators (P005 and P006)

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.0100
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0.1500

Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.0100
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	3.4500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.1700
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	3632.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	181.6000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	

Process Information: PETMIN USA INCORPORATED

+Process Name:	Ladle Preheaters (P002, P003 and P004)
+Process Type:	13.310
Primary Fuel:	Natural gas
Throughput:	15.00
Throughput Unit:	MMBTU/H

Process Notes:	Three identical Ladle dryers / preheaters, natural gas fired with maximum heat input of 15.00 MMBtu/hr, emissions are vented to the EAF baghouse. Throughputs and limits are for one preheater, except as noted.

Pollutant Information: PETMIN USA INCORPORATED - Ladle Preheaters (P002, P003 and P004)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.1120
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.4900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD
+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.1120
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.4900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD
+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.1200
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.2900
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD
+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1764.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	7726.0000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

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Facility Information: NUCOR STEEL KANKAKEE, INC.

RBLC ID:	IL-0126
+Facility Name:	NUCOR STEEL KANKAKEE, INC.
Date determination entered in RBLC:	12/05/2018
Permit Type:	Both B: (Add new process to existing facility) &C: (Modify process at existing facility)
Facility Description:	Nucor Steel produces steel billets from scrap metal in an electric arc furnace shop. The billets produced at the plant are either further processed at the rolling mills. The rolling mills at the plant produce steel bars and rods in various shapes and sizes from the billets produced at the plant.
Permit Notes:	Operation of certain existing emission units at the plant were considered to be affected units for the project. These existing units were appropriately addressed in the permit. The existing units that were considered as affected units are an existing electric arc furnace, a reheat furnace and existing roadways.

Process Information: NUCOR STEEL KANKAKEE, INC.

+Process Name:	Natural Gas-Fired Reheat Furnace
+Process Type:	81.290
Primary Fuel:	Natural Gas
Throughput:	125.50
Throughput Unit:	mmBtu/hr
Process Notes:	

Pollutant Information: NUCOR STEEL KANKAKEE, INC. - Natural Gas-Fired Reheat Furnace

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0700
Emission Limit 1 Unit:	LBS/MMBTU
Emission Limit 1 Avg. Time/Condition:	DAILY (24-HR) AVERAGE
Emission Limit 2:	11.3000
Emission Limit 2 Unit:	LBS/HR
Emission Limit 2 Avg. Time/Condition:	AVERAGE VALID TEST RUN

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0130
Emission Limit 1 Unit:	LBS/MMBTU

Emission Limit 1 Avg. Time/Condition:	3-HR BLOCK AVERAGE
Emission Limit 2:	5.0000
Emission Limit 2 Unit:	PERCENT OPACITY
Emission Limit 2 Avg. Time/Condition:	VERIFIED USING METHOD 9 TESTING
+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	65200.0000
Emission Limit 1 Unit:	TONS
Emission Limit 1 Avg. Time/Condition:	TOTAL 12 CONSECUTIVE MONTHS
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NUCOR STEEL KANKAKEE, INC.

+Process Name:	Rolling Mill and Cutting Torches
+Process Type:	81.290
Primary Fuel:	
Throughput:	500000.00
Throughput Unit:	tons/yr
Process Notes:	

Pollutant Information: NUCOR STEEL KANKAKEE, INC. - Rolling Mill and Cutting Torches

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	6.6500
Emission Limit 1 Unit:	TON/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	424.0000
Emission Limit 1 Unit:	TONS
Emission Limit 1 Avg. Time/Condition:	TOTAL 12 CONSECUTIVE MONTHS
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.1000
Emission Limit 1 Unit:	LBS/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	6.6500
Emission Limit 1 Unit:	TON/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	2.4600
Emission Limit 1 Unit:	TON/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: NUCOR STEEL KANKAKEE, INC.

+Process Name:	Gas-Fired Space Heaters
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	25.00
Throughput Unit:	mmBtu/hr
Process Notes:	Throughput addresses all space heaters

Pollutant Information: NUCOR STEEL KANKAKEE, INC. - Gas-Fired Space Heaters

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+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0019
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	INDIVIDUAL UNITS

Emission Limit 2: 0.1500
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition: TOTAL FROM ALL UNITS

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0.1000
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 1.9300
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition: (TOTAL FROM ALL UNITS)

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 10197.0000
Emission Limit 1 Unit: TON/YR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition: INDIVIDUAL UNITS
Emission Limit 2: 0.1500
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition: TOTAL FROM ALL UNITS

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition: FOR INDIVIDUAL UNITS
Emission Limit 2: 0.1500
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition: TOTAL FROM ALL UNITS

Process Information: NUCOR STEEL KANKAKEE, INC.

+Process Name:	Cooling Towers
+Process Type:	81.290
Primary Fuel:	
Throughput:	4500.00
Throughput Unit:	gallons/minute
Process Notes:	

Pollutant Information: NUCOR STEEL KANKAKEE, INC. - Cooling Towers

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0010
Emission Limit 1 Unit:	WEIGHT PERCENT
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	4000.0000
Emission Limit 2 Unit:	TOTAL DISOLVED SOLID
Emission Limit 2 Avg. Time/Condition:	

Process Information: NUCOR STEEL KANKAKEE, INC.

+Process Name:	Roadways
+Process Type:	81.290
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: NUCOR STEEL KANKAKEE, INC. - Roadways

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	2.3900
Emission Limit 1 Unit:	TON/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.4800
Emission Limit 1 Unit:	TON/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0

Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.1200
Emission Limit 1 Unit:	TON/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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**NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".**

Report Date: 03/29/2021 Control Technology Determinations (Freeform)

Facility Information: CALCASIEU PASS LNG PROJECT

RBLC ID:	LA-0331
+Facility Name:	CALCASIEU PASS LNG PROJECT
Date determination entered in RBLC:	02/14/2019
Permit Type:	A: New/Greenfield Facility
Facility Description:	New Liquefied Natural Gas (LNG) production, storage, and export terminal.
Permit Notes:	Application Received September 2, 2015.

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Combined Cycle Combustion Turbines (CCCT1 to CCCT5)
+Process Type:	15.210
Primary Fuel:	Natural Gas
Throughput:	921.00
Throughput Unit:	MM BTU/h
Process Notes:	

Pollutant Information: CALCASIEU PASS LNG PROJECT - Combined Cycle Combustion Turbines (CCCT1 to CCCT5)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.5000
Emission Limit 1 Unit:	PPMV

Emission Limit 1 Avg.
Time/Condition: 30 DAY ROLLING AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 5.0000
Emission Limit 1 Unit: PPMV
Emission Limit 1 Avg.
Time/Condition: 30 DAY ROLLING AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 9.5300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 9.5300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 4.0000
Emission Limit 1 Unit: PPMV
Emission Limit 1 Avg.
Time/Condition: ANNUAL AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)

Emission Limit 1: 1.1000
Emission Limit 1 Unit: PPMV
Emission Limit 1 Avg. Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 2602275.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition: ANNUAL TOTAL
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name: Hot Oil Heaters (HOH1 to HOH6)
+Process Type: 12.310
Primary Fuel: Natural Gas
Throughput: 115.00
Throughput Unit: MM BTU/h
Process Notes:

Pollutant Information: CALCASIEU PASS LNG PROJECT - Hot Oil Heaters (HOH1 to HOH6)

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0.0380
Emission Limit 1 Unit: LB/MM BTU
Emission Limit 1 Avg. Time/Condition: 3-HOUR AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0.0820
Emission Limit 1 Unit: LB/ MM BTU
Emission Limit 1 Avg. Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:

Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0.0006
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	354456.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	

Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Acid Gas Thermal Oxidizer (AGTO)
+Process Type:	19.200
Primary Fuel:	Natural Gas
Throughput:	186.00
Throughput Unit:	MM BTU/h
Process Notes:	Thermal Oxidizer to combust sour gas from the acid removal unit.

Pollutant Information: CALCASIEU PASS LNG PROJECT - Acid Gas Thermal Oxidizer (AGTO)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0900
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0082
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)

Emission Limit 1:	0.0082
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	2.3700
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0100
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	768337.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	ANNUAL TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Large Emergency Engines (>50kW)
+Process Type:	17.110
Primary Fuel:	Diesel Fuel
Throughput:	5364.00
Throughput Unit:	HP
Process Notes:	Three emergency black-start engines and two emergency generators

Pollutant Information: CALCASIEU PASS LNG PROJECT - Large Emergency Engines (>50kW)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	5.6000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	3.5000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.2000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.2000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.7900
Emission Limit 1 Unit:	G/KW-H

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0
Emission Limit 1 Unit:	LB/HP-H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1481.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	ANNUAL TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Fugitive Equipment Leaks
+Process Type:	50.002
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	Fugitive Emissions

Pollutant Information: CALCASIEU PASS LNG PROJECT - Fugitive Equipment Leaks

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+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	5.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	ANNUAL TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	3141.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	ANNUAL TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Flares (WRMFLR, CLDFLR, LPFLR)
+Process Type:	19.390
Primary Fuel:	Natural Gas
Throughput:	21.74
Throughput Unit:	MM BTU/h
Process Notes:	Flare system to provide safe and reliable disposal of streams released during start-up, shutdown, plant upsets, and emergency conditions.

Pollutant Information: CALCASIEU PASS LNG PROJECT - Flares (WRMFLR, CLDFLR, LPFLR)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0680
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.3100
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0074
Emission Limit 1 Unit:	LB/MM BTU

Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0074
Emission Limit 1 Unit: LB/MM BTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 4.0000
Emission Limit 1 Unit: PPMV
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0060
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Marine Loading Flare
+Process Type:	19.390
Primary Fuel:	Natural Gas
Throughput:	0.31
Throughput Unit:	MM BTU/h
Process Notes:	Control Device for LNG loading process.

Pollutant Information: CALCASIEU PASS LNG PROJECT - Marine Loading Flare

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0680
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.3100
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0074
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0074
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0

Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO_2)
Emission Limit 1:	4.0000
Emission Limit 1 Unit:	PPMV
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0060
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO_2e)
Emission Limit 1:	1107.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	ANNUAL TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Aeroderivative Simple Cycle Combustion Turbine
+Process Type:	16.110
Primary Fuel:	Natural Gas
Throughput:	263.00
Throughput Unit:	MM BTU/h
Process Notes:	

Pollutant Information: CALCASIEU PASS LNG PROJECT - Aeroderivative Simple Cycle Combustion Turbine

+Pollutant Name	Nitrogen Oxides (NOx)

Emission Limit 1: 25.0000
Emission Limit 1 Unit: PPMV
Emission Limit 1 Avg. Time/Condition: 30 DAY ROLLING AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 36.0000
Emission Limit 1 Unit: PPMV
Emission Limit 1 Avg. Time/Condition: 30 DAY ROLLING AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 μ (TPM10)
Emission Limit 1: 4.5000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 μ (TPM2.5)
Emission Limit 1: 4.5000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 4.0000
Emission Limit 1 Unit: PPMV
Emission Limit 1 Avg. Time/Condition: ANNUAL AVERAGE
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	1.5000
Emission Limit 1 Unit:	PPMV
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	134907.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	ANNUAL TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Storage Tanks
+Process Type:	50.002
Primary Fuel:	
Throughput:	7183.15
Throughput Unit:	CF
Process Notes:	Pentane and Amine Flash Drums

Pollutant Information: CALCASIEU PASS LNG PROJECT - Storage Tanks

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Simple Cycle Combustion Turbines (SCCT1 to SCCT3)
+Process Type:	15.110

Primary Fuel:	Natural Gas
Throughput:	927.00
Throughput Unit:	MM BTU/h
Process Notes:	

Pollutant Information: CALCASIEU PASS LNG PROJECT - Simple Cycle Combustion Turbines (SCCT1 to SCCT3)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	9.0000
Emission Limit 1 Unit:	PPMV
Emission Limit 1 Avg. Time/Condition:	30 DAY ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	25.0000
Emission Limit 1 Unit:	PPMV
Emission Limit 1 Avg. Time/Condition:	30 DAY ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	8.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	8.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	4.0000
Emission Limit 1 Unit:	PPMV
Emission Limit 1 Avg. Time/Condition:	ANNUAL AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	1.4000
Emission Limit 1 Unit:	PPMV
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1426146.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	ANNUAL TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: CALCASIEU PASS LNG PROJECT

+Process Name:	Firewater Pumps
+Process Type:	17.110
Primary Fuel:	Diesel Fuel
Throughput:	634.00
Throughput Unit:	kW
Process Notes:	

Pollutant Information: CALCASIEU PASS LNG PROJECT - Firewater Pumps

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+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	3.1000
Emission Limit 1 Unit:	G/HP-H
Emission Limit 1 Avg. Time/Condition:	

Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 3.7000
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 μ (TPM10)
Emission Limit 1: 0.3000
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 μ (TPM2.5)
Emission Limit 1: 0.3000
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.4400
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0400
Emission Limit 1 Unit: LB/GAL

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	44.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	ANNUAL TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: C4GT, LLC

RBLC ID:	VA-0328
+Facility Name:	C4GT, LLC
Date determination entered in RBLC:	05/09/2018
Permit Type:	A: New/Greenfield Facility
Facility Description:	Natural gas-fired combined cycle power plant
Permit Notes:	The permit was written with two options for the turbines: Option 1 - GE 7HA.02 Option 2 - Siemens SGT6-8000H Facility Wide Pollutants for Siemens: CO: 293.5 NOx: 295.8 PM: 253.8 SOx: 39.3 VOC: 113.7

Process Information: C4GT, LLC

+Process Name:	GE Combustion Turbine - Option 1 - Normal Operation
+Process Type:	15.210
Primary Fuel:	natural gas
Throughput:	34000.00
Throughput Unit:	MMCF/YR
Process Notes:	Option 1: Two on one configuration: 3,482 MMBtu/hr combustion turbine with 475 MMBtu/hr duct-fired HRSG. Emission limits reflect the operation of one turbine with or without duct firing.

Pollutant Information: C4GT, LLC - GE Combustion Turbine - Option 1 - Normal Operation

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0069
Emission Limit 1 Unit:	LB/MMBTU WITHOUT DUC
Emission Limit 1 Avg. Time/Condition:	AV OF 3 TEST RUNS
Emission Limit 2:	0.0049
Emission Limit 2 Unit:	LB/MMBTU WITH DUC
Emission Limit 2 Avg. Time/Condition:	AV OF 3 TEST RUNS

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0069
Emission Limit 1 Unit:	LB/MMBTU WITHOUT DUC
Emission Limit 1 Avg. Time/Condition:	AV OF 3 TEST RUNS
Emission Limit 2:	0.0049
Emission Limit 2 Unit:	LB/MMBTU WITH DUC
Emission Limit 2 Avg. Time/Condition:	AV OF 3 TEST RUNS

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0.0011
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	3 HR AVG
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	1 H AV
Emission Limit 2:	141.3000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING TOTAL

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	1.0000
Emission Limit 1 Unit:	PPMVD@ 15% O2
Emission Limit 1 Avg. Time/Condition:	3 HR AV/WITHOUT DB

Emission Limit 2:	1.6000
Emission Limit 2 Unit:	PPMVD@ 15% O2
Emission Limit 2 Avg. Time/Condition:	3 HR AV/WITH DB

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.7000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	3 HR AV/WITHOUT DB
Emission Limit 2:	1.4000
Emission Limit 2 Unit:	PPMVD @ 15% O2
Emission Limit 2 Avg. Time/Condition:	3 HR AV/WITH DB

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	2.5000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 H AV/WITHOUT DUCT BURNING
Emission Limit 2:	2.7000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	3 H AV/WITH DUCT BURNING

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	883.0000
Emission Limit 1 Unit:	LB CO2E/MW-H
Emission Limit 1 Avg. Time/Condition:	12 MO ROLLING TOTAL
Emission Limit 2:	6745.0000
Emission Limit 2 Unit:	BTU/KW-H NET HHV
Emission Limit 2 Avg. Time/Condition:	INITIAL HEAT RATE TEST

Process Information: C4GT, LLC

+Process Name:	Siemens Combustion Turbine - Option 2 - Normal Operation
+Process Type:	15.210
Primary Fuel:	Natural Gas
Throughput:	35000.00
Throughput Unit:	MMCF/YR
Process Notes:	Option 2: Two on one configuration: 3,116 MMBtu/hr combustion turbine with 991 MMBtu/hr duct-fired HRSG. Emission limits reflect the operation of one turbine with or without duct firing.

Pollutant Information: C4GT, LLC - Siemens Combusion Turbine - Option 2 - Normal Operation

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0065
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	AV OF 3 TEST RUNS/WITHOUT DUCT BURNING
Emission Limit 2:	0.0065
Emission Limit 2 Unit:	LB/MMBTU
Emission Limit 2 Avg. Time/Condition:	AV OF 3 TEST RUNS/WITH DUCT BURNING

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0065
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	AV OF 3 TEST RUNS/WITHOUT DUCT BURNING
Emission Limit 2:	0.0065
Emission Limit 2 Unit:	LB/MMBTU
Emission Limit 2 Avg. Time/Condition:	AV OF 3 TEST RUNS/WITH DUCT BURNING

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0.0011
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	3 H AV
Emission Limit 2:	19.3000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	1 H AV
Emission Limit 2:	141.4000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING TOTAL

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	1.8000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	3 H AV/WITH OR WITHOUT DB

Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	1.0000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	3 H AV/WITHOUT DB
Emission Limit 2:	2.0000
Emission Limit 2 Unit:	PPMVD @ 15% O2
Emission Limit 2 Avg. Time/Condition:	3 H AV/WITH DB

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	2.2000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 H AV/WITHOUT DB
Emission Limit 2:	2.7000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	3 H AV/WITH DB

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	883.0000
Emission Limit 1 Unit:	LB CO2E/MW H
Emission Limit 1 Avg. Time/Condition:	12 MO ROLLING TOTAL
Emission Limit 2:	6625.0000
Emission Limit 2 Unit:	BTU/KW H NET HHV
Emission Limit 2 Avg. Time/Condition:	INITIAL HEAT RATE TEST

Process Information: C4GT, LLC

+Process Name:	Auxiliary Boiler
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	902.00
Throughput Unit:	mmcf/y
Process Notes:	

Pollutant Information: C4GT, LLC - Auxiliary Boiler

+Pollutant Name	Nitrogen Oxides (NOx)

Emission Limit 1:	0.0110
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	CORRECTED TO 3% O2
Emission Limit 2:	1.2000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0370
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	3.9000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.8000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	3.3000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING TOTAL

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.8000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	3.3000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING TOTAL

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0.0012
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.6000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING AV

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0050
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	2.3000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING AV

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	53863.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	12 MO ROLLING TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: C4GT, LLC

+Process Name:	Dew Point Heater
+Process Type:	19.600
Primary Fuel:	natural gas
Throughput:	140.00
Throughput Unit:	MMCF/YR
Process Notes:	Dew Point Heater (16.0 MMBTU/HR)

Pollutant Information: C4GT, LLC - Dew Point Heater

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.8000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	

Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 2.6000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 μ (TPM10)
Emission Limit 1: 0.5000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 μ (TPM2.5)
Emission Limit 1: 0.5000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0
Emission Limit 1 Unit:

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	8208.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: C4GT, LLC

+Process Name:	Emergency Diesel GEN
+Process Type:	17.110
Primary Fuel:	Ultra Low Sulfur Diesel
Throughput:	500.00
Throughput Unit:	H/YR
Process Notes:	

Pollutant Information: C4GT, LLC - Emergency Diesel GEN

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	4.8000
Emission Limit 1 Unit:	G/HP H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.6000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING AV

+Pollutant Name Particulate matter, filterable (FPM)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: G/HP H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: G/HP H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: G/HP H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 2.6000
Emission Limit 1 Unit: G/HP H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 5.2000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING TOTAL

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:

Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	981.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	12 MO ROLLING TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: C4GT, LLC

+Process Name:	GE Combustion Turbine - Tuning & Water Washing
+Process Type:	15.210
Primary Fuel:	natural gas
Throughput:	34000.00
Throughput Unit:	MMCF/YR
Process Notes:	Alternative operating scenario: during periods of tuning and water washing

Pollutant Information: C4GT, LLC - GE Combustion Turbine - Tuning & Water Washing

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	638.0000
Emission Limit 1 Unit:	LB/TURBINE/CAL DAY
Emission Limit 1 Avg. Time/Condition:	24 HR AV
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	194.0000

Emission Limit 1 Unit:	LB/TURBINE/DAY
Emission Limit 1 Avg. Time/Condition:	24 HR AV
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: C4GT, LLC

+Process Name:	GE Combustion Turbine - Startup and Shutdown
+Process Type:	15.210
Primary Fuel:	natural gas
Throughput:	34000.00
Throughput Unit:	MMCF/YR
Process Notes:	Startup and Shutdown

Pollutant Information: C4GT, LLC - GE Combustion Turbine - Startup and Shutdown

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+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	273.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START 60 MIN OR LESS
Emission Limit 2:	163.0000
Emission Limit 2 Unit:	LB/TURBINE/EVENT
Emission Limit 2 Avg. Time/Condition:	WARM START 50 MIN OR LESS

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	840.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START 60 MIN OR LESS
Emission Limit 2:	188.0000
Emission Limit 2 Unit:	LB/TURBINE/EVENT
Emission Limit 2 Avg. Time/Condition:	WARM START 50 MIN OR LESS

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	60.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START 60 MIN OR LESS
Emission Limit 2:	0
Emission Limit 2 Unit:	LB/TURBINE/EVENT

Emission Limit 2 Avg. Time/Condition:	WARM START 50 MIN OR LESS

Process Information: C4GT, LLC

+Process Name:	Siemens Combustion Turbine - Tuning & Water Washing
+Process Type:	15.210
Primary Fuel:	Natural Gas
Throughput:	35000.00
Throughput Unit:	MMCF/YR
Process Notes:	Alternative operating scenario: during periods of tuning and water washing

Pollutant Information: C4GT, LLC - Siemens Combustion Turbine - Tuning & Water Washing

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	564.0000
Emission Limit 1 Unit:	LB/TURBINE CAL DAY
Emission Limit 1 Avg. Time/Condition:	24 HR AV
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	309.0000
Emission Limit 1 Unit:	LB/TURBINE/DAY
Emission Limit 1 Avg. Time/Condition:	24 HR AV
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: C4GT, LLC

+Process Name:	Siemens Combustion Turbine - Startup & Shutdown
+Process Type:	15.210
Primary Fuel:	Natural Gas
Throughput:	35000.00
Throughput Unit:	MMCF/YR
Process Notes:	Startup and Shutdown

Pollutant Information: C4GT, LLC - Siemens Combustion Turbine - Startup & Shutdown

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	95.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START 55 MIN OR LESS
Emission Limit 2:	117.0000
Emission Limit 2 Unit:	LB/TURBINE/EVENT
Emission Limit 2 Avg. Time/Condition:	WARM START 55 MIN OR LESS

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	434.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START 55 MIN OR LESS
Emission Limit 2:	397.0000
Emission Limit 2 Unit:	LB/TURBINE/EVENT
Emission Limit 2 Avg. Time/Condition:	WARM START 55 MIN OR LESS

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	37.0000
Emission Limit 1 Unit:	LB/TURBINE/EVENT
Emission Limit 1 Avg. Time/Condition:	COLD START 55 MIN OR LESS
Emission Limit 2:	34.0000
Emission Limit 2 Unit:	LB/TURBINE/EVENT
Emission Limit 2 Avg. Time/Condition:	WARM START 55 MIN OR LESS

Process Information: C4GT, LLC

+Process Name:	Emergency Fire Water Pump
+Process Type:	17.210
Primary Fuel:	Ultra Low Sulfur Diesel
Throughput:	500.00
Throughput Unit:	HR/YR
Process Notes:	315 BHP

Pollutant Information: C4GT, LLC - Emergency Fire Water Pump

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	15.0000
Emission Limit 1 Unit:	G/HP/HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0

Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: G/HP HR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: G/HP HR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 2.6000
Emission Limit 1 Unit: G/HP HR
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0
Emission Limit 1 Unit:

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1040.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	12 MO ROLLING TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	3.0000
Emission Limit 1 Unit:	G/HP-HR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: C4GT, LLC

+Process Name:	Circuit Breakers - 6
+Process Type:	99.999
Primary Fuel:	
Throughput:	0.50
Throughput Unit:	%
Process Notes:	Quantity 6 Annual leakage rate

Pollutant Information: C4GT, LLC - Circuit Breakers - 6

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: C4GT, LLC

+Process Name:	Equipment Leaks from Natural Gas Components
+Process Type:	99.999
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	Work practice requirements

Pollutant Information: C4GT, LLC - Equipment Leaks from Natural Gas Components

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: C4GT, LLC

+Process Name:	Cooling Tower
+Process Type:	99.009
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	No Controls Feasible. P2=Total dissolved solids content of the cooling water effluent shall not exceed 6250 mg/L. Compliance is based on monthly water quality testing.

Pollutant Information: C4GT, LLC - Cooling Tower

+Pollutant Name	Particulate matter, filterable < 10 µ (FPM10)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: TVA - JOHNSONVILLE COGENERATION

RBLC ID:	*TN-0164
+Facility Name:	TVA - JOHNSONVILLE COGENERATION
Date determination entered in RBLC:	03/21/2019
Permit Type:	Both B: (Add new process to existing facility) &C: (Modify process at existing facility)
Facility Description:	Combustion turbines and combined cycle plant
Permit Notes:	Permit 972969 adds startup and shutdown limits to the requirements established in PSD permit 970816F.

Process Information: TVA - JOHNSONVILLE COGENERATION

+Process Name:	Dual-fuel CT and HRSG with duct burner
+Process Type:	15.210
Primary Fuel:	Natural Gas
Throughput:	1020.00
Throughput Unit:	MMBtu/hr

Process Notes:	Rated input capacity is 1020 MMBtu/hr (CT) and 319 MMBtu/hr (duct burner) when burning natural gas and 1084 MMBtu/hr when burning #2 oil.

Pollutant Information: TVA - JOHNSONVILLE COGENERATION - Dual-fuel CT and HRSG with duct burner

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+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0050
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	WHEN BURNING NATURAL GAS
Emission Limit 2:	0.0150
Emission Limit 2 Unit:	LB/MMBTU
Emission Limit 2 Avg. Time/Condition:	WHEN BURNING #2 OIL

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	30-DAY AVG WHEN BURNING NATURAL GAS
Emission Limit 2:	10.0000
Emission Limit 2 Unit:	PPMVD @ 15% O2
Emission Limit 2 Avg. Time/Condition:	30-DAY AVG WHEN BURNING #2 OIL

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	30-DAY AVG WHEN BURNING NATURAL GAS
Emission Limit 2:	8.0000
Emission Limit 2 Unit:	PPMVD @ 15% O2
Emission Limit 2 Avg. Time/Condition:	30-DAY AVG WHEN BURNING #2 OIL

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1800.0000
Emission Limit 1 Unit:	LB/MWH
Emission Limit 1 Avg. Time/Condition:	12-MONTH MOVING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: TVA - JOHNSONVILLE COGENERATION

+Process Name:	Two Auxiliary Boilers
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	450.00
Throughput Unit:	MMBtu/hr, each boiler
Process Notes:	

Pollutant Information: TVA - JOHNSONVILLE COGENERATION - Two Auxiliary Boilers

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0080
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0840
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0130
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	30-DAY AVG EXCLUDING STARTUP & SHUTDOWN
Emission Limit 2:	0.2000
Emission Limit 2 Unit:	LB/MMBTU
Emission Limit 2 Avg. Time/Condition:	30-DAY AVG, APPLIES AT ALL TIMES

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	117.0000
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	12-MONTH MOVING AVERAGE
Emission Limit 2:	0

Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: FILER CITY STATION

RBLC ID:	MI-0427
+Facility Name:	FILER CITY STATION
Date determination entered in RBLC:	01/26/2018
Permit Type:	B: Add new process to existing facility
Facility Description:	New natural gas combined heat and power plant proposed at existing cogenerating power plant permitted to burn wood, coal and tire derived fuel.
Permit Notes:	

Process Information: FILER CITY STATION

+Process Name:	EUCCT (Combined cycle CTG with unfired HRSG)
+Process Type:	15.210
Primary Fuel:	Natural gas
Throughput:	1934.70
Throughput Unit:	MMBTU/H
Process Notes:	A 1,934.7 MMBTU/H natural gas fired heavy frame industrial combustion turbine. The turbine operates in combined-cycle with an unfired heat recovery steam generator (HRSG).

Pollutant Information: FILER CITY STATION - EUCCT (Combined cycle CTG with unfired HRSG)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	4.0000
Emission Limit 1 Unit:	PPM
Emission Limit 1 Avg. Time/Condition:	24-H ROLL.AVG., EXCEPT STARTUP/SHUTDOWN
Emission Limit 2:	17.4000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	24-H ROLL.AVG., EXCEPT STARTUP/SHUTDOWN

+Pollutant Name	Nitrogen Oxides (NOx)

Emission Limit 1: 3.0000
Emission Limit 1 Unit: PPM
Emission Limit 1 Avg. Time/Condition: 24-H ROLL.AVG., EXCEPT STARTUP/SHUTDOWN
Emission Limit 2: 21.4000
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg. Time/Condition: 24-H ROLL.AVG., EXCEPT STARTUP/SHUTDOWN

+Pollutant Name Particulate matter, filterable (FPM)
Emission Limit 1: 0.0025
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0066
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0066
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 992286.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition: 12-MO.ROLL.TIME PERIOD
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: FILER CITY STATION

+Process Name:	EUCCT (Startup/Shutdown)
+Process Type:	15.210
Primary Fuel:	Natural gas
Throughput:	1934.70
Throughput Unit:	MMBTU/H
Process Notes:	This emission unit is being entered as a separate process to account for the emission limits associated with startup/shutdown events, which could not be included within the previous EUCCT original process name. A 1,934.7 MMBTU/H natural gas fired heavy frame industrial combustion turbine. The turbine operates in combined-cycle with an unfired heat recovery steam generator (HRSG).

Pollutant Information: FILER CITY STATION - EUCCT (Startup/Shutdown)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	1580.0000
Emission Limit 1 Unit:	POUNDS
Emission Limit 1 Avg. Time/Condition:	POUNDS PER EVENT
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	32.0000
Emission Limit 1 Unit:	POUNDS
Emission Limit 1 Avg. Time/Condition:	PER EVENT
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: FILER CITY STATION

+Process Name:	EUAUXBOILER (Auxiliary boiler)
+Process Type:	12.310
Primary Fuel:	Natural gas
Throughput:	182.00
Throughput Unit:	MMBTU/H

Process Notes:	A natural gas fired auxiliary boiler, rated at 182 MMBTU/H to provide auxiliary steam when the plant is off-line, used to maintain warm drums on the HRSG and maintain the steam turbine generator seals.

Pollutant Information: FILER CITY STATION - EUAUXBOILER (Auxiliary boiler)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0400
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0400
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	30 DAY ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0050
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)

Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	93346.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	12-MO.ROLL. TIME PERIOD
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: FILER CITY STATION

+Process Name:	EUCOOLTWR (Cooling Tower--Wet Mechanical Drift)
+Process Type:	99.009
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	A four-cell evaporative cooling tower in series with mechanical chilling to cool turbine inlet air. Particulate emissions will be controlled with high efficiency drift eliminators.

Pollutant Information: FILER CITY STATION - EUCOOLTWR (Cooling Tower--Wet Mechanical Drift)

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0006
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	VENDOR-CERTIFIED MAX. DRIFT RATE
Emission Limit 2:	7700.0000
Emission Limit 2 Unit:	PPM
Emission Limit 2 Avg. Time/Condition:	MAX. TDS IN COOLING WATER

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0006
Emission Limit 1 Unit:	%

Emission Limit 1 Avg. Time/Condition:	VENDOR-CERTIF. MAX DRIFT RATE
Emission Limit 2:	7700.0000
Emission Limit 2 Unit:	PPM
Emission Limit 2 Avg. Time/Condition:	MAX TDS IN COOLING WATER

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0006
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	VENDOR-CERTIF. MAX. DRIFT RATE
Emission Limit 2:	7700.0000
Emission Limit 2 Unit:	PPM
Emission Limit 2 Avg. Time/Condition:	MAX TDS IN COOLING WATER

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: GUERNSEY POWER STATION LLC

RBLC ID:	OH-0374
+Facility Name:	GUERNSEY POWER STATION LLC
Date determination entered in RBLC:	03/08/2019
Permit Type:	A: New/Greenfield Facility
Facility Description:	1,650 MW combined cycle combustion turbine electrical generating facility
Permit Notes:	Installation PTI for a new 1,650 MW combined cycle natural-gas fired turbine plant and associated auxiliary boiler, firewater pumps, emergency generators and fuel gas heaters

Process Information: GUERNSEY POWER STATION LLC

+Process Name:	Auxiliary Boiler (B001)
+Process Type:	12.310
Primary Fuel:	Natural gas
Throughput:	185.00
Throughput Unit:	MMBTU/H
Process Notes:	185.0 MMBtu/hr natural gas-fired boiler with low-NOx burners and flue gas recirculation (FGR)

Pollutant Information: GUERNSEY POWER STATION LLC - Auxiliary Boiler (B001)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	3.7000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.2500
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD
+Pollutant Name	Carbon Monoxide
Emission Limit 1:	10.1800
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	25.4500
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD
+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.9300
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	2.3300
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD
+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	1.3000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	3.2500
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD
+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	1.3000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	

Emission Limit 2: 3.2500
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 1.3000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 3.2500
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.2800
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.7000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0.0430
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.1100
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 54167.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Visible Emissions (VE)
Emission Limit 1: 0
Emission Limit 1 Unit:

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GUERNSEY POWER STATION LLC

+Process Name:	Combined Cycle Combustion Turbines (3, identical) (P001 to P003)
+Process Type:	15.210
Primary Fuel:	Natural gas
Throughput:	3516.00
Throughput Unit:	MMBTU/H
Process Notes:	Three identical Combustion Turbines; GE 7HA.02 natural gas-fired lean pre-mix combined cycle combustion turbine generator equipped with dry low-NOx (DLN) burners nominally rated at 3,516 MMBtu/hr HHV at 100% load and -18° F exhausting through a heat recovery steam generator (HRSG) with supplemental natural gas-fired duct burners nominally rated at 997 MMBtu/hr HHV controlled with catalytic oxidation and selective catalytic reduction (SCR) and cooled with an air-cooled condenser (ACC) used to generate electricity. Throughputs and limits are for a single turbine except as noted.

Pollutant Information: GUERNSEY POWER STATION LLC - Combined Cycle Combustion Turbines (3, identical) (P001 to P003)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	33.8500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	WITH DUCT BURNER. SEE NOTES.
Emission Limit 2:	26.3700
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	WITHOUT DUCT BURNERS. SEE NOTES.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	20.7600
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	WITH DUCT BURNER. SEE NOTES.
Emission Limit 2:	16.1700
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	WITHOUT DUCT BURNERS. SEE NOTES.

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 11.7300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: WITH DUCT BURNER. SEE NOTES.
Emission Limit 2: 4.9200
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg.
Time/Condition: WITHOUT DUCT BURNERS. SEE NOTES.

+Pollutant Name Particulate matter, total (TPM)
Emission Limit 1: 0.0073
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: SEE NOTES.
Emission Limit 2: 23.3000
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg.
Time/Condition: WITH DUCT BURNERS. SEE NOTES.

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0073
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: SEE NOTES.
Emission Limit 2: 23.3000
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg.
Time/Condition: WITH DUCT BURNERS. SEE NOTES.

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0073
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: SEE NOTES.
Emission Limit 2: 23.3000
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg.
Time/Condition: WITH DUCT BURNERS. SEE NOTES.

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0015
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: SEE NOTES.
Emission Limit 2: 6.7700
Emission Limit 2 Unit: LB/H

Emission Limit 2 Avg. Time/Condition:	WITH DUCT BURNERS. SEE NOTES.

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0.0011
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	SEE NOTES.
Emission Limit 2:	4.9600
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	WITH DUCT BURNERS. SEE NOTES.

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	846.0000
Emission Limit 1 Unit:	LB/MW-H
Emission Limit 1 Avg. Time/Condition:	WITHOUT DUCT BURNER. SEE NOTES.
Emission Limit 2:	1000.0000
Emission Limit 2 Unit:	LB/MW-H
Emission Limit 2 Avg. Time/Condition:	WITH DUCT BURNERS. SEE NOTES.

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GUERNSEY POWER STATION LLC

+Process Name:	Emergency Generators (2 identical, P004 and P005)
+Process Type:	17.110
Primary Fuel:	Diesel fuel
Throughput:	2206.00
Throughput Unit:	HP
Process Notes:	Two identical Emergency Generators; 1,645 kW (2,206 HP) emergency diesel-fired generator to provide on-site emergency power capabilities independent of the utility grid. Throughputs and limits are for a single generator except as noted.

Pollutant Information: GUERNSEY POWER STATION LLC - Emergency Generators (2 identical, P004 and P005)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	23.2100
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	NMHC+NOX. SEE NOTES.
Emission Limit 2:	1.1600
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	NMHC+NOX. SEE NOTES.

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	23.2100
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	NMHC+NOX. SEE NOTES.
Emission Limit 2:	1.1600
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	NMHC+NOX. SEE NOTES.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	12.6900
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.6300
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.7300
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.0370
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.7300
Emission Limit 1 Unit:	LB/H

Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0370
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.7300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0370
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0015
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0220
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 3.4000
Emission Limit 1 Unit: X10-3 LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 1.7000
Emission Limit 2 Unit: X10-4 T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 120.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Visible Emissions (VE)

Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GUERNSEY POWER STATION LLC

+Process Name:	Emergency Fire Pump (P006)
+Process Type:	17.210
Primary Fuel:	Diesel fuel
Throughput:	410.00
Throughput Unit:	HP
Process Notes:	410 HP emergency diesel-fired fire pump to provide on-site firefighting capabilities independent of the utility grid

Pollutant Information: GUERNSEY POWER STATION LLC - Emergency Fire Pump (P006)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.7000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	NMHC+NOX. SEE NOTES.
Emission Limit 2:	0.1400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	NMHC+NOX. SEE NOTES.

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	2.7000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	NMHC+NOX. SEE NOTES.
Emission Limit 2:	0.1400
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	NMHC+NOX. SEE NOTES.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.3600
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.1200

Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Particulate matter, total (TPM)
Emission Limit 1: 0.1300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.0065
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.1300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.0065
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.1300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.0065
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0015
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.0053
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0.0015
Emission Limit 1 Unit: LB/MMBTU

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	8.1000
Emission Limit 2 Unit:	X10-4 T/YR
Emission Limit 2 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	29.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	PER ROLLING 12 MONTH PERIOD
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Visible Emissions (VE)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GUERNSEY POWER STATION LLC

+Process Name:	Fuel Gas Heaters (2 identical, P007 and P008)
+Process Type:	13.310
Primary Fuel:	Natural gas
Throughput:	15.00
Throughput Unit:	MMBTU/H
Process Notes:	Two identical Fuel Gas Heaters; 15.0 MMBtu/hr natural gas-fired fuel gas heater with low-NOx burners. The natural gas heaters will heat a water bath.

Pollutant Information: GUERNSEY POWER STATION LLC - Fuel Gas Heaters (2 identical, P007 and P008)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.3000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	1.3100

Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0.8300
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 3.6400
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0750
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.3300
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Particulate matter, total (TPM)
Emission Limit 1: 0.0750
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.0330
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0750
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0.3300
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg. Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0750
Emission Limit 1 Unit: LB/H

Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.0330
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.0230
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.1000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0.0035
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0.0150
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 7695.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: PER ROLLING 12 MONTH PERIOD
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Visible Emissions (VE)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: MIDWEST FERTILIZER COMPANY LLC

RBLC ID:	IN-0263
+Facility Name:	MIDWEST FERTILIZER COMPANY LLC
Date determination entered in RBLC:	07/07/2017
Permit Type:	C: Modify process at existing facility
Facility Description:	STATIONARY NITROGEN FERTILIZER MANUFACTURING FACILITY
Permit Notes:	

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	STARTUP HEATER EU-002
+Process Type:	13.310
Primary Fuel:	NATURAL GAS
Throughput:	70.00
Throughput Unit:	MMBTU/HR
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - STARTUP HEATER EU-002

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.1300
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3HR AVERAGE
Emission Limit 2:	200.0000
Emission Limit 2 Unit:	H/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.5220
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3HOUR AVERAGE
Emission Limit 2:	200.0000
Emission Limit 2 Unit:	H/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.5220
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	200.0000
Emission Limit 2 Unit:	H/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	12.6110
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	200.0000
Emission Limit 2 Unit:	H/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.5560
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	200.0000
Emission Limit 2 Unit:	H/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.3780
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	200.0000
Emission Limit 2 Unit:	H/YR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	8184.0000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	200.0000
Emission Limit 2 Unit:	H/YR

Emission Limit 2 Avg. Time/Condition:	

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	UREA SYNTHESIS PLANT (EU-006)
+Process Type:	61.012
Primary Fuel:	
Throughput:	2640.00
Throughput Unit:	METRIC TON/DAY
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - UREA SYNTHESIS PLANT (EU-006)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	387.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	UREA AMMONIUM NITRATE PLANT (EU-007)
+Process Type:	61.012
Primary Fuel:	
Throughput:	5160.00
Throughput Unit:	METRIC TON/DAY
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - UREA AMMONIUM NITRATE PLANT (EU-007)

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	1173.0000
Emission Limit 1 Unit:	TONS/12 MONTH
Emission Limit 1 Avg. Time/Condition:	ROLLING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	UREA GRANULATION UNIT (EU-008)
+Process Type:	61.012
Primary Fuel:	
Throughput:	1320.00
Throughput Unit:	METRIC TON/DAY
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - UREA GRANULATION UNIT (EU-008)

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.1630
Emission Limit 1 Unit:	LB/TON
Emission Limit 1 Avg. Time/Condition:	3HOUR AVERAGE
Emission Limit 2:	368040.0000
Emission Limit 2 Unit:	TON/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.1630

Emission Limit 1 Unit:	LB/TON
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	368040.0000
Emission Limit 2 Unit:	TON/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.1630
Emission Limit 1 Unit:	LB/TON
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	368040.0000
Emission Limit 2 Unit:	TON/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	NITRIC ACID PLANT (EU-009)
+Process Type:	62.014
Primary Fuel:	
Throughput:	1840.00
Throughput Unit:	METRIC TON/DAY
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - NITRIC ACID PLANT (EU-009)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.1780
Emission Limit 1 Unit:	LB/TON
Emission Limit 1 Avg. Time/Condition:	NORMAL OPERATIONS
Emission Limit 2:	0.0830
Emission Limit 2 Unit:	TON/EVENT
Emission Limit 2 Avg. Time/Condition:	4 EVENTS/YR, 3HR/EVENT DURING STARTUP

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	EIGHTEEN CELL COOLING TOWER (EU-010)
+Process Type:	99.999
Primary Fuel:	
Throughput:	0

Throughput Unit:	
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - EIGHTEEN CELL COOLING TOWER (EU-010)

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	2000.0000
Emission Limit 1 Unit:	MG/L
Emission Limit 1 Avg. Time/Condition:	AVG ON A MONTHLY BASIS
Emission Limit 2:	0.0005
Emission Limit 2 Unit:	%
Emission Limit 2 Avg. Time/Condition:	DRIFT

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	2000.0000
Emission Limit 1 Unit:	MG/L
Emission Limit 1 Avg. Time/Condition:	AVG. ON A MONTHLY BASIS
Emission Limit 2:	0.0005
Emission Limit 2 Unit:	%
Emission Limit 2 Avg. Time/Condition:	DRIFT

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	2000.0000
Emission Limit 1 Unit:	MG/L
Emission Limit 1 Avg. Time/Condition:	AVG. ON A MONTHLY BASIS
Emission Limit 2:	0.0005
Emission Limit 2 Unit:	%
Emission Limit 2 Avg. Time/Condition:	DRIFT

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	NATURAL GAS AUXILIARY BOILERS (EU-012A, EU-012B, EU-012C)
+Process Type:	12.310
Primary Fuel:	NATURAL GAS
Throughput:	218.60
Throughput Unit:	MMBTU/H
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - NATURAL GAS AUXILIARY BOILERS (EU-012A, EU-012B, EU-012C)

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	1.9000
Emission Limit 1 Unit:	LB/MMCF EACH
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	7.6000
Emission Limit 1 Unit:	LB/MMCF EACH
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	7.6000
Emission Limit 1 Unit:	LB/MMCF EACH
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

0.02 lb/MMbtu

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	20.4000
Emission Limit 1 Unit:	LB/MMCF EACH
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	1877.3900
Emission Limit 2 Unit:	MMCF/12 MONTH EACH
Emission Limit 2 Avg. Time/Condition:	ROLLING AVERAGE

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	37.2200
Emission Limit 1 Unit:	LB/MMCF EACH

Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	1877.3900
Emission Limit 2 Unit:	MMCF/12 MONTH EACH
Emission Limit 2 Avg. Time/Condition:	ROLLING AVERAGE

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	5.5000
Emission Limit 1 Unit:	LB/MMCF EACH
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	1877.3900
Emission Limit 2 Unit:	MMCF/12 MONTH EACH
Emission Limit 2 Avg. Time/Condition:	ROLLING AVERAGE

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	59.6100
Emission Limit 1 Unit:	TON/MMCF EACH
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	1877.3900
Emission Limit 2 Unit:	MMCF/12 MONTH EACH
Emission Limit 2 Avg. Time/Condition:	ROLLING AVERAGE

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	EMERGENCY GENERATORS (EU014A AND EU-014B)
+Process Type:	17.110
Primary Fuel:	DISTILLATE OIL
Throughput:	3600.00
Throughput Unit:	HP EACH
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - EMERGENCY GENERATORS (EU014A AND EU-014B)

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	G/HP-H EACH
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	500.0000
Emission Limit 2 Unit:	H/YR EACH

Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: G/HP-H EACH
Emission Limit 1 Avg.
Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 500.0000
Emission Limit 2 Unit: H/YR EACH
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: G/HP-H EACH
Emission Limit 1 Avg.
Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 500.0000
Emission Limit 2 Unit: H/YR EACH
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 4.4200
Emission Limit 1 Unit: G/HP-H EACH
Emission Limit 1 Avg.
Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 500.0000
Emission Limit 2 Unit: H/YR EACH
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 2.6100
Emission Limit 1 Unit: G/HP-H EACH
Emission Limit 1 Avg.
Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 500.0000
Emission Limit 2 Unit: H/YR EACH
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.3500
Emission Limit 1 Unit: G/HP-H EACH
Emission Limit 1 Avg.
Time/Condition: 3 HOUR AVERAGE

Emission Limit 2:	500.0000
Emission Limit 2 Unit:	H/YR EACH
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	1044.0000
Emission Limit 1 Unit:	TON/12 CONSEC. MONTH
Emission Limit 1 Avg. Time/Condition:	EACH
Emission Limit 2:	500.0000
Emission Limit 2 Unit:	H/YR EACH
Emission Limit 2 Avg. Time/Condition:	

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	AMMONIA STORAGE FLARE (EU-016)
+Process Type:	19.390
Primary Fuel:	NATURAL GAS
Throughput:	1.10
Throughput Unit:	MMBTU/H
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - AMMONIA STORAGE FLARE (EU-016)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	3 HR AVG.
Emission Limit 2:	168.0000
Emission Limit 2 Unit:	H/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	COMPLIANCE DETERMINED AT END OF EA MONTH

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0019
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	3 HOUR AVERAGE
Emission Limit 2:	168.0000
Emission Limit 2 Unit:	H/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	COMPLIANCE DETERMINED AT END OF MONTHS

+Pollutant Name Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: 3 HOUR AVERAGE
Emission Limit 2: 168.0000
Emission Limit 2 Unit: H/12 CONSEC MONTH
Emission Limit 2 Avg.
Time/Condition: COMPLIANCE DETERMINED AT END OF MONTHS

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 125.0000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: WHILE VENTING 3 HOUR AVG.
Emission Limit 2: 0.0680
Emission Limit 2 Unit: LB/MMBTU
Emission Limit 2 Avg.
Time/Condition: DURING NORMAL OP. 3 HR AVG.

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0.3700
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: NORMAL OPERATION 3 HR AVG.
Emission Limit 2: 168.0000
Emission Limit 2 Unit: H/YR VENTING
Emission Limit 2 Avg.
Time/Condition: COMPLIANCE DETERMINED AT END OF EA MONTH

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0054
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: NORMAL OPERATIONS 3 HR AVG.
Emission Limit 2: 168.0000
Emission Limit 2 Unit: H/12 CONSEC. MONTH
Emission Limit 2 Avg.
Time/Condition: COMPLIANCE DETERMINED AT END OF EA MONTH

+Pollutant Name Carbon Dioxide
Emission Limit 1: 563.0000
Emission Limit 1 Unit: TON/12 CONSEC. MONTH
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 168.0000
Emission Limit 2 Unit: H/12 CONSEC. MONTH

Emission Limit 2 Avg.
Time/Condition: COMPLIANCE DETERMINED AT END OF EA MONTH

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	FRONT END FLARE EU-017
+Process Type:	19.390
Primary Fuel:	NATURAL GAS
Throughput:	1.12
Throughput Unit:	MMBTU/H
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - FRONT END FLARE EU-017

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	1.9000
Emission Limit 1 Unit:	LB/MMCF
Emission Limit 1 Avg. Time/Condition:	3 HR AVG.
Emission Limit 2:	336.0000
Emission Limit 2 Unit:	H/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	VENTING

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	7.6000
Emission Limit 1 Unit:	LB/MMCF
Emission Limit 1 Avg. Time/Condition:	3 HR AVG
Emission Limit 2:	336.0000
Emission Limit 2 Unit:	H/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	VENTING

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	7.6000
Emission Limit 1 Unit:	LB/MMCF
Emission Limit 1 Avg. Time/Condition:	3 HR AVG
Emission Limit 2:	336.0000
Emission Limit 2 Unit:	H/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	VENTING

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0680
Emission Limit 1 Unit:	LB/MMBTU

Emission Limit 1 Avg.
Time/Condition: NORMAL OPS. 3 HR AVG.
Emission Limit 2: 595.4900
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg.
Time/Condition: VENTING OPS. 3 HR AVG.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.3700
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	NORMAL OPS. 3 HR AVG.
Emission Limit 2:	3240.1600
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	VENTING OPS. 3 HR AVG.

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	NORMAL OPS. 3 HR AVG
Emission Limit 2:	47.2600
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	VENTING OPS. 3 HR AVG.

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	116.8900
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	NORMAL OPS. 3 HR AVG
Emission Limit 2:	512.2000
Emission Limit 2 Unit:	TON/H
Emission Limit 2 Avg. Time/Condition:	VENTING OPS., 3 HR AVG.

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	BACK END FLARE (EU-018)
+Process Type:	19.390
Primary Fuel:	NATURAL GAS
Throughput:	1.12
Throughput Unit:	MMBTU/H
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - BACK END FLARE (EU-018)

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0019
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	3 HR AVG
Emission Limit 2:	336.0000
Emission Limit 2 Unit:	HR/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	3 HR AVG.
Emission Limit 2:	336.0000
Emission Limit 2 Unit:	HR/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0075
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	3 HR AVG.
Emission Limit 2:	336.0000
Emission Limit 2 Unit:	HR/12 CONSEC. MONTHS
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0680
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	NORMAL OPS. 3 HR AVG.
Emission Limit 2:	624.9400
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	VENTING OPS. 3 HR AVG.

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.3700
Emission Limit 1 Unit:	LB/MMBTU

Emission Limit 1 Avg. Time/Condition:	NORMAL OPS. 3 HR AVG.
Emission Limit 2:	804.7600
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	VENTING OPS. 3 HR AVG.

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	NORMAL OPS. 3 HR AVG.
Emission Limit 2:	11.7300
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	VENTING OPS. 3 HR AVG.

+Pollutant Name	Carbon Dioxide
Emission Limit 1:	116.8900
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	NORMAL OPS. 3 HR AVG
Emission Limit 2:	573.0000
Emission Limit 2 Unit:	TON/12 CONSEC. MONTH
Emission Limit 2 Avg. Time/Condition:	

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	TRUCK AND RAIL LOADING OPERATION (EU-021A)
+Process Type:	61.012
Primary Fuel:	
Throughput:	4800.00
Throughput Unit:	METRIC TON/DAY
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - TRUCK AND RAIL LOADING OPERATION (EU-021A)

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HR AVG.
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HR AVG.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	3 HR AVG.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MIDWEST FERTILIZER COMPANY LLC

+Process Name:	PAVED ROADS AND PARKING LOTS
+Process Type:	99.190
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: MIDWEST FERTILIZER COMPANY LLC - PAVED ROADS AND PARKING LOTS

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0

Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Report Date: 03/29/2021 Control Technology Determinations (Freeform)

Facility Information: INDECK NILES, LLC

RBLC ID:	MI-0423
+Facility Name:	INDECK NILES, LLC
Date determination entered in RBLC:	06/02/2017
Permit Type:	A: New/Greenfield Facility
Facility Description:	Natural gas combined cycle power plant.
Permit Notes:	The permit includes equipment not entered into the RBLC due to a lack of emission limits or material limits; these include a cold cleaner, a number of space heaters, and two fuel tanks.

Process Information: INDECK NILES, LLC

+Process Name:	FGCTGHRSG (2 Combined Cycle CTGs with HRSGs)
+Process Type:	15.210
Primary Fuel:	Natural gas
Throughput:	8322.00
Throughput Unit:	MMBTU/H
Process Notes:	There are 2 combined cycle natural gas-fired combustion turbine generators (CTGs) with heat recovery steam generators (HRSG) identified as EUCTGHRSG1 & EUCTGHRSG2 in the flexible group FGCTGHRSG. The total hours for startup and shutdown for each train shall not exceed 500 hours per 12-month rolling time period. The

throughput capacity is 3421 MMBTU/H for each turbine, and 740 MMBTU/H for each duct burner for a combined throughput of 4161 MMBTU/H or 8322 MMBTU/H for both trains.

Pollutant Information: INDECK NILES, LLC - FGCTGHRSG (2 Combined Cycle CTGs with HRSGs)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	24.7000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	24-H ROLLING AVG
Emission Limit 2:	3537.0000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	OPERATING HR. DURING STARTUP OR SHUTDOWN
+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	38.1000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	24-H ROLLING AVERAGE
Emission Limit 2:	286.0000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	OPERATING HR DURING STARTUP OR SHUTDOWN
+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	9.9000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	19.8000
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 19.8000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 4.0000
Emission Limit 1 Unit: PPM
Emission Limit 1 Avg.
Time/Condition: TEST PROTOCOL WILL SPECIFY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 11.7000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2: 0.0600
Emission Limit 2 Unit: LB/MMBTU
Emission Limit 2 Avg.
Time/Condition: TEST PROTOCOL WILL SPECIFY AVG TIME

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 4.6000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 2097001.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: 12-MONTH ROLLING TIME PERIOD
Emission Limit 2: 0
Emission Limit 2 Unit:

Emission Limit 2 Avg.
Time/Condition:

Process Information: INDECK NILES, LLC

+Process Name:	EUAUXBOILER (Auxiliary Boiler)
+Process Type:	12.310
Primary Fuel:	natural gas
Throughput:	182.00
Throughput Unit:	MMBTU/H
Process Notes:	One natural gas-fired auxiliary boiler rated at 182 MMBTU/H fuel heat input.

Pollutant Information: INDECK NILES, LLC - EUAUXBOILER (Auxiliary Boiler)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0400
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0400
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	30 DAY ROLLING AVG TIME PERIOD
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0050
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	1.3600

Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: HOURLY, TEST PROTOCOL
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 1.3600
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: HOURLY, TEST PROTOCOL
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0040
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition: TEST PROTOCOL WILL SPECIFY AVG TIME.
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 0.6000
Emission Limit 1 Unit: LB/MMSCF
Emission Limit 1 Avg. Time/Condition: BASED ON FUEL RECEIPT RECORDS
Emission Limit 2: 2000.0000
Emission Limit 2 Unit: GR/MMSCF
Emission Limit 2 Avg. Time/Condition: BASED UPON FUEL RECEIPT RECORDS

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 93346.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition: 12-MO ROLLING TIME PERIOD
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: INDECK NILES, LLC

+Process Name:	FGFUELHTR (Two fuel pre-heaters identified as EUFUELHTR1 & EUFUELHTR2)
+Process Type:	13.310
Primary Fuel:	Natural gas
Throughput:	27.00
Throughput Unit:	MMBTU/H
Process Notes:	Two natural gas fired dew point heaters for warming the natural gas fuel (EUFUELHTR1 & EUFUELHTR2 in flexible group FGFUELHTR). The total combined heat input during operation shall not exceed 27 MMBTU/H (each) as well. The CO2e limit is for both units combined; however the other limits are per unit.

Pollutant Information: INDECK NILES, LLC - FGFUELHTR (Two fuel pre-heaters identified as EUFUELHTR1 & EUFUELHTR2)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.2200
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY; EACH UNIT
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.6500
Emission Limit 1 Unit:	LB/H
Emission Limit 1 Avg. Time/Condition:	HOURLY; EACH UNIT
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.0020
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name Particulate matter, total < 10 μ (TPM10)
Emission Limit 1: 0.2000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY; EACH FUEL HEATER
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 μ (TPM2.5)
Emission Limit 1: 0.2000
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY; EACH FUEL HEATER
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.1500
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY; EACH FUEL HEATER
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 2000.0000
Emission Limit 1 Unit: GR/MMSCF
Emission Limit 1 Avg.
Time/Condition: BASED UPON FUEL RECEIPT RECORDS.
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 13848.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: 12-MO ROLLING TIME PERIOD; COMBINED LIMI
Emission Limit 2: 0
Emission Limit 2 Unit:

Emission Limit 2 Avg. Time/Condition:

Process Information: INDECK NILES, LLC

+Process Name:	EUEMENGINE (Diesel fuel emergency engine)
+Process Type:	17.110
Primary Fuel:	Diesel Fuel
Throughput:	22.68
Throughput Unit:	MMBTU/H
Process Notes:	a 2,922 horsepower (HP) (2,179 kilowatts (kW)) diesel fueled emergency engine manufactured in 2011 or later and a displacement of

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Pollutant Information: INDECK NILES, LLC - EUEMENGINE (Diesel fuel emergency engine)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	3.5000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL SHALL SPECIFY AVG TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	6.4000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.2000
Emission Limit 1 Unit:	G/KW-H
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	1.5800

Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 1.5800
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 1.8700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg. Time/Condition: TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 15.0000
Emission Limit 1 Unit: PPM
Emission Limit 1 Avg. Time/Condition: FUEL SUPPLIER CERTIFICATION RECORDS
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 928.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition: 12-MO. ROLLING TIME PERIOD
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: INDECK NILES, LLC

+Process Name:	EUFPENGINE (Emergency engine--diesel fire pump)
+Process Type:	17.210
Primary Fuel:	Diesel
Throughput:	1.66
Throughput Unit:	MMBTU/H
Process Notes:	A 260 brake horsepower (bhp) diesel-fueled emergency engine manufactured in 2011 or later and a displacement of

Pollutant Information: INDECK NILES, LLC - EUFPENGINE (Emergency engine--diesel fire pump)

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.6000
Emission Limit 1 Unit:	G/BHP-H
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG. TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	3.0000
Emission Limit 1 Unit:	G/BHP-H
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, filterable (FPM)
Emission Limit 1:	0.1500
Emission Limit 1 Unit:	G/BHP-H
Emission Limit 1 Avg. Time/Condition:	TEST PROTOCOL WILL SPECIFY AVG TIME.
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.5700
Emission Limit 1 Unit:	LB/H

Emission Limit 1 Avg.
Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.5700
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: HOURLY
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.6400
Emission Limit 1 Unit: LB/H
Emission Limit 1 Avg.
Time/Condition: TEST PROTOCOL WILL SPECIFY AVG TIME
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)
Emission Limit 1: 15.0000
Emission Limit 1 Unit: PPM
Emission Limit 1 Avg.
Time/Condition: FUEL SUP. CERT. RECORDS OR SAMPLE TEST
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 13.5800
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg.
Time/Condition: 12 MO. ROLLING TIME PERIOD
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: LINEAR ALPHA OLEFINS PLANT

RBLC ID:	TX-0811
+Facility Name:	LINEAR ALPHA OLEFINS PLANT
Date determination entered in RBLC:	10/06/2016
Permit Type:	B: Add new process to existing facility
Facility Description:	Manufactures linear alpha olefins (LAO) from ethylene
Permit Notes:	

Process Information: LINEAR ALPHA OLEFINS PLANT

+Process Name:	Industrial-Sized Furnaces, Natural Gas-fired
+Process Type:	12.310
Primary Fuel:	natural gas
Throughput:	217.00
Throughput Unit:	MM BTU / H
Process Notes:	Thermal Fluid ("hot oil") Heater, throughput based on higher heating value basis

Pollutant Information: LINEAR ALPHA OLEFINS PLANT - Industrial-Sized Furnaces, Natural Gas-fired

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0060
Emission Limit 1 Unit:	LB / MM BTU
Emission Limit 1 Avg. Time/Condition:	HHV BASIS, ANNUAL AVERAGE
Emission Limit 2:	0.0140
Emission Limit 2 Unit:	LB/MMBTU
Emission Limit 2 Avg. Time/Condition:	HHV BASIS, 1-HR AVERAGE

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	2.1500
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg.
Time/Condition:

Process Information: LINEAR ALPHA OLEFINS PLANT

+Process Name:	SOCMI Floating Roof Storage Tanks
+Process Type:	64.004
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	(9) Internal Floating Roof tanks in 1-hexene, 1-octene and 1-decene service with capacities of 300–450 Mgal

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Pollutant Information: LINEAR ALPHA OLEFINS PLANT - SOCMI Floating Roof Storage Tanks

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+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0100
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LINEAR ALPHA OLEFINS PLANT

+Process Name:	SOCMI Fixed Roof Storage Tanks
+Process Type:	64.004
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	(10) fixed roof storage in C12–C24 alpha olefin service with capacities of 50–160 Mgal.

Pollutant Information: LINEAR ALPHA OLEFINS PLANT - SOCMI Fixed Roof Storage Tanks

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+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.1700
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LINEAR ALPHA OLEFINS PLANT

+Process Name:	SOCMI Equipment Leaks
+Process Type:	64.002
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: LINEAR ALPHA OLEFINS PLANT - SOCMI Equipment Leaks

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	6.8700
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LINEAR ALPHA OLEFINS PLANT

+Process Name:	Process Vents
+Process Type:	64.003
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: LINEAR ALPHA OLEFINS PLANT - Process Vents

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.5300
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: LINEAR ALPHA OLEFINS PLANT

+Process Name:	SOCMI Transfer Operations
+Process Type:	64.005
Primary Fuel:	
Throughput:	120000.00
Throughput Unit:	gal/hr
Process Notes:	Truck, railcar and barge loading

Pollutant Information: LINEAR ALPHA OLEFINS PLANT - SOCMI Transfer Operations

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	99.9000
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	TXO
Emission Limit 2:	99.5000
Emission Limit 2 Unit:	%
Emission Limit 2 Avg. Time/Condition:	VAPOR COMBUSTOR

Process Information: LINEAR ALPHA OLEFINS PLANT

+Process Name:	Other Combustion
+Process Type:	19.900
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	Collateral emissions from control devices (thermal oxidizer and vapor combustor) for truck, railcar and barge loading activities

Pollutant Information: LINEAR ALPHA OLEFINS PLANT - Other Combustion

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0600
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	HHV BASIS, ANNUAL AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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**NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".**

Facility Information: INDORAMA LAKE CHARLES FACILITY

RBLC ID:	LA-0314
+Facility Name:	INDORAMA LAKE CHARLES FACILITY
Date determination entered in RBLC:	03/13/2017
Permit Type:	C: Modify process at existing facility
Facility Description:	modify and restart-up a mothballed facility to produce 1,009 million lbs/yr of ethylene
Permit Notes:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Modular Ethylene Cracking Furnaces - 001
+Process Type:	64.003
Primary Fuel:	natural gas/fuel gas
Throughput:	1028.00
Throughput Unit:	MM BTU/hr
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Modular Ethylene Cracking Furnaces - 001

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0100
Emission Limit 1 Unit:	LB/MM BTU

Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0400
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Ethylene Cracking Furnace - 015
+Process Type:	64.003
Primary Fuel:	natural gas/fuel gas
Throughput:	168.00
Throughput Unit:	mm btu
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Ethylene Cracking Furnace - 015

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0980
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0400
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MM BTU

Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Dryer Regenerator Heater - 005
+Process Type:	13.390
Primary Fuel:	process fuel gas
Throughput:	29.00
Throughput Unit:	mm btu/hr
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Dryer Regenerator Heater - 005

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0820
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO_2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0600
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	boiler A and B (010 and 011)
+Process Type:	12.310

Primary Fuel:	natural gas/fuel gas
Throughput:	248.00
Throughput Unit:	mm btu/hr (each)
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - boiler A and B (010 and 011)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0600
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0820
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	boiler B-201
+Process Type:	12.310
Primary Fuel:	natural gas/fuel gas
Throughput:	229.00
Throughput Unit:	mm btu
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - boiler B-201

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0

Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0600
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0370
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0.0054
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Flare No. 1 - 008

+Process Type: 19.310
Primary Fuel: natural gas
Throughput: 85097.00
Throughput Unit: MM BTU/yr
Process Notes:

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Flare No. 1 - 008

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0070
Emission Limit 1 Unit: LB/MM BTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0070
Emission Limit 1 Unit: LB/MM BTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0.0680
Emission Limit 1 Unit: LB/MM BTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0.3100
Emission Limit 1 Unit: LB/MM BTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	98.0000
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	REMOVAL EFFICIENCY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Pyrolysis Gasoline Tank Flare - 009
+Process Type:	19.310
Primary Fuel:	natural gas
Throughput:	0.66
Throughput Unit:	mm btu/hr
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Pyrolysis Gasoline Tank Flare - 009

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LBS/MM BTU

Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0680
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.3100
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	98.0000
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	REMOVAL EFFICIENCY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	vessel evacuation flare - 018
+Process Type:	19.310
Primary Fuel:	natural gas
Throughput:	3.04
Throughput Unit:	mm btu/hr
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - vessel evacuation flare - 018

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0680
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.3100
Emission Limit 1 Unit:	LBS/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0

Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	98.0000
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	REMOVAL EFFICIENCY
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Diesel Firewater pump engines (6 units)
+Process Type:	17.210
Primary Fuel:	diesel
Throughput:	425.00
Throughput Unit:	hp
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Diesel Firewater pump engines (6 units)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)

Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Diesel emergency generator engine - EGEN
+Process Type:	17.210
Primary Fuel:	diesel
Throughput:	350.00
Throughput Unit:	hp
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Diesel emergency generator engine - EGEN

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0
Emission Limit 1 Unit:	

Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	cooling towers - 007
+Process Type:	99.009
Primary Fuel:	
Throughput:	86500.00
Throughput Unit:	gpm
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - cooling towers - 007

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0005
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	DRIFT RATE
Emission Limit 2:	1400.0000
Emission Limit 2 Unit:	PPM
Emission Limit 2 Avg. Time/Condition:	TDS

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0005
Emission Limit 1 Unit: %
Emission Limit 1 Avg. Time/Condition: DRIFT RATE
Emission Limit 2: 1400.0000
Emission Limit 2 Unit: PPM
Emission Limit 2 Avg. Time/Condition: TDS

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name: oil tank FA-712 - 012
+Process Type: 64.004
Primary Fuel:
Throughput: 66150.00
Throughput Unit: gal
Process Notes:

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - oil tank FA-712 - 012

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name: storm water surge tank TK-9 - 013
+Process Type: 64.004

Primary Fuel:	
Throughput:	291410.00
Throughput Unit:	gallons
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - storm water surge tank TK-9 - 013

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	process water storage tanks TK-301A/B - 017
+Process Type:	64.004
Primary Fuel:	
Throughput:	350000.00
Throughput Unit:	gallons
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - process water storage tanks TK-301A/B - 017

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Unleaded Gasoline Tank TK-33
+Process Type:	42.005
Primary Fuel:	
Throughput:	1000.00

Throughput Unit:	gallons
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Unleaded Gasoline Tank TK-33

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Methanol Tank TK-2
+Process Type:	64.004
Primary Fuel:	
Throughput:	1469.00
Throughput Unit:	gallons
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Methanol Tank TK-2

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	pyrolysis gasoline tank V-410
+Process Type:	64.004
Primary Fuel:	
Throughput:	946996.00
Throughput Unit:	gallons
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - pyrolysis gasoline tank V-410

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	wastewater treatment system
+Process Type:	22.200
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - wastewater treatment system

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: INDORAMA LAKE CHARLES FACILITY

+Process Name:	Fugitive Emissions
+Process Type:	64.002
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: INDORAMA LAKE CHARLES FACILITY - Fugitive Emissions

+Pollutant Name	Volatile Organic Compounds (VOC)

Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: GREENSVILLE POWER STATION

RBLC ID:	VA-0325
+Facility Name:	GREENSVILLE POWER STATION
Date determination entered in RBLC:	09/16/2016
Permit Type:	A: New/Greenfield Facility
Facility Description:	The proposed project will be a new, nominal 1,600 MW combined-cycle electrical power generating facility utilizing three combustion turbines each with a duct-fired heat recovery steam generator (HRSG) with a common reheat condensing steam turbine generator (3 on 1 configuration). The proposed fuel for the turbines and duct burners is pipeline-quality natural gas.
Permit Notes:	

Process Information: GREENSVILLE POWER STATION

+Process Name:	COMBUSTION TURBINE GENERATOR WITH DUCT-FIRED HEAT RECOVERY STEAM GENERATORS (3)
+Process Type:	15.210
Primary Fuel:	natural gas
Throughput:	3227.00
Throughput Unit:	MMBTU/HR
Process Notes:	3227 MMBTU/HR CT with 500 MMBTU/HR Duct Burner, 3 on 1 configuration.

Pollutant Information: GREENSVILLE POWER STATION - COMBUSTION TURBINE GENERATOR WITH DUCT-FIRED HEAT RECOVERY STEAM GENERATORS (3)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	890.0000
Emission Limit 1 Unit:	LB/MWH

Emission Limit 1 Avg.
Time/Condition: NET OUTPUT AFTER 30 YEARS OF OPERATION
Emission Limit 2: 1911596.0000
Emission Limit 2 Unit: TONS/YR
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 1.6000
Emission Limit 1 Unit: PPMVD
Emission Limit 1 Avg.
Time/Condition: 3 HR AVG
Emission Limit 2: 286.0000
Emission Limit 2 Unit: TONS/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING AVG

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 2.0000
Emission Limit 1 Unit: PPMVD
Emission Limit 1 Avg.
Time/Condition: 1 HR AVG
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1: 0.0039
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: AVG OF 3 TEST RUNS
Emission Limit 2: 14.1000
Emission Limit 2 Unit: LB/H
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0039
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition: AVG OF 3 TEST RUNS
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfur Dioxide (SO2)

Emission Limit 1:	0.0011
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	DURING NORMAL OPERATION INCLUDING SU/SD
Emission Limit 2:	18.7000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER TURBINE

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0.0006
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.9000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	12 MO ROLLING AVG

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	1.4000
Emission Limit 1 Unit:	PPMVD
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	214.8000
Emission Limit 2 Unit:	T/YR
Emission Limit 2 Avg. Time/Condition:	PER TURBINE-12 MO ROLLING TOTAL

Process Information: GREENSVILLE POWER STATION

+Process Name:	AUXILIARY BOILER (1) AND FUEL GAS HEATERS (6)
+Process Type:	12.310
Primary Fuel:	NATURAL GAS
Throughput:	185.00
Throughput Unit:	MMBTU/HR
Process Notes:	The auxiliary boiler will provide steam to the steam turbine at startup and at cold starts to warm up the ST rotor. The steam from the auxiliary boiler will not be used to augment the power generation of the combustion turbines or steam turbine. The boiler is proposed to operate 8760 hrs/yr but will be limited by an annual fuel throughput based on a capacity factor of 10%.

Pollutant Information: GREENSVILLE POWER STATION - AUXILIARY BOILER (1) AND FUEL GAS HEATERS (6)

+Pollutant Name	Volatile Organic Compounds (VOC)

Emission Limit 1:	0.5000
Emission Limit 1 Unit:	T/12 MO ROLL AVG
Emission Limit 1 Avg. Time/Condition:	12 MONTH ROLLING TOTAL
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0110
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0.0011
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0.0001
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0350
Emission Limit 1 Unit:	LBS/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	6.6000
Emission Limit 2 Unit:	LB/H
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0.0070
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	117.1000
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GREENSVILLE POWER STATION

+Process Name:	DIESEL-FIRED EMERGENCY GENERATOR 3000 kW (1)
+Process Type:	17.110
Primary Fuel:	DIESEL FUEL
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: GREENSVILLE POWER STATION - DIESEL-FIRED EMERGENCY GENERATOR 3000 kW (1)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	163.6000
Emission Limit 1 Unit:	LB/MMBTU

Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 1178.0000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING TOTAL

+Pollutant Name Carbon Monoxide
Emission Limit 1: 3.5000
Emission Limit 1 Unit: G/KW
Emission Limit 1 Avg.
Time/Condition: PER HR
Emission Limit 2: 5.8000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING TOTAL

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 6.4000
Emission Limit 1 Unit: G/KW
Emission Limit 1 Avg.
Time/Condition: PER HR
Emission Limit 2: 10.6000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING TOTAL

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.4000
Emission Limit 1 Unit: G/KW
Emission Limit 1 Avg.
Time/Condition: PER HR
Emission Limit 2: 1.0000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING TOTAL

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.4000
Emission Limit 1 Unit: G/KR
Emission Limit 1 Avg.
Time/Condition: PER HR
Emission Limit 2: 0.7000
Emission Limit 2 Unit: T/YR
Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING TOTAL

+Pollutant Name Sulfur Dioxide (SO2)

Emission Limit 1:	0.0015
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfuric Acid (mist, vapors, etc)
Emission Limit 1:	0.0001
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	6.4000
Emission Limit 1 Unit:	G/KW
Emission Limit 1 Avg. Time/Condition:	PER HR
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GREENSVILLE POWER STATION

+Process Name:	DIESEL-FIRED WATER PUMP 376 bph (1)
+Process Type:	17.210
Primary Fuel:	DIESEL FUEL
Throughput:	0
Throughput Unit:	
Process Notes:	FWP-1: 104.0 tons/year (12-month rolling total)

Pollutant Information: GREENSVILLE POWER STATION - DIESEL-FIRED WATER PUMP 376 bph (1)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.3000
Emission Limit 1 Unit:	G/HP-H
Emission Limit 1 Avg. Time/Condition:	PER HR
Emission Limit 2:	0

Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0.0001
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 μ (TPM2.5)
Emission Limit 1: 0.3000
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg. Time/Condition: HR
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 3.0000
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg. Time/Condition: PER HR
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 104.0000
Emission Limit 1 Unit: T/YR
Emission Limit 1 Avg. Time/Condition: 12 MO ROLLING TOTAL
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 2.6000
Emission Limit 1 Unit: G/HP-H

Emission Limit 1 Avg. Time/Condition:	HR
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Sulfur Dioxide (SO2)
Emission Limit 1:	0.0015
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GREENSVILLE POWER STATION

+Process Name:	PROPANE-FIRED EMERGENCY GENERATORS 150 kW (2)
+Process Type:	17.230
Primary Fuel:	PROPANE
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: GREENSVILLE POWER STATION - PROPANE-FIRED EMERGENCY GENERATORS 150 kW (2)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	136.1000
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	121.0000
Emission Limit 2 Unit:	T/YR

Emission Limit 2 Avg.
Time/Condition: 12 MO ROLLING AVG

+Pollutant Name Carbon Monoxide
Emission Limit 1: 4.0000
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg.
Time/Condition: HR
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 2.0000
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg.
Time/Condition: HR
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0.0001
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg.
Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.1900
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg.
Time/Condition: PER HR
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg.
Time/Condition:

+Pollutant Name Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1: 0.0190
Emission Limit 1 Unit: G/HP-H
Emission Limit 1 Avg.
Time/Condition: PER HR

Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	1.0000
Emission Limit 1 Unit:	G/HP-H
Emission Limit 1 Avg. Time/Condition:	PER HR
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GREENSVILLE POWER STATION

+Process Name:	CIRCUIT BREAKERS (11)
+Process Type:	99.999
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: GREENSVILLE POWER STATION - CIRCUIT BREAKERS (11)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1032.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GREENSVILLE POWER STATION

+Process Name:	AUXILIARY COOLER
+Process Type:	99.190
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: GREENSVILLE POWER STATION - AUXILIARY COOLER

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.0100
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	DRIFT RATE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0100
Emission Limit 1 Unit:	%
Emission Limit 1 Avg. Time/Condition:	DRIFT RATE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GREENSVILLE POWER STATION

+Process Name:	CIRCUIT BREAKERS (3)
+Process Type:	99.999
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: GREENSVILLE POWER STATION - CIRCUIT BREAKERS (3)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	19.0000
Emission Limit 1 Unit:	T/YR
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: GREENSVILLE POWER STATION

+Process Name:	GAS PIPING COMPONENTS-FUGITIVE LEAKS

+Process Type: 99.999
Primary Fuel:
Throughput: 0
Throughput Unit:
Process Notes:

Pollutant Information: GREENSVILLE POWER STATION - GAS PIPING COMPONENTS-FUGITIVE LEAKS

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: GREENSVILLE POWER STATION

+Process Name: INLET CHILLERS (4)
+Process Type: 99.999
Primary Fuel:
Throughput: 0
Throughput Unit:
Process Notes:

Pollutant Information: GREENSVILLE POWER STATION - INLET CHILLERS (4)

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 1500.0000
Emission Limit 1 Unit: MG/L
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 1500.0000
Emission Limit 1 Unit: MG/L
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0

Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: LINEAR ALKYL BENZENE (LAB) UNIT

RBLC ID:	LA-0275
+Facility Name:	LINEAR ALKYL BENZENE (LAB) UNIT
Date determination entered in RBLC:	06/23/2016
Permit Type:	C: Modify process at existing facility
Facility Description:	LAB production unit, PSD-LA-291(M2) issued October 18, 1998 - PSD-LA-291(M3) issued November 29, 2010. Permit PSD-LA-291(M4) for emission limits revision, No BACT change.
Permit Notes:	

Process Information: LINEAR ALKYL BENZENE (LAB) UNIT

+Process Name:	Heaters (3 units)
+Process Type:	12.310
Primary Fuel:	Natural Gas and Ethane
Throughput:	0
Throughput Unit:	
Process Notes:	LH-1(H-201): 87.3 MM BTU/hr - fires CH4 & Ethane LH-2(H-202): 21.0 MM BTU/hr - fires CH4 & Ethane LH-3(H-601): 220.5 MM BTU/hr - fires CH4, Ethane, and hydrogen waste gas

Pollutant Information: LINEAR ALKYL BENZENE (LAB) UNIT - Heaters (3 units)

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0

Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: LINEAR ALKYL BENZENE (LAB) UNIT

+Process Name:	LF-1 - LAB Unit Flare
+Process Type:	19.310
Primary Fuel:	Natural Gas
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: LINEAR ALKYL BENZENE (LAB) UNIT - LF-1 - LAB Unit Flare

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	10.1500
Emission Limit 1 Unit:	LBS/HR
Emission Limit 1 Avg. Time/Condition:	HOURLY MAXIMUM
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0.4000
Emission Limit 1 Unit:	LBS/HR
Emission Limit 1 Avg. Time/Condition:	HOURLY MAXIMUM
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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Facility Information: JOHNSONVILLE COGENERATION

RBLC ID:	TN-0162
+Facility Name:	JOHNSONVILLE COGENERATION
Date determination entered in RBLC:	05/19/2016
Permit Type:	Both B: (Add new process to existing facility) &C: (Modify process at existing facility)
Facility Description:	Existing gas-fired combustion turbine with new heat recovery steam generator (HRSG) with duct burner and two new gas-fired auxiliary boilers.
Permit Notes:	Facility-wide emissions increases do not include decreases due to shutdown of coal-fired units.

Process Information: JOHNSONVILLE COGENERATION

+Process Name:	Natural Gas-Fired Combustion Turbine with HRSG
+Process Type:	15.210
Primary Fuel:	Natural Gas
Throughput:	1339.00
Throughput Unit:	MMBtu/hr
Process Notes:	Turbine throughput is 1019.7 MMBtu/hr when burning natural gas and 1083.7 MMBtu/hr when burning No. 2 oil. Duct burner throughput is 319.3 MMBtu/hr. Duct burner firing will occur during natural gas combustion only.

Pollutant Information: JOHNSONVILLE COGENERATION - Natural Gas-Fired Combustion Turbine with HRSG

+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0050
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0.0150
Emission Limit 2 Unit:	LB/MMBTU
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	30 UNIT-OPERATING-DAY MOVING AVERAGE
Emission Limit 2:	10.0000
Emission Limit 2 Unit:	PPMVD @ 15% O2
Emission Limit 2 Avg. Time/Condition:	15 UNIT-OPERATING-DAY MOVING AVERAGE

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	30 UNIT-OPERATING-DAY MOVING AVERAGE
Emission Limit 2:	8.0000
Emission Limit 2 Unit:	PPMVD @ 15% O2
Emission Limit 2 Avg. Time/Condition:	15 UNIT-OPERATING-DAY MOVING AVERAGE

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	1800.0000
Emission Limit 1 Unit:	LB/MWH
Emission Limit 1 Avg. Time/Condition:	12-MONTH MOVING AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: JOHNSONVILLE COGENERATION

+Process Name:	Two Natural Gas-Fired Auxiliary Boilers
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	450.00
Throughput Unit:	MMBtu/hr
Process Notes:	Two 450 MMBtu/hr natural gas-fired auxiliary boilers will provide steam generation during threshold transitional periods and during malfunction events when the CT and HRSG are not able to operate.

Pollutant Information: JOHNSONVILLE COGENERATION - Two Natural Gas-Fired Auxiliary Boilers

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+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	0.0080
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0840
Emission Limit 1 Unit:	LB/MMBTU

Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0130
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	117.0000
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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Required fields are denoted by "+".

Facility Information: MAGNOLIA LNG FACILITY

RBLC ID:	LA-0307
+Facility Name:	MAGNOLIA LNG FACILITY
Date determination entered in RBLC:	03/08/2017
Permit Type:	A: New/Greenfield Facility
Facility Description:	A new facility to liquefy 8.0 million metric tons per year of natural gas
Permit Notes:	

Process Information: MAGNOLIA LNG FACILITY

+Process Name:	Gas Turbines (8 units)
+Process Type:	15.110
Primary Fuel:	natural gas

Throughput:	333.00
Throughput Unit:	mm btu/hr
Process Notes:	

Pollutant Information: MAGNOLIA LNG FACILITY - Gas Turbines (8 units)

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0620
Emission Limit 1 Unit:	LB/MM BTU
Emission Limit 1 Avg. Time/Condition:	THREE ONE-HOUR TEST AVERAGE
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)

Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	25.0000
Emission Limit 1 Unit:	PPMVD
Emission Limit 1 Avg. Time/Condition:	@15 %O2
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MAGNOLIA LNG FACILITY

+Process Name:	Thermal oxidizers (2 units)
+Process Type:	50.008
Primary Fuel:	natural gas
Throughput:	21.00
Throughput Unit:	mm btu/hr
Process Notes:	

Pollutant Information: MAGNOLIA LNG FACILITY - Thermal oxidizers (2 units)

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	

Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MAGNOLIA LNG FACILITY

+Process Name:	Auxiliary boilers
+Process Type:	12.310

Primary Fuel:	natural gas
Throughput:	171.00
Throughput Unit:	mm btu/hr
Process Notes:	

Pollutant Information: MAGNOLIA LNG FACILITY - Auxiliary boilers

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+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MAGNOLIA LNG FACILITY

+Process Name:	Diesel Engines
+Process Type:	17.110
Primary Fuel:	Diesel
Throughput:	0
Throughput Unit:	
Process Notes:	Water Pumps (2 units) = 355 hp Tank Deluge Pumps (2 units) = 800 hp Generator = 1340 hp

Pollutant Information: MAGNOLIA LNG FACILITY - Diesel Engines

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	

Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: MAGNOLIA LNG FACILITY

+Process Name: flares
+Process Type: 19.390
Primary Fuel: natural gas
Throughput: 7.33
Throughput Unit: kg/hr
Process Notes:

Pollutant Information: MAGNOLIA LNG FACILITY - flares

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, filterable < 2.5 µ (FPM2.5)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:

Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

Process Information: MAGNOLIA LNG FACILITY

+Process Name:	Regenerative Heaters
+Process Type:	13.310
Primary Fuel:	natural gas
Throughput:	7.37
Throughput Unit:	mm btu/hr
Process Notes:	

Pollutant Information: MAGNOLIA LNG FACILITY - Regenerative Heaters

+Pollutant Name	Particulate matter, total < 10 µ (TPM10)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0
Emission Limit 1 Unit:	

Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Nitrogen Oxides (NOx)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Monoxide
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 0
Emission Limit 1 Unit:
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

Process Information: MAGNOLIA LNG FACILITY

+Process Name:	fugitives
+Process Type:	64.002
Primary Fuel:	
Throughput:	0
Throughput Unit:	
Process Notes:	

Pollutant Information: MAGNOLIA LNG FACILITY - fugitives

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Dioxide Equivalent (CO2e)
Emission Limit 1:	0
Emission Limit 1 Unit:	
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	0
Emission Limit 2 Unit:	
Emission Limit 2 Avg. Time/Condition:	

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NOTE: Draft determinations are marked with a " * " beside the RBLC ID.
Required fields are denoted by "+".

Facility Information: TENASKA PA PARTNERS/WESTMORELAND GEN FAC

RBLC ID:	PA-0306
+Facility Name:	TENASKA PA PARTNERS/WESTMORELAND GEN FAC
Date determination entered in RBLC:	06/09/2017
Permit Type:	U: Unspecified

Facility Description:	The plan approval will allow construction and temporary operation of a power plant is a single 2 on 1 combined cycle turbine configuration with 2 combustion turbines serving a single steam turbine generator equipped with heat recovery steam generator with supplemental 400MMBtu/hr natural gas fired duct burners. The approximate maximum plant nominal generating capacity is 930-1065 MW. Additional facilities will include 245 MMBtu/hr Auxiliary Boiler, one cooling tower, one diesel-fired emergency generator, and one diesel-fired emergency fire pump engine.
Permit Notes:	Application for plan approval 65-00990E received on 12/10/2015 from Tenaska to reduce the facility wide PTE authorized under plan approval 65-00990C based on revised emission information for startup and shutdown from the manufacturer.

Process Information: TENASKA PA PARTNERS/WESTMORELAND GEN FAC

+Process Name:	Large combustion turbine
+Process Type:	15.210
Primary Fuel:	Natural Gas
Throughput:	0
Throughput Unit:	
Process Notes:	This process entry is for operations with the duct burner. Limits entered are for each turbine.

Pollutant Information: TENASKA PA PARTNERS/WESTMORELAND GEN FAC - Large combustion turbine

---

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	2.0000
Emission Limit 1 Unit:	PPMVD@15% O2
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	26.5000
Emission Limit 2 Unit:	LB/HR
Emission Limit 2 Avg. Time/Condition:	

+Pollutant Name	Carbon Monoxide
Emission Limit 1:	15.9000
Emission Limit 1 Unit:	LB/HR
Emission Limit 1 Avg. Time/Condition:	3 HR AVERAGE
Emission Limit 2:	318.6000
Emission Limit 2 Unit:	TPY
Emission Limit 2 Avg. Time/Condition:	12 MONTH ROLLING BASIS

+Pollutant Name	Volatile Organic Compounds (VOC)

Emission Limit 1: 2.4000
Emission Limit 1 Unit: PPMDV@15% O2
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 9.4000
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0.0006
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition: HHV
Emission Limit 2: 1.8000
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total (TPM)
Emission Limit 1: 0.0039
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 11.8000
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 μ (TPM10)
Emission Limit 1: 0.0039
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 11.8000
Emission Limit 2 Unit: LB/HR
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Carbon Dioxide Equivalent (CO2e)
Emission Limit 1: 1881905.0000
Emission Limit 1 Unit: TPY
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name	Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1:	0.0039
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	11.8000
Emission Limit 2 Unit:	LB/HR
Emission Limit 2 Avg. Time/Condition:	

Process Information: TENASKA PA PARTNERS/WESTMORELAND GEN FAC

+Process Name:	245 MMBtu natural gas fired Auxiliary boiler
+Process Type:	12.310
Primary Fuel:	Natural Gas
Throughput:	1052.00
Throughput Unit:	MMscf/yr
Process Notes:	Total fuel usage of the auxiliary boiler shall not exceed 1052 MMsch/yr on a 12-month rolling basis

Pollutant Information: TENASKA PA PARTNERS/WESTMORELAND GEN FAC - 245 MMBtu natural gas fired Auxiliary boiler

+Pollutant Name	Nitrogen Oxides (NOx)
Emission Limit 1:	0.0110
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.0000
Emission Limit 2 Unit:	PPMDV @ 15% O2
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Carbon Monoxide
Emission Limit 1:	0.0370
Emission Limit 1 Unit:	LB/MMBTU
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	19.8500
Emission Limit 2 Unit:	LB/HR
Emission Limit 2 Avg. Time/Condition:	
+Pollutant Name	Particulate matter, total (TPM)
Emission Limit 1:	4.0000
Emission Limit 1 Unit:	TPY

Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 10 µ (TPM10)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition: 3 HR AVG
Emission Limit 2: 4.0000
Emission Limit 2 Unit: TPY
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Particulate matter, total < 2.5 µ (TPM2.5)
Emission Limit 1: 0.0075
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition: 3 HR AVG
Emission Limit 2: 4.0000
Emission Limit 2 Unit: TPY
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Sulfuric Acid (mist, vapors, etc)
Emission Limit 1: 0.0049
Emission Limit 1 Unit: TPY
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 0
Emission Limit 2 Unit:
Emission Limit 2 Avg. Time/Condition:

+Pollutant Name Volatile Organic Compounds (VOC)
Emission Limit 1: 0.0054
Emission Limit 1 Unit: LB/MMBTU
Emission Limit 1 Avg. Time/Condition:
Emission Limit 2: 2.8900
Emission Limit 2 Unit: TPY
Emission Limit 2 Avg. Time/Condition:

Process Information: TENASKA PA PARTNERS/WESTMORELAND GEN FAC

+Process Name:	Large Combustion turbine
+Process Type:	15.110
Primary Fuel:	Natural gas
Throughput:	0
Throughput Unit:	
Process Notes:	This process entry is for the VOC emissions of turbine operation without the duct burner. Limit entered is for one turbine

Pollutant Information: TENASKA PA PARTNERS/WESTMORELAND GEN FAC - Large Combustion turbine

+Pollutant Name	Volatile Organic Compounds (VOC)
Emission Limit 1:	1.4000
Emission Limit 1 Unit:	PPMVD @ 15% O2
Emission Limit 1 Avg. Time/Condition:	
Emission Limit 2:	9.4000
Emission Limit 2 Unit:	LB/HR
Emission Limit 2 Avg. Time/Condition:	

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ATTACHMENT 3

Analysis of NOx Emissions for Selected Coal-Fired Units

by

Dr. Ranajit (Ron) Sahu, Consultant[1]

I was asked to review the recent NOx performance of selected coal-fired Electricity Generating Units (EGUs) located in areas impacting 2015 ozone moderate non-attainment areas as well as the units that are impacting the 2008 ozone non-attainment areas.

Generally, the units at issue are either equipped with Selective Catalytic Reduction (SCR) and have relatively elevated NOx levels. Or, in other cases they do not have SCR installed and, as a result, have elevated NOx emissions levels.

In all cases, I assessed NOx emissions as a 30-day average, expressed in units of pounds per million Btu heat input (lb/MMBtu).

My analysis, while presented in this report by state, followed the same general approach for the two sets of units at issue – i.e., units with SCR and those without. I therefore address the overall methodology in this section and do not then repeat that in each subsequent state-by-state analysis.

A. Assessment of NOx Emissions for Units Equipped with SCR

Generally speaking units that have SCR installed should achieve low NOx levels, especially on a 30-day rolling average basis. While the SCR catalyst does require a minimum operating temperature (MOT) in order to provide requisite NOx reductions, and while this MOT may not be met until a certain minimum load (i.e., minimum heat input or electrical power output) for a unit, the lowest heat inputs or capacity factors at which SCR can be effective can be addressed using a number of operational strategies meaning that the NOx-reduction efficiency of SCRs can be maintained at a high level for the vast majority of the time. I have addressed these operational strategies in other prior reports and include excerpted discussions of them in Appendix A. Thus, unless a unit is operated as a cyclic unit with frequent low load operation (i.e., below its SCR's capability after employing operational strategies), the 30-day average NOx emissions levels should be low, if the SCR is properly operated.

In this analysis, rather than address theoretical SCR capability of a particular unit's SCR and its performance, which would require non-public information on the design of the SCR and its catalyst along with unit operating parameters, I instead focus on the actual demonstrated NOx emissions levels achieved by the unit as reported to EPA's Clean Air Markets (or Acid Rain) database. While

[1] Resume provided in Appendix B.

this data is reported on an hourly basis, and includes the unit's heat input, power output, and NOx emissions levels, I focused my analysis on the daily and monthly reported performance. Based on past experience in these types of analysis, I considered the reported monthly NOx performance for a substantial but recent time period. Typically I reviewed monthly data from October 2017 through September 2022. This 60-month period covering 5 ozone seasons (i.e., May through October periods in 2018, 2019, 2020, 2021, and 2022) provide a representative record of the units performance under a wide range of operating time periods including periods before, during, and after the COVID 19 pandemic.

Also based on past experience, since I analyzed monthly data for a 60-month time period, I did not also need to repeat the analysis for rolling 30-day average time periods because there is little difference between 30-day rolling averages and monthly averages as long as the latter are considered for a substantial (i.e., the 5 year or 60-month period in this analysis) period, for the purposes of this analysis.

Here, the purpose was to determine the recent performance of the unit and its SCR, as reflected in the reported NOx emission rate. Importantly, it is assumed that if a unit has reported actual, low levels of NOx in this recent time period (as opposed to, for example, more distant past time periods when the SCR at the unit may have been first installed), when otherwise operating normally or in a representative manner, it can achieve that or similarly low level of NOx at other times, such as by properly or more optimally operating its existing SCR. Thus, expectations of low NOx from proper SCR operation are judged not by some theoretical standard but by the unit's own, recent, reported NOx performance.

Based on this analysis, for each unit with existing SCR, I conclude that such units have demonstrated low NOx levels (generally NOx levels of 0.07 lb/MMBtu or lower) on a monthly (i.e., 30-day average) basis in recent time periods and can therefore reasonably be required to do so in the future. The coal fired EGUs with SCRs installed that I analyzed in this report have each demonstrated that they have recently achieved and maintained significantly lower NOx emissions rates than what they often operate at, and that they can therefore consistently achieve those lower NOx rates if required to do so. Low capacity factors and MOT are not the factors that are precluding the coal fired EGUs from operating at those demonstrated, lower NOx emission rates.

B. Assessment of NOx Emissions for Units Currently Operating without SCR

There is no question that SCR is a proven NOx-reducing technology for coal-fired units, regardless of the type of coal burned. In the US fleet today there are SCR's in use at bituminous, sub-bituminous, as well as lignite coal units. Thus, the technical feasibility of installing and operating SCRs at units that do not have them is not at issue.

B.1 Cost Effectiveness of SCR On Coal Fired EGUs Generally

The widespread installation of SCRs on coal fired EGUs in the United States is indicative of the fact that SCRs are a proven cost-effective means of NOx reduction at coal fired EGUs. Over 60 percent of existing coal fired EGUs in the US over 100 MWs have SCRs, and for over 20 years all new operating coal fired EGUs have included SCRs. There can be no doubt that as an industrial sector, SCRs are reasonable to install, cost effective NOx reduction technologies.

B.2 Cost-Effectiveness of SCR

I have also conducted a second, unit specific analysis of the cost per ton of NOx reduction at selected coal fired EGUs in the US. I then compared my unit specific calculations of the cost per ton of NOx reduction at those units with the cost per ton of NOx reductions that regulatory agencies have determined to be cost effective at other coal fired EGUs in the US. SCRs would be cost effective at those units. Following long-standing practice using EPA-approved approaches, cost-effectiveness was addressed by estimating the dollars per ton of NOx reduced using SCR. The cost or numerator of the cost-effectiveness metric represents the annualized cost of the capital and operating costs of the SCR while the denominator or tons reduced represents the efficacy of the SCR.

For this analysis, I used the SCR cost-effectiveness methodology used by EPA as reflected in the Sargent and Lundy report on SCR.[2] This analysis considers the capital as well as the operating costs for the SCR. In conducting the analysis, I used the so-called overnight cost methodology, not including carrying costs of capital during construction. In all other aspects, the analytical methodology is highly conservative, i.e., reflects a higher than expected cost of the SCR.

Specifically, I used the following:

(i) the EPA-assumed capital cost of over $300/kW for the SCR. This is conservative based on past actual incurred costs for SCRs in US coal units, which have typically ranged from $250/kW or lower;

(ii) the post-SCR NOx level of generally around 0.03 to 0.05 lb/MMBtu, reflecting an SCR NOx reduction of less than 90%. While SCR can achieve 90% or greater NOx reduction, the efficiency does depend on the baseline or pre-SCR NOx levels, with higher efficiencies possible when baseline NOx levels are higher. Thus, while assuming a 90% reduction with SCR is appropriate with the baseline NOx is, say, 0.3 lb/MMBtu, it would not be appropriate to assume that the same 90% reduction would be possible if the baseline NOx is lower, at, say, 0.1 lb/MMBtu. I therefore adjust or assume appropriate NOx reduction efficiencies with SCR depending on the baseline NOx level for a unit;

[2] https://www.epa.gov/sites/default/files/2018-05/documents/attachment_5-3_scr_cost_development_methodology.pdf

(iii) for the baseline NOx level, I used the median of the actual NOx levels reported in the past 5 years or so;

(iv) for the unit's operations, I used a capacity factor that was the higher of the 2017-2021 median capacity factor or its more recent January-September 2022 capacity factor. This is a reasonable assumption given how COVID affected the capacity factors purely on a historical look-back basis. In most instances, this capacity factor is conservative i.e., it could be higher in the future, which would make my estimated cost-effectiveness conservative as well, meaning that the SCR would be even more cost-effective than I estimate;

(v) for annualizing the capital cost, I used EPA's standard assumptions of a 7% annual interest rate and a 30-year life of the SCR. The latter is conservative since SCR units can last longer than 30 years. Of course, the catalyst replacement or refurbishment would occur more frequently, typically every 3-5 years, depending on the unit's capacity factor;

(vi) a multi-unit capital cost discount of 15% when a plant has more than one unit. This simply reflects the procurement benefit of contracting with vendors for multiple SCRs at the same plant. In reality, this is likely conservative, since multi-unit discounts could and should be higher if proper procurement strategies are used.

Using the inputs above I obtain and report the estimated SCR cost-effectiveness values. In order to determine whether the estimated values are cost-effective or not, I compare them with policy thresholds used by EPA and various states. I note that some states such as Connecticut have deemed SCR to be cost effective when the cost-effectiveness was greater than $ 13,635 /ton reduced, Regs. Conn. State Agencies § 22a-174-22e(h)(1)(A)(iii), and New Jersey found SCR on oil-fired boilers cost effective at up to $18,000 per ton. NJ DEP, State Implementation Plan Revision for Infrastructure and Transport Requirements for the 70 ppb and 75 ppb 8-hour Ozone NAAQS and Negative Declaration for the Oil and Natural Gas Control Technique Guidelines 15 (May 2019), https://dep.nj.gov/wp-content/uploads/airplanning/InfraTransportSIP2019-FinalSIP.pdf. EPA has previously found SCRs cost effective at $11,000 per ton. 87 Fed. Reg. 20,036, 20,081 (Apr. 6, 2022). Thus, based on my experience, EPA and states have deemed controls such as SCR to be cost-effective in the range of $10,000 to $15,000 per ton reduced. I note that many of these regulatory cost-effectiveness values have not been adjusted upward for inflation. Collectively, I reiterate that there is substantial conservatism built into the cost calculation that I have conducted.

B.2 Installation Schedule for SCR

In addition to cost-effectiveness, I was also asked to address the estimated time that will be needed to install SCR(s) at plants that do not have SCR at the present. EPA has previously concluded that an SCR can be installed at a coal fired EGU in as little as 21 months, while multiple SCRs at the same facility may take longer. Environmental Protection Agency, Final Report, Engineering and Economic Factors Affecting the Installation of Control Technologies for Multipollutant Strategies

(2002), EPA-600/R-02/073, available at https://archive.epa.gov/clearskies/web/pdf/multi102902.pdf ("It is expected that one SCR system requires about 21 months of total effort for planning, engineering, installation, and startup. Multiple SCR systems at one facility would take longer to install (e.g., approximately 35 months for seven SCRs."). Industry estimates are even shorter. Institute Of Clean Air Companies, Typical Installation Timelines for NOx Emissions Control Technologies On Industrial Sources (December 2006), available at https://cdn.ymaws.com/www.icac.com/resource/resmgr/ICAC_NOx_Control_Installatio.pdf (48-58 weeks from commercial RFQ date). Other state air agencies have similarly relied upon a 21-month installation timeline. See Maryland Department of the Environment TECHNICAL SUPPORT DOCUMENT FOR COMAR 26.11.38 - Control of NOx Emissions from Coal-Fired Electric Generating Units available at https://mde.maryland.gov/programs/Regulations/air/Documents/TSD_Phase1_with_Appendix.pdf. I note that there are no significant long-lead items that drive longer SCR installation schedules. Further, I note that "typical" SCR schedules reflecting historical installation timelines are generally based on a business-as-usual (BAU) approach, with little incentive for faster installation.

While an exact unit specific SCR installation timeline is necessarily a unit-specific determination, it is my opinion that SCRs at specific units or plants can, as a general matter, especially with incentivized contracting approaches, be achieve in a time range of 26-36 months. This is particularly true if those units have already started consideration of SCR installation, such as for compliance with other regulatory requirements such as Regional Haze or the Cross State Air Pollution Rule.

When estimating timelines for SCR installation in the present context – i.e., recognizing that substantial ozone reductions can be obtain via precursor NOx reductions at units without SCRs – it is fair, in my opinion, to assume the following:

(i) that the SCR installation project will prioritize time reduction in contracting and not simply follow typical or BAU approaches with regards to project planning, engineering, contracting, procurement, fabrication, installation, and commissioning, etc.;

(ii) that some degree of prior planning or prior assessment of SCR at each unit without SCR has likely occurred in the past or is in process. In other words, it is more likely than not that any US coal unit that is currently operating without SCR has likely considered and perhaps even planned for a SCR retrofit project even though such a project has not obviously yet been implemented. This is particularly likely given EPA's draft Cross State Air Pollution Rule, due to be finalized in March 2023, and other regulatory obligations such as EPA's Regional Haze obligations. Thus, an SCR installation project at any unit not currently using SCR cannot reasonably be a complete surprise and will not need to be started from scratch. This presumption will also reduce installation times to the lower end of the 26-36 month range.

I now show the results of my analysis on a state-by-state basis. I note that I was not asked to address every single coal-unit in each of the states below, but selected, example, units.

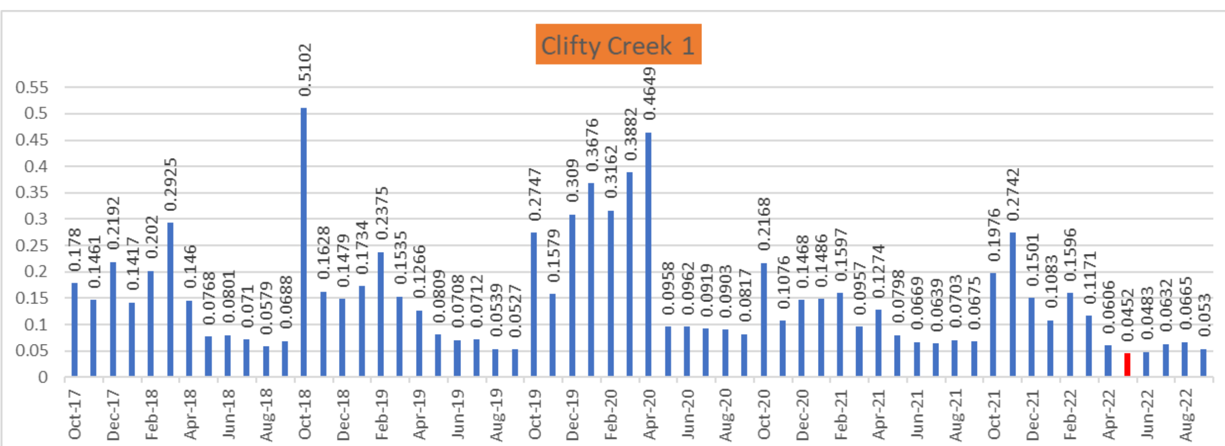
Indiana

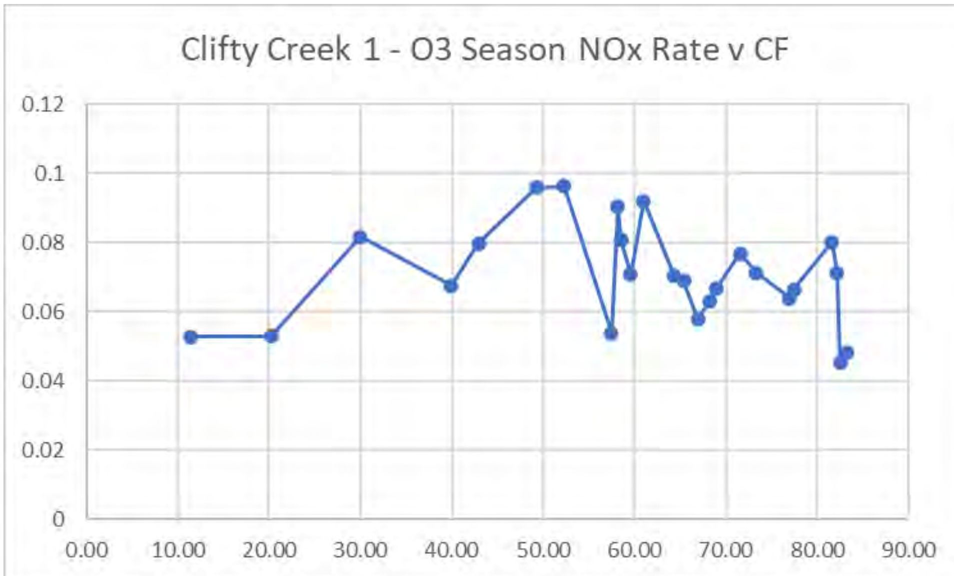
(A) Units with SCR

In Indiana, I address Clifty Creek Units 1 through 5. Each of these units is rated at around 217 MW and has an existing SCR. The table below summarizes the NOx performance in the last three columns, in units of lb/MMBtu. While the minimum NOx levels in the 60-month period analyzed were lower than 0.07 lb/MMBtu for each unit, the highest-month NOx as well as the highest-month NOx during the ozone seasons were substantially greater than 0.07 lb/MMBtu, especially for Units 4 and 5.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max O3 Months
Clifty Creek, IN	1	217.3	0.0452	0.5102	0.0962
	2	217.3	0.0461	0.4083	0.0962
	3	217.3	0.0457	0.4489	0.0962
	4	217.3	0.0605	0.3955	0.2473
	5	217.3	0.0646	0.3874	0.1954

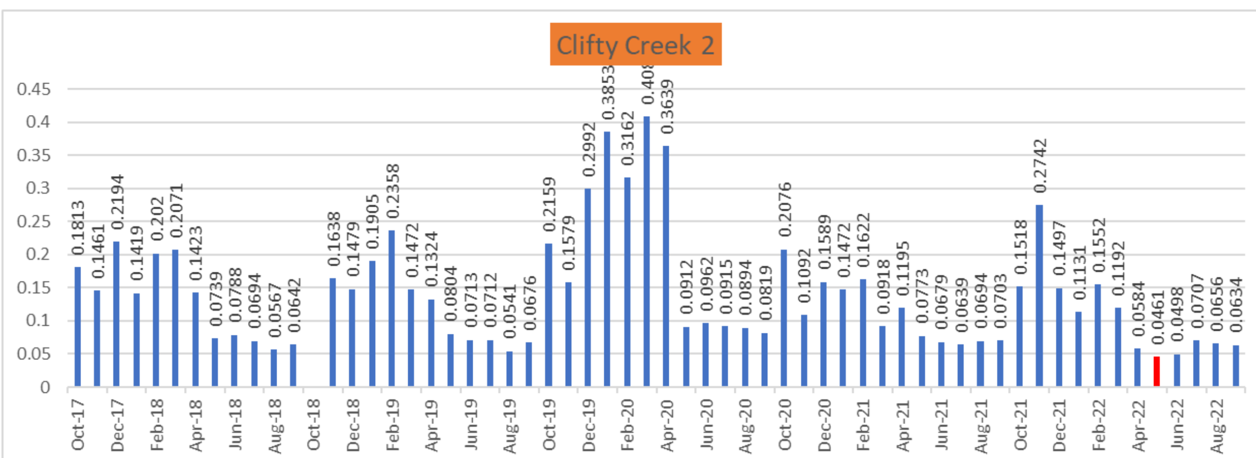
Below, I show, for each unit, two separate charts. The first chart shows the actual NOx by month, in lb/MMBtu. The lowest month is shown in red. In the chart that follows I show the actual monthly NOx levels (in lb/MMBtu on the vertical axis) during just the ozone season months, as a function of the monthly capacity factor (on the horizontal axis). As I noted earlier, SCR performance can potentially degrade at low capacity factors since a unit may spend operating times (within the 30-day average) below the MOT for the SCR, thus emitting NOx that is not reduced by the SCR.



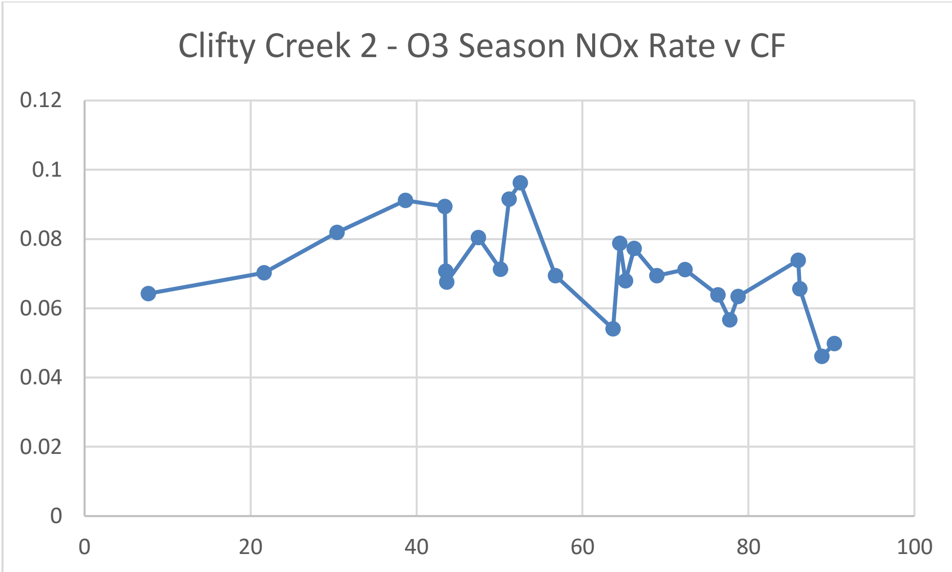


The chart above for Clifty Creek 1 shows that even at low monthly capacity factors (i.e., 10 and 20 percent), the NOx performance was below 0.07 lb/MMBtu. Collectively, the data above confirm that Clifty Creek 1's SCR can be operated such that it can meet a 30-day average NOx level of 0.07 lb/MMBtu.

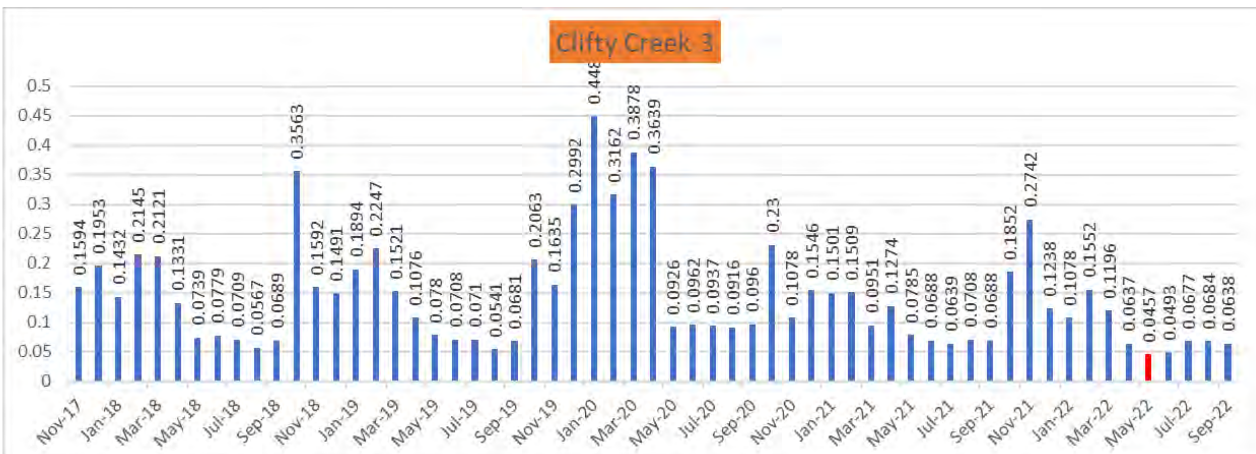
Next, I show similar charts below for Clifty Creek 2. Again, the lowest NOx month in the first chart (0.0461 lb/MMBtu) is shown in red.



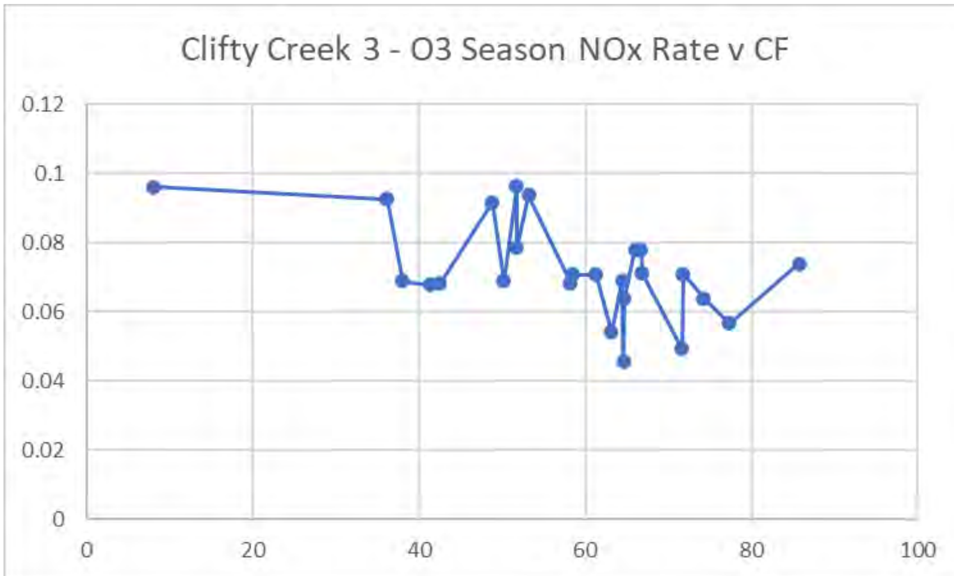
The ozone season monthly data as a function of capacity factor, shown below, also confirm that Clifty Creek 2 should be able to meet a 30-day average NOx level of 0.07 lb/MMBtu.



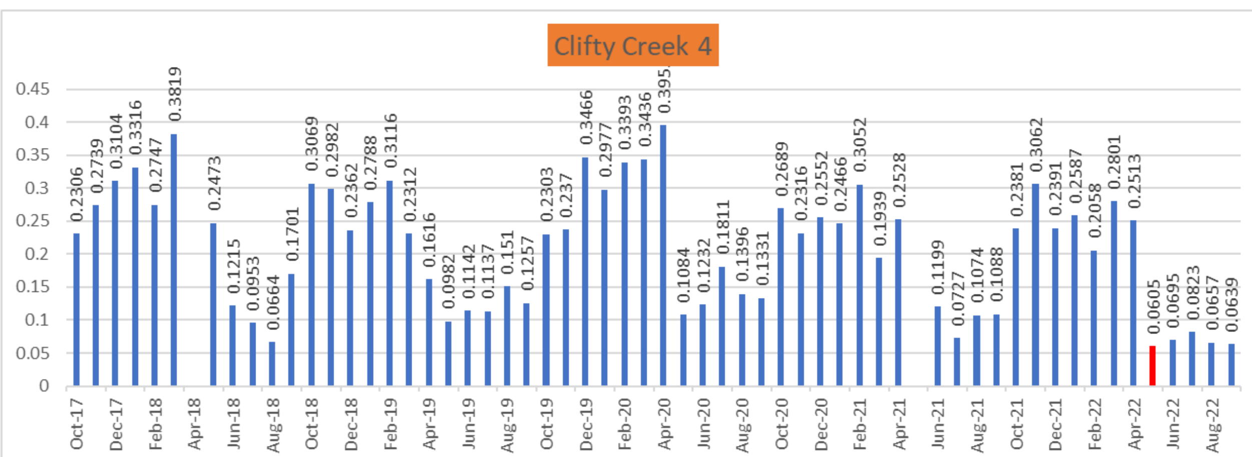
The performance charts for Clifty Creek 3, shown below, are similar to those for Clifty Creek 1 and 2 noted above.

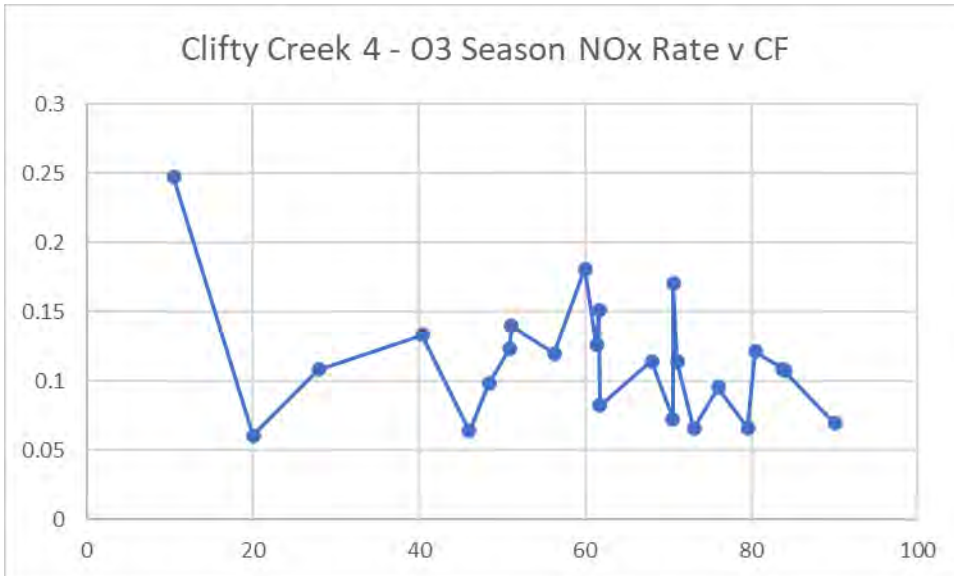


However, the NOx levels at the lowest capacity factors in the ozone season months, shown in the chart below, are not as low as for Clifty Creek Units 1 and 2. The reason for the higher NOx levels for the lowest capacity factors (as compared to Clifty Creek Units 1 and 2) was not readily ascertainable. Regardless, based on the overall NOx levels that the unit achieved, a 30-day average level of 0.07 lb/MMBtu should be achievable at this unit.

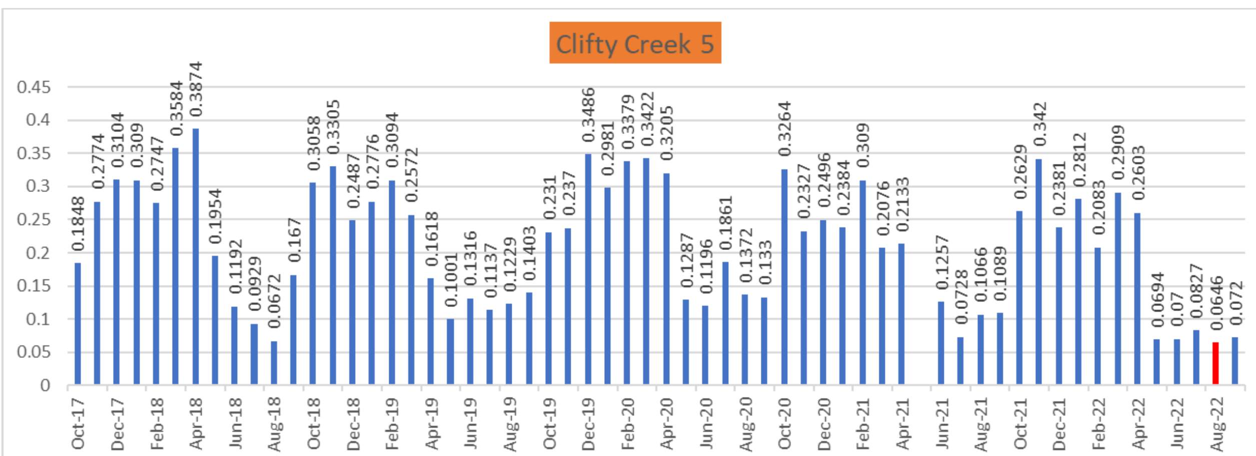


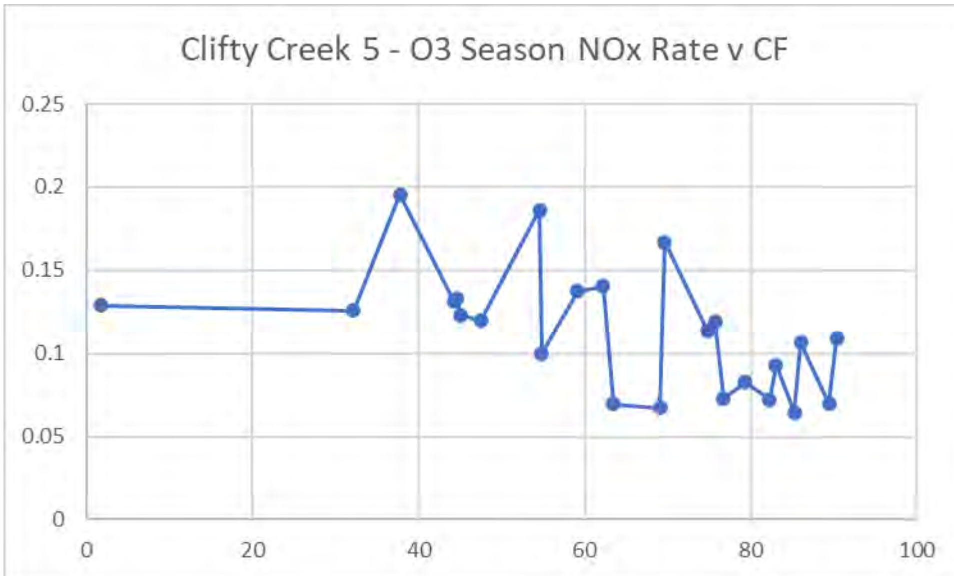
The monthly NOx and ozone season NOx as a function of capacity factor for Clifty Creek 4 are shown below. The NOx levels are higher than Units 1, 2, and 3. While there are several months, including the lowest month shown in red below, where the NOx level was below 0.07 lb/MMBtu, in general, the NOx performance for many months in the last 5 years was significantly greater than in the case of Units 1-3. Clearly, the SCR for this Unit 4 is not being operated optimally or as well as the SCRs for Units 1-3. However, the SCR's capability to reduce NOx is clearly shown by the low NOx levels achieved in several months throughout the 5-year period.





The NOx data for Clifty Creek Unit 5 are similar to that of Unit 4 above – i.e., not as good as the performance for Units 1-3.





Yet, given the performance of the SCRs at Units 1-3, it is my opinion that the SCR's for Unit 5 above (and Unit 4, prior) can be operated better and therefore realize lower levels of NOx similar to Units 1-3's demonstrated performance.

(B) Units Without SCR

The only Indiana unit without SCR that I analyzed was Unit 6 also at Clifty Creek. The summary of the cost-effectiveness for an SCR at this unit is shown in the table below. I have previously discussed the various inputs, and their general conservativeness earlier. The cost-effectiveness is estimated to be $9,609 per ton of NOx reduced. As such SCR is cost-effective for this unit based on previous cost effectiveness determinations by regulatory agencies at other units as discussed earlier.

SUMMARY OF SCR COST-EFFECTIVENESS								
Plant	Unit	UnitSize [1]	MedianNOx [2]	SCREff	PostSCRNOx	CapFac [3]	SCR CE [4]	SCR CE w/Multi-unit Discount
Clifty Creek	6	217	0.263	80	0.053	36.4	$ 9,609	N/A

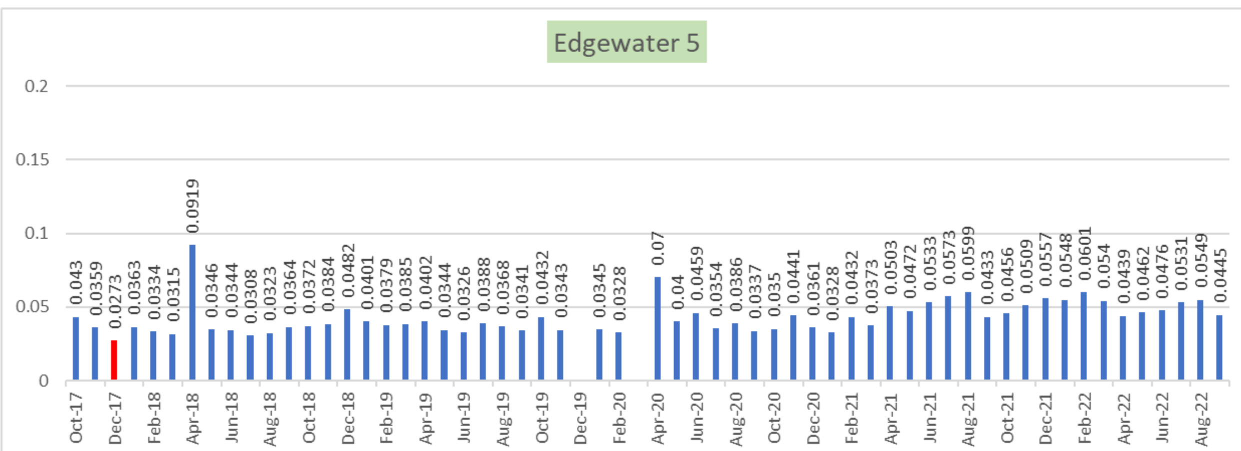
[1] UnitSize	MW
[2] MedianNOx	2018-Sep 2022 Monthly NOx (lb/MMBtu)
[3] CapFac	Maximum of: Median Monthly 2017-2021 or Jan-Oct 2022
[4] SCR CE	SCR Cost-Effectiveness, $/ton

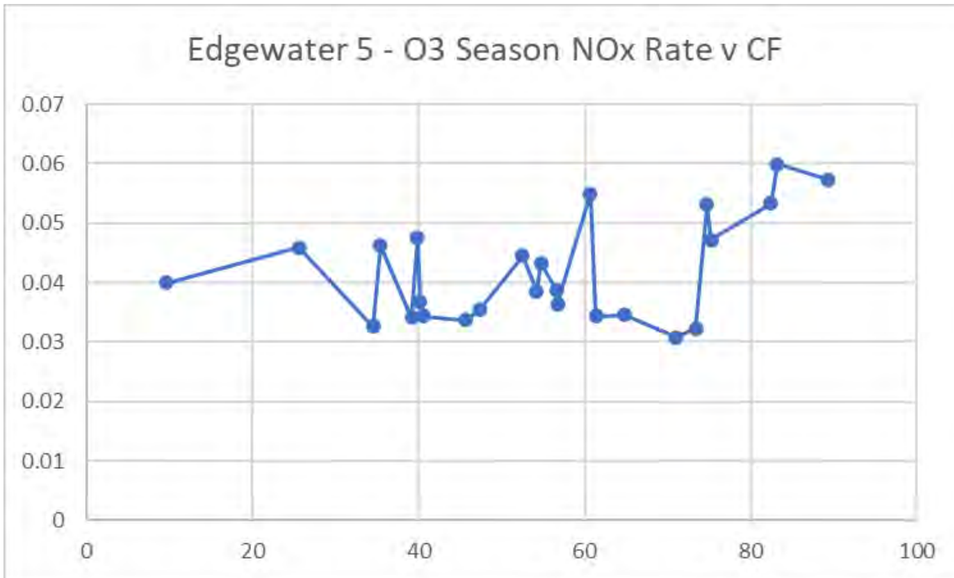
Wisconsin

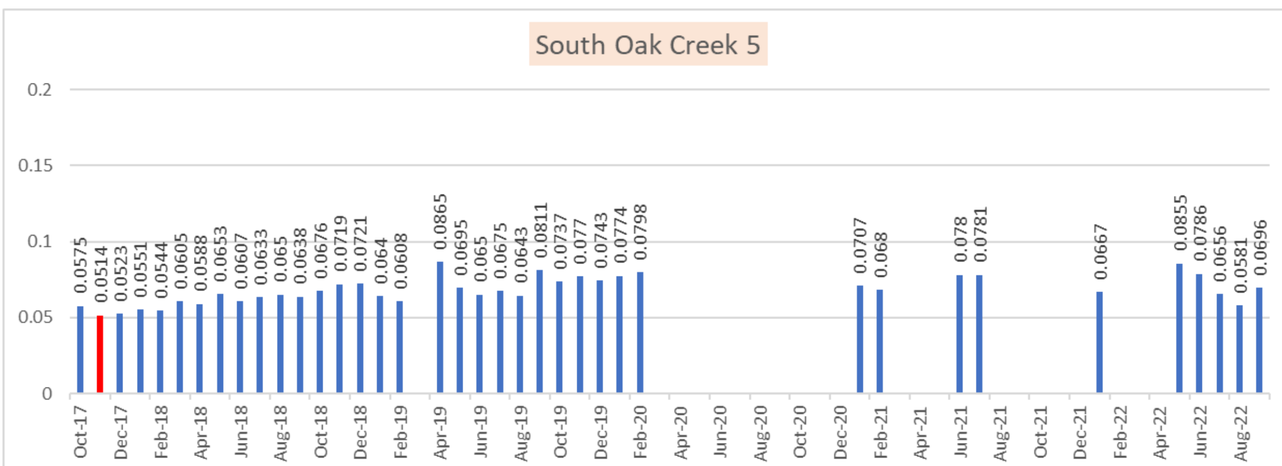
(A) Units with SCR

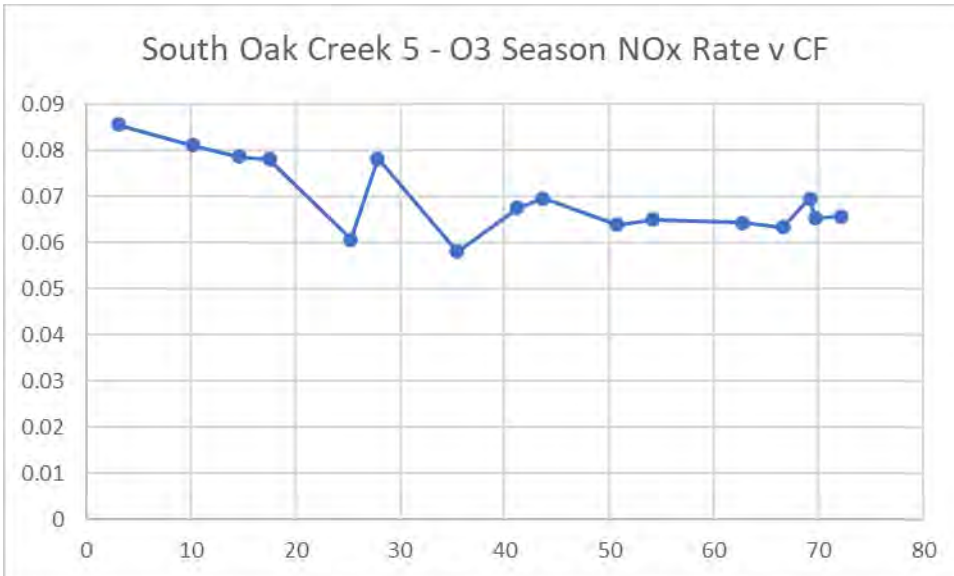
For Wisconsin, I address Unit 5 (approximately 380 MW) at the Edgewater plant and also Unit 5 (approximately 300 MW) at the South Oak Creek plant. Both of these units have existing SCRs. The summary of the NOx performance for these two units is shown in the table below. Both units are being operated with good NOx performance; however, as the NOx level for the maximum months shown below are greater than 0.07 lb/MMBtu, there remains room for improvement in SCR operation at each unit. In addition, the highest ozone season NOx level for the South Oak Creek Unit 5 is also greater than 0.07 lb/MMBtu.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max O3 Months
Edgewater	5	380	0.0273	0.0919	0.0599
South Oak Creek	5	300	0.0514	0.0865	0.0855




Edgewater 5 - O3 Season NOx Rate v CF
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
20
40
60
80
100


South Oak Creek 5
0.2
0.15
0.1
0.05
0
0.0575 0.0514 0.0523 0.0551 0.0544 0.0605 0.0588 0.0653 0.0607 0.0633 0.065 0.0638 0.0676 0.0719 0.0721 0.064 0.0608 0.0865 0.0695 0.065 0.0675 0.0643 0.0811 0.0737 0.077 0.0743 0.0774 0.0798 0.0707 0.068 0.078 0.0781 0.0667 0.0855 0.0786 0.0656 0.0581 0.0696
Oct-17 Dec-17 Feb-18 Apr-18 Jun-18 Aug-18 Oct-18 Dec-18 Feb-19 Apr-19 Jun-19 Aug-19 Oct-19 Dec-19 Feb-20 Apr-20 Jun-20 Aug-20 Oct-20 Dec-20 Feb-21 Apr-21 Jun-21 Aug-21 Oct-21 Dec-21 Feb-22 Apr-22 Jun-22 Aug-22



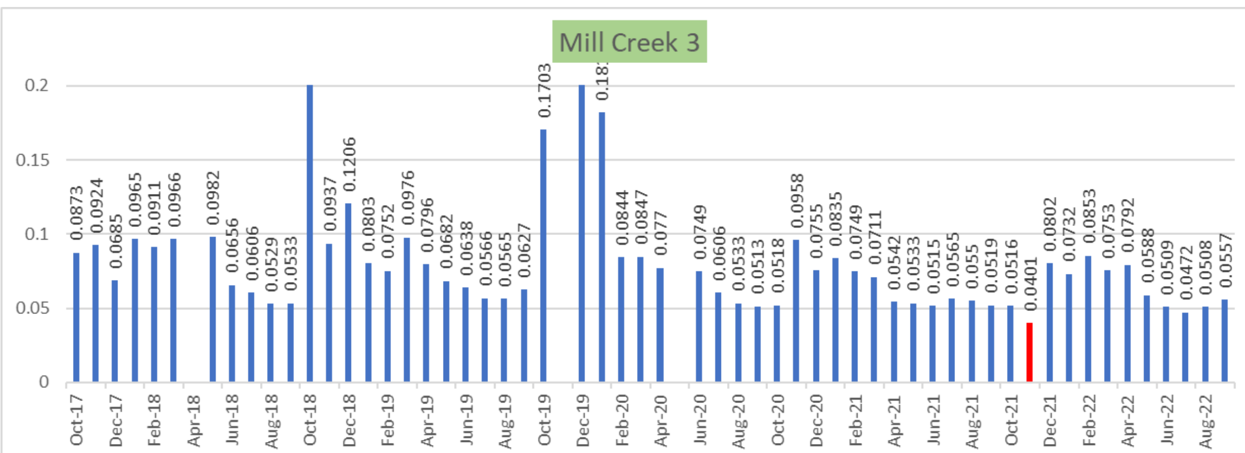
South Oak Creek 5 - O3 Season NOx Rate v CF
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
10
20
30
40
50
60
70
80

Kentucky

(A) Units with SCR

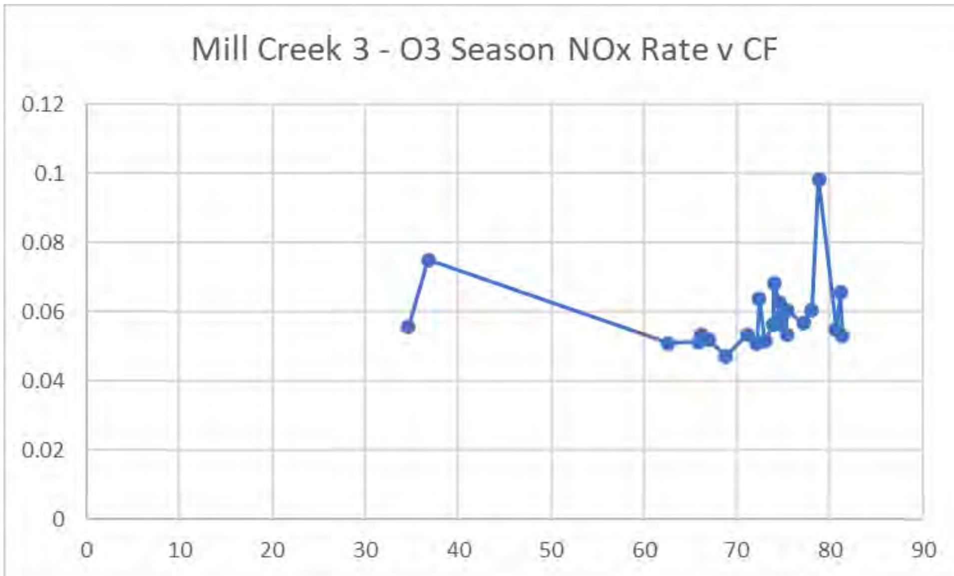
I analyzed Unit 3 (463 MW) and Unit 4 (544 MW) at the Mill Creek plant. These units have SCR installed. Each of them can clearly achieve reliably lower NOx emission rates. They are clearly not operating their SCRs according to the SCR's NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max O3 Months
Mill Creek, KY	3	463	0.0401	0.3172	0.0982
	4	544	0.0468	0.2422	0.0802

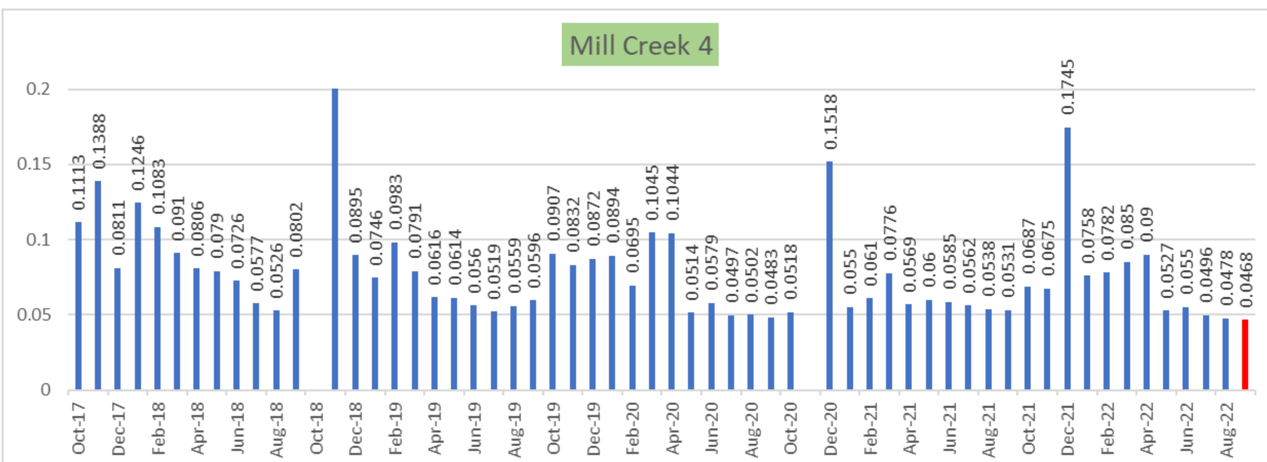


The chart above confirms that Mill Creek Unit 3 has achieved levels well below 0.07 lb/MMBtu on many months of recent operation, with a low of 0.04 lb/MMBtu, shown in red.

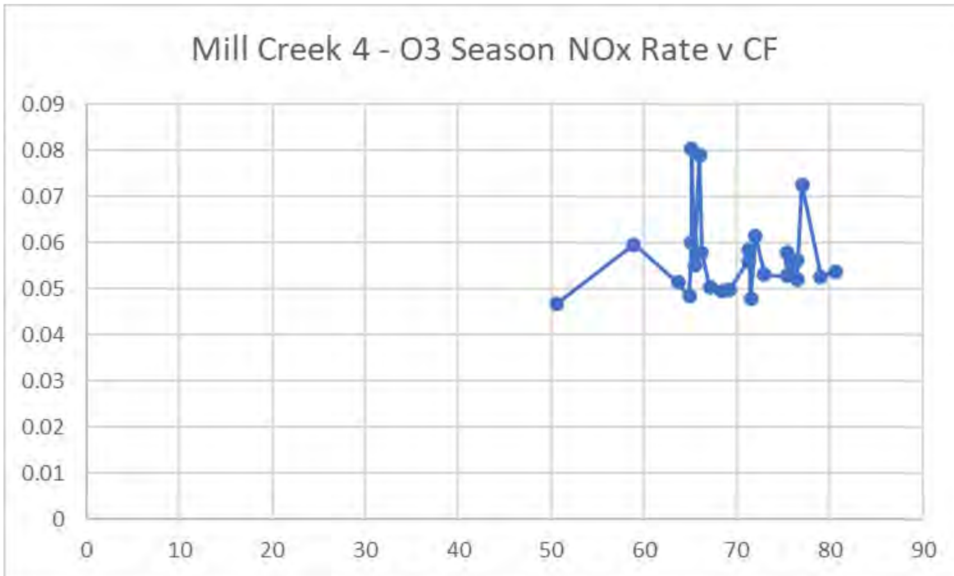
The chart below shows that Mill Creek Unit 3 has achieved less than 0.07 lb/MMBtu over a wide range of ozone-season operating capacity factors.



Similar to its sister unit, Mill Creek Unit 4 has also achieved NOx levels well below 0.07 lb/MMBtu as shown in the chart below. The low value of less than 0.047 lb/MMBtu is shown in red.



While Unit 4 has not operated at very low capacity factors during the ozone season, as shown in the chart below, it has operated below 0.07 lb/MMBtu across its range of operating capacity factors.



Based on the above, I conclude that Mill Creek Units 3 and 4 can operate their SCRs and achieve monthly average NOx levels of 0.07 lb/MMBtu.

(B) Units Without SCR

For Kentucky, I analyzed Unit 1 (463 MW) and Unit 2 (544 MW) at the Mill Creek plant. The summary of the cost-effectiveness for SCRs at these units is shown in the table below. I have previously discussed the various inputs, and their general conservativeness earlier. The cost-effectiveness is calculated to be $4,148 per ton of NOx reduced for Mill Creek 1 and $4,100 per ton of NOx reduced for Mill Creek 2. As such SCR is highly cost-effective for these units.

SUMMARY OF SCR COST-EFFECTIVENESS								
Plant	Unit	UnitSize [1]	MedianNOx [2]	SCREff	PostSCRNOx	CapFac [3]	SCR CE [4]	SCR CE w/Multi-unit Discount [5]
Mill Creek	1	356	0.280	80	0.056	68.7	$ 4,879	$ 4,148
Mill Creek	2	356	0.283	80	0.057	68.5	$ 4,824	$ 4,100

[1] UnitSize MW
[2] MedianNOx 2018-Sep 2022 Monthly NOx (lb/MMBtu)
[3] CapFac Maximum of: Median Monthly 2017-2021 or Jan-Oct 2022
[4] SCR CE SCR Cost-Effectiveness, $/ton
[5] Multi-unit discount assumed to be 15% lower.

Missouri

(A) Units Without SCR

For Missouri I analyzed Units 1-4 at the Labadie plant. The summary of the cost-effectiveness for SCRs at these units is shown in the table below. Again, I have previously discussed the various inputs, and their general conservativeness earlier. The cost-effectiveness is calculated to be between $11,904 and $12,559 per ton of NOx reduced for the four Labadie units. Again SCR is cost-effective for these units.

SUMMARY OF SCR COST-EFFECTIVENESS								
Plant	Unit	UnitSize [1]	MedianNOx [2]	SCREff	PostSCRNOx	CapFac [3]	SCR CE [4]	SCR CE w/Multi-unit Discount [5]
Labadie	1	574	0.092	60	0.037	82.1	$ 14,206	$ 12,075
Labadie	2	574	0.093	60	0.037	78.8	$ 14,578	$ 12,392
Labadie	3	621	0.095	60	0.038	79.1	$ 14,005	$ 11,904
Labadie	4	621	0.093	60	0.037	76.9	$ 14,774	$ 12,558

[1] UnitSize MW
[2] MedianNOx 2018-Sep 2022 Monthly NOx (lb/MMBtu)
[3] CapFac Maximum of: Median Monthly 2017-2021 or Jan-Oct 2022
[4] SCR CE SCR Cost-Effectiveness, $/ton
[5] Multi-unit discount assumed to be 15% lower.

Colorado

<u>(A) Units Without SCR</u>

For Colorado I analyzed Units 1 at the Rawhide plant. The summary of the cost-effectiveness for SCRs at this unit is shown in the table below. Again, I have previously discussed the various inputs, and their general conservativeness earlier. The cost-effectiveness is calculated to be $11,114 per ton of NOx reduced. Therefore, SCR is cost-effective for this unit.

SUMMARY OF SCR COST-EFFECTIVENESS								
Plant	Unit	UnitSize [1]	MedianNOx [2]	SCREff	PostSCRNOx	CapFac [3]	SCR CE [4]	SCR CE w/Multi-unit Discount
Rawhide	1	294	0.118	70	0.035	82.3	$ 11,114	N/A

[1] UnitSize	MW
[2] MedianNOx	2018-Sep 2022 Monthly NOx (lb/MMBtu)
[3] CapFac	Maximum of: Median Monthly 2017-2021 or Jan-Oct 2022
[4] SCR CE	SCR Cost-Effectiveness, $/ton

Texas

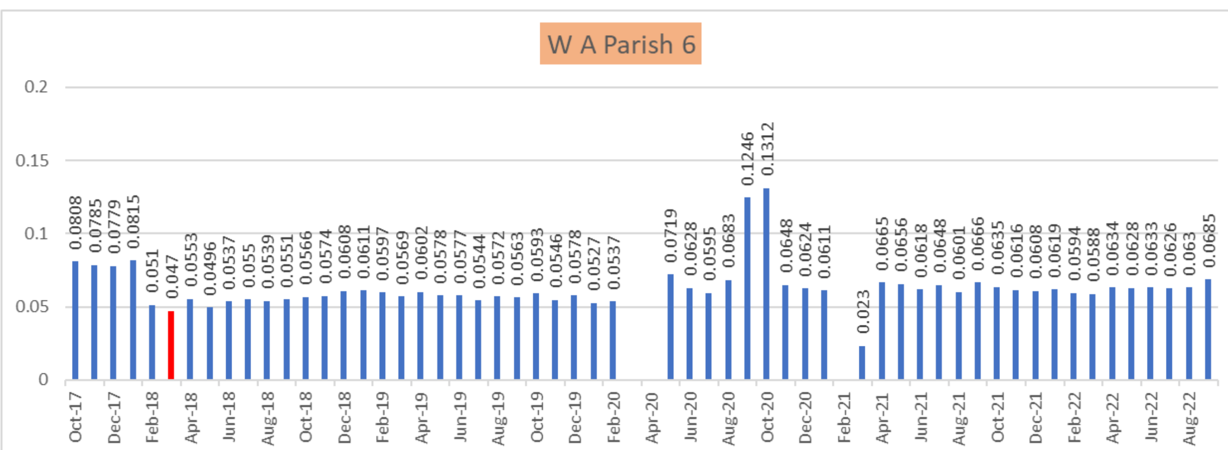
<u>(A) Units with SCR</u>

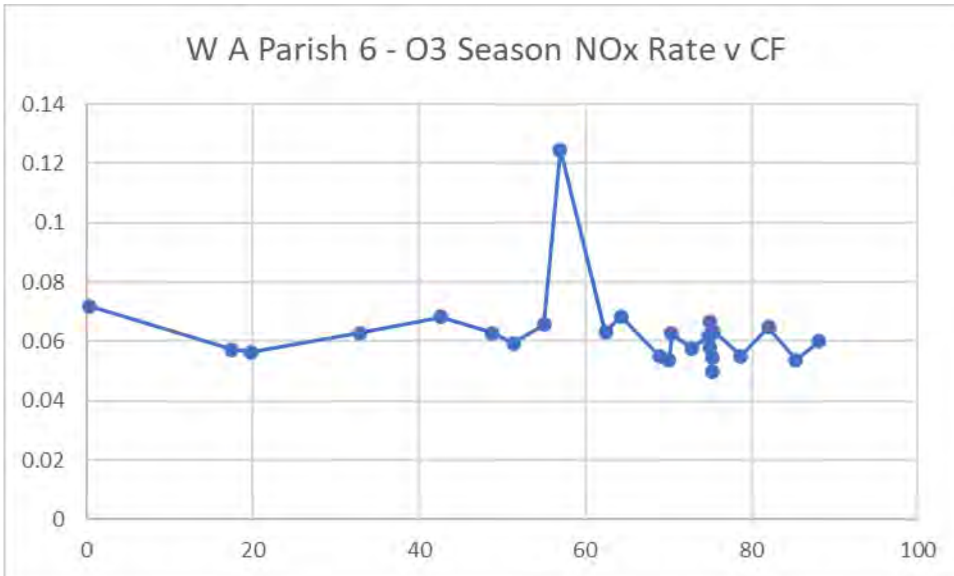
For units that have SCR already installed, I assessed Unit 6 (734 MW), Unit 7 (615 MW), and Unit 8 (654 MW) at the W. A. Parish plant. Each of them can clearly achieve reliably lower NOx emission rates. They are not operating their SCRs according to the SCR's NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the summary table below and the respective Unit-specific charts that follow clearly demonstrate.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max O3 Months
W A Parish, TX	6	734	0.047	0.1312	0.1246
	7	615	0.04	0.0976	0.0731
	8	654	0.0388	0.0846	0.0522

Note the minimum monthly NOx levels achieved by each of the three W A Parish units above – i.e., less than 0.05 lb/MMBtu.

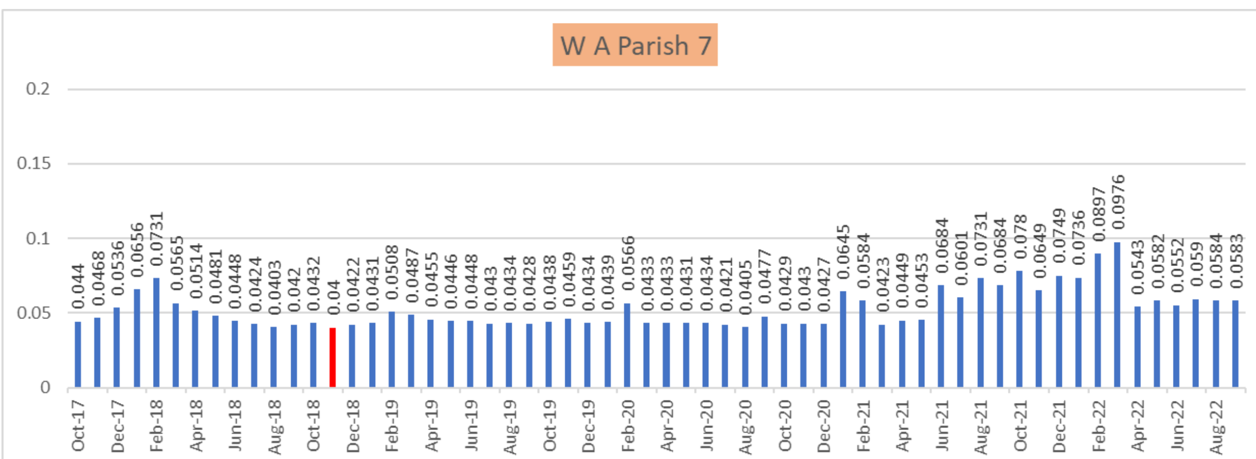
The monthly NOx chart for the last 60 months for Unit 6 is shown below, following by the NOx versus ozone season capacity factor chart for this unit .



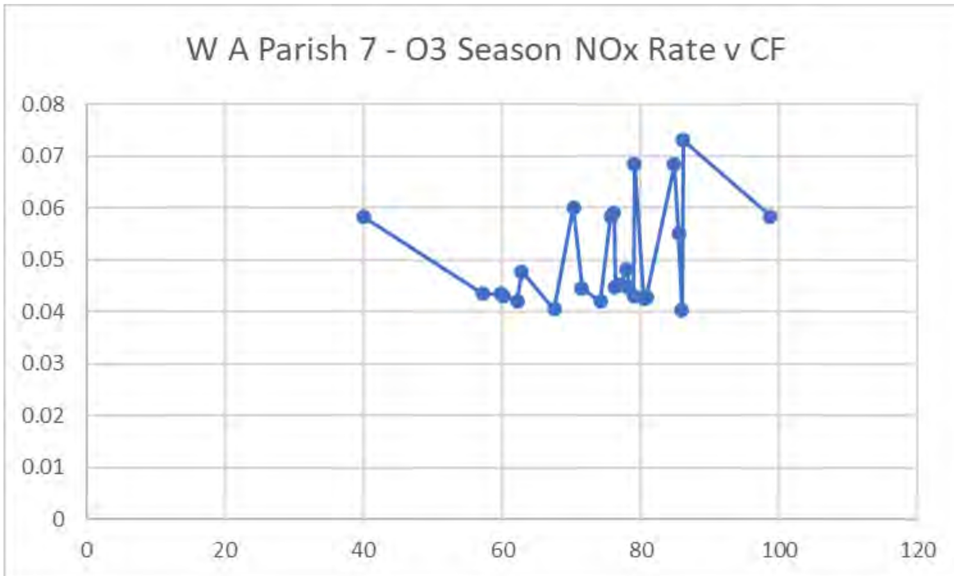


Both of the charts above confirm that Parish Unit 6 can achieve less than 0.07 lb/MMBtu monthly average NOx levels.

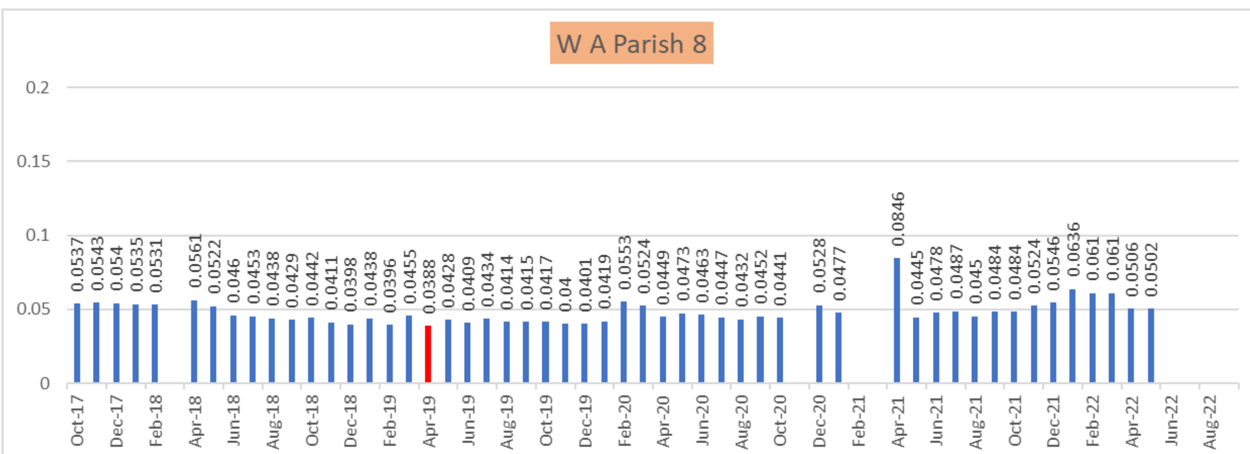
I reach a similar conclusion for Parish Unit 7 by reviewing its operating data as summarized in the two charts below. Monthly NOx levels have generally been less than 0.05 lb/MMBtu, with just a few months exceeding 0.07 lb/MMBtu in the last 60 months.



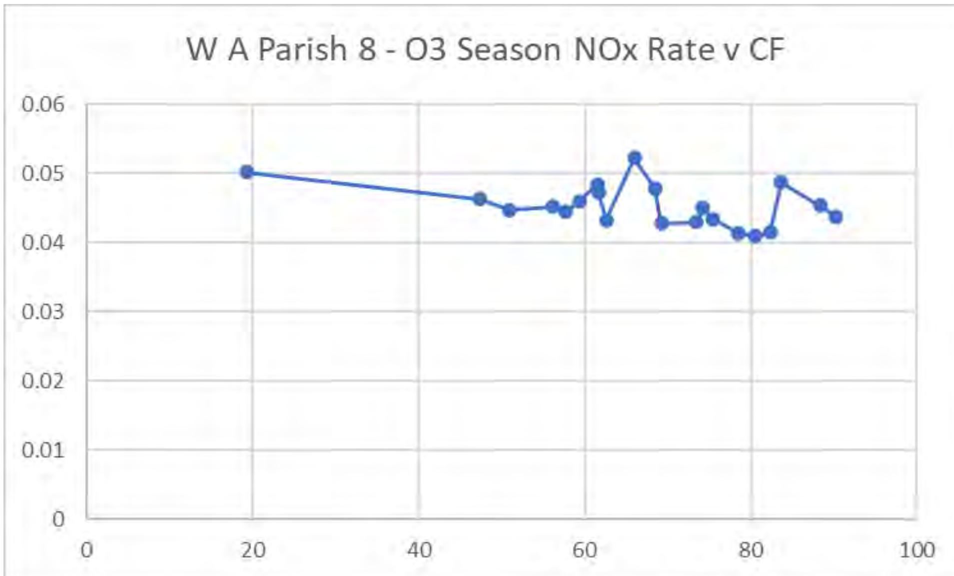
The chart below confirms that Unit 7 generally operates at a high ozone-season capacity factor and has no difficulty meeting monthly NOx levels of 0.07 lb/MMBtu.



The demonstrated NOx performance of Parish Unit 8 is also like that of Unit 7 above. Over the last 60 months the unit has generally maintained NOx levels of less than 0.05 lb/MMBtu. I note that the unit has not operated recently due to a fire in the unit in the summer of 2022.



When operating in the ozone season, the capacity factors and NOx levels for Unit 8 are shown below. As the chart clearly shows the unit has met and can therefore meet NOx levels of less than 0.07 lb/MMBtu across its operating monthly capacity factor range.



<u>I therefore conclude that W A Parish Units 6, 7, and 8 can achieve monthly-average NOx levels less than 0.07 lb/MMBtu with little additional effort.</u>

<u>(A) Units without SCR</u>

In addition to the three W A Parish units with existing SCRs that I address above, I also estimated the cost-effectiveness for a dozen Texas coal-fired units that currently operate without SCR.

I analyzed Unit 1 at JK Spruce (556 MW); Unit 1 (893 MW) and Unit 2 (957 MW) at Limestone; Unit 1 (793 MW), Unit 2 (793 MW), and Unit 3 (793 MW) at Martin Lake; Unit 1 (615 MW), Unit 2 (615 MW), and Unit 3 (460 MW) at Sam Seymour/Fayette; Units 1 and 2 at Tolk (568 MW each); and Unit 1 (416MW) at San Miguel. The summary of the cost-effectiveness for SCRs at each of these units is shown in the table below. Again, I have previously discussed the various inputs, and their general conservativeness earlier. The cost-effectiveness for every unit except Tolk 1 and 2 is calculated to be below $9,000 per ton of NOx reduced, with a very modest multi-unit discount on the SCR capital cost (15%) as noted prior. As such SCR is very cost-effective for these units. The cost-effectiveness for Tolk Units 1 and 2 are each below $12,000, indicating that SCRs are also cost effective at the two Tolk units as well, when compared to previous cost effectiveness decisions by regulatory agencies at other plants.

SUMMARY OF SCR COST-EFFECTIVENESS								
Plant	Unit	UnitSize [1]	MedianNOx [2]	SCREff	PostSCRNOx	CapFac [3]	SCR CE [4]	SCR CE w/Multi-unit Discount [5]
J K Spruce	1	556	0.146	70	0.044	69.5	$ 9,255	
Limestone	1	893	0.152	70	0.045	55.1	$ 10,501	$ 8,926
Limestone	2	957	0.168	70	0.050	63	$ 8,411	$ 7,149
Martin Lake	1	793	0.151	70	0.045	62.6	$ 9,538	$ 8,108
Martin Lake	2	793	0.152	70	0.046	60.1	$ 9,838	$ 8,362
Martin Lake	3	793	0.144	70	0.043	66	$ 9,618	$ 8,175
Sam Seymour	1	615	0.125	70	0.037	74.5	$ 10,158	$ 8,634
Sam Seymour	2	615	0.114	70	0.034	76.6	$ 10,573	$ 8,987
Sam Seymour	3	460	0.126	70	0.038	86.8	$ 8,927	$ 7,588
Tolk	1	568	0.161	80	0.032	35.6	$ 14,029	$ 11,925
Tolk	2	568	0.156	80	0.031	36.8	$ 13,903	$ 11,818
San Miguel	1	410	0.156	70	0.047	76.8	$ 8,273	

[1] UnitSize MW

[2] MedianNOx 2018-Sep 2022 Monthly NOx (lb/MMBtu)

[3] CapFac Maximum of: Median Monthly 2017-2021 or Jan-Oct 2022

[4] SCR CE SCR Cost-Effectiveness, $/ton

[5] Multi-unit discount assumed to be 15% lower.

Appendix A[3]

Excerpts Addressing SCR Performance to Obtain Low NOx Levels

[3] Appendix A contains excerpts of a prior report I have authored. The entire report is available at https://www.regulations.gov/comment/EPA-HQ-OAR-2021-0668-0758

F. Strategies to Achieve Better SCR Performance and Lower NOx Levels

As noted earlier, an SCR, using specially formulated catalysts and relying on good mixing of the reducing agent (ammonia) and the exhaust gas containing NOx, prior to the introduction into the SCR itself, achieves high levels of NOx reduction as long as inlet gas temperatures are high enough for maintaining high catalyst activity and by avoiding damage to the catalysts such as by blocking the catalyst pores and/or chemically deactivating the catalyst.

As such since the heart of the NOx reduction occurs at the catalyst, the SCR itself (i.e.., the mechanical housing) and its age is of less significance, as long as it is maintained with some care.

It should be noted that all catalyst activity deteriorates over time due to inevitable degradation, especially for those catalyst layers that first see the incoming gas. In addition, the presence of pollutants such as sulfur compounds can adversely affect catalyst activity because reactions of such compounds and the ammonia reagent can cause a range of salts to form and deposit on the catalyst surfaces, which then inhibit NOx reduction.

Thus maintaining SCR activity requires an anticipation of likely deterioration mechanisms and accounting for them during operation. This includes factors such as proper catalyst management (i.e., rotating catalysts such that front layers are replaced by rear layers and/or sent to be rejuvenated or replaced) using actual activity data; managing and maintain high inlet gas temperatures above the so-called catalyst minimum operating temperature (MOT) while the load in the unit varies; and cycling the unit such that any deposition of ammonium salts can be reversed at higher gas temperatures.

There are myriad such strategies, with likely optimal combinations that can only be determined on a unit-specific analysis because of variabilities include coal type, type and age of the boiler, geometries and temperature profiles, and location of the SCR in the exhaust gas path, among some of the variables. While attempts were made, using vendor contacts, to ascertain which specific strategy/strategies may have been used at the units of interest in this analysis (i.e., those for which data were analyzed earlier) specific information was not forthcoming due to confidentiality reasons.

Thus, this section provides a general discussion of approaches that can be used to maintain good SCR catalyst performance with age and changing unit operation – i.e., with more cycling than baseload operations, at lower capacity factors.

F1. Catalyst Management

After design, which is not discussed in this report, proper catalyst management is essential for maintaining high levels of catalyst performance over time. Since catalyst deterioration over time is inevitable, it needs to be monitored and managed. The following figures are drawn from a major SCR catalyst vendor and illustrate the factors and concepts in catalyst management.

Figure 1 – SCR Catalyst Management Overview

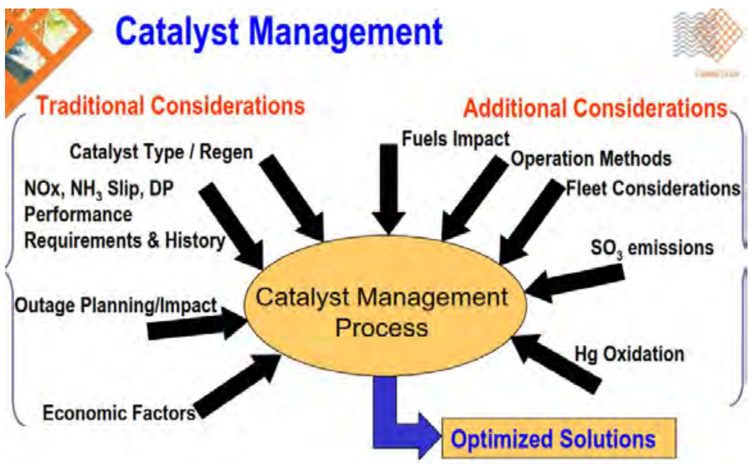
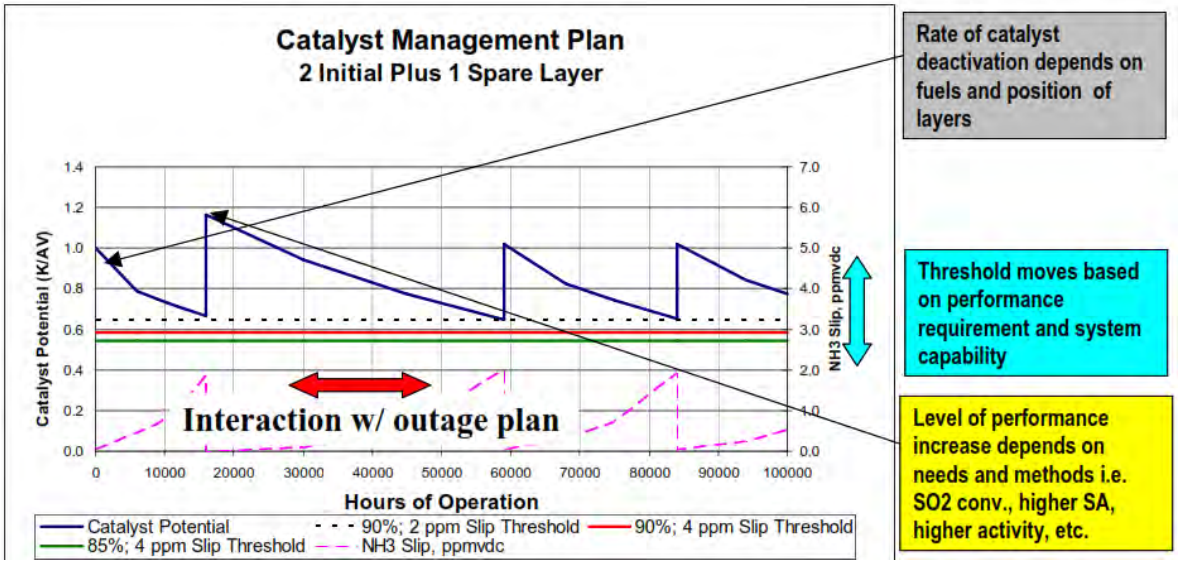


Figure 1 shows the many factors that are considered in properly managing catalyst activity to make sure it is maintained at a high level. Important technical factors that affect this include catalyst type (noted above), the quantity of catalyst (not noted above), the arrangements of the catalyst layers in the SCR along the gas path and the type of screens located ahead of the catalyst to ensure that the catalyst is not impacted by particulate matter (i.e., ash from the boiler) to the extent possible.[7]

Figure 2 below shows a conceptual catalyst management plan where the SCR contains space for three layers of catalyst along the gas path. The simple idea is that as the lead layer's performance deteriorates over time (the blue saw-tooth profile in the upper panel), it is replaced with catalyst from the other layers, and then either cleaned and regenerated or replaced with new catalyst.

[7] SCRs can be located in the so-called "high-dust" configuration in which the catalyst is placed prior to particulate matter controls such that the gas temperature is in the proper range for good catalyst operation. Dust management in this configuration is a critical factor in catalyst life and activity.

Figure 2 – Catalyst Management Plan Example



Of course catalyst management is useless without proper monitoring of the catalyst activity. Figures 3 and 4 below illustrate some basic concepts.

Figure 3 – Catalyst Testing

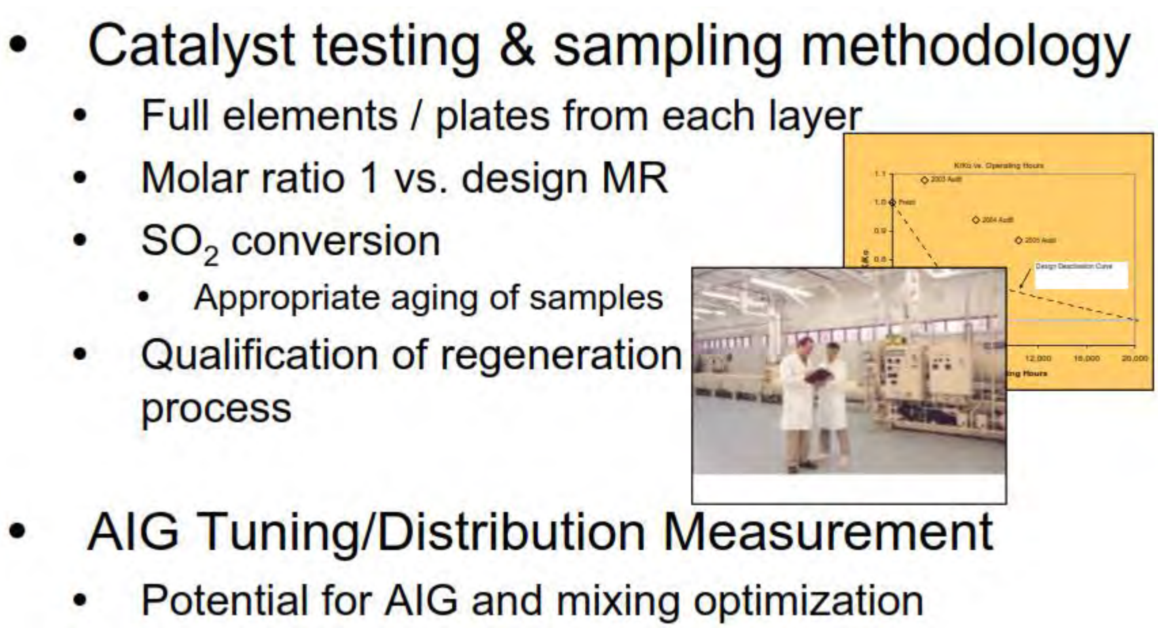
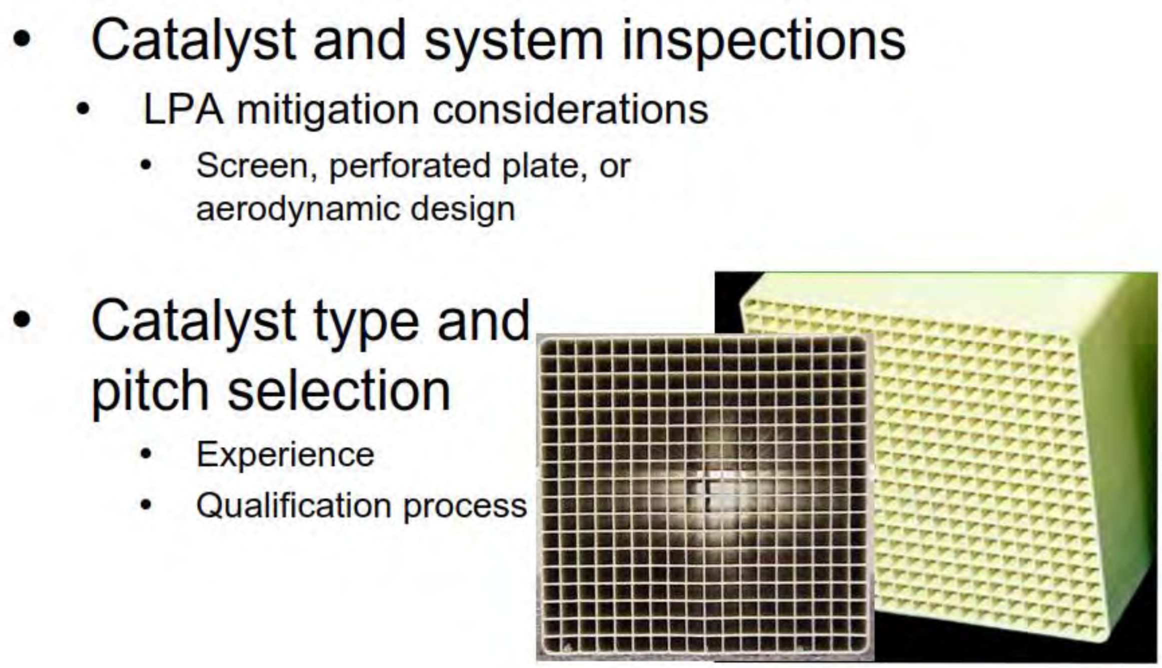


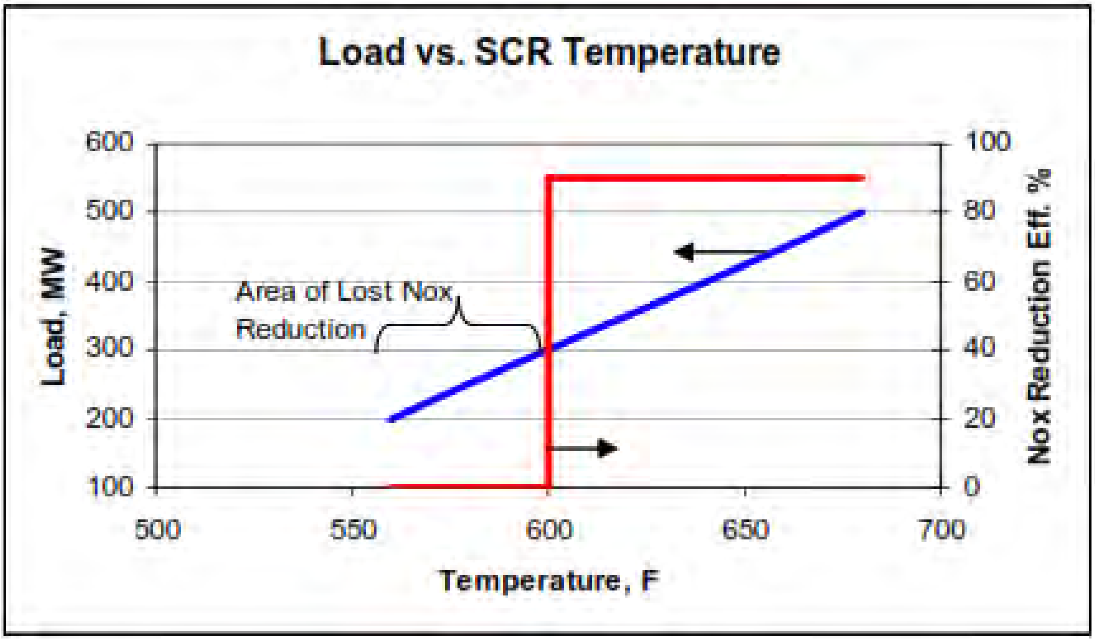
Figure 4 – Catalyst Inspection



<u>F2. Catalyst Performance and Inlet Temperature</u>

Like all catalysts, SCR catalysts require a minimum operating temperature (MOT) below which they have little activity – and therefore little NOx reduction. Therefore, it is important that catalysts with the lowest possible MOTs are selected (or substituted when older catalyst layers are replaced per the catalyst management discussion prior) and then temperatures above the MOT are maintained under the widest range of loads. This is shown conceptually in Figure 5 below. The MOT is assumed to be 600 F – and therefore there is 90% NOx reduction above that temperature and no reduction below that as shown in the red curve. The blue curve shows a unit's gas temperature at SCR inlet as a function of load. Thus, in this example, the SCR would not provide any NOx reduction below a unit load of 300 MW. If the red curve is shifted to the left – i.e., to lower temperatures - more NOx reduction can occur at lower loads, allowing for load cycling to lower loads. Conversely, if the blue curve is shifted to the right by increasing inlet temperature at lower loads, again more NOx reduction can occur at those lower loads.

Figure 5 – Unit Load and SCR Performance



An example of implementation of the strategy of lowering MOT is shown below in Figure 6 for Gibson Unit 1, a sister unit to Gibson Unit 2, whose NOx performance was previously reviewed.

Figure 6 – MOT reduction at Gibson Unit 1

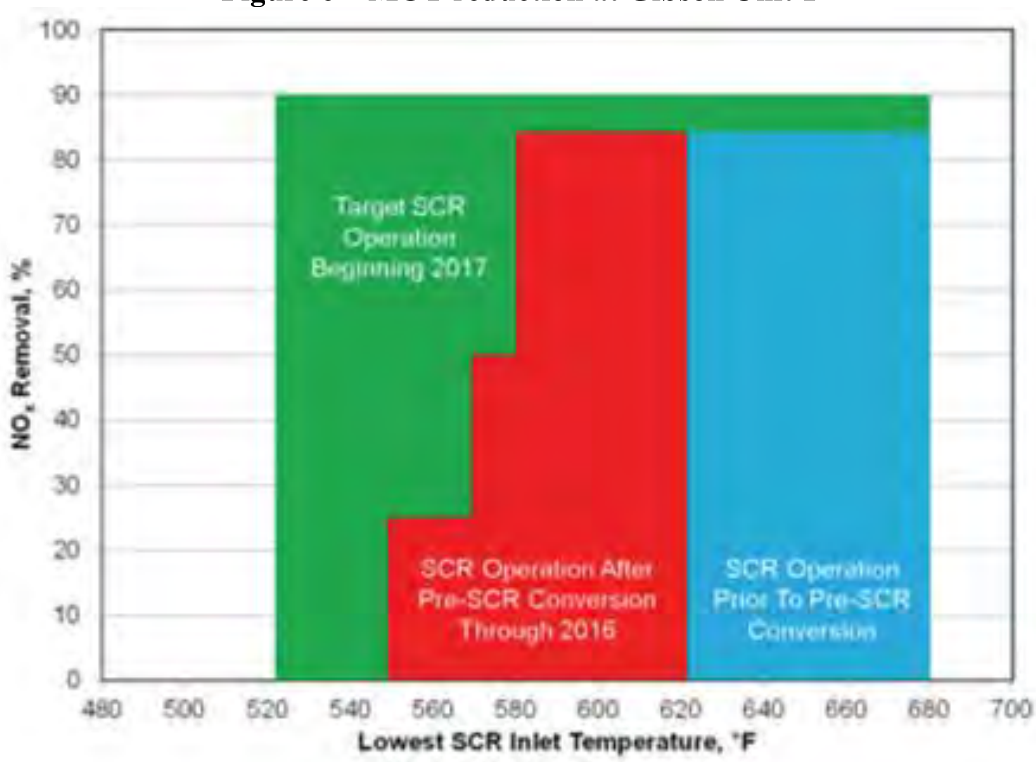
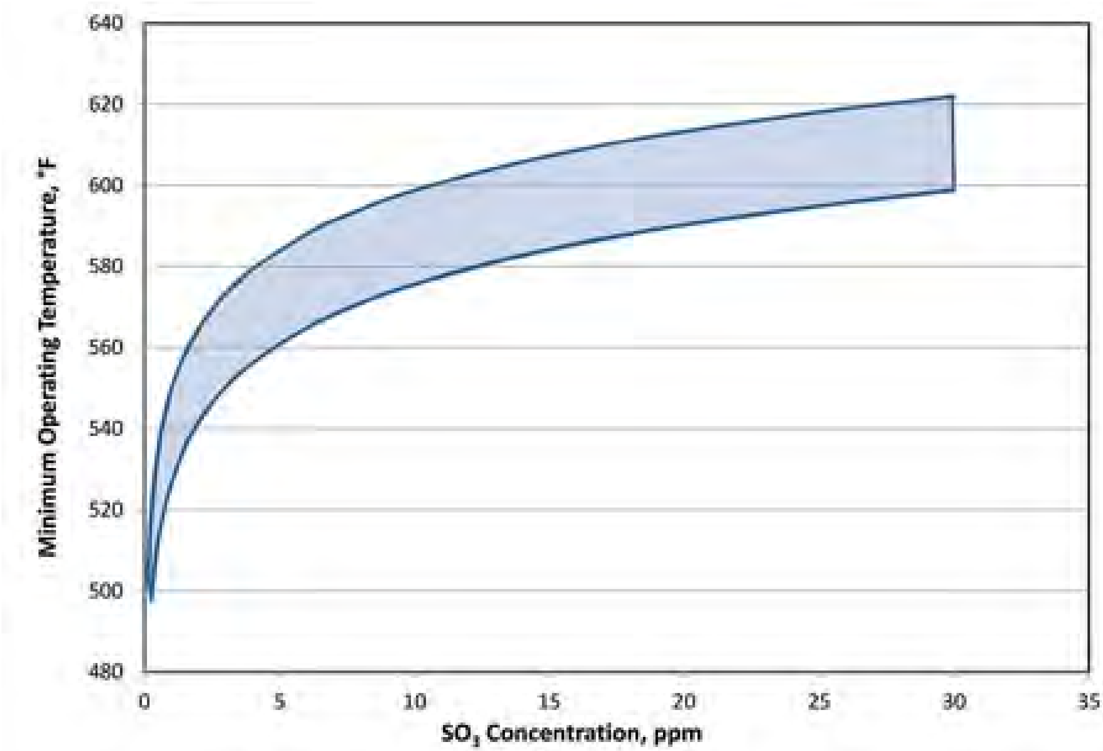


Figure 6 shows how the SCR inlet temperature, which was 550 – 620 F after SCR conversion through 2016, has been reduced to 520 F beginning 2017 – allowing for lower loads where higher levels of NOx can be reduced. The figure also shows that the SCR catalyst itself after 2017 provides higher NOx reduction (to 90%) compared to the earlier catalyst (85%).

One of the strategies to obtain lower MOT is to reduce the SO_3 that can be formed in the exhaust gases as discussed in the next section. If lower SO_3 levels can be maintained, the MOT can be lowered. A generic relationship between MOT and SO_3 concentrations is shown in Figure 7 below.

Figure 7 – Relationship between MOT and SO_3 Concentration



It has been reported that Duke Energy has obtained MOTs as low as 500 F at Gibson station by lowering SO_3 in the inlet gas using sorbent injection.[8]

Regarding the blue curve in Figure 5, additional strategies have been used to maintain high inlet gas temperatures (i.e., above MOT) under a range of loads. As noted in the literature,[9] one option

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[8] https://www.power-eng.com/coal/boilers/scr-performance/#gref
Power Engineering, SCR Performance March 2017

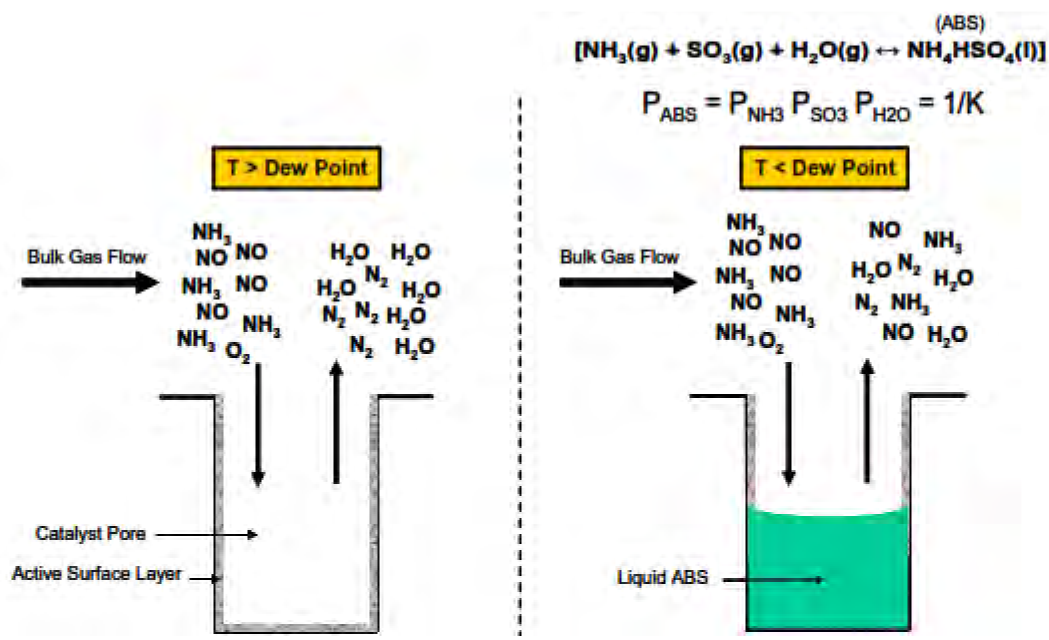
[9] https://www.powermag.com/scr-reheat-burners-keep-nox-in-spec-at-low-loads/
Power, March 1, 2015

is to install gas-side economizer bypass ductwork to divert a portion of the hot flue gas that would normally enter the economizer and send it directly to the inlet of the SCR. In other instances, direct reheating of the exhaust gases using so-called SCR reheat burners can increase the gas temperature to the SCR. These are installed in the ductwork.

F3. Reduction of SCR Catalyst Activity Due to Ammonium Salts

As noted briefly earlier, sulfur compounds in the exhaust gases can oxidize to SO_3 and then combine with ammonia to form several salts which can deposit in catalyst pores and therefore not allow NOx reduction in those areas of the catalyst. The concept is shown in Figure 8 below.

Figure 8 – Ammonium Salt Formation and Deposition



This salt formation is reversible however, allowing the catalyst activity to be regained. Simply increasing the gas temperature by increasing the unit load can reverse this phenomenon. Thus unit cycling to high capacity factors, which occurs normally in many cycling units, can mitigate this temporary loss of activity.

In some cases ensuring that the least amount of ammonia is used (and properly mixed and distributed across the catalyst layer) will minimize the ammonia slip and lead to the least amount of salt formation, if very low sulfur compounds are present. On the other hand, some amount of ammonia slip may be beneficial to NOx reduction if significant levels of sulfur compounds are present and if the resulting SO_3 can be reduced to avoid salt formation when the SO_3 reacts with ammonia. SO_3 removal upstream of the air heater, and ideally upstream of the SCR reactor itself, by injecting sorbents[10] (often used for MACT acid gas compliance) can be an important strategy at both high- and low-loads. For higher-load operation, the goal is to reduce SO_3 to very low levels prior to the SCR or even earlier at the air heater inlet. This relieves the constraint on ammonia slip because there is not enough SO_3 available to form appreciable amounts of salts. With the ammonia slip constraint relaxed, modest increases in ammonia slip are possible, which allows the NOx reduction efficiency to be increased. This illustrates the unit-specific nature of optimization.

F4. Upgraded Instrumentation and Automation

Maintaining proper process conditions, especially during cycling conditions, requires instrumentation and control systems that can react quickly to load changes, measure critical parameters such as inlet NOx concentrations, inlet gas temperatures, inlet SO_3 conditions, etc. and many other parameters and appropriately adjust inputs such as ammonia injection, using feedback loops. The role of upgrading instrumentation is therefore critical in achieving optimum SCR performance. Over time improvements in sensors, measurement software, optimization software, and the like, make it imperative that the instrumentation and controls that are installed in SCRs that are aging should be evaluated and upgraded in order to enable more current hardware and software to allow for greater control of key variables such as temperatures, in-line NOx and ammonia measurements, and the spatial distribution of these parameters in the SCR inlet duct.

A recent article discusses this in the context of Brandon Shores, whose strong NOx performance was noted earlier.[11]

Conclusion

There are numerous strategies that can be used to operate SCRs optimally at cycling units, including during low load operations.

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[10] Of course using coal with lower sulfur levels, such as PRB coals will reduce SO_3 emissions all other parameters being the same.

[11] http://www.emersonautomationexperts.com/papers/Optimization-of-Emissions-Reduction-Equipment-SCR.pdf

Appendix B

Copy of Resume

RANAJIT (RON) SAHU, PH.D, CEM (NEVADA)

CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

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EXPERIENCE SUMMARY

Dr. Sahu has over thirty two 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.

He has over thirty years of project management experience and has successfully managed and executed hundreds of projects in this time period. 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.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past three decades include various trade associations as well as individual companies such as steel mills, petroleum refineries, chemical plants, cement manufacturers, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, land development companies, and various entities in the public sector including EPA, the US Dept. of Justice, several states (including New York, New Jersey, Connecticut, Kansas, Oregon, New Mexico, Pennsylvania, and others), various agencies such as the California DTSC, and various cities and municipalities. Dr. Sahu has executed projects in all 50 US states, numerous local jurisdictions and internationally.

In addition to consulting, for approximately two decades, Dr. Sahu taught numerous courses in several Southern California universities as adjunct faculty, including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management). He also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental and engineering areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing 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 with project management, environmental

	consulting, project management, as well as regulatory and engineering support consulting services.
1995-2000	Parsons ES, **Associate, Senior Project Manager and Department Manager for** Air Quality/Geosciences/Hazardous Waste Groups, Pasadena, CA.
	Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.
1992-1995	Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department.
1990-1992	Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department.
1989-1990	Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.
1988-1989	Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984-1988	Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.
1984	M. S., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.
1978-1983	B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

"Thermodynamics and Heat Transfer," Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

“Advanced Hazardous Waste Management” University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

“Environmental Risk Assessment,” Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 1998.

“Hazardous Waste Remediation” Loyola Marymount University, Dept. of Civil Engineering. Various years beginning 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

“Environmental Planning and Management,” 5 week program for visiting Chinese delegation, 1994.

“Environmental Planning and Management,” 1 day program for visiting Russian delegation, 1995.

“Air Pollution Planning and Management,” IEP, UCR, Spring 1996.

“Environmental Issues and Air Pollution,” IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-mid-1990s.

Air and Waste Management Association, West Coast Section, 1989-mid-2000s.

PROFESSIONAL CERTIFICATIONS

EIT, California (#XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, 2000 - 2021.

CEM, State of Nevada (#EM-1699).

PUBLICATIONS (PARTIAL LIST)

"Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).

"Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).

"On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).

"Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).

"Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).

"A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).

"Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R. Gavalas, *Combust. Flame*, **77**, 337-346 (1989).

"Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).

"Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.

"Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).

"HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).

"Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).

"Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).

"NOx Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

“From Purchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada,” with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.

“The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants,” with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

"Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).

"Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

Annex A

Expert Litigation Support

A. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

1. In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled "Hitting the Ethanol Blend Wall – Examining the Science on E15."

B. Matters for which Dr. Sahu has provided affidavits and expert reports include:

2. Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.

3. Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

4. Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

5. Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).

6. Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).

7. Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.

8. Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc.*, 5:04-cv-00034-KSF (Eastern District of Kentucky).

9. Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.

10. Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.

11. Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.

12. Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.

13. Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo's eight new proposed PRB-fired PC boilers located at seven TX sites.

14. Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).

15. Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.

16. Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

17. Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.

18. Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with *General Power Products, LLC v MTD Products Inc*., 1:06 CVA 0143 (Southern District of Ohio, Western Division) .

19. Expert Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.

20. Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.

21. Affidavits (May 2010/June 2010 in the Office of Administrative Hearings))/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).

22. Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).

23. Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.us

24. Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.

25. Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone's proposed Unit 3 in Texas.

26. Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*

27. Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper's proposed Pee Dee plant in South Carolina).

28. Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.

29. Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

30. Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

31. Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

32. Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

33. Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

34. Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.

35. Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (Eastern District of Michigan).

36. Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.

37. Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (District of Colorado).

38. Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

39. Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

40. Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. Public Service Company of New Mexico* (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE) (District of New Mexico).

41. Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

42. Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

43. Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant*

Generation Company LLC, Case No. 5:10-cv-00156-DF-CMC (Eastern District of Texas, Texarkana Division).

44. Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

45. Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.

46. Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

47. Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority,* Civil Action No. 4:11-cv-00791 (Southern District of Texas, Houston Division).

48. Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

49. Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

50. Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.,* Civil Action No. A-08-CA-648-LY (Western District of Texas, Austin Division).

51. Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.,* Case No. 3:10-cv-747 (TJM/DEP) (Northern District of New York).

52. Declaration (October 2011) on behalf of the Plaintiffs in the matter of *American Nurses Association et. al. (Plaintiffs), v. US EPA (Defendant)*, Case No. 1:08-cv-02198-RMC (US District Court for the District of Columbia).

53. Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association,* Case No. 11-417-MJP (Western District of Washington).

54. Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

55. Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency,* Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).

56. Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).

57. Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality,* Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261st Judicial District).

58. Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.,* Civil Action No. 07-CV-5298 (JKG) (Eastern District of Pennsylvania).

59. Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project.

60. Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.

61. Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.

62. Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.

63. Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

64. Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.

65. Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

66. Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.

67. Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

68. Declaration (April 2013) on behalf of Petitioners in the matter of *Sierra Club, et al., (Petitioners) v Environmental Protection Agency et al. (Resppondents),* Case No., 13-1112, (Court of Appeals, District of Columbia Circuit).

69. Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

70. Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of *A. J. Acosta Company, Inc., v. County of San Bernardino*, Case No. CIVSS803651.

71. Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.

72. Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.

73. Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

74. Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.

75. Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).

76. Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States*, Civil Action No. 13-1820 RC (District Court for the District of Columbia).

77. Declaration (April 2014) on behalf of Respondent-Intervenors in the matter of *Mexichem Specialty Resins Inc., et al., (Petitioners) v Environmental Protection Agency et al.,* Case No., 12-1260 (and Consolidated Case Nos. 12-1263, 12-1265, 12-1266, and 12-1267), (Court of Appeals, District of Columbia Circuit).

78. Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).

79. Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).

80. Direct Prefiled Testimony (August 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of Consumers Energy Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17317 (Michigan Public Service Commission).

81. Declaration (July 2014) on behalf of Public Health Intervenors in the matter of *EME Homer City Generation v. US EPA* (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).

82. Expert Report (September 2014), Rebuttal Expert Report (December 2014) and Supplemental Expert Report (March 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

83. Expert Report (November 2014) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

84. *Declaration (January 2015) relating to Startup/Shutdown in the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.*

85. Pre-filed Direct Testimony (March 2015), Supplemental Testimony (May 2015), and Surrebuttal Testimony (December 2015) on behalf of Friends of the Columbia Gorge in the matter of the Application for a Site Certificate for the Troutdale Energy Center before the Oregon Energy Facility Siting Council.

86. Brief of Amici Curiae Experts in Air Pollution Control and Air Quality Regulation in Support of the Respondents, On Writs of Certiorari to the US Court of Appeals for the District of Columbia, No. 14-46, 47, 48. *Michigan et. al., (Petitioners) v. EPA et. al., Utility Air Regulatory Group (Petitioners) v. EPA et. al., National Mining Association et. al., (Petitioner) v. EPA et. al.,* (Supreme Court of the United States).

87. Expert Report (March 2015) and Rebuttal Expert Report (January 2016) on behalf of Plaintiffs in the matter of *Conservation Law Foundation v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

88. Declaration (April 2015) relating to various Technical Corrections for the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.

89. Direct Prefiled Testimony (May 2015) on behalf of the Michigan Environmental Council, the Natural Resources Defense Council, and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Increase its Rates, Amend its Rate Schedules and Rules Governing the Distribution and Supply of Electric Energy and for Miscellaneous Accounting Authority, Case No. U-17767 (Michigan Public Service Commission).

90. Expert Report (July 2015) and Rebuttal Expert Report (July 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

91. Declaration (August 2015, Docket No. 1570376) in support of "Opposition of Respondent-Intervenors American Lung Association, et. al., to Tri-State Generation's Emergency Motion;" Declaration (September 2015, Docket No. 1574820) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors for Remand Without Vacatur;" Declaration (October 2015) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors to State and Certain Industry Petitioners' Motion to Govern, *White Stallion Energy Center, LLC v. US EPA*, Case No. 12-1100 (US Court of Appeals for the District of Columbia).

92. Declaration (September 2015) in support of the Draft Title V Permit for Dickerson Generating Station (Proposed Permit No 24-031-0019) on behalf of the Environmental Integrity Project.

93. Expert Report (Liability Phase) (December 2015) and Rebuttal Expert Report (February 2016) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., Environmental Law and Policy Center, and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

94. Declaration (December 2015) in support of the Petition to Object to the Title V Permit for Morgantown Generating Station (Proposed Permit No 24-017-0014) on behalf of the Environmental Integrity Project.

95. Expert Report (November 2015) on behalf of Appellants in the matter of *Sierra Club, et al. v. Craig W. Butler, Director of Ohio Environmental Protection Agency et al.,* ERAC Case No. 14-256814.

96. Affidavit (January 2016) on behalf of Bridgewatch Detroit in the matter of *Bridgewatch Detroit v. Waterfront Petroleum Terminal Co., and Waterfront Terminal Holdings, LLC.*, in the Circuit Court for the County of Wayne, State of Michigan.

97. Expert Report (February 2016) and Rebuttal Expert Report (July 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

98. Direct Testimony (May 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

99. Declaration (June 2016) relating to deficiencies in air quality analysis for the proposed Millenium Bulk Terminal, Port of Longview, Washington.

100. Declaration (December 2016) relating to EPA's refusal to set limits on PM emissions from coal-fired power plants that reflect pollution reductions achievable with fabric filters on behalf of Environmental Integrity Project, Clean Air Council, Chesapeake Climate Action Network, Downwinders at Risk represented by Earthjustice in the matter of *ARIPPA v EPA, Case No. 15-1180.* (D.C. Circuit Court of Appeals).

101. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

102. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Backus Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

103. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Drakulic Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

104. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Deutsch Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

105. Affidavit (February 2017) pertaining to deficiencies water discharge compliance issues at the Wood River Refinery in the matter of *People of the State of Illinois (Plaintiff) v. Phillips 66 Company, ConocoPhillips Company, WRB Refining LP (Defendants)*, Case No. 16-CH-656, (Circuit Court for the Third Judicial Circuit, Madison County, Illinois).

106. Expert Report (March 2017) on behalf of the Plaintiff pertaining to non-degradation analysis for waste water discharges from a power plant in the matter of *Sierra Club (Plaintiff) v. Pennsylvania Department of Environmental Protection (PADEP) and Lackawanna Energy Center*, Docket No. 2016-047-L (consolidated), (Pennsylvania Environmental Hearing Board).

107. Expert Report (March 2017) on behalf of the Plaintiff pertaining to air emissions from the Heritage incinerator in East Liverpool, Ohio in the matter of *Save our County (Plaintiff) v. Heritage Thermal Services, Inc. (Defendant), Case No. 4:16-CV-1544-BYP*, (US District Court for the Northern District of Ohio, Eastern Division).

108. Rebuttal Expert Report (June 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight (Plaintiffs) v Coyote Creek Mining Company LLC (Defendant),* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

109. Expert Affidavit (August 2017) and Penalty/Remedy Expert Affidavit (October 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant,)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

110. Expert Report (August 2017) on behalf of Appellant in the matter of *Patricia Ann Troiano (Appellant) v. Upper Burrell Township Zoning Hearing Board (Appellee)*, Court of Common Pleas of Westmoreland County, Pennsylvania, Civil Division.

111. Expert Report (October 2017), Supplemental Expert Report (October 2017), and Rebuttal Expert Report (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

112. Declaration (December 2017) on behalf of the Environmental Integrity Project in the matter of permit issuance for ATI Flat Rolled Products Holdings, Breckenridge, PA to the Allegheny County Health Department.

113. Expert Report (Harm Phase) (January 2018), Rebuttal Expert Report (Harm Phase) (May 2018) and Supplemental Expert Report (Harm Phase) (April 2019) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

114. Declaration (February 2018) on behalf of the Chesapeake Bay Foundation, et. al., in the matter of the Section 126 Petition filed by the state of Maryland in *State of Maryland v. Pruitt (Defendant)*, Civil Action No. JKB-17-2939 (Consolidated with No. JKB-17-2873) (US District Court for the District of Maryland).

115. Direct Pre-filed Testimony (March 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of *NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC*, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

116. Expert Affidavit (April 2018) and Second Expert Affidavit (May 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

117. Direct Pre-filed Testimony and Affidavit (December 2018) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

118. Expert Report (February 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

119. Declaration (March 2019) on behalf of Earthjustice in the matter of comments on the renewal of the Title V Federal Operating Permit for Valero Houston refinery.

120. Expert Report (March 2019) on behalf of Plaintiffs for Class Certification in the matter of *Resendez et al v Precision Castparts Corporation* in the Circuit Court for the State of Oregon, County of Multnomah, Case No. 16cv16164.

121. Expert Report (June 2019), Affidavit (July 2019) and Rebuttal Expert Report (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

122. Affidavit/Expert Report (August 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

123. Expert Report (October 2019) relating to the appeal of air permit (Plan Approval) on behalf of Appellants in the matter of *Clean Air Council and Environmental Integrity Project (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection and Sunoco Partners Marketing and Terminals L.P.*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-057-L.

124. Expert Report (December 2019), Affidavit (March 2020), Supplemental Expert Report (July 2020), and Declaration (February 2021) on behalf of Earthjustice in the matter of *Objection to the*

Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

125. Affidavit (December 2019) on behalf of Plaintiff-Intervenor (Surfrider Foundation) in the matter of *United States and the State of Indiana (Plaintiffs), Surfrider Foundation (Plaintiff-Intervenor), and City of Chicago (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant),* Civil Action No. 2:18-cv-00127 (US District Court for the Northern District of Indiana, Hammond Division).

126. Declarations (January 2020, February 2020, May 2020, July 2020, and August 2020) and Pre-filed Testimony (April 2021) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

127. Expert Report (April 2020) on behalf of the plaintiff in the matter of Orion Engineered Carbons, GmbH (Plaintiff) vs. Evonik Operations, GmbH (formerly Evonik Degussa GmbH) (Respondent), before the German Arbitration Institute, Case No. DIS-SV-2019-00216.

128. Expert Independent Evaluation Report (June 2020) for *PacifiCorp's Decommissioning Costs Study Reports dated January 15, 2020 and March 13, 2020 relating to the closures of the Hunter, Huntington, Dave Johnston, Jim Bridger, Naughton, Wyodak, Hayden, and Colstrip (Units 3&4) plants*, prepared for the Oregon Public Utility Commission (Oregon PUC).

129. Direct Pre-filed Testimony (July 2020) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

130. Expert Report (August 2020) and Rebuttal Expert Report (September 2020) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware Operating – NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

131. Expert Report (July 2020) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

132. Expert Report (August 2020) and Supplemental Expert Report (February 2021) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

133. Expert Report (August 2020) and Supplemental Expert Report (December 2020) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

134. Pre-filed Direct Testimony (October 2020) and Sur-rebuttal Testimony (November 2020) on behalf of petitioners (Ten Persons Group, including citizens, the Town of Braintree, the Town of Hingham, and the City of Quincy) in the matter of Algonquin Gas Transmission LLC, Weymouth MA, No. X266786 Air Quality Plan Approval, before the Commonwealth of Massachusetts, Department of Environmental Protection, the Office of Appeals and Dispute Resolution, OADR Docket Nos. 2019-008, 2019-009, 2019010, 2019-011, 2019-012 and 2019-013.

135. Expert Report (November 2020) on behalf of Protect PT in the matter of *Protect PT v. Commonwealth of Pennsylvania Department of Environmental Protection and Apex Energy (PA) LLC*, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2018-080-R (consolidated with 2019-101-R)(the "Drakulic Appeal").

136. Expert Report (December 2020) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (Defendants)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

137. Pre-filed Testimony (January 2021) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

138. Expert Reports (March 2021 and May 2021) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, Central Planning Board, City of Newark, New Jersey.

139. Expert Report (April 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 2:20-CV-01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Eastern District of Louisiana, New Orleans Division).

140. Expert Report (April 2021) for *Floyd Ruffin (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-cv-00334-CJB-JCW (US District Court for the Eastern District of Louisiana, New Orleans Division).

141. Expert Report (April 2021) and Sur-Rebuttal Report (June 2021) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

142. Expert Report (May 2021) for *Clifford Osmer (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendants)* related to No. 18-CV-12557 (US District Court for the Eastern District of Louisiana).

143. Expert Report (May 2021) and Rebuttal Expert Report (January 2022) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 1:19-CV-00694-JB-MU-C (US District Court for the Southern District of Alabama, Southern Division).

144. Expert Report (June 2021) and Declarations (May 2021 and June 2021) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division.)

145. Expert Witness Disclosure (June 2021) on behalf of the Plaintiffs in the matter of *Jay Burdick, et. al., (Plaintiffs) v. Tanoga Inc. (d/b/a Taconic) (Defendant)*, Index No. 253835, (State of New York Supreme Court, County of Rensselaer).

146. Expert Report (June 2021) on behalf of Appellants in the matter of *PennEnvironment and Earthworks (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection (Appellee) and MarkWest Liberty Midstream and resource, LLC (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2020-002-R.

147. Expert Report (June 2021) for *Antonia Saavedra-Vargas (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:18-CV-11461 (US District Court for the Eastern District of Louisiana, New Orleans Division).

148. Affidavit (June 2021) for Lourdes Rubi in the matter of *Lourdes Rubi (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendants)*, related to 12-968 BELO in MDL No. 2179 (US District Court for the Eastern District of Louisiana, New Orleans Division).

149. Expert Report (June 2021) for *Wallace Smith (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:19-CV-12880 (US District Court for the Eastern District of Louisiana, New Orleans Division).

150. Declaration (July 2021) on behalf of Plaintiffs in the matter of *Stephanie Mackey and Nick Migliore, on behalf* of *themselves and all others similarly situated (Plaintiffs) v. Chemtool Inc. and Lubrizol Corporation (Defendants)*, Case No. 2021-L-0000165, State of Illinois, Circuit Court of the 17th Judicial Circuit, Winnebago County.

151. Declaration (July 2021, August 2021) on behalf of Petitioners in the matter of the Petition for a Hearing on the Merits Regarding Air Quality Permit No. 3340-RMD issued to New Mexico Terminal Services, LLC by *Mountain View Neighborhood Association et. al., (Petitioners) v. City of Albuquerque Environmental Health Department*, AQCB Petition No. 2020-1 before the Albuquerque-Bernalillo County Air Quality Control Board.

152. Expert Disclosure (September 2021) on behalf of the Plaintiffs in the matter of *State of New York, Town of Hempstead, Town of Brookhaven, Incorporated Village of Garden City and Long Island Power Authority et. al., (Plaintiffs) v. Covanta Hempstead Company et. al., (Defendants)*, Index No. 7549/2013 before the Supreme Court of the State of New York, County of Nassau.

153. Expert Report (October 2021) for *John A. Battiste (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 1:21-CV-00118 (US District Court for the Southern District of Alabama, Mobile Division)

154. Declaration/Expert Report (October 2021) for *Charles K. Grasley et. al., (Plaintiffs) v. Chemtool Incorporated (Defendant)*, Case No. 2021-L-0000162 (State of Illinois, In the Circuit Court of the 17th Judicial Circuit, Winnebago County).

155. Declaration (October 2021) and Expert Report (November 2021) on behalf of the Plaintiffs in the matter of Toll Brothers, Inc., and Porter Ranch Development Company (Plaintiffs) v. Sempra Energy, Southern California Gas Company et. al., (Defendants), Southern California [Aliso Canyon] Gas Leak Cases, JCCP No.: 4861, Lead Case No.: BC674622, Superior Court of the State of California for the County of Los Angeles.

156. Expert Report (November 2021) and Declaration (September 2022) on behalf of Plaintiffs in Re: Deepwater Horizon BELO Cases, Case No. 3:19cv963-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

157. Declaration (November 2021) for the *United States of America and the State of Kansas, Department of Health and Environment (Plaintiffs) v. Coffeyville Resources Refining & Marketing, LLC (Defendant)*, Civ. No. 6:04-cv-01064-JAR-KGG (US District Court for the District of Kansas).

158. Expert Report/Affidavit (December 2021) on behalf of the City of Detroit in the matter of Marathon Petroleum Company (Claimant) v. City of Detroit Building Safety Engineering and Environmental Department, BSEED Case No. MCR 2018-2525, DAH Appeal No. 21-SWA-01, before the State of Michigan, City of Detroit Department of Appeals and Hearings.

159. Expert Report (December 2021) for *John Pabst (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 21-CV-00290 (US District Court for the Eastern District of Louisiana).

160. Expert Report (December 2021) for *Audrey Annette Tillery-Perdue individually and as person representative of the estate of Eddie Lewis Perdue (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendant)*, Civil Action No. 5:19-cv-00052-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

161. Expert Report (February 2022) for *Richard Dufour (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 19-cv-00591 (US District Court for the Southern District of Mississippi).

162. Expert Report (February 2022) and Rebuttal Expert Report (June 2022, in preparation) for *Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

163. Expert Report (February 2022) in the matter of the *Appeal Petition for Hearing on Air Quality Permit No. 8585 on behalf of Earth Care New Mexico et. al., (Petitioners) v. New Mexico Environment Department and Associated Asphalt and Materials, LLC (Applicant),* No. EIB 21-48 before the State of New Mexico Environmental Improvement Board.

164. Expert Report (March 2022) and Affidavit (June 2022) in the matter of Clean Air Council et. al., (Appellants) v. Commonwealth of Pennsylvania, Department of Environmental Protection (Appellee) and Renovo Energy Center (Permittee) EHB Docket No. 2021-055-R before the Commonwealth of Pennsylvania Environmental Hearing Board.

165. Declaration (March 2022) in the matter of Max Midstream Texas LLC Air Quality Permit No. 162941 for the Seahawk Crude Condensate Terminal in Calhoun County Texas, TCEQ Docket No. 2022-0157-AIR, before the Texas Commission on Environmental Quality.

166. Expert Pre-filed Testimony (April 2022) in the matter of Application of TPC Group LLC for New State and PSD Air Quality Permits (various), TCEQ Docket No. 2021-1422-AIR, SOAH Docket No. 582-22-0799, Before the Texas State Office of Administrative Hearings.

167. Expert Report (April 2022) and Rebuttal Report (August 2022) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

168. Rule 26 Disclosure (May 2022) in the matter of the *Water Works and Sewer Board of the City of Gadsden (*Plaintiff*) v. 3M Company, et. al., (Defendants)*, Civil Action No.: 31 CV-2016-900676.00 (Circuit County of Etowah County, Alabama)

169. Expert Report (June 2022) for *Heather Schumacher (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-011939 (Circuit Court of Cook County, Illinois.)

170. Expert Report (June 2022), Rebuttal Reports (August 2022, September 2022) for Plaintiffs in *Phylliss Grayson et. al. (Plaintiffs), v Lockheed Martin Corporation (Defendant),* Case No. 6:20-cv-01770. (US District Court for the Middle District of Florida – Orlando Division.)

171. Expert Affidavit (July 2022) for Center for Environmental Rights in connection with the 2019 South Africa Integrated Resource Plan in *African Climate Alliance et. al. v. The Minister of Mineral Resources and Energy et. al.*, in the High Court of South Africa, Gauteng Division, Pretoria.

172. Expert Affidavit (July 2022) for Center for Environmental Rights in connection with the Limpopo Mine (Lephalale Coal Mines Ltd.) in *Earthlife Africa v. The Minister of Forestry, Fisheries and Environment et. al.*, in the High Court of South Africa, Gauteng Division, Pretoria, Case No. 9149/2022.

173. Pre-filed Testimony (July 2022) and Rebuttal Testimony (September 2020) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)* before the Washington Utilities and Transportation Commission, Docket UE-220066 and UG-220067 (Consolidated).

174. Expert Affidavit (October 2022) for *Concerned Citizens of Cook County GA (Petitioner) v. Georgia Department of Natural Resources (Respondent) and Spectrum Energy Georgia, LLC (Respondent Intervenor)* before the Office of State Administrative Hearings, State of Georgia, Docket No: 2303405-OSAH-BNR-AQ-37-Barnes.

C. Occasions where Dr. Sahu has provided oral testimony in depositions, at trial or in similar proceedings include the following:

175. Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.

176. Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.

177. Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

178. Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

179. Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et* al. *v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).

180. Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia DEP.

181. Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.

182. Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.

183. Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.

184. Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.

185. Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

186. Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al*.

187. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coleto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

188. Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

189. Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

190. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).

191. Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

192. Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

193. Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

194. Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

195. Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

196. Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

197. Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

198. Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

199. Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

200. Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

201. Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

202. Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).

203. Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

204. Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

205. Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

206. Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

207. Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost

Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

208. Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

209. Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

210. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

211. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

212. Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

213. Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

214. Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

215. Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the *US Federal Trade Commission (FTC) v. ECM Biofilms* (FTC Docket #9358).

216. Deposition (February 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

217. Oral Testimony at Hearing (April 2015) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

218. Deposition (August 2015) on behalf of Plaintiff in the matter of *Conservation Law Foundation (Plaintiff) v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

219. Testimony at Hearing (August 2015) on behalf of the Sierra Club in the matter of *Amendments to 35 Illinois Administrative Code Parts 214, 217, and 225* before the Illinois Pollution Control Board, R15-21.

220. Deposition (May 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

221. Trial Testimony (October 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

222. Deposition (April 2016) on behalf of the Plaintiffs in *UNatural Resources Defense Council, Respiratory Health Association, and Sierra Club (Plaintiffs) v. Illinois Power Resources LLC and Illinois Power Resources Generation LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (Central District of Illinois, Peoria Division).

223. Trial Testimony at Hearing (July 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

224. Trial Testimony (December 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

225. Trial Testimony (July-August 2016) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

226. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

227. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Backus Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

228. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Drakulic Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

229. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Deutsch Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

230. Deposition Testimony (July 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight v Coyote Creek Mining Company LLC (Defendant)* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

231. Deposition Testimony (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

232. Deposition Testimony (December 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

233. Deposition Testimony (January 2018) in the matter of National Parks Conservation Association (NPCA) v. State of Washington Department of Ecology and British Petroleum (BP) before the Washington Pollution Control Hearing Board, Case No. 17-055.

234. Trial Testimony (January 2018) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

235. Trial Testimony (April 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

236. Deposition (June 2018) (harm Phase) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

237. Trial Testimony (July 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

238. Deposition (January 2019) and Trial Testimony (January 2019) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

239. Deposition (February 2019) and Trial Testimony (March 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

240. Deposition (June 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

241. Deposition (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

242. Deposition (December 2019) on behalf of the Plaintiffs in the matter of David Kovac, individually and on behalf of wrongful death class of Irene Kovac v. BP Corporation North America Inc., Circuit Court of Jackson County, Missouri (Independence), Case No. 1816-CV12417.

243. Deposition (February 2020, virtual) and testimony at Hearing (August 2020, virtual) on behalf of Earthjustice in the matter of *Objection to the Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation*, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

244. Hearing (July 14-15, 2020, virtual) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

245. Hearing (September 2020, virtual) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware* Operating – *NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

246. Deposition (December 2020, March 4-5, 2021, all virtual) and Hearing (April 2021, virtual) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

247. Hearing (September 2020, virtual) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating*

Internal Combustion Engines (RICE) Greater Than 100 Horsepower prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

248. Deposition (December 2020, virtual and Hearing February 2021, virtual) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

249. Deposition (January 2021, virtual) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

250. Deposition (February 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (*Defendants*)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

251. Deposition (April 2021, virtual) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

252. Deposition (June 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division).

253. Deposition (June 2021, virtual) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

254. Testimony (June 2021, virtual) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, (Central Planning Board, City of Newark, New Jersey).

255. Testimony at Hearing (October 2021) on behalf of Evraz Rocky Mountain Steel in the matter of Colorado's Proposed Revisions to Regulation 22, the Greenhouse Gas Emissions and Energy Management for the Manufacturing Sector in Colorado (GEMM Rule), before the Colorado Air Quality Control Commission.

256. Deposition (November 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 2:20-CV-01329 (Related to 12-968 BELO in MDL No. 2179). (US District Court for the Eastern District of Louisiana).

257. Testimony at Hearing (November 2021) on behalf of *National Parks Conservation Association, et. al.*, in the matter of the Proposed Revisions to Colorado's Regional Haze State Implementation Plan (SIP) and Colorado Regulation 23, before the Colorado Air Quality Control Commission.

258. Deposition (December 2021) on behalf of Plaintiffs in Re: Deepwater Horizon BELO Cases, Case No. 3:19cv963-MCR-GRJ (US District Court for the Northern District of Florida, Pensacola Division).

259. Deposition (December 2021) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 1:19-CV-00694-JB-MU-C (US District Court for the Southern District of Alabama, Southern Division).

260. Testimony at Hearing (February 2022, virtual) in the matter of the *Appeal Petition for Hearing on Air Quality Permit No. 8585 on behalf of Earth Care New Mexico et. al., (Petitioners) v. New Mexico Environment Department and Associated Asphalt and Materials, LLC (Applicant),* No. EIB 21-48 before the State of New Mexico Environmental Improvement Board.

261. Deposition (March 2022) and Rebuttal Deposition (July 2022) for *Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois.)

262. Deposition (April 2022, virtual) in the matter of Application of TPC Group LLC for New State and PSD Air Quality Permits (various), TCEQ Docket No. 2021-1422-AIR, SOAH Docket No. 582-22-0799, Before the Texas State Office of Administrative Hearings.

263. Deposition (May 2022, virtual) in the matter of the *Water Works and Sewer Board of the City of Gadsden (Plaintiff) v. 3M Company, et. al., (*Defendants*)*, Civil Action No.: 31 CV-2016-900676.00 (Circuit County of Etowah County, Alabama)

264. Deposition (June 2022 and September 2022, both virtual) for *Teresa* Fornek *(Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

265. Deposition (June 2022, virtual) on behalf of the Plaintiffs in the matter of Toll Brothers, Inc., and Porter Ranch Development Company (Plaintiffs) v. Sempra Energy, Southern California Gas Company et. al., (Defendants), Southern California [Aliso Canyon] Gas Leak Cases, JCCP No.: 4861, Lead Case No.: BC674622, Superior Court of the State of California for the County of Los Angeles.

266. Deposition (July 2022) for *Richard Dufour (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 19-cv-00591 (US District Court for the Southern District of Mississippi).

267. Trial (August 2022) on behalf of the Plaintiffs in the matter of Modern *Holdings, LLC, et al. (Plaintiffs) v. Phillips (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

268. Trial (August 2022, in person) for *Susan Kamuda (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

269. Deposition (September 2022, virtual) for *Heather Schumacher (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010744 (Circuit Court of Cook County, Illinois.)

270. Deposition (September 2022) on behalf of Plaintiffs in *Phylliss Grayson et. al. (Plaintiffs), v Lockheed Martin Corporation (Defendant),* Case No. 6:20-cv-01770. (US District Court for the Middle District of Florida – Orlando Division.)

271. Hearing (October 2022) on behalf of the Puyallup Tribe of Indians in the matter of *Washington Utilities and Transportation Commission (Complainant) v. Puget Sound Energy (Respondent)* before the Washington Utilities and Transportation Commission, Docket UE-220066 and UG-220067 (Consolidated).

272. Deposition (September 2022) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

273. Trial (October 2022, in person) for *Teresa Fornek (Plaintiff) v. Sterigenics U.S., LLC, et. al., (Defendant)*, Case No. 2018-L-010475 (Circuit Court of Cook County, Illinois).

ATTACHMENT 4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS TX 75202-2733

FEB 11 2015

Ms. Kathy Singleton
MC 206, State Implementation Plan Team
Air Quality Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Re: Dallas-Fort Worth Attainment Demonstration for the 2008 Eight-Hour Ozone Nonattainment Area, Project Number 2013-015-SIP-NR; Dallas-Fort Worth Reasonable Further Progress State Implementation Plan Revision for the 2008 Eight-Hour Ozone Standard, Project Number 2013-014-SIP-NR;Revisions to Chapter 115, Project Number 2013-048-115-AI; and Revisions to Chapter 117, Project Number 2013-049-117-AI

Dear Ms. Singleton:

Thank you for the opportunity to review the four proposed revisions that address the Dallas/Fort Worth (DFW) nonattainment area under the 2008 ozone standard. We have enclosed comments on the proposed attainment demonstration and RFP SIPs, and on the proposed revisions to Chapters 115 and 117. We appreciate the work by the TCEQ in developing these documents. Nonetheless, additional ozone reductions will be necessary to demonstrate attainment.

The proposed attainment demonstration (Project Number 2013-015-SIP-NR) is based on an attainment date of December 31, 2018. On December 23, 2014, the U.S. Court of Appeals for the D.C. Circuit held that the end of year attainment dates were not consistent with Congressional intent. *NRDC v. EPA*, 2014 U.S. App. LEXIS 24253 (D.C. Cir. 2014). Therefore, the EPA intends to promulgate a rulemaking to revise the attainment dates to a timeframe consistent with the court's decision. As a result, we anticipate that the attainment date will be earlier than the end of the 2018 ozone season, which means that the attainment year ozone season for the DFW nonattainment area will likely be 2017 rather than 2018.

We understand the loss of a year to demonstrate attainment presents challenges for the State. For example, the State will lose a year of expected ozone reductions from fleet turnover. These potential reductions will need to be "found" in other means to show attainment by the 2017 ozone season. While this will take further analysis and consideration by Texas, we are committed to working with you to identify solutions.

We look forward to discussing the enclosed comments with you. Please feel free to contact me or Ms. Carrie Paige of my staff at 214-665-6521, if you have questions.

Sincerely yours,

Guy Donaldson, Chief
Air Planning Section

Enclosure

Project Number 2013-015-SIP-NR

Comments addressing the Dallas-Fort Worth Attainment Demonstration (AD)

The attainment year ozone season is the ozone season immediately preceding a nonattainment area's attainment date. In light of the recent decision made by the U.S. Court of Appeals for the D.C. Circuit,[1] we anticipate that the attainment date for the DFW area will be earlier than the end of the 2018 ozone season and thus, the attainment year ozone season for the DFW area will likely be 2017. Please revise the applicable elements of the attainment demonstration submittal to reflect the earlier attainment date. We expect the SIP requirements rule will be finalized soon addressing the Court's decision regarding the attainment date.

The attainment demonstration Motor Vehicle Emissions Budget (MVEB) will need to be revised to reflect the earlier attainment date.

The contingency plan is based on emission reductions from fleet turnover in 2019. The contingency plan will need to be revised to reflect the earlier attainment date. In addition, in the June 6, 2013 proposal for the ozone implementation rule, we proposed establishment of MVEBs consistent with the use of on-road fleet turnover as a contingency measure (see 78 FR 34178, 34199). Having such budgets would help to ensure that reductions from a fleet turnover contingency measure would be surplus and available for the SIP in the event that the contingency measures are triggered. TCEQ should include a MVEB for the fleet turnover contingency measure.

TCEQ has worked to refine its modeling platform using 2006 base case periods and evaluation of 2018 future year ozone levels. In accomplishing this work, TCEQ has performed a number of analyses to evaluate the model performance of the 2006 base case periods following EPA's modeling guidance. We appreciate TCEQ providing the supplemental modeling with updated emission inventory and model projections based on both EPA's existing 2007 modeling guidance and the new DRAFT modeling guidance methods that are currently out for public review and comment until March 13, 2015. We note using the new DRAFT modeling guidance methods, TCEQ projects all but one monitor to be in attainment (below 76 ppb) in 2018, and the Denton Airport South monitor is projected to be 76.13 ppb (design value or DV of 76). Using EPA's 2007 modeling guidance methods the values were projected to be slightly higher in 2018 with Denton at 77 ppb and Eagle Mtn. Lake and Grapevine monitors projected to be 76 ppb.

As part of the model platform evaluation and weight of evidence (WOE) TCEQ has done a number of modeling analyses and also evaluated emissions and monitoring trends. Overall we think the modeling is performing reasonably well, but there are some concerns with model performance of transported ozone and ozone precursors as discussed below and by TCEQ in Appendix C of the proposal. Overall the WOE components raise some concern about whether the DFW area will be able to obtain the 2008 8-hour ozone standard of 75 ppb in 2018. The recent court decision that indicates the attainment year will likely be 2017 for moderate classification areas such as DFW, makes it less clear that the area will attain the standard by 2017 without additional reductions. See below for more detailed comments on the modeling and WOE.

[1] *NRDC v. EPA*, 2014 U.S. App. LEXIS 24253 (D.C. Cir. Dec. 23, 2014).

Comments addressing the RACM analysis

Please provide the estimated amount of NOx emission reductions (in tpd) that would reduce ozone values at the monitors by 1 ppb. In the Tables in Appendix D, please include the estimated emissions reductions associated with each of the measures. This additional information will help determine which measures, separately or in combination, would assist in advancing the attainment date for measures that can be implemented prior to the beginning of the attainment year ozone season.

Within the RACM analysis, the TCEQ estimates that reducing the source cap for the kilns in Ellis County would not provide significant NOx emission reductions for the DFW area. However, a reduction in the source cap of 4.6 tpd, as estimated by the TCEQ, does appear significant, compared with the emissions reductions estimated for other sources of NOx in the DFW area. What modeling or other analyses were performed that support the TCEQ's conclusion regarding the source cap?

The TCEQ provided an evaluation of emissions from all of the utility electric generators in east and central Texas. However, the discussion in Appendix D on the formation, background levels, and transport of ozone strongly supports the implementation of controls on NOx sources located to the east and southeast of the DFW nonattainment area. How would a reduction in NOx emissions from utility electric generators in just the counties closest to the eastern and southern boundaries of the DFW area impact the DFW area?

Comments addressing the proposed VOC RACT analysis

EPA supports the inclusion of major sources of VOC located in Wise County to become subject to the requirements of 30 TAC Chapter 115.

EPA appreciates the VOC RACT analysis provided by TCEQ.

Comments addressing the proposed NOx RACT analysis

There has been a significant drop in the ambient NOx concentration for Ellis County in part due to past NOx control measures concerning cement kilns operating in the DFW nonattainment area and we applaud TCEQ for these efforts. Because of significant changes in the type and number of cement kilns in Ellis County, however, TCEQ's rules need to be reevaluated to insure these reductions are maintained, and the emission limits reflect a RACT level of control as required by the Clean Air Act.

In particular, the retirement of the higher emitting wet kilns and operation of more energy efficient and lower emitting dry kilns in Ellis County makes it necessary for the TCEQ to revisit its NOx cap limit, set forth in 2007 at 17.4 tons per day (tpd). This limit was set, in part, based on higher emission rates for wet kilns. Therefore, with fewer sources contributing to the cap, the dry kilns essentially have a less stringent emission rate requirement. We can no longer conclude the emission limit that is in place reflects a RACT level of control. An evaluation of the RACT for cement kilns in Ellis County is needed that reflects the level of control that can reasonably be achieved and new limits to reflect the reasonable level of control. TCEQ can either establish appropriate rate based limits (lbs/ton of clinker) for each unit or it can establish a cap based on appropriate rate based emission rates. It is important to recognize that the SIP emission limit needs to reflect RACT. We believe that a rate base limit will preserve any necessary operational flexibility as it sets no limit on production rates. Failure to conduct a thorough RACT analysis for cement kilns which would include appropriate emission limits would prevent us from approving the RACT portion of the attainment plan submittal.

Comments addressing the proposed AD SIP, Appendix H: Local Initiatives Submitted by the North Central Texas Council of Governments

We appreciate the work done by the North Central Texas Council of Governments (NCTCOG) in developing the list of local initiatives. The submittal letter from the NCTCOG indicates that the initiatives are "expected to be implemented by 2018." In light of the recent Court decision[2] and consequential need for EPA to establish an earlier attainment date, please list the local initiatives that will be completed by March 1, 2017.

DFW AD/WOE Detailed comments

As discussed above, EPA provided new DRAFT modeling guidance (Dec. 2014) that is currently out for review and stakeholder comments until March 13, 2015. EPA's current plan is to review comments and finalize the revised modeling guidance by the end of the year (2015). The guidance may change further based on comments. In this transitional period, we recommend that TCEQ continue to provide the attainment test analysis using both the existing 2007 modeling guidance approach and the new approach recommended in the December 2014 DRAFT modeling guidance.

The updated modeling results provided in early January by TCEQ indicate one monitor at 76 ppb in 2018 using the new DRAFT guidance and existing guidance methods indicate 77 ppb at Denton and 76 ppb at Eagle Mtn. Lake and Grapevine. We note that these numbers will most likely go up some with an attainment demonstration based on 2017. We request that TCEQ supplement their analysis as needed to show that the area will attain by 2017.

There should be further analysis and documentation evaluating the days being used in the attainment test. The days that are being used at each monitor should be identified. In limiting the days to 10 days, an evaluation of the performance on each day and the type of meteorology/transport phenomena of each day should be provided. The main principal of the attainment test is to limit the days to the higher days at the monitor, but there needs to be an evaluation of the days used to make sure that the set of days used represents the conceptual model for the area and is representative of all the days that yield ozone exceedances. In doing this evaluation it may be that more than 10 days are necessary for some monitors. For example: the later summer episode is important to the conceptual model and some of these days may not be included based on the 10 days threshold.

Overall, the WOE analysis is not overly supportive that the modeling is conservative. TCEQ has provided information on recent ozone trends to support its conclusion the area will attain by 2018. Most of the recent years, however, have been average or below normal in overall conduciveness for ozone formation. Temperature has been high for some of these years which does lead to higher ozone, but wind speeds have also been higher than normal which leads to lower ozone concentration with more dispersion. 2011 was one of these type of years. 2014 had very favorable meteorology and was one of the lowest ozone monitoring years in the Eastern half of the US with a 2014 DFW area DV of 81 ppb. It was abnormal, due to its lower than average temperature and frequency of frontal passages that led to reduced background build up, and not likely to be repeated.

The 2013 DV data for the DFW area was 87 ppb, indicating an 11 ppb drop would have to occur within four to five years to reach attainment in 2017 or 2018. Even considering the anomalous 2014, the area has to drop another 6 ppb.

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[2] *NRDC v. EPA*, 2014 U.S. App. LEXIS 24253 (D.C. Cir. Dec. 23, 2014).

We note that normal on-road/non-road fleet turnover within areas of DFW and Texas will help lower ozone levels in the DFW area. In TCEQ's SIP proposal, TCEQ provides a long term trends analysis that also included a linear relationship to estimate the long term ozone level change. This equation indicates the 8-hour values have dropped at a rate of 1.1 ppb per year. We modified the table to extrapolate the DFW 8-hour ozone DVs in 2017 and 2018, which were still 80-82 ppb for these future years based on this rate of reduction. See Figure 1 on page 7. Since the overwhelming majority of reductions of NOx in the plan are the federal measures for on road and off road sources, it seems unreasonable to expect this rate of reduction to accelerate. Based on the monitoring data and lack of additional large reductions in NOx within areas of Texas that impact DFW, it is difficult to see how the area would reach attainment in 2018 based solely on federal measures reductions from mobile and non-road. The fact that the attainment year will likely be 2017 makes the chance of attainment smaller.

Evaluation of the model performance data and source apportionment indicates that the model may be oversensitive to low-level NOx reductions and has some issues with NOx level predictions in the DFW area. We note that the kv patch (vertical diffusivity patch) to induce more vertical mixing may be resulting in better ozone performance in the base case, but the atmosphere may not be mixing as rapidly as the patch is indicating. This would result in the model being overly sensitive to low-level NOx reductions. This may compensate for emission projection errors in the base case, thus resulting in better model performance. We suspect the model may be providing more mixing than really occurs based on NO_2 monitoring throughout the domain compared to modeled values. In particular, it tends to under-predict NOx concentrations in the western half of the domain and over-predict NOx concentrations in the upwind region. These issues with the NOx modeled levels could result in inaccurate ozone predictions and raise uncertainty in the attainment demonstration.

While the State has provided a large chapter on Weight of Evidence, the principal evidence is the recent monitor data. The monitor data does not show the large drops in local ozone levels and therefore raises a fundamental question whether the photochemical modeling is working as an accurate tool for assessing attainment in 2018 for DFW.

We also note that the modeling seems to project significant reductions due to out-of-state emission reductions, which reflects some of the expected trends in declining regional ozone levels.

Episode Analysis

Overall the June 2006 episode is a good episode and representative of the type of days from the conceptual model that drive the early summer exceedances in the DFW area. The inclusion of Aug-Sep 2006 is an improvement and attempts to include days that make up the latter summer period in DFW that are historically the worst days overall and usually drive the DV for the area. Latter summer 2006 was not typical and was actually light on ozone exceedances compared to the conceptual model, but was a step in the right direction. Because this period was below average it still hinders the analysis of later summer ozone events. Given the bimodal (peaks in June and higher peaks in Aug/Sep) we still have concern that the days that drive the overall DV and attainment of the area are underrepresented in the analysis.

Model Performance Analysis

We appreciate TCEQ's efforts to analyze the Model Performance of the base case modeling. In Appendix C, we note that for the August/September episode, the average over-prediction of observed Maximum Daily Average 8-hour Ozone (MDA8) ozone values is over 10 ppb (Figure 4-4 of the proposal, first set of bars), which is sufficient to cause concern. The TCEQ is investigating the causes of this bias and will take appropriate steps to ameliorate it, if possible, in the near future.

Strong underestimation of NOx at Kaufman area high monitored values could be affecting daytime scavenging. Hinton peak NOx may seem to be slightly overestimated, but given the close proximity to the I-35 corridor which is a large NO/NO2 source, modeled values would likely be higher for both the bilinear interpolation values and the 3x3 array values. Looking at the Ft. Worth NW monitor, it appears ozone on some high ozone days is being overestimated with a spread in the 75-90 ppb range, but the NOx seems underestimated on some of the higher ozone days/higher NOx monitored days. The underestimation bias on the highest NOx monitored days may be part of the reason for ozone overestimation especially in the latter summer episode. The overestimation of isoprene may also be playing into what is perceived as an ozone overestimation bias on the highest values.

The model performance time series analysis in Appendix C had modeled concentrations of HRVOC species much higher than observed at Hinton Street C401 and at Fort Worth Northwest C13 monitors.

Modeling on a number of days seems to be overestimating the MDA8 and overall ozone levels at the upwind monitors in the DFW area and this overestimation of background may be part of the reason for overestimation at downwind monitors. On some of these days this may indicate the local production is actually biased low on days that appear to have good downwind model performance. Looking at the analysis at the other upwind regional monitors (Italy, San Augustine, Clarksville, and Palestine) all appear to have an overestimation of regional levels and are especially off in the nighttime values. Modeled nighttime values range from 20-60 ppb higher, compared to monitor values. This is probably leading to the DFW upwind monitor performance issues especially on the morning hours and even on the MDA8 for many days. This issue may lead to the model being more responsive to regional background level changes than local changes.

We recommend identifying the 10 days used for each monitor on the daily ozone MDA8 plots in Figure 4 of the proposal. This could potentially be accomplished by adding the specific monitors on each day that was the day was used for the RRF analysis. As discussed above please document and show how the days (10 or more) fit with the overall conceptual model for the DFW area.

We appreciate the Source apportionment modeling that was included and find it informative. We note that it seems to indicate lower contributions from outside of Texas, than the upwind monitor analysis that Texas included. This is not surprising as the upwind monitor analysis approach can overestimate the amount of background ozone that is contributing to the exceedance since the monitor is not always completely upwind and does not necessarily pair in time with the contribution further downwind. On some of the highest transport days that also saw local exceedances predicted in DFW, the non-Texas component was usually less than 50 ppb and often 45-40 ppb or less. The source apportionment analysis comports with previous source apportionment analyses indicating that on many high ozone days in the DFW area, Texas sources contribute approximately half of the ozone.

WOE/Corroborative Analysis

Recent NOx trends (Figure 5-10 in TCEQ's Proposal) indicate a fairly flat NOx trend for several NO monitors in the western area of the DFW area (Eagle Mtn. Lake, Denton, and Parker County monitors). These monitors are in areas more impacted by the growth in NOx sources for Oil and Gas Development that seem to be countering the normal reduction in NOx levels seen at other monitors due to fleet turnover reductions (on-road and Nonroad). These higher NOx levels in the modeling domain that seem to be fairly flat with no change since 2009 raise concern that the area is not seeing the NOx reductions needed to bring the ozone levels down at these monitors.

We note that the attainment demonstration modeling includes reductions in NOx and VOC in Wise County from controls proposed for RACT in Wise County. These emission reductions were discussed/quantified in Appendix B of the proposal. Any SIP revisions based on removing Wise County would have to have the modeling adjusted so that it does not take credit for unenforceable reductions. Please confirm the estimate NOx emission reductions in Wise County match with the adopted regulations for NOx control in Wise County.

Previous control requirements put in place on natural gas fired compressor engines in the DFW 9-county area and in many upwind counties relied on NSCR catalytic convertors that typically require periodic changing of catalysts to maintain estimated control levels. Has Texas done any follow-up to confirm that proper maintenance is occurring to ensure the controls are still meeting the requirements?

The modeling includes emissions from Natural Gas production in the Barnett Shale area and projects NOx emissions to directly correlate with a decline in production levels. We have some concern that as well pressure diminishes that natural gas fired engines driving natural gas compressors may be utilized more than the current usage per production amount. This may result in the projected NOx emissions not dropping as much as projected. The same volume of gas being produced with less well head pressure flow could need more overall actual compression to get to market. This situation could result in more NOx emissions than estimated based on the current emissions/production level relationship. We recommend that TCEQ perform a study to confirm that the emissions trends projected in the modeling have occurred.

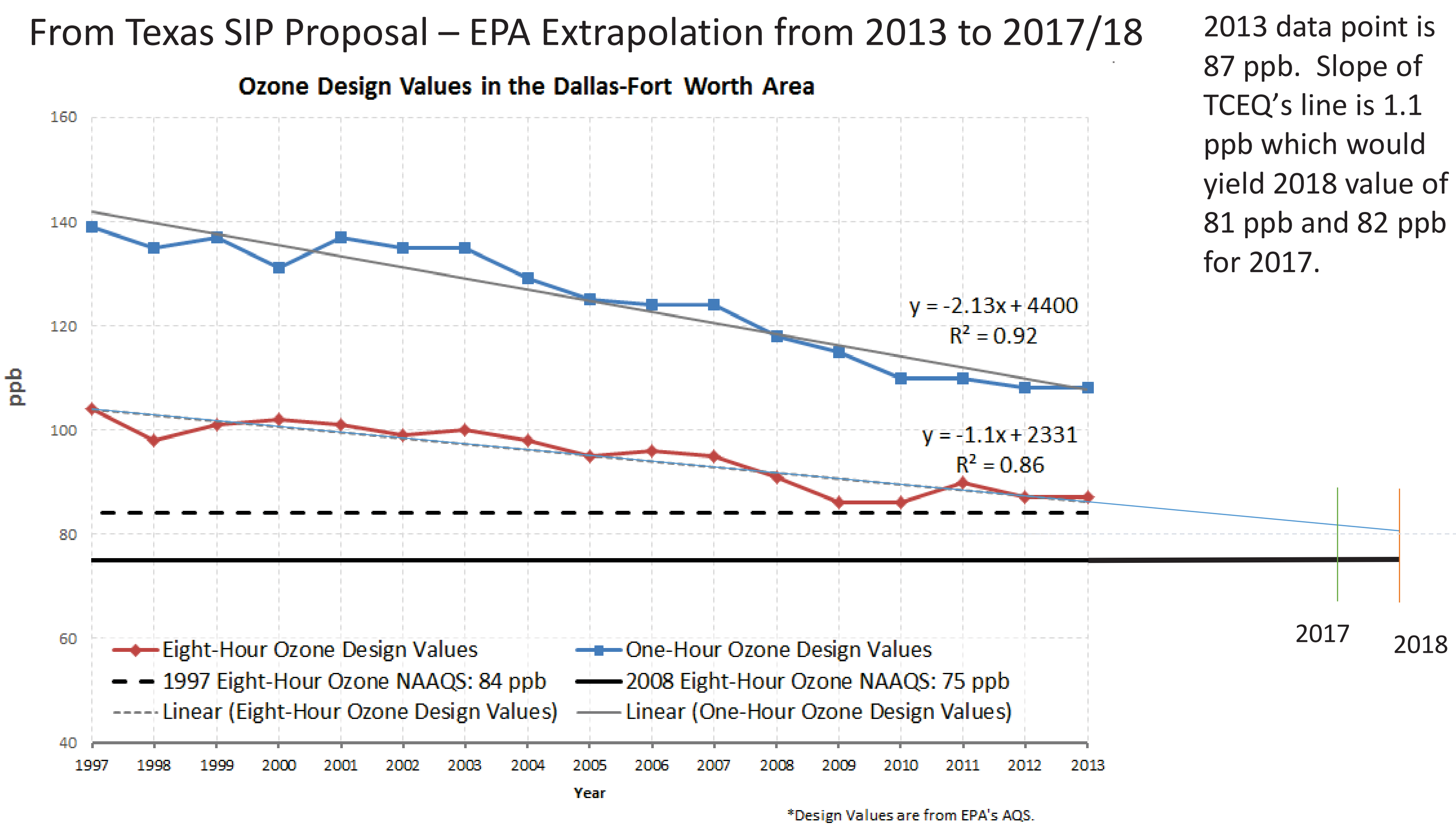
We note that there is some discussion of ERCs and DERCs in Appendix B of the proposal. That discussion indicates that there are 363 tpy of NOx ERCs and over 6000 tons of DERCs. Please clarify the calculation that resulted in 17 tpd of NOx being included in the model. Please explain and document how the NOx and VOC ERCs/DERCs were allocated in the modeling, including spatial allocation (daily DERC emissions plots). Also, please clarify if the attainment demonstration takes into account any emergency use of DERCs beyond the flow control limit (e.g., emergency use declared by ERCOT). It might be helpful to look at any past emergency usage of DERCs and generate a memo documenting past usage rates and whether or not the DFW area had any exceedances monitored on those days and provide that in the documentation.

Summary of Analysis of the Attainment Demonstration and WOE/Corroborative Analysis

We appreciate TCEQ's efforts to provide comprehensive modeling using an episode that includes additional days in attempt to provide representative modeling. As noted above, despite TCEQ efforts, there are concerns with model performance. There are also concerns that even with the additional episode days, the episode overall is not fully representative of the most difficult ozone scenarios. In addition, while current ozone trends and the model predictions support that ozone levels will continue to improve, it is not clear to EPA that these trends are sufficient for the area to attain by 2018.

Unfortunately, as discussed above, we anticipate that the attainment year ozone season for the DFW area will likely be 2017 rather than 2018. The attainment demonstration will need to be reworked to provide for attainment by 2017. EPA stands ready to work with TCEQ to develop streamlined modeling approaches and weight of evidence approaches for 2017. We note, however, that we believe it is likely that additional reductions will need to be included to demonstrate attainment.

Figure 1: Long term DFW 8-hour monitoring trends



2013 data point is 87 ppb. Slope of TCEQ's line is 1.1 ppb which would yield 2018 value of 81 ppb and 82 ppb for 2017.

Rule Project Number 2013-048-115-AI

Comments addressing Chapter 115 revisions to implement Reasonably Available Control Technology (RACT) for all emissions sources addressed in a control techniques guidelines (CTG) and all non-CTG major sources of VOCs in the DFW 2008 eight-hour ozone moderate nonattainment area (serious -- Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant, and moderate -- Wise).

1. Support for Revisions

   In general, we are supportive of this rule project to implement RACT for emissions sources of VOCs in the DFW ten county area.

2. Compliance Schedules for Wise County

   At the time of this review, Wise County is currently designated as nonattainment for the 2008 eight hour standard. Subchapter A Definitions, Section 115.119 (h), Compliance Schedules states: "Upon the date the commission publishes notice in the *Texas Register* that Wise County is no longer designated nonattainment for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard, the owner or operator of each storage tank is not required to comply with any of the requirements in this division."

   This provision is not approvable as proposed because it does not contain a replicable procedure to change the applicability of a SIP requirement. EPA's designation of Wise County is currently under review in the D.C. Circuit Court of Appeals (*Mississippi Commission on Environmental Quality v. EPA*). We understand that the litigation outcome and potential subsequent rulemaking by EPA concerning Wise County are unknown at this time. Although we appreciate the commission's dilemma, if Wise County is no longer designated as nonattainment in the future, a publication by the commission in the Texas Register that Wise County is no longer designated nonattainment is not sufficient to change the applicability of requirements to sources in Wise County. Under CAA Section 110(i), this change would require a SIP revision submitted by TCEQ after completion of the State's rulemaking process.

   Phrasing similar to that quoted above occurs in multiple places throughout this proposed SIP revision and must also be revised:

   Subchapter B, General Volatile Organic Compounds Sources, Division 1: Storage of VOCs, §115.119(h), Compliance Schedules.

   Subchapter B, General Volatile Organic Compounds Sources, Division 2: Vent Gas Control, §115.129(g), Compliance Schedules.

   Subchapter B, General Volatile Organic Compounds Sources, Division 3: Water Separation, §115.139(e), Counties and Compliance Schedules.

   Subchapter C, Volatile Organic Compound Transfer Operations, Division 1: Loading and Unloading of Volatile Organic Compounds, §115.219(g) Counties and Compliance Schedules. Subchapter C, Volatile Organic Compound Transfer Operations, Division 2: Filling of Gasoline Storage Vessels (Stage 1) for Motor Vehicle Fuel Dispensing Facilities, §115.229(f) Counties and Compliance Schedules.

Subchapter C, Volatile Organic Compound Transfer Operations, Division 3: Control of Volatile Organic Compound Leads from Transport Vessels, §115.239(e) Counties and Compliance Schedules.

Subchapter D, Petroleum Refining, Natural Gas Processing, and Petrochemical Processes, Division 3: Fugitive Emission Control in Petroleum Refining, Natural Gas/Gasoline Processing, and Petrochemical Processes in Ozone Nonattainment Areas, §115.359(e) Counties and Compliance Schedules.

Subchapter E, Solvent-Using Processes, Division 2: Surface Coating Processes, §115.429(f) Counties and Compliance Schedules.

Subchapter E, Solvent-Using Processes, Division 4: Offset Lithographic Printing, §115.449(i) Counties and Compliance Schedules.

Subchapter E, Solvent-Using Processes, Division 5: Control Requirements for Surface Coating Processes, §115.459(d) Counties and Compliance Schedules.

Subchapter E, Solvent-Using Processes, Division 6: Industrial Cleaning Solvents, §115.469(d) Counties and Compliance Schedules.

Subchapter E, Solvent-Using Processes, Division 7: Miscellaneous Industrial Adhesives, §115.479(d) Compliance Schedules.

Subchapter F, Miscellaneous Industrial Sources, Solvent-Using Processes Division 1: Cutback Asphalt, §115.519(e) Compliance Schedules.

3. Definition of Dallas-Fort Worth area (Subchapter A Definitions, §115.10 (11))

   The definition of the "Dallas-Fort Worth area" has been revised to refer to 3 different designations depending on the definition's applicability and based on the number of counties.

   For clarity, we suggest creating three distinct definitions, such as (A) "Dallas-Fort Worth area, 4 counties," (B) "Dallas-Fort Worth area, 9 counties" and (C) "Dallas-Fort Worth area, 10 counties" so that the terms used in the subchapters and divisions provide information about which definition is intended. As currently proposed, the definition requires a person to cross reference particular subchapters and divisions with the definition section to determine what counties "Dallas Fort Worth area" includes in that context.

   Alternatively, or possibly in addition, we suggest clarifying the definition of Dallas-Fort Worth area as it applies to a particular subchapter.

   An example of a reference which is somewhat problematic may be found in Subchapter C, Volatile Organic Compound Transfer Operations, Division 1: Loading and Unloading of Volatile Organic Compounds (Subchapter C, §115.219(f) Counties and Compliance Schedules). Reviewing the definition of Dallas-Fort Worth in §115.10, this subchapter is not specifically delineated in definition (A) or (B), therefore it seems that the applicable definition is (C) for all 10 counties. However, in §115.219(f), we believe TCEQ intended this reference to the DFW area to include only 9 counties (§115.10(11)(B)) because there is a separate paragraph that provides requirements for Wise County, §115.219(e). There are additional instances similar to this throughout the revisions.

Project Number 2013-014-SIP-NR

Comments Addressing the Dallas-Fort Worth Reasonable Further Progress SIP Revision

We appreciate the detailed work submitted in the RFP plan. It appears that the RFP and contingency reductions are available, but not always shown accurately. We found mathematical errors in several tables. For example, in Table 3-12 (Post-2011 RFP Target level of VOC emission for Wise County), page 3-12 of the submittal: the VOC target for the 2018 attainment year would be 28.29 tpd (29.33 – 1.04 = 28.29), but Table 3-12 shows 28.30 tpd. This error is also reflected in Table 3-16, line 9 and in Appendix 1, on Sheet 16. There also appears to be an error made in calculating the creditable RFP control reductions in NOx for the nine previously designated counties between 2017 and 2018, shown on line 3 of Table 3-15. The sum of NOx reductions projected for 2017 is 864.23 (Table 4-1) and the sum of NOx reductions projected for 2018 is 901.79 (Table 4-2). The difference between these two sums is 37.56, but Table 3-15 shows 14.42. Please indicate where the additional 23.14 tpd in NOx emission reductions has been placed (37.56 – 14.42 = 23.14). We did not find errors in such calculations for the VOC emission reductions.

The titles for Tables 4-23 and 4-24 identify them as providing the RFP contingency demonstrations for the 2017 milestone year, but the dates within the tables are 2018. Additionally, we believe several of the numbers provided in these tables reflect emissions for 2018 rather than for 2017.

The Airport Emissions Inventory – Wise County is within the DFW MSA and has airports, but there is no mention of Wise County within the Airport EI. Wise County had not been proposed as a nonattainment area when the Airport EI was completed (August 2011), but neither had Hunt and Henderson Counties, which are included in the Airport EI. Please explain why Wise County is not included in the Airport EI.

Rule Project Number 2013-049-117-AI

Comments on the Proposed Revisions to 30 TAC Chapter 117

1. Sections 117.210(c), 117.225, 117.405(d), 117.410(d), 117.425, 117.1110(b), 117.1125, 117.1310(b), and 117.1325 pertain to control of ammonia and carbon monoxide emissions which are not ozone precursors, and are therefore not necessary components of Texas ozone SIP. As a result, EPA supports TCEQ for clearly identifying that these sections are not intended for inclusion into the EPA-approved Texas SIP.

2. EPA supports the inclusion of major sources of NOx located in Wise County to become subject to requirements of 30 TAC Chapter 117.

3. At the time of this review, Wise County is currently designated as nonattainment for the 2008 eight-hour ozone standard.

   Section 117.9030(a)(2) states: "Upon the date the commission publishes notice in the *Texas Register* that Wise County is no longer designated nonattainment for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard, the owner or operator of a unit located at a major stationary source of NOX located in Wise County is not required to comply with the requirements of Subchapter B, Division 4 of this chapter." This provision is not approvable as proposed because it does not contain a replicable procedure to change the applicability of a SIP requirement. EPA's designation of Wise County is currently under review in the D.C. Circuit Court of Appeals (*Mississippi Commission on Environmental Quality v. EPA*). We understand that the litigation outcome and potential subsequent rulemaking by EPA concerning Wise County are unknown at this time. Although we appreciate the commission's dilemma, if Wise County is no longer designated as nonattainment in the future, a publication by the commission in the Texas Register that Wise County is no longer designated non-attainment is not sufficient to change the applicability of requirements to sources in Wise County. Under CAA Section 110(i), this change would require a SIP revision submitted by TCEQ after completion of the State's rulemaking process.

ATTACHMENT 5

Technical Memorandum

March 2, 2023 STI-1922078-TM

To: Josh Stebbins, Sierra Club

From: Lynn Alley and Kenneth Craig, Sonoma Technology

Re: Analysis of Air Quality Impacts from Coal-Fired EGUs on Ozone Nonattainment areas in Colorado, Indiana, Kentucky, Missouri, and Texas

Introduction and Summary

Sonoma Technology performed source apportionment modeling using the Comprehensive Air Quality Model with Extensions (CAMx) with Ozone Source Apportionment Technology (OSAT) to support the Sierra Club in evaluating ozone impacts from coal-fired power plants and other emission sources on downwind receptors in nonattainment areas. The source apportionment modeling was conducted for the 2016 ozone season (April to October) for a domain covering the continental United States at 12-km spatial resolution, and results were compiled into a database with an online dashboard application that can be used for data mining and analysis.

The source apportionment modeling simulations relied on the U.S. Environmental Protection Agency (EPA) 2016v2 (2016fj_16j) modeling platform, which draws on emissions data from the EPA National Emissions Inventory and data developed by the National Emissions Inventory Collaborative.[1] This EPA modeling platform tends to underpredict maximum daily average 8-hr (MDA8) ozone concentrations for days when the MDA8 ozone is greater than or equal to 60 ppb. Modeling results for the monitoring sites included in this report generally follow this trend. Overall, EPA found that "the ozone model performance results for the CAMx 2016fj (2016v2) simulation are within or close to the ranges found in other recent peer-reviewed applications" and that "the model performance results demonstrate the scientific credibility" of the 2016v2 modeling platform" (U.S. Environmental Protection Agency, 2022b).

Biases in the modeled ozone concentrations can contribute to uncertainty in the source apportionment contribution results. To help mitigate this uncertainty, the source apportionment modeling results are used in a "relative" sense rather than an "absolute" sense where possible. For

[1] The National Emissions Inventory Collaborative is a partnership between state emissions inventory staff, multi-jurisdictional organizations, federal land managers, EPA, and others to develop a North American air pollution emissions modeling platform for use in air quality planning.

this report, relative source contributions were calculated based on a daily 8-hr average basis by multiplying the absolute modeled source contribution by ratio of the monitored concentration and the total modeled ozone value. This approach has been used in past ozone source apportionment modeling analyses (e.g., Craig et al., 2020) and is similar to methods used by EPA to calculate ozone source contributions from a photochemical grid model (U.S. Environmental Protection Agency, 2022b). Anchoring the modeled apportionment results to ambient monitoring data can help mitigate uncertainty associated with imperfect model performance (Foley et al., 2015; Jones et al., 2005). The EGU ozone source apportionment results in this report should be considered indicative of the types of ozone impacts that can be expected from these facilities. Additional details on the models, data, and methods used can be found in **Appendix A**.

The results from this source apportionment modeling were used to analyze impacts of emissions from several facilities with coal-fired electric generating units (EGUs) in Colorado, Indiana, Kentucky, Missouri, and Texas on air quality monitoring station (AQS) locations and in environmental justice (EJ) zip codes in state nonattainment areas. The collective impact of all coal-fired EGUs for selected facilities, and the individual impact of specific facilities/units that either under-utilize [2] or lack selective catalytic reduction (SCR) controls, were analyzed. Modeled contributions are shown on days when the monitored MDA8 ozone concentration exceeded the 2015 ozone standard (70 ppb) in moderate nonattainment areas and exceeded the 2008 ozone standard (75 ppb) in severe nonattainment areas.

In summary, the modeling results showed that on numerous days in 2016, emissions from selected coal-fired EGUs in each state (CO, IN, KY, MO, and TX) had combined impacts of greater than 1% of the NAAQS (i.e., impacts of 0.75 or 0.70 ppb) at AQS monitoring locations and EJ zip code receptors within ozone nonattainment areas. On many of these days, these significant EGU impacts coincided with days when monitored MDA8 ozone concentrations exceeded the ozone NAAQS. Some selected individual facilities with coal-fired EGUs also had impacts in nonattainment areas greater than 1% of the NAAQS on high ozone days. These facilities include Clifty Creek in IN, Mill Creek in KY, Labadie in MO, WA Parish in TX, and Limestone in TX.

2015 Moderate Ozone Nonattainment Areas

For each state of interest—Colorado, Kentucky, Indiana, Missouri, and Texas—collective modeled contributions from selected coal-fired EGUs within the state and modeled contributions from select individual facilities and units that under-utilize or lack SCR controls were evaluated. Impacts were analyzed on days when the observed MDA8 ozone concentration exceeded the 2015 ozone NAAQS of 70 ppb at AQS monitors located within a moderate nonattainment area in each state of interest. Modeled impacts were also evaluated at EJ zip codes in nonattainment areas on monitor exceedance days.

[2] A unit with a SCR that is not achieving the SCR's lowest demonstrated NO_x emissions capabilities. This is defined as a unit that is not operating within 25% of its lowest demonstrated 30 day NO_x emission rate.

Relative source contributions at monitoring locations are presented, with contributions that equal or exceed 1% of the NAAQS (0.70 ppb) highlighted in red and contributions that equal or exceed 0.5% of the NAAQS (0.35 ppb) highlighted in yellow. Relative source contributions from the model are calculated on an 8-hr average basis by multiplying the absolute modeled source contribution by the ratio of the monitored concentration and the total modeled ozone concentration. The resulting value gives a relative modeled contribution during a monitor exceedance day.

Modeled contributions at EJ zip codes in nonattainment areas are presented as absolute modeled concentrations since there are no ozone monitors at the EJ zip code locations. In **Appendix B**, tabular data for each state show monitoring MDA8 values compared with total modeled values on days when monitors exceeded the NAAQS.

Colorado

Impacts from all selected coal-fired EGUs in Colorado (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within Denver Metro/North Front Range, CO, 2015 moderate ozone nonattainment areas on days where the monitored MDA8 ozone concentrations in the nonattainment area exceeded the 70 ppb NAAQS.

Monitoring days in 2016 that exceeded 70 ppb in Colorado nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-1** in **Appendix B**. Modeled contributions from the selected coal-fired facilities in Colorado on those days are shown in **Table 1**.

Table 1. Modeled impacts from selected coal-fired EGUs[1] in Colorado (with or without SCR) at AQS monitors and EJ zip codes in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Aspen Park	Chatfield State Park	DENVER - CAMP	HIGHLAND RESERVOIR	La Casa	NATIONAL RENEWABLE ENERGY LABS - NREL	ROCKY FLATS-N	Welby	WELCH	80216	80223
6/16	0.14	0.08	0.23	0.04	0.23	0.24	0.24	0.22	0.13	0.21	0.09
6/17		0.36				0.41			0.36	0.28	0.25
6/18							0.94			0.62	0.48
6/19						0.55				0.57	0.50
6/26						0.47	0.45			0.45	0.49
6/27	1.31	1.40	1.24	1.31	1.24	1.40	1.27		1.40	1.17	1.17
6/28						0.82	0.84			0.70	0.68
7/7		0.21				0.36	0.31		0.27	0.39	0.30
7/12						0.14	0.14			0.20	0.21
7/14	0.28	0.29		0.27		0.30			0.27	0.23	0.22
7/16		0.43		0.48		0.52	0.44		0.46	0.55	0.53
7/17		0.82								0.74	0.67
7/19		0.18								0.24	0.21
7/22		0.29		0.34						0.43	0.28
7/25		0.99				1.10	1.07		1.01	0.90	0.90
7/27		0.94	1.03	0.89	1.03	1.03	0.96		0.93	0.83	0.80
7/28		1.09								0.94	0.96
7/29		1.08				1.09			0.98	0.71	0.67

Date	Aspen Park	Chatfield State Park	DENVER - CAMP	HIGHLAND RESERVOIR	La Casa	NATIONAL RENEWABLE ENERGY LABS - NREL	ROCKY FLATS-N	Welby	WELCH	80216	80223
7/30	1.01	1.00				0.93			1.06	0.75	0.76
8/2						0.73	0.77			0.60	0.55
8/3	1.77	1.65				1.50	1.44		1.45	1.21	1.23
8/7						1.01				0.76	0.82
8/12		0.58				0.53			0.51	0.55	0.51
8/16							0.82			0.80	0.77

[1] Selected coal-fired EGUs in Colorado include: Cherokee, Comanche, Craig (Yampa), Rawhide, and Ray D Nixon

Indiana

Impacts from all selected coal-fired EGUs in Indiana (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within the Indiana portion of the Louisville, KY-IN, and Chicago, IL-IN-WI, 2015 moderate ozone nonattainment areas on days where the monitored MDA8 ozone concentrations in the nonattainment area exceeded the 70 ppb NAAQS.

Monitoring days in 2016 that exceeded 70 ppb in Indiana nonattainment areas were compared with total modeled values from all sources and are presented in Table B-2 in Appendix B. Modeled contributions from the selected coal-fired facilities in Indiana on those days are shown in Table 2.

Table 2. Modeled impacts from selected coal-fired EGUs[1] in Indiana (with/without SCR) at AQS monitors and EJ zip codes in moderate ozone nonattainment areas, on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are red, and values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are yellow.

Date	Charlestown State Park	Gary-IITRI	HAMMOND CAAP	New Albany	Ogden Dunes-Water Treatment Plant	VALPARAISO
4/17		0.64			0.66	
4/18	0.43					1.19
4/19	0.84					
4/20	0.19			0.15		
5/24						0.37
6/9	0.88			0.81		
6/10	0.28	<0.01		0.27	<0.01	<0.01
6/11	1.71			1.79		
6/13				0.20		
6/19						1.73
6/25				1.58		
7/21	0.09					
7/27			0.06			
8/3		0.73	0.67		0.78	
8/10			0.65			

[1] Selected coal-fired EGUs in Indiana include: Cayuga, Clifty Creek, F.B. Culley, Michigan City, Petersburg, and Warrick

Kentucky

Impacts from all selected coal-fired EGUs in Kentucky (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within the Kentucky portion of the Louisville, KY-IN, and Cincinnati, OH-KY, 2015 moderate ozone nonattainment areas on days where the monitored MDA8 ozone concentrations in the nonattainment area exceeded the 70 ppb NAAQS. Impacts were also assessed for the Mill Creek Power Facility for all units combined, including Units 1 and 2 (without SCR controls) and Units 3 and 4 (with SCR controls).

Monitoring days in 2016 that exceeded 70 ppb in Kentucky nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-3** in **Appendix B**. Modeled contributions from the selected coal-fired facilities in Kentucky on those days are shown in **Table 3**. **Figure 1** shows the Mill Creek facility location and AQS ozone monitoring stations located in 2015 ozone moderate nonattainment areas. **Table 4** presents modeled contributions from the Mill Creek facility for all units combined, units without SCR, and units with SCR.

Table 3. Modeled Impacts from selected coal-fired EGUs[1] in Kentucky (with/without SCR) at AQS monitors in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Bates	BUCKNER	CANNONS LANE	NORTHERN KENTUCKY UNIVERSITY (NKU)	SHEPHERDSVILLE	Watson Lane
5/24		1.34	1.44	2.22		
6/3						0.74
6/10	2.54		4.10			
6/11	2.35	1.47	2.02	2.37		
6/13			0.42	0.22		2.25
6/25			2.45			
6/30	0.89		1.73			
7/19			0.89			
7/21			4.50			
7/23			4.29			
8/3			0.82			
9/14	0.56				0.88	0.68
9/23		0.86	0.52			
9/24	1.27		1.18			
9/25			1.50			

[1] Selected coal-fired EGUs in Kentucky include: E.W. Brown, Ghent, H.L Spurlock, J. Sherman Cooper, Mill Creek, Shawnee, and Trimble County

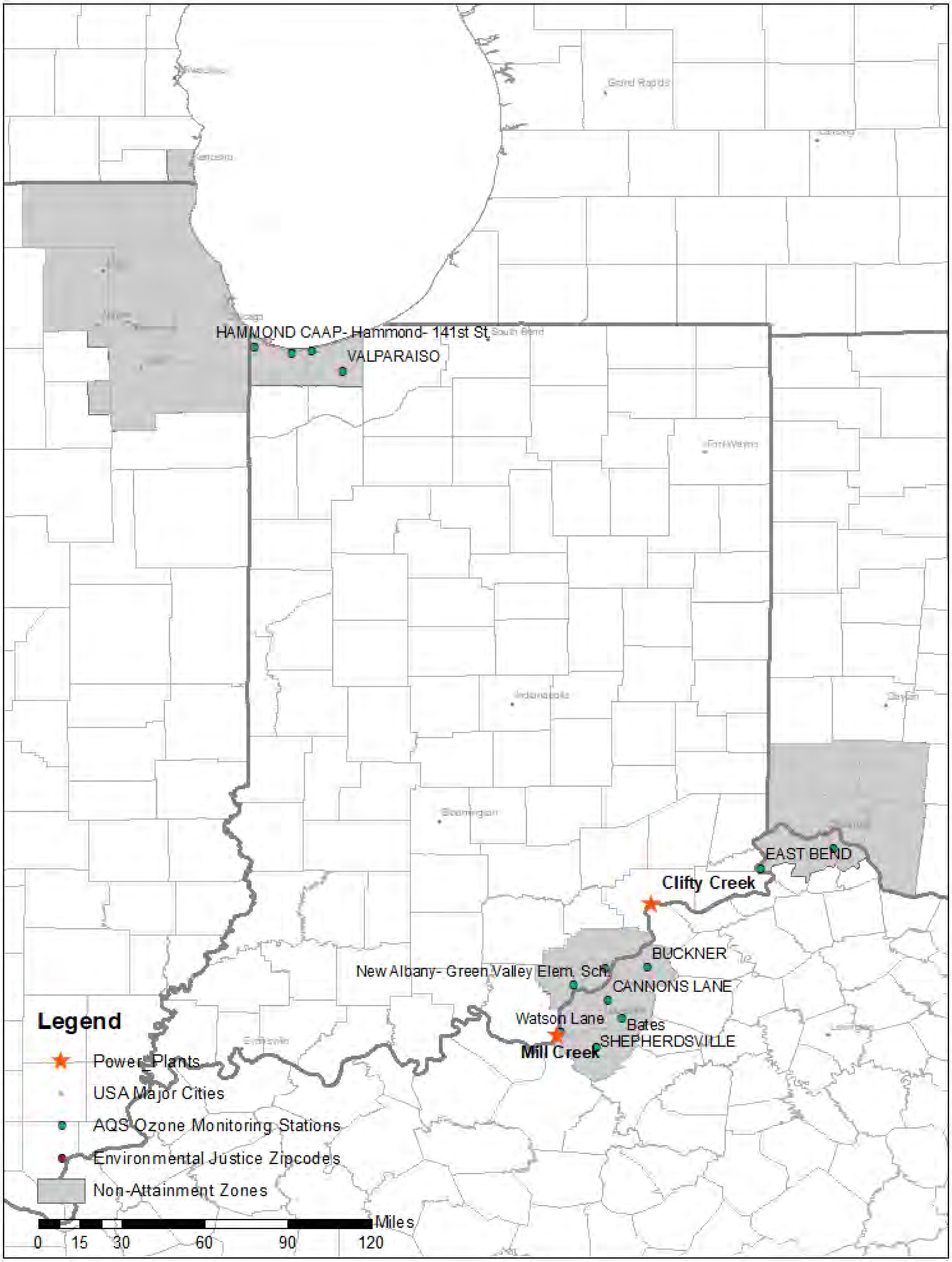


Figure 1. Kentucky Mill Creek facility location with AQS ozone monitoring locations that exceeded the NAAQS in 2015 ozone moderate nonattainment areas.

Table 4. Modeled impacts from **Mill Creek, KY**, facility at AQS monitors in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr modeled ozone contributions are relative values (ppb) at AQS monitors. Values from all units combined that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Contribution from Mill Creek sum of all units combined, (from Units 1 and 2 without SCR), [from Units 3 and 4 with SCR]

Date	Bates	BUCKNER	CANNONS LANE	NORTHERN KENTUCKY UNIVERSITY (NKU)	SHEPHERDSVILLE	Watson Lane
5/24		0.89 (0.82) [0.07]	1.04 (0.95) [0.08]	0.30 (0.28) [0.02]		
6/3						0.65 (0.55) [0.09]
6/10	2.04 (1.52) [0.52]		3.50 (2.59) [0.91]			
6/11	1.61 (1.08) [0.53]	0.61 (0.41) [0.20]	1.04 (0.70) [0.34]	0.09 (0.06) [0.03]		
6/13			0.11 (0.09) [0.02]			1.87 (1.46) [0.40]
6/25			1.42 (1.09) [0.32]			
6/30	0.55 (0.44) [0.11]		1.30 (1.03) [0.27]			
7/19			0.10 (0.07) [0.03]			
7/21			4.18 (3.41) [0.77]			
7/23			3.92 (2.87) [1.06]			
8/3			0.26 (0.21) [0.05]			
9/14	0.05 (0.04) [0.01]				0.49 (0.38) [0.11]	0.43 (0.33) [0.10]
9/23		0.63 (0.58) [0.05]	0.39 (0.35) [0.04]			
9/24	0.24 (0.21) [0.02]		0.23 (0.20) [0.02]			
9/25			0.72 (0.30) [0.42]			

Missouri

Impacts from all selected coal-fired EGUs in Missouri (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within the Missouri portion of the St. Louis, MO-IL, moderate ozone nonattainment area on days where the monitored MDA8 ozone concentrations in the nonattainment area exceeded the 70 ppb NAAQS. Impacts were also assessed for the Labadie Power Facility for all units combined, which include Units 1, 2, 3, and 4 (without SCR controls).

Monitoring days in 2016 that exceeded 70 ppb in Missouri nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-4** in **Appendix B**. Modeled contributions from the selected coal-fired facilities in Missouri on those days are shown in **Table 5**. **Figure 2** shows the Labadie facility location, AQS ozone monitoring stations and EJ zip codes located in 2015 ozone moderate nonattainment areas. **Table 6** presents modeled contributions from the Labadie facility.

Table 5. Modeled impacts from selected coal-fired[1] EGUs in Missouri (with/without SCR) at AQS monitors and EJ zip codes in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arnold West	Blair Street	Farrar	Maryland Heights	Orchard Farm	Pacific	West Alton	Zip 63031, 63042, 63044	Zip 63033	Zips 63103, 63104, 63106, 63107, 63108	Zips 63109, 63111, 63116, 63118, 63139	Zips 63112, 63113, 63115, 63120, 63133, 63147	Zips 63135, 63136, 63137, 63138	Zip 63801	Zip 63869
5/23					0.50		0.70	0.34	0.74	0.30	0.30	0.30	0.37	2.50	2.65
6/8				0.76				0.38	0.83	0.16	0.08	0.16	0.42	0.92	1.11
6/9							1.91	1.35	1.99	0.79	0.72	0.79	1.00	4.10	4.42
6/10			1.40				2.47	1.48	2.36	0.91	0.63	0.91	1.18	4.52	5.09
6/13							1.91	0.72	0.98	0.23	0.18	0.23	0.49	1.74	2.74
6/16				1.12				0.60	2.51	1.04	1.55	1.04	1.26	1.03	0.96
6/18	0.03			0.31	1.67	0.08	1.01	0.51	0.50	0.07	0.03	0.07	0.25	0.21	0.11
6/27						2.11		1.06	1.70	0.66	0.40	0.66	0.85	0.51	0.72
7/20				0.53				0.33	0.41	0.16	0.12	0.16	0.21	6.50	6.55
7/23				1.87				1.46	2.46	0.98	1.11	0.98	1.23	2.90	5.94
8/4					3.62		2.11	2.38	3.32	1.43	1.42	1.43	1.66	5.56	7.03
8/9	0.08	0.08		0.36			0.27	0.07	0.14	0.05	0.04	0.05	0.07	1.14	2.11
8/10					2.41		1.89	0.56	0.74	0.18	0.16	0.18	0.37	5.86	3.77
9/21					0.23			0.06	0.10	0.03	0.04	0.03	0.05	0.29	0.23
9/22					3.58		1.98	2.21	3.23	1.35	1.43	1.35	1.62	3.51	2.88
9/23		1.38			3.09		2.43	2.12	3.68	2.12	0.86	1.19	1.19	1.19	1.19
9/24					0.52		0.64	0.32	0.71	0.32	0.56	0.42	0.42	0.42	0.42

[1] Selected coal-fired EGUs in Missouri include: Hawthorn, John Twitty, Labadie, New Madrid, Sikeston, Sioux, and Thomas Hill

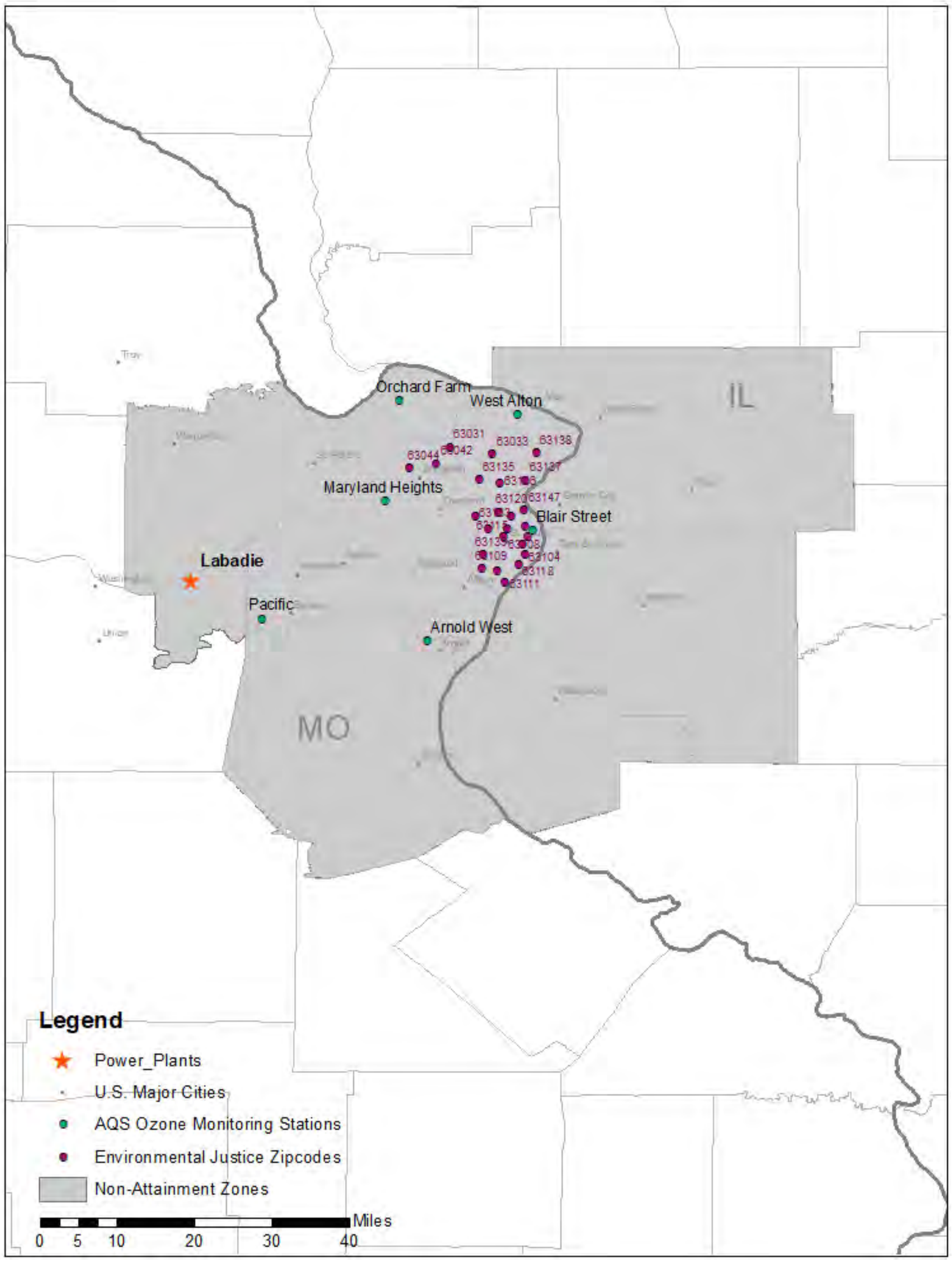


Figure 2. Missouri Labadie facility location with AQS ozone monitoring stations that exceeded the NAAQS and EJ zip codes located in 2015 ozone moderate nonattainment areas.

Table 6. Modeled impacts from **Labadie, MO**, facility (Units 1, 2, 3, 4 without SCR) at AQS monitors and EJ zip codes in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr modeled ozone contributions are relative values (ppb) at AQS Monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arnold West	Blair Street	Farrar	Maryland Heights	Orchard Farm	Pacific	West Alton	Zip 63031, 63042, 63044	Zip 63033	Zip 63103, 63104, 63106, 63107, 63108	Zip 63109, 63111, 63116, 63118, 63139	Zip 63112, 63113, 63115, 63120, 63133, 63147	Zip 63135, 63136, 63137, 63138	Zip 63801	Zip 63869
5/23					0.22		0.21	0.12	0.26	0.08	0.06	0.08	0.13	0.02	0.02
6/8				0.57				0.01	0.01	0.01	0.01	0.01	<0.01	0.16	0.24
6/9							0.74	0.92	0.93	0.26	0.13	0.26	0.46	0.09	0.08
6/10			0.06				1.10	1.30	1.86	0.72	0.42	0.72	0.93	0.04	0.04
6/13							0.24	0.49	0.34	0.10	0.06	0.10	0.17	0.01	<0.01
6/16				0.48				0.04	0.06	0.17	0.81	0.17	0.03	<0.01	<0.01
6/18	<0.01			<0.01	<0.01	0.04	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01
6/27						1.06		<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.13	0.16
7/20				0.48				0.27	0.20	0.08	0.03	0.08	0.10	0.06	0.09
7/23				1.35				0.67	0.89	0.44	0.52	0.44	0.45	0.03	0.02
8/4					1.87		0.43	1.19	1.05	0.65	0.65	0.65	0.53	0.06	0.05
8/9	0.04	0.04		0.31			0.03	0.05	0.05	0.02	0.02	0.02	0.02	0.01	0.01
8/10					0.34		0.06	0.08	0.10	0.04	0.03	0.04	0.05	<0.01	<0.01
9/21					0.12			0.02	0.03	0.01	0.01	0.01	0.02	<0.01	<0.01
9/22					1.50		0.28	0.56	0.35	0.09	0.04	0.09	0.18	<0.01	<0.01

Date	Arnold West	Blair Street	Farrar	Maryland Heights	Orchard Farm	Pacific	West Alton	Zip 63031, 63042, 63044	Zip 63033	Zip 63103, 63104, 63106, 63107, 63108	Zip 63109, 63111, 63116, 63118, 63139	Zip 63112, 63113, 63115, 63120, 63133, 63147	Zip 63135, 63136, 63137, 63138	Zip 63801	Zip 63869
9/23		0.91			2.51		1.40	1.64	2.58	0.79	0.46	0.79	1.29	<0.01	<0.01
9/24					0.24		0.02	0.03	0.02	0.01	<0.01	0.01	0.01	<0.01	<0.01

Texas

Impacts from all selected coal-fired EGUs in Texas (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within 2015 moderate ozone nonattainment areas (Dallas-Fort Worth, Houston-Galveston-Brazoria, and San Antonio) on days where monitoring concentrations exceeded the 70 ppb NAAQS. Impacts were also assessed for several individual facilities with coal-fired units that lacked or under-utilized SCR controls.

Monitoring days in 2016 that exceeded 70 ppb in Texas nonattainment areas were compared with total modeled values from all sources and are presented for the ozone nonattainment areas in **Appendix B** for Dallas-Fort Worth (**Table B-5)**, Houston-Galveston-Brazoria (**Table B-6**), and San Antonio (**Table B-7**). Modeled contributions from the coal-fired facilities in Texas on those days in each nonattainment area are shown in **Tables 7 through 9. Table 10** shows individual Texas facilities that have modeled contributions ≥ 0.5% of the NAAQS (0.35 ppb) on monitored 2016 NAAQS exceedance day/s. **Figure 3** shows locations of facilities listed in **Table 10**, AQS ozone monitoring stations, and EJ zip codes located in 2015 ozone moderate nonattainment areas. **Tables 11 through 19** present modeled contributions from the individual facilities in nonattainment areas where the facility had modeled contributions ≥ 0.5% of the NAAQS (0.35 ppb).

Table 7. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		0.01											0.01	0.01
6/7	0.04	0.08	0.03	0.04		0.01	0.02		0.01	0.01	0.01		0.03	0.03
6/8					2.02							1.83	1.56	1.59
6/9					0.88							0.65	0.79	0.92
6/10					0.74								0.86	0.76
6/20			1.22		1.20				1.08				0.89	0.90
6/29										0.33			0.33	0.36
6/30					0.63			0.39	0.40			0.61	0.28	0.29
7/1					0.87			0.72	0.62			1.00	0.64	0.71
7/26							1.60			1.41			0.96	1.00
8/5								0.37				0.44	0.28	0.32
8/31		0.38											0.27	0.33
9/11			0.36										0.27	0.38
9/20									2.25				2.00	2.48
9/21					0.67				0.55				0.38	0.32
9/22					0.79							0.74	0.73	0.59
10/1								0.03				0.01	0.07	0.08
10/3		0.88			0.46								0.28	0.23

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Twin Oaks, Tolk, WA Parish, and Welsh

Table 8. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	Zip 77479
4/3			0.31										0.48	0.47	0.44
4/5	0.44												0.33	0.26	0.72
4/7		0.54											0.36	0.27	0.84
4/14		0.37											0.79	0.87	0.70
4/15				0.27				0.26					0.78	0.55	0.35
4/23		0.06	0.09	0.29				0.54		0.13		0.35	1.58	1.56	1.20
4/27	0.39		0.61										0.28	0.22	1.50
5/4		0.66											0.37	0.37	0.26
5/6				0.94			0.60	1.04		0.67			2.04	1.77	1.47
5/7	0.25	<0.01	0.22										0.50	0.51	0.67
5/13				0.65				0.68					1.42	1.31	0.86
6/8		0.04			0.21			0.30					2.79	1.51	0.85
7/21			0.28							0.27		0.74	1.17	1.68	0.94
7/22			0.32										1.42	1.20	1.32
8/3			0.23										0.87	0.68	0.67
8/4	0.28												0.82	0.68	0.65
9/21					0.07								0.96	0.50	0.21
9/28						0.41					0.92		1.03	0.65	0.69
9/29									0.64				0.47	0.38	0.31
10/2					0.02						0.01		0.73	0.41	0.15
10/3								0.07					0.67	0.37	0.23
10/10								0.07					1.43	1.09	0.52
10/26			0.09										0.85	0.71	0.43

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Tolk, Twin Oaks, WA Parish, and Welsh

Table 9. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the San Antonio ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Calaveras Lake	Camp Bullis	San Antonio Northwest	Zip 78101	Zip 78112	Zip 78221	Zip 78223	Zip 78263	Zip 78264
5/5			0.16	0.33	0.56	0.38	0.37	0.33	0.62
5/6			1.64	1.43	1.03	1.53	1.58	1.43	1.09
9/28	0.46			0.28	0.20	0.09	0.14	0.28	0.13
10/2		1.56	1.50	2.13	2.32	2.43	2.44	2.13	2.49
10/11		1.06	1.04	1.30	1.28	1.09	1.21	1.30	1.24

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Tolk, Twin Oaks, TWA Parish, and Welsh

Table 10. Individual Texas facilities and units that have modeled contributions ≥ 0.5% of the NAAQS (0.35 ppb) on monitored 2016 NAAQS exceedance days

Facility	Modeled Units
WA Parish, TX	5, 6, 7, and 8 combined ('with SCR')
Fayette Power Project, TX	1, 2, and 3 combined ('No SCR')
JK Spruce, TX	1 ('No SCR') 2 ('With SCR') (contributions shown combined)
Limestone, TX	1, and 2 combined ('No SCR')
Martin Lake, TX	1, 2, and 3 combined ('No SCR')
Welsh, TX	1 and 3 combined ('No SCR')

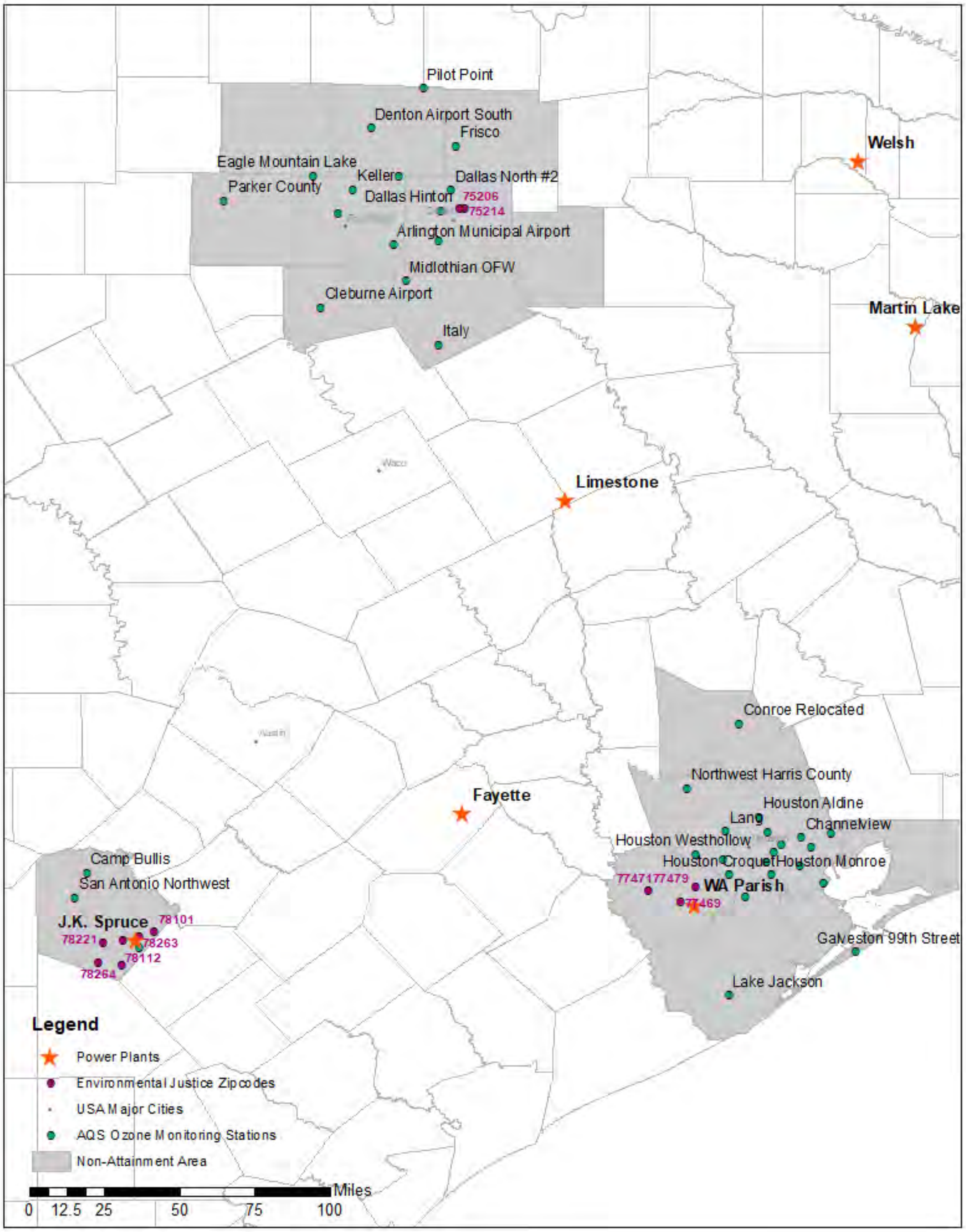


Figure 3. Facility locations with AQS ozone monitoring stations that exceeded that NAAQS and EJ zip codes located in 2015 ozone moderate nonattainment areas.

Table 11. Modeled impacts from WA Parish facility (Units 5, 6, 7, 8 combined, with SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollo w	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
4/3			0.03										0.13	0.09	0.14
4/5	0.14												0.18	0.12	0.56
4/7		0.06											0.15	0.05	0.66
4/14		0.01											0.03	0.01	0.02
4/15				0.07				0.07					0.61	0.36	0.20
4/23		<0.01	0.01	0.20				0.46		0.05		0.27	1.49	1.48	1.12
4/27	0.29		0.58										0.27	0.20	1.48
5/4		0.11											0.02	<0.01	0.01
5/6				0.12			<0.01	0.32		0.02			1.33	1.11	0.78
5/7	0.06	<0.01	0.02										0.26	0.25	0.48
5/13				0.26				0.32					1.30	1.15	0.65
6/8		0.01			0.10			0.13					2.70	1.35	0.75
7/21			0.28							0.27		0.71	1.17	1.68	0.94
7/22			0.31										1.42	1.19	1.32
8/3			0.21										0.86	0.68	0.67
8/4	0.21												0.80	0.65	0.62
9/21					0.01								0.91	0.44	0.15

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
9/28						0.08					0.54		0.58	0.08	0.26
9/29									0.18				0.12	<0.01	0.01
10/2					0.01						<0.01		0.73	0.40	0.14
10/3								0.05					0.65	0.36	0.22
10/10								0.06					1.43	1.09	0.52
10/26			0.01										0.81	0.66	0.38

Table 12. Modeled impacts from **Fayette** facility (Units 1, 2, 3 combined, without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01											<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					<0.01							<0.01	<0.01	<0.01

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/9					0.26							0.19	0.18	0.19
6/10					0.12								0.10	0.10
6/20			0.54		0.51				0.48				0.40	0.40
6/29										0.02			0.02	0.02
6/30					0.01			0.01	0.01			0.01	0.01	0.01
7/1					0.23			0.13	0.18			0.14	0.16	0.16
7/26							0.15			0.13			0.08	0.08
8/5								0.09				0.13	0.04	0.05
8/31		<0.01											<0.01	<0.01
9/11			<0.01										<0.01	<0.01
9/20									0.77				0.76	0.82
9/21					0.01				0.01				0.01	0.01
9/22					0.01							<0.01	0.01	<0.01
10/1								<0.01				<0.01	<0.01	<0.01
10/3		0.09			0.01								<0.01	<0.01

Table 13. Modeled impacts from JK Spruce facility (Unit 1, no SCR + Unit 2, with SCR combined) at AQS monitors and EJ zip codes in the San Antonio ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Calaveras Lake	Camp Bullis	San Antonio Northwest	Zip 78101	Zip 78112	Zip 78221	Zip 78223	Zip 78263	Zip 78264
5/5			0.16	0.33	0.55	0.38	0.36	0.33	0.60
5/6			0.81	0.65	0.13	0.71	0.79	0.65	0.15
9/28	0.42			0.25	0.16	0.05	0.11	0.25	0.09
10/2		0.58	0.61	1.28	1.46	1.61	1.62	1.28	1.62
10/11		0.23	0.11	0.76	0.54	0.31	0.56	0.76	0.29

Table 14. Modeled impacts from Limestone facility (Units 1, 2 combined, no SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01											<0.01	<0.01

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/7	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					0.86							0.63	0.48	0.39
6/9					0.02							0.07	0.28	0.40
6/10					0.47								0.64	0.54
6/20			0.06		0.21				0.11				0.04	0.04
6/29										0.03			0.02	0.02
6/30					0.39			0.05	0.22			0.12	0.07	0.04
7/1					0.37			0.35	0.20			0.62	0.14	0.20
7/26							0.71			0.51			0.33	0.30
8/5								0.02				0.02	0.05	0.07
8/31		<0.01											<0.01	<0.01
9/11			<0.01										<0.01	<0.01
9/20									0.65				0.56	0.73
9/21					0.23				0.22				0.13	0.07
9/22					0.55							0.36	0.52	0.34
10/1								<0.01				<0.01	0.02	0.02
10/3		0.50			0.33								0.20	0.12

Table 15. Modeled impacts from **Limestone** facility (Units 1, 2 combined, no SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.70 ppb). Values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
4/3			0.19										0.18	0.19	0.17
4/5	0.04												0.04	0.04	0.04
4/7		0.44											0.14	0.09	0.13
4/14		0.23											0.57	0.65	0.51
4/15				0.12				0.10					0.10	0.11	0.09
4/23		0.01	<0.01	0.01				0.01		<0.01		0.01	0.02	0.02	0.01
4/27	<0.01		<0.01										<0.01	<0.01	<0.01
5/4		0.04											0.08	0.09	0.09
5/6				<0.01			<0.01	<0.01		<0.01			<0.01	0.01	<0.01
5/7	0.01	<0.01	0.01										0.03	0.04	0.02
5/13				0.13				0.12					0.05	0.06	0.07
6/8		<0.01			<0.01			<0.01					<0.01	<0.01	<0.01
7/21			<0.01							<0.01		<0.01	<0.01	<0.01	<0.01
7/22			<0.01										<0.01	<0.01	<0.01
8/3			<0.01										<0.01	<0.01	<0.01

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
8/4	0.01												0.01	0.01	0.01
9/21					0.01								0.01	0.01	0.01
9/28						0.03					0.08		0.17	0.28	0.16
9/29									0.27				0.15	0.11	0.11
10/2					<0.01						<0.01		<0.01	<0.01	<0.01
10/3								<0.01					<0.01	<0.01	<0.01
10/10								<0.01					<0.01	<0.01	<0.01
10/26			0.01										0.01	0.01	0.01

Table 16. Modeled impacts from Limestone facility (Units 1, 2 combined, no SCR) at AQS monitors and EJ zip codes in the San Antonio ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.70 ppb). Values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Calaveras Lake	Camp Bullis	San Antonio Northwest	Zip 78101	Zip 78112	Zip 78221	Zip 78223	Zip 78263	Zip 78264
5/5			0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
5/6			<0.01	0.35	0.35	0.34	0.35	0.35	0.35
9/28	<0.01			0.01	0.01	0.01	0.01	0.01	0.01

10/2		0.01	<0.01	0.07	0.08	0.10	0.08	0.07	0.09
10/11		<0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table 17. Modeled impacts from Martin Lake facility (Units 1, 2, 3 combined, no SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01											<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					0.54							0.60	0.71	0.85
6/9					0.11							0.08	0.06	0.06
6/10					<0.01								<0.01	<0.01
6/20			0.04		0.07				0.06				0.04	0.04
6/29										0.09			0.08	0.10
6/30					0.20			0.30	0.15			0.42	0.17	0.22
7/1					0.05			0.06	0.04			0.07	0.05	0.05

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
7/26							0.35			0.42			0.41	0.49
8/5								0.03				0.03	0.03	0.04
8/31		0.02											<0.01	<0.01
9/11			<0.01										<0.01	<0.01
9/20									0.11				0.24	0.49
9/21					0.36				0.27				0.21	0.22
9/22					0.18							0.36	0.16	0.23
10/1								<0.01				<0.01	<0.01	0.01
10/3		0.02			0.08								0.06	0.10

Table 18. Modeled impacts from Welsh facility (Units 1, 3 combined, no SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.70 ppb). Values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		0.01											0.01	0.01
6/7	0.03	0.06	0.03	0.04		0.01	0.02		0.01	0.01	0.01		0.03	0.03
6/8					0.38							0.42	0.35	0.34
6/9					0.02							0.02	0.01	0.01
6/10					<0.01								<0.01	<0.01
6/20			0.01		0.04				0.02				0.01	0.01
6/29										0.13			0.17	0.20
6/30					0.02			0.01	0.02			0.02	0.01	0.01
7/1					0.01			0.01	0.01			0.01	0.01	0.01
7/26							0.01			0.02			0.01	0.02
8/5								0.01				0.01	0.01	0.01
8/31		0.30											0.26	0.31
9/11			0.26										0.26	0.37

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
9/20									0.01				0.02	0.04
9/21					0.02				0.02				0.01	0.01
9/22					<0.01							<0.01	<0.01	<0.01
10/1								0.02				0.01	0.04	0.05
10/3		<0.01			<0.01								<0.01	<0.01

Table 19. Modeled impacts from **Welsh** facility (Units 1, 3 combined, no SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
4/3			0.01										<0.01	<0.01	<0.01
4/5	<0.01												0.01	0.01	0.01
4/7		<0.01											<0.01	<0.01	<0.01

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
4/14		0.02											0.03	0.03	0.02
4/15				0.01				0.01					0.01	0.01	0.01
4/23		0.03	0.06	0.07				0.06		0.06		0.05	0.04	0.04	0.05
4/27	<0.01		<0.01										<0.01	<0.01	<0.01
5/4		0.32											0.01	0.01	0.01
5/6				0.58			0.43	0.54		0.48			0.49	0.45	0.48
5/7	0.08	<0.01	0.08										0.07	0.07	0.06
5/13				0.08				0.07					0.02	0.03	0.05
6/8		0.01			0.02			0.03					0.02	0.03	0.02
7/21			<0.01							<0.01		<0.01	<0.01	<0.01	<0.01
7/22			<0.01										<0.01	<0.01	<0.01
8/3			<0.01										<0.01	<0.01	<0.01
8/4	0.01												<0.01	<0.01	<0.01
9/21					0.01								0.01	0.01	0.01
9/28						0.01					0.01		0.01	0.01	0.01
9/29									<0.01				<0.01	<0.01	<0.01
10/2					<0.01						<0.01		<0.01	<0.01	<0.01
10/3								<0.01					<0.01	<0.01	<0.01
10/10								<0.01					<0.01	<0.01	<0.01
10/26			0.01										<0.01	<0.01	<0.01

2008 Severe Ozone Nonattainment Areas

For Colorado and Texas, collective modeled contributions from selected coal-fired EGUs within the state, as well as modeled contributions from select individual facility and units that under-utilize or lack SCR controls, were evaluated. Impacts were analyzed on days when the observed MDA8 ozone concentration exceeded the 2015 ozone NAAQS of 75 ppb at AQS monitors located within a severe nonattainment area in each state of interest. Modeled impacts were also estimated at EJ zip codes in nonattainment areas on monitor exceedance days.

Relative source contributions at monitoring locations are also presented, with contributions that equal or exceed 1% of the NAAQS (0.75 ppb) highlighted in red and contributions that equal or exceed 0.5% of the NAAQS (≈0.37 ppb) highlighted in yellow. Relative source contributions from the model are calculated on an 8-hr average basis by multiplying the absolute modeled source contribution by the ratio of the monitored concentration and the total modeled ozone concentration. The resulting value gives a relative modeled contribution during a monitor exceedance day.

Modeled contributions at EJ zip codes in nonattainment areas are presented as absolute modeled concentrations since there are no ozone monitors at the EJ zip code locations. In **Appendix B**, tabular data for each state show monitoring MDA8 values compared with total modeled values on days when monitors exceeded the NAAQS.

Colorado

Impacts from selected coal-fired EGUs in Colorado (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within the Denver-Boulder-Greely-Ft. Collins-Loveland 2008 severe ozone nonattainment area on days where the monitored MDA8 ozone concentrations exceeded the 75 ppb NAAQS.

Monitoring days in 2016 that exceeded 75 ppb in Colorado nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-8** in **Appendix B**. Modeled contributions from the coal-fired facilities in Colorado on those days are shown in **Table 20**.

Table 20. Modeled impacts from selected coal-fired EGUs[1] in Colorado (with/without SCR) at AQS monitors and EJ zip codes in severe ozone nonattainment areas on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Aspen Park	Chatfield State Park	HIGHLAND RESERVOIR	NATIONAL RENEWABLE ENERGY LABS - NREL	ROCKY FLATS-N	WELCH	Zip 80216	Zip 80223
6/16	0.14			0.24	0.24		0.21	0.09
6/18					0.94		0.62	0.48
6/19				0.55			0.57	0.50
6/27		1.39		1.39	1.27	1.39	1.17	1.17
6/28					0.84		0.70	0.68
7/7				0.36			0.39	0.30
7/14		0.29		0.30			0.23	0.22
7/16		0.43		0.52			0.55	0.53
7/25				1.10	1.07	1.01	0.90	0.90
7/27		0.94	0.88	1.03	0.96	0.93	0.83	0.80
7/29				1.08			0.71	0.67
7/30		1.00					0.75	0.76
8/3		1.65		1.50			1.21	1.23

[1] Selected coal-fired EGUs in Colorado include: Cherokee, Comanche, Craig (Yampa), Rawhide, and Ray D Nixon

Texas

Impacts from all selected coal-fired EGUs in Texas (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within 2008 severe ozone nonattainment areas (Dallas-Fort Worth and Houston-Galveston-Brazoria) on days where monitoring concentrations exceeded the 75 ppb NAAQS. Impacts were also assessed for several facilities that had units that lacked or under-utilized SCR controls.

Monitoring days in 2016 that exceeded 75 ppb in Texas nonattainment areas were compared with total modeled values from all sources and are presented in **Appendix B** for the Dallas-Fort Worth (**Table B-9**) and Houston-Galveston-Brazoria (**Table B-10**) nonattainment areas. Modeled contributions from all selected coal-fired facilities in Texas on those days in each nonattainment area are shown in **Tables 21 and 22**. **Table 23** shows individual Texas facilities that have modeled contributions ≥ 0.5% of the NAAQS (0.37 ppb) on monitored 2008 NAAQS exceedance day/s. **Figure 3** shows locations of facilities listed in **Table 23**, AQS ozone monitoring stations, and EJ zip codes located in 2015 ozone moderate nonattainment areas. **Tables 24 through 29** present modeled contributions from the individual facilities in nonattainment areas where the facility had modeled contributions ≥ 0.5% of the NAAQS (0.37 ppb).

Table 21. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area, on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		0.01										0.01	0.01
6/7	0.04	0.08	0.03	0.04		0.02		0.01	0.01	0.01		0.03	0.03
6/8					2.02						1.83	1.56	1.59
6/20								1.08				0.89	0.90
6/30					0.63		0.39	0.40			0.61	0.28	0.29
7/1					0.87		0.72					0.64	0.71

8/31		0.38										0.27	0.33
9/21					0.67							0.38	0.32

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Tolk, Twin Oaks, WA Parish, and Welsh

Table 22. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area, on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, , while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Westhollow	Lang	Northwest Harris County	Zip 77469	Zip 77471	Zip 77479
4/15				0.27	0.26			0.78	0.55	0.35
4/23		0.06		0.29	0.54	0.13	0.35	1.58	1.56	1.20
5/4		0.66						0.37	0.37	0.26
5/6				0.94	1.04	0.67		2.04	1.77	1.47
5/7	0.25							0.50	0.51	0.67
5/13				0.65				1.42	1.31	0.86
6/8					0.30			2.79	1.51	0.85
7/21							0.74	1.17	1.68	0.94
7/22			0.32					1.42	1.20	1.32
8/3			0.23					0.87	0.68	0.67
10/3					0.07			0.67	0.37	0.23
10/10					0.07			1.43	1.09	0.52

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Tolk, Twin Oaks, WA Parish, and Welsh

Table 23. Individual Texas facilities and units that have modeled contributions ≥ 0.5% of the NAAQS (0.37 ppb) on monitored 2008 NAAQS exceedance days

Facility	Modeled Units
WA Parish, TX	5, 6, 7, and 8 combined ('with SCR')
Fayette Power Project, TX	1, 2, and 3 combined ('No SCR')
Limestone, TX	1, and 2 combined ('No SCR')
Martin Lake, TX	1, 2, and 3 combined ('No SCR')
Welsh, TX	1 and 3 combined ('No SCR')

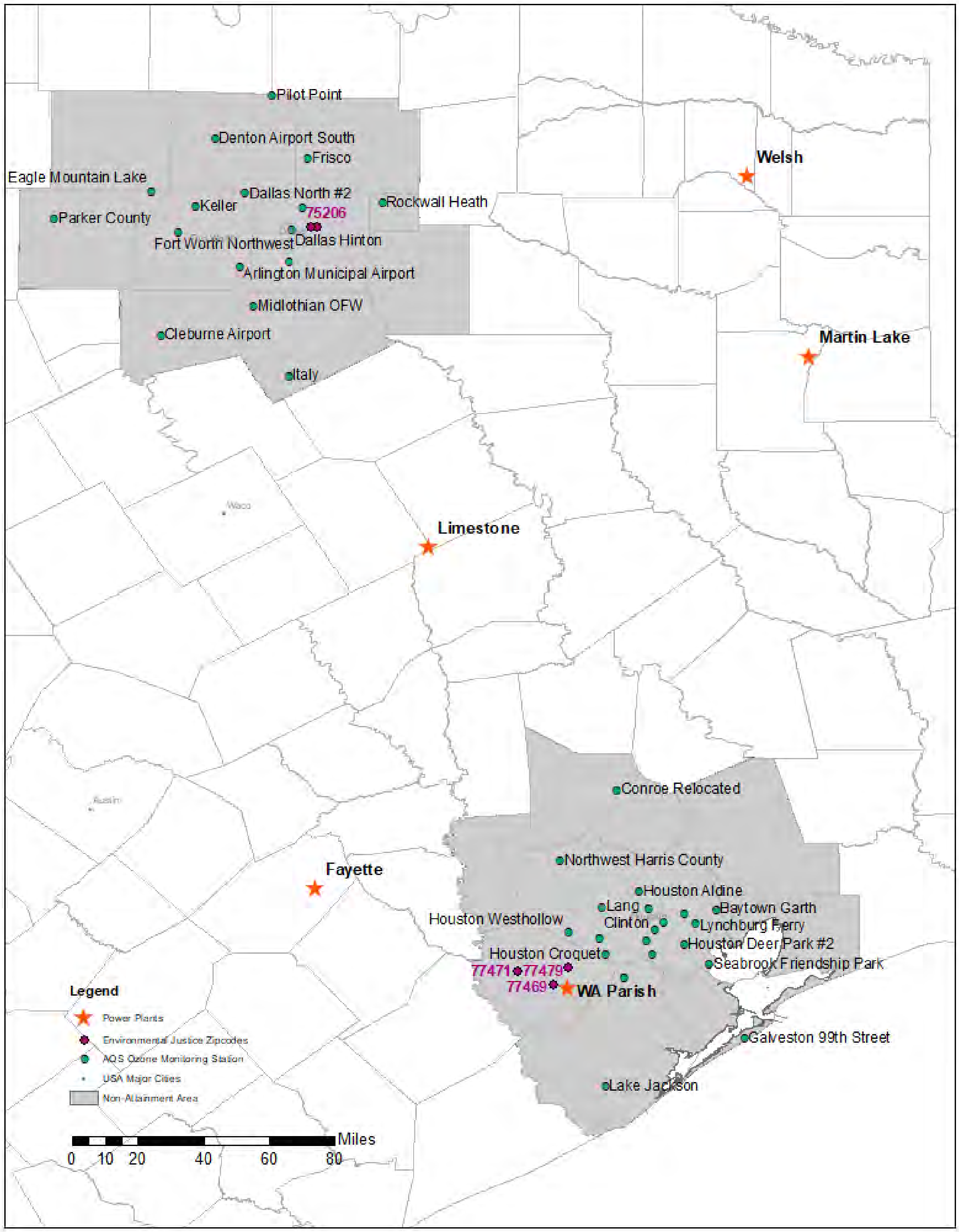


Figure 4. Facility locations with AQS ozone monitoring stations that exceeded the NAAQS and EJ zip codes located in 2008 ozone severe nonattainment areas.

Table 24. Modeled impacts from **WA Parish** facility (Units 5, 6, 7, 8 combined, with SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Westhollow	Lang	Northwest Harris County	Zip 77469	Zip 77471	Zip 77479
4/15				0.07	0.07			0.61	0.36	0.20
4/23		<0.01		0.20	0.46	0.05	0.27	1.49	1.48	1.12
5/4		0.11						0.02	<0.01	0.01
5/6				0.12	0.32	0.02		1.33	1.11	0.78
5/7	0.06							0.26	0.25	0.48
5/13				0.26				1.30	1.15	0.65
6/8					0.13			2.70	1.35	0.75
7/21							0.71	1.17	1.68	0.94
7/22			0.31					1.42	1.19	1.32
8/3			0.21					0.86	0.68	0.67
10/3					0.05			0.65	0.36	0.22
10/10					0.06			1.43	1.09	0.52

Table 25. Modeled impacts from **Fayette** facility (Units 1, 2, 3 combined, without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.75 ppb). Values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01										<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					<0.01						<0.01	<0.01	<0.01
6/20								0.48				0.40	0.40
6/30					0.01		0.01	0.01			0.01	0.01	0.01
7/1					0.23		0.13					0.16	0.16
8/31		<0.01										<0.01	<0.01
9/21					0.01							0.01	0.01

Table 26. Modeled impacts from **Limestone** facility (Units 1 and 2 without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01										<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					0.86						0.63	0.48	0.39
6/20								0.11				0.04	0.04
6/30					0.39		0.05	0.22			0.12	0.07	0.04
7/1					0.37		0.35					0.14	0.20
8/31		<0.01										<0.01	<0.01
9/21					0.23							0.13	0.07

Table 27. Modeled impacts from Martin Lake facility (Units 1, 2, and 3 combined without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. . Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01										<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					0.54						0.60	0.71	0.85
6/20								0.06				0.04	0.04
6/30					0.20		0.30	0.15			0.42	0.17	0.22
7/1					0.05		0.06					0.05	0.05
8/31		0.02										<0.01	<0.01
9/21					0.36							0.21	0.22

Table 28. Modeled impacts from Welsh facility (Units 1 and 3 without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.75 ppb). Values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		0.01										0.01	0.01
6/7	0.03	0.06	0.03	0.04		0.02		0.01	0.01	0.01		0.03	0.03
6/8					0.38						0.42	0.35	0.34
6/20								0.02				0.01	0.01
6/30					0.02		0.01	0.02			0.02	0.01	0.01
7/1					0.01		0.01					0.01	0.01
8/31		0.30										0.26	0.31
9/21					0.02							0.01	0.01

Table 29. Modeled impacts from Welsh facility (Units 1 and 3 without SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.75 ppb). Values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Westhollow	Lang	Northwest Harris County	Zip 77469	Zip 77471	Zip 77479
4/15				0.01	0.01			0.01	0.01	0.01
4/23		0.03		0.07	0.06	0.06	0.05	0.04	0.04	0.05
5/4		0.32						0.01	0.01	0.01
5/6				0.58	0.54	0.48		0.49	0.45	0.48
5/7	0.08							0.07	0.07	0.06
5/13				0.08				0.02	0.03	0.05
6/8					0.03			0.02	0.03	0.02
7/21							<0.01	<0.01	<0.01	<0.01
7/22			<0.01					<0.01	<0.01	<0.01
8/3			<0.01					<0.01	<0.01	<0.01
10/3					<0.01			<0.01	<0.01	<0.01
10/10					<0.01			<0.01	<0.01	<0.01

Appendix A. Modeling Methods

Photochemical Grid Model and Source Apportionment

To quantify the ozone impacts due to precursor emissions from individual EGUs and other emission source groups, Sonoma Technology performed CAMx OSAT source apportionment model simulations for the 2016 ozone season (April to October). The modeling domain covers all lower 48 U.S. states, plus adjacent portions of Canada and Mexico, using a horizontal grid resolution of 12 km x 12 km. The domain and configurations used were based on those developed by EPA in recent ozone transport assessments using CAMx OSAT (U.S. Environmental Protection Agency, 2022a), and included the use of the carbon-bond 6 gas phase chemistry mechanism and the two-mode course/fine (CF) aerosol chemistry mechanism.

The Comprehensive Air Quality Model with Extensions (CAMx version 7.10) (Ramboll US Corporation, 2020) is a publicly available, peer-reviewed, state-of-the-science three-dimensional grid-based (Eulerian) photochemical air quality model designed to simulate the emission, transport, diffusion, chemical transformation, and removal of gaseous and particle pollutants in the atmosphere over spatial scales ranging from continental to urban. CAMx was designed to approach air quality wholistically by including capabilities for modeling multiple air quality issues, including tropospheric ozone, fine particles, visibility degradation, acid deposition, air toxics, and mercury. The ability of photochemical grid models, such as CAMx, to treat a large number of sources and their chemical interactions makes them well suited for assessing the impacts of natural and anthropogenic emissions sources on air quality. CAMx is widely used to support regulatory air quality assessments and air quality management policy decisions in the United States. In recent years, the EPA has used CAMx to support the NAAQS designation process (U.S. Environmental Protection Agency, 2015) and evaluate interstate pollutant transport (U.S. Environmental Protection Agency 2015a, 2021a, 2022a).

CAMx also includes OSAT, which can be used to estimate the contributions of individual sources, groups of sources, or source regions to ozone concentrations at a given receptor location (Yarwood et al., 1996). Source apportionment modeling is useful for understanding model performance, designing emission control strategies, and performing culpability assessments to identify emission sources that contribute significantly to pollution. The key precursor species for ozone production are volatile organic compounds (VOC) and oxides of nitrogen (NO_x). OSAT uses reactive tracers to track the fate of these precursor emissions and the ozone formation resulting from them within a CAMx simulation. The ozone and precursors are tracked and apportioned by OSAT without perturbing the host model chemistry; therefore, the OSAT results are fully consistent with the host model results for total concentrations. OSAT can efficiently estimate source contributions from multiple emission sources within a single model simulation. Importantly, while source apportionment modeling can be used to estimate source contributions to ozone concentrations for a given set of emission inputs, sensitivity modeling approaches such as brute-force modeling[3] or the direct decoupled method (DDM)[4] are needed to quantify the effect of a given emission control scenario (e.g., 90% NO_x reduction at power plants) on ozone concentrations.

2016 EPA Model Platform

The CAMx OSAT simulations were based on EPA's 2016 air quality modeling platform. A modeling platform consists of a structured system of connected data and models that provide a consistent and transparent basis for assessing the air quality impact of anticipated changes in emissions. EPA develops and evaluates a new modeling platform each time the National Emissions Inventory (NEI) is updated (every three years). EPA has recently used the 2016 modeling platform to support the proposed Federal Implementation Plan ("Transport Rule") to help states fully resolve their obligations under the "Good Neighbor" provision of the Clean Air Act for the 2015 ozone NAAQS (U.S. Environmental Protection Agency, 2022a).

The CAMx OSAT simulations relied on EPA's 2016v2 (2016fj_16j) modeling platform. This platform draws on emissions data from the 2017 NEI (released spring of 2020) and data developed by the National Emissions Inventory Collaborative.[5] The NEI is compiled by EPA on a triennial basis, primarily from data submitted by state, local, and tribal air agencies. The 2017 NEI includes emissions from five source sectors: point sources, nonpoint (or area) sources, onroad mobile sources, nonroad mobile sources, and fire events. These NEI source sectors are divided into 20 sectors for the modeling platform. For the 2016v2 modeling platform, EPA updated the 2017 NEI data to represent year 2016 through the incorporation of 2016-specific state and local data along with adjustment methods appropriate for each emission sector.

For air quality modeling purposes, the 2016 NEI data was augmented by EPA to include biogenic emissions and data from Canadian and Mexican emissions inventories. In addition, the annualized point source data for EGUs in the NEI were replaced with hourly 2016 continuous emissions monitoring (CEMS) data from EPA's Clean Air Markets Division for SO_2 and NO_x. Annual emissions for pollutants were converted to an hourly basis using CEMS input data (U.S. Environmental Protection Agency, 2022c). The EGUs in the modeling platform are matched to units found in the National Electric Energy Data System (NEEDS) v6.20 database.[6] Onroad and nonroad mobile source emissions were developed using the version 3 of the Motor Vehicle Emissions Simulator (MOVES3) using activity data provided by state and local agencies.

[3] The brute-force modeling method involves running the model both with and without emission controls applied to the source(s) of interest. The difference in pollutant concentrations between the two simulations yields the impact of the emission control scenario.
[4] DDM provides sensitivity coefficients that relate emissions changes to model outcomes. These sensitivity coefficients can be used to evaluate how pollutant concentrations would respond to a range of changes in emissions from a source or group of sources.
[5] The National Emissions Inventory Collaborative is a partnership between state emissions inventory staff, multi-jurisdictional organizations, federal land managers, EPA, and others to develop a North American air pollution emissions modeling platform for use in air quality planning.
[6] https://www.epa.gov/airmarkets/national-electric-energy-data-system-needs-v6 dated 5/28/2021

Source Apportionment Tagging

Sonoma Technology worked with the Sierra Club to identify sources and source groups to be tagged for ozone attribution analysis. In total, approximately 500 emission source tags were identified and modeled across multiple simulations. The tagged sources fell into one of the following categories:

- **EGU point sources (~250 tags)**: Coal and natural gas power plants, and in some cases individual units within a facility. Units may be tagged individually, by control equipment, by retirement date, and/or grouped by region.
- **Non-EGU point sources (~150 tags)**: Industrial point sources, tagged individually and/or grouped by state.
- **Transportation**: Onroad mobile sources separated by light- and heavy-duty vehicle emissions, grouped by region.
- **Building Combustion**: Commercial, institutional, and residential fossil fuel building combustion from the NEI nonpoint sector, grouped by state or ozone nonattainment area. This excludes residential wood combustion.

Meteorology

Meteorological inputs for the CAMx-OSAT simulations were developed by EPA for the 2016 modeling platform using version 3.8 of the Weather Research and Forecasting (WRF) numerical weather prediction model (Skamarock et al., 2008).The meteorological outputs from WRF include hourly varying winds, temperature, moisture, vertical diffusion rates, clouds, and rainfall rates. Selected physics options used in the WRF simulations include the Pleim-Xiu land surface model, Asymmetric Convective Model version 2 planetary boundary layer scheme, Kain-Fritsch cumulus parameterization, Morrison double moment microphysics, and RRTMG longwave and shortwave radiation schemes. Additional details about this WRF simulation and its performance evaluation can be found in U.S. Environmental Protection Agency (2021b).

Initial and Boundary Conditions

Initial and lateral boundary conditions for the 2016v2 modeling platform were developed from three-dimensional global atmospheric chemistry simulations with the Hemispheric version of the Community Multi-scale Air Quality Model (H-CMAQ) version 3.1.1 (Mathur et al., 2017). EPA used an H-CMAQ simulation for 2016 develop boundary conditions for a CAMx simulation at a horizontal grid resolution of 36 km x 36 km. The outputs from this simulation were used to provide initial and boundary conditions for the 12 km model simulation. OSAT tracks ozone transported through the boundaries, as well as ozone formation resulting from precursor emissions transported through the boundaries.

Post-Processing

The raw result from a CAMx OSAT simulation is hourly ozone contributions from each source tag at each grid cell in the modeling domain for the 2016 ozone season. These hourly contributions were extracted and post-processed for several hundred receptor sites, including ozone monitoring sites as well as locations identified by Sierra Club as environmental justice receptors within ozone nonattainment areas. At each receptor and for each day, the 8-hr average ozone contribution was calculated for each source tag using the averaging period corresponding to the period of highest modeled 8-hr average concentration at the receptor location. Although this analysis approach may not capture the largest ozone contributions modeled during the day, it does reflect contributions during time periods when modeled ozone concentrations are highest. This analysis approach also ensures that ozone contributions from all source tags[7] sum to total modeled 8-hr ozone concentration each day. The post-processed OSAT results along with relevant metadata were compiled into a web-based shinyapps.io dashboard application to facilitate future data mining and analysis.

OSAT outputs can also be used in a “relative sense” (rather than a “absolute sense”) to apportion an ozone observation (e.g., a design value) into contributions from individual tags. One advantage to such an approach is that the contribution can be tied to an observed ozone concentration, rather than tied strictly to a modeled ozone concentration that may be biased. Ozone contributions were calculated using OSAT results in a “relative sense”. Relative contribution fractions for each tag on a daily basis were calculated by multiplying the absolute modeled source contribution by the ratio of the monitored concentration and the total modeled ozone value.

Model Performance Evaluation

EPA evaluated its 2016 modeling platform using statistical assessments of modeled ozone predictions versus observations paired in time and space. Overall, EPA found that “the ozone model performance results for the CAMx 2016fj (2016v2) simulation are within or close to the ranges found in other recent peer-reviewed applications (e.g., Simon et al., 2012 and Emery et al., 2017)” and that “the model performance results demonstrate the scientific credibility” of the 2016v2 modeling platform.” Additional details on the ozone model performance evaluation for EPA’s 2016v2 platform can be found in the Technical Support Document (TSD) for the modeling platform (U.S. Environmental Protection Agency, 2022b).

[7] Including a leftover residual contribution from all untagged sources calculated by CAMx.

Appendix B. Monitoring Value and Modeling Value Tables on NAAQS Exceedance Days

The following tables present monitoring maximum daily average 8-hr (MDA8) values compared with total modeled MDA8 values on days when monitors exceeded the NAAQS.

Table B-1. Colorado monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Aspen Park	Chatfield State Park	DENVER - CAMP	HIGHLAND RESERVOIR	La Casa	NATIONAL RENEWABLE ENERGY LABS -	ROCKY FLATS-N	Welby	WELCH
6/16	81 (66)	75 (64)	74 (69)	72 (63)	73 (69)	86 (73)	82 (72)	72 (69)	74 (70)
6/17		74 (69)				72 (66)			71 (68)
6/18							79 (69)		
6/19						76 (78)			
6/26						75 (71)	71 (68)		
6/27	75 (67)	76 (65)	71 (67)	71 (62)	71 (67)	83 (73)	78 (70)		82 (73)
6/28						74 (66)	76 (68)		
7/7		71 (67)				80 (64)	72 (64)		74 (65)
7/12						73 (62)	73 (61)		
7/14	72 (70)	81 (66)		73 (62)		79 (59)			75 (64)
7/16		78 (69)		73 (71)		79 (73)	71 (70)		73 (73)
7/17		71 (63)							
7/19		75 (54)							
7/22		72 (44)		71 (43)					
7/25		71 (67)				83 (67)	89 (66)		76 (70)
7/27		86 (70)	73 (59)	76 (68)	73 (59)	88 (64)	81 (61)		82 (67)
7/28		75 (65)							
7/29		75 (60)				77 (57)			73 (60)
7/30	73 (57)	76 (59)				73 (57)			73 (58)
8/2						72 (55)	74 (53)		
8/3	74 (74)	80 (73)				76 (69)	74 (65)		75 (74)
8/7						73 (57)			

Date	Aspen Park	Chatfield State Park	DENVER - CAMP	HIGHLAND RESERVOIR	La Casa	NATIONAL RENEWABLE ENERGY LABS -	ROCKY FLATS-N	Welby	WELCH
8/12		73 (73)				72 (73)			72 (76)
8/16							75 (67)		

Table B-2. Indiana monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Charlestown State Park	Gary-IITRI	HAMMOND CAAP	New Albany-Green Valley Elem. Sch.	Ogden Dunes-Water Treatment Plant	VALPARAISO
4/17		73 (56)			71 (57)	
4/18	73 (63)					71 (66)
4/19	72 (63)					
4/20	71 (60)			73 (61)		
5/24						72 (57)
6/9	77 (70)			71 (67)		
6/11	72 (69)	78 (61)		73 (69)	78 (62)	77 (58)
6/10	83 (69)			80 (64)		
6/13				71 (69)		
6/19						72 (55)
6/25				83 (77)		
7/21	72 (85)					
7/27			78 (66)			
8/3		71 (72)	76 (69)		72 (69)	
8/10			75 (64)			

Table B-3. Kentucky monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Bates	BUCKNER	CANNONS LANE	NORTHERN KENTUCKY UNIVERSITY (NKU)	SHEPHERDS-VILLE	Watson Lane
5/24		74 (63)	71 (59)	71 (65)		
6/3						72 (65)
6/10	71 (69)		80 (74)			
6/11	81 (72)	72 (71)	80 (71)	71 (70)		
6/13			76 (66)	75 (65)		73 (74)
6/25			72 (88)			
6/30	73 (65)		86 (74)			
7/19			71 (69)			
7/21			74 (80)			
7/23			71 (65)			
8/3			71 (66)			
9/14	74 (63)				77 (70)	77 (70)
9/23		73 (57)	72 (66)			
9/24	73 (67)		73 (64)			
9/25			73 (59)			

Table B-4. Missouri monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Arnold West	Blair Street	Farrar	Maryland Heights	Orchard Farm	Pacific	West Alton
5/23					75 (65)		75 (63)
6/8				78 (62)			
6/9							74 (71)
6/10			76 (62)				72 (70)
6/13							86 (67)
6/16				71 (62)			
6/18	73 (63)			77 (67)	76 (60)	77 (67)	74 (60)
6/27						73 (77)	
7/20				72 (55)			
7/23				73 (76)			
8/4					81 (78)		75 (76)
8/9	71 (51)	79 (48)		81 (43)			74 (57)
8/10					72 (70)		71 (59)
9/21					78 (62)		
9/22					71 (66)		78 (69)
9/23		74 (64)			78 (66)		78 (76)
9/24					72 (66)		71 (64)

Table B-5. Dallas-Fort Worth nonattainment area, Texas monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point
6/6		80 (60)										
6/7	95 (81)	85 (67)	82 (78)	81 (79)		72 (63)	95 (79)		83 (67)	85 (69)	88 (58)	
6/8					83 (67)							78 (68)
6/9					75 (62)							75 (66)
6/10					73 (63)							
6/20			71 (52)		72 (63)				77 (68)			
6/29										72 (70)		
6/30					76 (78)			76 (77)	76 (80)			83 (79)
7/1					79 (75)			76 (81)	71 (79)			75 (73)
7/26							73 (51)			72 (55)		
8/5								73 (58)				71 (55)
8/31		78 (68)										
9/11			73 (55)									
9/20									72 (51)			
9/21					81 (78)				75 (75)			
9/22					72 (73)							73 (74)
10/1								74 (62)				75 (58)
10/3		72 (55)			71 (60)							

Table B-6. Houston-Galveston-Brazoria ozone nonattainment area, Texas monitoring days in 201 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County
4/3			73 (52)									
4/5	75 (61)											
4/7		74 (53)										
4/14		71 (35)										
4/15				83 (54)				79 (56)				
4/23		84 (62)	74 (67)	78 (68)				79 (73)		80 (71)		78 (71)
4/27	75 (61)		75 (58)									
5/4		82 (58)										
5/6				84 (65)			71 (59)	84 (73)		78 (67)		
5/7	80 (68)	71 (51)	71 (58)									
5/13				78 (59)				73 (72)				
6/8		75 (67)			72 (76)			78 (75)				
7/21			72 (61)							74 (65)		79 (66)
7/22			83 (47)									
8/3			89 (58)									
8/4	71 (59)											
9/21					74 (64)							
9/28						72 (65)					75 (64)	
9/29									73 (69)			
10/2					73 (59)						73 (57)	
10/3								84 (70)				
10/10								80 (71)				
10/26			74 (56)									

Table B-7. San Antonio ozone nonattainment area, Texas monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Calaveras Lake	Camp Bullis	San Antonio Northwest
5/5			73 (56)
5/6			71 (59)
9/28	71 (59)		
10/2		74 (64)	76 (71)
10/11		81 (71)	72 (69)

Table B-8. Colorado monitoring days in 2016 exceeding the 2008 ozone NAAQS of 75 ppb at AQS monitors in severe ozone nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Aspen Park	Chatfield State Park	HIGHLAND RESERVOIR	NATIONAL RENEWABLE ENERGY LABS - NREL	ROCKY FLATS-N	WELCH
6/16	81 (66)			86 (73)	82 (72)	
6/18					79 (69)	
6/19				76 (78)		
6/26						
6/27		76 (65)		83 (73)	78 (70)	82 (73)
6/28					76 (68)	
7/7				80 (64)		
7/14		81 (66)		79 (59)		
7/16		78 (69)		79 (73)		
7/25				83 (67)	89 (66)	76 (70)
7/27		86 (70)	76 (68)	88 (64)	81 (61)	82 (67)
7/29				77 (57)		
7/30		76 (59)				
8/3		80 (73)		76 (69)		

Table B-9. Dallas-Fort Worth nonattainment area, Texas monitoring days in 2016 exceeding the 2008 ozone NAAQS of 75 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point
6/6		80 (60)									
6/7	95 (81)	85 (67)	82 (78)	81 (79)		95 (79)		83 (67)	85 (69)	88 (58)	
6/8					83 (67)						78 (68)
6/20								77 (68)			
6/30					76 (78)		76 (77)	76 (80)			83 (79)
7/1					79 (75)		76 (81)				
8/31		78 (68)									
9/21					81 (78)						

Table B-10. Houston-Galveston-Brazoria ozone nonattainment area, Texas monitoring days in 2016 exceeding the 2008 ozone NAAQS of 75 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Westhollow	Lang	Northwest Harris County
4/15				83 (54)	79 (56)		
4/23		84 (62)		78 (68)	79 (73)	80 (71)	78 (71)
5/4		82 (58)					
5/6				84 (65)	84 (73)	78 (67)	
5/7	80 (68)						
5/13				78 (59)			
6/8					78 (75)		
7/21							79 (66)
7/22			83 (47)				
8/3			89 (58)				
10/3					84 (70)		
10/10					80 (71)		

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ATTACHMENT 6a

Proposed Rule - Air Approval Plans; Texas; Reasonably Available Control Technology in the Houston-Galveston-Brazoria Ozone Nonattainment Area

EPA Docket: EPA–R06–OAR–2020–0165

Proposed: March 10, 2021

Comments of Environmental and Community Groups:

AIR ALLIANCE HOUSTON

EARTHJUSTICE

SIERRA CLUB

TEXAS ENVIRONMENTAL JUSTICE ADVOCACY SERVICES

April 9, 2021

Submitted via regulations.gov and email

Comments of Environmental and Community Groups

These comments are submitted on behalf of Air Alliance Houston, Earthjustice, Sierra Club, and Texas Environmental Justice Advocacy Services ("t.e.j.a.s.") (collectively, "Commenters").

Air Alliance Houston is a non-profit environmental group that seeks to reduce air pollution and other health threats in the Houston region, and to protect public health and environmental integrity through applied research, education, and advocacy, which includes actions to assist our constituents in the area facing this air pollution in their daily lives.

Earthjustice is the nation's largest nonprofit environmental law organization. It fights for a future where children can breathe clean air, no matter where they live, and where all communities are safer, healthier places to live and work.

Sierra Club is one of the oldest and largest national nonprofit grassroots environmental organizations in the country, with more than 820,000 members nationwide, including 28,663 members in Texas, dedicated to exploring, enjoying, and protecting the wild places and resources of the earth; practicing and promoting the responsible use of the earth's ecosystems and resources; educating and enlisting humanity to protect and restore the quality of the natural and human environment; and using all lawful means to carry out these objectives.

t.e.j.a.s. is a non-profit group whose mission is to create sustainable, healthy communities in the Houston Ship Channel region by educating individuals on health impacts from environmental pollution and empowering them to promote the enforcement of environmental laws. In furtherance of this mission, t.e.j.a.s. engages in advocacy and organizing around environmental issues in Texas, including pollution created by refineries and petrochemical facilities along the Houston Ship Channel.

I. Introduction

EPA must not finalize this proposal. Texas's SIP submission to EPA includes no revisions to the state's outdated requirements for reasonably available control technology ("RACT") emission limits for existing sources in the Houston-Galveston-Brazoria ("HGB") nonattainment area. This failure not only contravenes the Clean Air Act and is arbitrary, but it further exacerbates an already egregious environmental justice issue in the HGB area.

Under the Clean Air Act, moderate and higher ozone nonattainment areas must develop plans that require "implementation of reasonably available control technology under [42 U.S.C. §] 7502(c)(1)" for "all…major stationary sources of [volatile organic compounds]" and oxides of nitrogen ("NOx"). 42 U.S.C. § 7511a(b)(2), (f). Revisions to SIPs must incorporate RACT for sources of VOCs covered by EPA-issued control technique guidelines ("CTGs"), as well as for other major sources of VOCs and NOx.

RACT "defines the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility." Memorandum from R. Strelow, Asst. Adm'r, EPA, Office or Air and Waste Management, to Reg'l Adm'rs, EPA Regions I-X, re: *Guidance for Determining Acceptability of SIP Regulations in Non-Attainment Areas* at 2 (Dec. 9, 1976) ("Strelow Memo") (Attachment 1). RACT "means devices, systems, process modifications, or other apparatus or techniques that are reasonably available taking into account: (1) [t]he necessity of imposing such controls in order to attain and maintain a national ambient air quality standard; [and] (2) [t]he social, environmental, and economic impact of such controls" 40 C.F.R. § 51.100(o).

"RACT encompasses stringent, or even 'technology forcing,' requirement[s]." Strelow Memo 2; *accord Sierra Club v. EPA*, 972 F.3d 290, 294 (3d Cir. 2020) ("RACT is a technology-forcing standard designed to induce improvements and reductions in pollution for existing sources."); *see also Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457, 492 (2001) (Breyer, J., concurring) (noting that technology forcing requirements "are still paramount in today's [Clean Air] Act"). "In every case RACT should represent the toughest controls considering technological and economic feasibility that can be applied to a specific situation. Anything less than this is by definition less than RACT and not acceptable for areas where it is not possible to demonstrate attainment." Strelow Memo 3.

Because the HGB area failed to meet its revised attainment deadline for the 2008 ozone National Ambient Air Quality Standards ("NAAQS"), EPA reclassified the area to be in "serious" nonattainment, with a deadline of July 20, 2021. 84 Fed. Reg. 44,238 (Aug. 23, 2019). To remedy its failure to meet its attainment deadlines, Texas is statutorily required to implement RACT-level controls on existing sources in this nonattainment area. But the state has not updated its RACT rules to require more stringent measures to reduce NOx and VOC emissions in the HGB area. And Texas's failure does not fall equally on residents in the HGB area. Instead, as we described below, the state's nonattainment for the HGB area has a disproportionate harm on people of color and low-income populations living near major emission sources. This is particularly true for ozone precursors like VOCs, which are highly concentrated in distinct census tracts.

Texas's failure is inexcusable. And the state's failure to meet its attainment deadlines is proof that additional controls are needed. Despite comments that highlighted potential avenues for additional controls,[1] the state's submission would keep the same RACT determinations used for the 1997 eight-hour ozone NAAQS. EPA's approval of this RACT SIP would be unlawful and contrary to the Clean Air Act. For the reasons outlined below, EPA must reject Texas's RACT SIP submission for the HGB area and require the state issue additional RACT controls.

II. Approving Texas's RACT SIP would be unlawful and arbitrary.

In its submission to EPA, Texas failed to meet its statutory requirements under the Clean Air Act by seeking approval of its existing RACT controls without rationally evaluating additional measures that could reduce emissions in the HGB area. Instead of "determin[ing] whether the existing controls or emissions reduction approach at [existing] source[s] can be updated or improved with reasonably available controls or strategies to achieve increased levels of emission reduction," 81 Fed. Reg. 58,010, 58,037 (Aug. 24, 2016), Texas reflexively relies on its existing controls, which are more than a decade old at this point. EPA's proposal to approve Texas's RACT SIP is unlawful, and contrary to EPA's own rule on implementing the 2008 ozone NAAQS and binding caselaw.

In that implementation rule, EPA emphasized that only in "some cases" would a RACT determination for the 1-hour or 1997 ozone NAAQS be sufficient for the 2008 ozone NAAQS RACT requirement. 80 Fed. Reg. 12,264, 12,279 (Mar. 6, 2015). EPA stated that this decision was based on a belief that in "some cases" "a new RACT determination under the 2008 standard would result in the same or similar control technology as the initial RACT determination under the 1-hour or 1997 standard because the fundamental control techniques, as described in the CTGs and ACTs [alternative control techniques], are still applicable." *Id.* Only in the circumstance where updated RACT would yield only small additional emission reductions at an unreasonable cost would reliance on an existing RACT determination be justified. *Id*. at 12,280. But given that many CTGs and ACTs have not been updated, EPA also emphasized that "in many cases, more recent technical information is available in other forms." *Id*. at 12,278 (emphasis added). This includes "information received during the public comment period." *Id.* at 12,279. Notably, existing regulatory requirements can indicate whether a particular degree of emission limitation does not constitute RACT. *See Sierra Club*, 972 F.3d at 300 & n.69 ("an average of the current emissions being generated by existing systems[] will not usually be sufficient to satisfy the RACT standard."). Thus, a RACT determination is unlawful and arbitrary when other states have RACT requirements that are more stringent. Further, as RACT is technology

[1] Comments on Proposed Houston-Galveston-Brazoria (HGB) Serious Classification Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambien[t] Air Quality Standard (NAAQS) (Oct. 28, 2019) (TCEQ Docket No. 2019-0692-SIP) (Attachment 2).

forcing, existing RACT determinations are not the only relevant criteria in making a RACT determination: EPA has made explicit that best available control technology ("BACT") determinations are relevant, too. EPA, Response to Comments on Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements 102 (Feb. 13, 2015) (EPA-HQ-OAR-2010-0885-0191).

EPA's explanation in its 2008 ozone NAAQS implementation rule is consistent with how EPA has interpreted RACT requirements in the past. EPA has repeatedly stated that states cannot rely on existing RACT determinations from previous ozone standards without explaining how these RACT measures continue to meet the "stringent" RACT standard. Strelow Memo 2; *see* 81 Fed. Reg. 58,037/3. The agency has found that "[p]ast experience has shown that due to ongoing innovation, cost-effective control technologies and process alternatives for many sectors continue to be developed…." 81 Fed. Reg. 58,037/3. And courts have held that "RACT is not designed to rubber-stamp existing control methods." *Sierra Club*, 972 F.3d at 295.

Here, Texas failed to meet the standard outlined by EPA that would allow the state to use its previous RACT determination. Specifically, Texas failed to respond to Commenters' undisputed expert report that outlined how additional controls could result in a large reduction of emissions in the HGB area. *See, e.g.*, *NRDC v. EPA*, 571 F.3d 1245, 1254 (D.C. Cir. 2009) ("If a state is presented with information indicating that a previous RACT determination is inappropriate, the state must consider that information and modify its RACT determinations accordingly.") Commenters' expert, Dr. Ron Sahu, found that many of the largest sources of NOx emissions in the HGB area are associated with electric power generation.[2] And not only did Texas fail to conduct any analysis of the largest NOx source, W.A. Parish station, the state also failed to consider how additional controls could result in NOx and VOC emission reductions at this source. *Id.* at 14-15. For example, Dr. Sahu analyzed the potential NOx reductions for one unit at the largest source of NOx emissions in the HGB area and found that an additional RACT determination, such as requiring a replacement or re-activated Selective Catalytic Reduction ("SCR") catalyst, could have reduced the unit's NOx emissions in 2017 by 1091 tons. *Id.* at 15. Similar reductions could be achieved at other units in the same facility by similar RACT controls for NOx, as well as for VOCs at other facilities. Texas failed to respond rationally to these comments. For example, Texas's only response to these comments about the W.A. Parish station was to claim—without providing any supporting analysis—that it "determined that for all NO_X major sources in the HGB area, current EPA-approved state rules satisfy FCAA NO_X RACT requirements under the 2008 eight-hours ozone NAAQS for the HGB area," pointing to "Table F-4" as containing the determination. TCEQ, Response to Comments 21 (EPA-R06-OAR-2020-0165-0003). Thus, contrary to governing requirements, Texas failed to

[2] Dr. Ranajit (Ron) Sahu, Comments on the Reasonably Available Control Technology (RACT) and Reasonably Available Control Measures (RACM) for the 2008 Ozone NAAQS Attainment SIP Modifications Proposed by the Texas Commission on Environmental Quality (TCEQ) for the Houston-Galveston-Brazoria (HGB) and Dallas-Fort Worth (DFW) Non-Attainment Areas at 14 (Oct. 28, 2019) ("Sahu Report") (Attachment 3).

rationally address the comments showing more stringent controls were necessary to satisfy RACT.

But instead of an analysis that reviewed whether Texas has properly considered the information before it, EPA states in its Technical Support Document ("TSD") that it "believes" that "any new RACT determinations by the state would be expected to result in the same or similar control technology as the RACT determinations made for the 1-hour or the 1997 ozone standards." TSD 18. EPA's statement is without evidentiary basis and contrary to its own implementation rule for the 2008 ozone NAAQS. To approve Texas's RACT SIP in its current form would be unlawful and arbitrary. As EPA stated in the final rule implementing the 2008 ozone NAAQS, it is only "[a]bsent data or public comments indicating that the previous RACT determination is no longer appropriate" that a state can choose to "not adopt additional SIP controls to meet the new RACT requirement for these sources." 80 Fed. Reg. 12,280. Texas has not met that standard here.

EPA's approval of Texas's submission would rubber stamp Texas's do-nothing-approach to implementing RACT. As such, this action would be arbitrary and contrary to the Clean Air Act.

III. TCEQ's failure to update its RACT regulations exacerbates emissions burdens in the HGB nonattainment area and contravenes EPA's legal obligation to ameliorate environmental justice issues.

The acute harms of ozone and related air pollution in the Houston nonattainment area are not felt evenly. Numerous studies and data demonstrate that low resource communities and communities of color bear a higher burden. For example, in the historic Harrisburg and Manchester neighborhoods in east Houston, 97% of residents are people of color, 90% are low income, and 37% live in poverty.[3] Overall, there is a concentration of major industrial sources of air pollution in such communities.[4] As of 2016, 26 Risk Management Plan industrial facilities—facilities that handle extremely hazardous substances and must report their emissions to the EPA's Toxic Release Inventory—operate in Manchester.[5] These major industrial sources are among the types of existing sources that are subject to RACT requirements in Texas's SIP.

A recent study by Sustainable Systems Research, LLC ("SSR") highlights the extent to which vulnerable communities in the HGB area are put in harm's way by the lack of emissions reductions.[6] By reviewing TCEQ's point source emissions inventory ("PSEI") data in conjunction with U.S. Census data, SSR was able to evaluate the emission burdens of

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[3] Center for Science and Democracy at the Union of Concerned Scientists, Double Jeopardy in Houston, Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities 5-6 (Oct. 2016), https://www.ucsusa.org/sites/default/files/attach/2016/10/ucs-double-jeopardy-in-houston-full-report-2016.pdf (Attachment 4).
[4] *Id*. at 3-6, 13.
[5] *Id*. at 19.
[6] Sustainable Systems Research, LLC, Evaluation of Vulnerability and Stationary Source Pollution in Houston (Sept. 2020) ("2020 Houston Vulnerability Study") (Attachment 5).

communities in the HGB area. Their analysis found that there are widespread disparities in community burdens for pollutants like VOCs, PM_{10}, and $PM_{2.5}$, and that these disparities are "greater for people of color and limited-English households than for households living in poverty."[7] Furthermore, many of these communities are subject to unauthorized emissions of VOCs, especially those living near the vicinity of the Houston Ship Channel.[8]

Texas's failure to implement additional RACT measures exacerbates the burden felt by these communities. As SSR's research shows, VOC emissions in the HGB area are highly concentrated in particularly vulnerable census tracts (see figure 1 below). By failing to enact additional RACT measures, Texas subjects these communities to a disproportionate burden of pollution that threatens their public health. Furthermore, EPA's approval of the state's RACT SIP would contravene Executive Order 13990's commitment to advance environmental justice. As stated in the order, it is the nation's policy to "promote and protect our public health and the environment; … to ensure access to clean air…; [and] to prioritize…environmental justice." 86 Fed. Reg. 7037, 7037 (Jan. 25, 2021) (emphasis added). EPA's proposed approval of this SIP would betray the spirit and letter of the order's commitment to environmental justice.

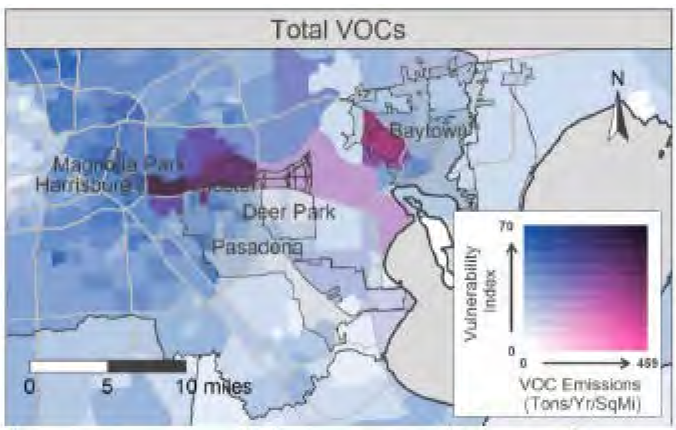

Figure 1, from *2020 Houston Vulnerability Study*, at 31.

IV. If EPA approves some or all of the submittal, EPA must make clear what RACT obligations remain outstanding.

In its proposal, EPA notes that Texas has not updated its RACT for the oil and gas sector to reflect changes to the EPA's Oil and Gas CTG. 86 Fed. Reg. 13,681. This is despite having a 2018 deadline to update its RACT SIP in accordance with the new CTG. While EPA has stated that it is committed to working with Texas to "expedite the development and submission of the required SIP revisions" for the new CTG, it is still unclear if EPA is proposing to approve all of Texas's RACT obligations under the 2008 NAAQS. *Id.* Plainly, EPA cannot lawfully or rationally do so—not just because the RACT SIP submittal has the illegalities and irrationalities discussed above, but also because it does not even purport to

[7] *Id.* at 15*, see also id.* at 17 tbl.2.
[8] *Id.* at 35.

meet the governing requirements established by the Oil and Gas CTG. Thus, if, contrary to law and rationality, EPA chooses to approve any part of this RACT SIP, it must make clear which portions of Texas's RACT SIP fulfill the state's obligations under the 2008 NAAQS remain unfulfilled.

V. Conclusion

For the foregoing reasons, EPA must not approve Texas's RACT SIP submission. By definition, RACT must include the "toughest controls": anything less is not RACT. Strelow Memo 3. Though Commenters provided analysis and highlighted serious gaps in Texas's proposal, Texas's final submission lacks any rational analysis of how the outdated emission limits it submitted to EPA meet RACT, and EPA's proposed approval fails either to engage with Texas's lack of analysis or to undertake its own analysis. Fundamentally, too, EPA's approval of Texas's RACT for the HGB area would contravene the purpose of requiring RACT in SIPs, by allowing the state to rely on outdated controls that fail to meaningfully reduce emissions to achieve attainment.

Attachment List

1. Memorandum from R. Strelow, Asst. Adm'r, EPA, Office or Air and Waste Management, to Reg'l Adm'rs, EPA Regions I-X, re: *Guidance for Determining Acceptability of SIP Regulations in Non-Attainment Areas* (Dec. 9, 1976) ("Strelow Memo")

2. Comments on Proposed Houston-Galveston-Brazoria (HGB) Serious Classification Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambien[t] Air Quality Standard (NAAQS) (Oct. 28, 2019) (TCEQ Docket No. 2019-0692-SIP)

3. Dr. Ranajit (Ron) Sahu, Comments on the Reasonably Available Control Technology (RACT) and Reasonably Available Control Measures (RACM) for the 2008 Ozone NAAQS Attainment SIP Modifications Proposed by the Texas Commission on Environmental Quality (TCEQ) for the Houston-Galveston-Brazoria (HGB) and Dallas-Fort Worth (DFW) Non-Attainment Areas (Oct. 28, 2019) ("Sahu Report")

4. Center for Science and Democracy at the Union of Concerned Scientists, Double Jeopardy in Houston, Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities (Oct. 2016)

5. Sustainable Systems Research, LLC, Evaluation of Vulnerability and Stationary Source Pollution in Houston (Sept. 2020) ("2020 Houston Vulnerability Study")

Attachments

Attachment 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Washington, D.C. 20460

December 9, 1976

MEMORANDUM

SUBJECT: Guidance for determining Acceptability of SIP Regulations in Non-attainment Areas

FROM: Roger Strelow, Assistant Administrator for Air and Waste Management

MEMO TO: Regional Administrators, Regions I-X

The basis for fully approving state-submitted SIP regulations continues to be demonstrated attainment and maintenance of all national ambient air quality standards as expeditiously as practicable. If the plan demonstrates attainment and maintenance, EPA is required to approve the state regulations. EPA cannot disapprove them because they are too stringent or because EPA Considers them not stringent enough (for example, because they are less stringent than a comparable Federal regulation or because they control fewer sources than controlled by Federal regulations), providing the overall SIP shows attainment and maintenance as quickly or quicker than any other available control strategy. If the state plan shows attainment and maintenance, Federal regulations may be revoked at the time of approval.

Especially for oxidant, carbon monoxide, and particulate matter (in areas dominated by urban fugitive dust), control measures required to attain the standards may be technically impossible or socially or economically unacceptable within a short time frame. In this situation, EPA still cannot disapprove state regulations because they are "too stringent," and industry cannot successfully challenge an approval on the ground that the requirements are technologically or economically infeasible. On the other hand, EPA must disapprove the state regulations if they are not stringent enough. The test for approvability of individual regulations is whether they require, at a minimum, all reasonably available controls on a source as expeditiously as practicable. This memorandum seeks to provide guidance as to how to ascertain if state regulations meet these minimum requirements. The use of any given level of control which fails to assure attainment should only be considered to be an interim measure. As control technology improves and as new control measures become feasible for an area, it will be necessary for the SIP to be periodically revised to include these measures until attainment and maintenance can be demonstrated.

1. Reasonably Available Control Measures

a. Stationary Sources

With respect to individual point sources and area sources with defined emission points (i.e., those amenable to the application of "classical" control equipment), reasonably available control technology (RACT) defines the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. Thus, RACT encompasses stringent, or even "technology forcing," requirement that goes beyond simple "off-the-shelf" technology. As noted, RACT is the minimum EPA can accept in non-attainment state plans.

The determination of RACT and the corresponding emission rate, ensuring the proper application and operation of RACT, may vary from source to source due to source configuration, retrofit feasibility, operation procedures, raw materials, and other technical or economic characteristics of an individual source or group of sources. In order to assist the Regions in determining the impact of these variables on RACT, OAQPS is continuing to develop RACT guidance materials (see attached status report). This material describes what can be accomplished with good technology and defines things that should be considered in establishing an emission limit for a specific source of that type. In determining RACT for an individual source or group of sources, the control agency, using the available guidance, should select the best available controls, deviating from those controls only where local conditions are such that they cannot be applied there and imposing even tougher controls where conditions allow. For example, the best available control for a boiler burning coal and bark at a pulp mill is multiclone followed by an electrostatic precipitator (ESP), the two control devices having an overall collection efficiency of 99.5%. However, in areas where the bark or similar fuel has a high salt content as a result of the logs being floated in the estuary portion of the river, it may be that the technological and economic

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* As stated at the outset of this memorandum, the test for approving the entire control strategy – and for EPA thus not having to promulgate any measures – continues to be demonstrated attainment and maintenance of the NAAQS.

problems of installing and operating a large, corrosion resistant ESP may prove unreasonable. More technological and economically feasible controls consisting of a multiclone and ,wet collector designed to withstand the corrosive conditions, and perhaps functioning more effectively on a salt fume than an ESP, depending on the pressure drop employed, may constitute RACT under the conditions cited. In every case RACT should represent the toughest controls considering technological and economic feasibility that can be applied to a specific situation. Anything less than this is by definition less than RACT and not acceptable for areas where it is not possible to demonstrate attainment

As a further assistance to the Regions in defining RACT for the more difficult or the far from textbook situations, OAQPS's Emission Standards and Engineering Division (ESED) will establish a consulting group to support the Regions. This group will include ESED staff but will also include technical expertise from OE and the Regional Offices. In specific instances, the National Air Pollution Control Techniques Advisory Committee (NAPCTAC) may be asked to assist in a RACT determination. The consulting group is being established as a service to the Regions and it should not be looked at as a clearinghouse for regional RACT determinations. These decisions are yours to make. The group is designed to help you as needed on the most difficult cases.

b. Mobile and Area Sources

As with point sources, measures which constitute reasonably available controls for mobile sources and area sources with undefined emission points may represent relatively stringent requirements which in many situations forces the application of measures not previously adopted or implemented in a given area. These measures include vehicle inspection and maintenance, transportation control and land use measures, certain controls on fugitive and reentrained dust, and other measures which may influence customary life styles. They do not include clearly un- reasonable measures such as substantial gasoline rationing. Moreover, what may be reasonable in one area may be un- reasonable in another. For example, while it may be reasonable as a transportation control measure to quickly reduce the number of cars permitted to enter the central business district in a city with a good mass transit system, it would not be reasonable to do this on the same timetable in a city with a poor mass transit system.

2. Documentation

In those situations where the State's control strategy can- not demonstrate attainment it will be necessary for the State to document that their control strategy represents the application of reasonably available control measures to all available source categories. The Region should not approve a control strategy that does not contain sufficient documentation to show that the required control measures are the toughest that are reasonably available for the sources in the area covered by the control strategy.

3. Replacement of Federal Regulation

In some areas the SIPS already contain EPA regulations representing reasonably available controls that generally reflect a national definition of reasonably available controls for that source category and that were arrived at by EPA after proposal and public hearing, (e.g., Stage I and I1 gasoline marketing regulations in 16 AQCRs; transportation control measures in 28 AQCRs).

In these situations there is inherently less flexibility in the definition by the state of reasonably available controls and specific justification will be needed before EPA could ap- prove a regulation which exempts significantly more sources, or which imposes controls significantly less stringent, than the Federal regulations. This justification should document the specific case-by-case economic. technical or other factors which cause the state's regulations, although significantly different from the Federal regulation, to include all that is reasonable for a specific area. (The state regulation would still have to con- form to the criteria outlined for defining reasonable control measures.) Such justification must be provided not only as a basis for approval of the state regulations, but also to protect the enforceability of comparable Federal and state regulations in other areas. In the absence of acceptable justification, the state regulation exempting some sources can be approved as far as it goes and the Federal regulation should remain in effect to cover sources for which the state's regulation does not apply. Of course, nothing should preclude a state from adopting and this Agency approving a regulation which requires more control than the Federally promulgated regulation.

Since it is the Agency's objective to encourage the states to develop and implement regulations to replace EPA regulations, the Agency may approve state regulations that are only marginally different from the Federal regulations without the detailed justification noted above if, in the Regional Administrator's judgment, the impact on emissions differs imperceptibly (less than 5% in cases where it is possible to quantify the difference) from that of the Federal regulations and there is no significant threat of undermining EPA activities elsewhere in the nation. When determining if a state regulation is environmentally equivalent to the Federal regulation, EPA can only look at the particular measure being implemented. In other words, it would be unacceptable to approve a measure requiring significantly less control than the corresponding Federal measure on the basis that other control measures implemented in the same area are significantly more stringent than the comparable Federal measures. In areas where attainment cannot be demonstrated, all reasonable measures on all source categories are needed.

To further encourage states to replace EPA regulations, reasonable additional time generally may be granted to com- ply with replacement regulations providing the new compliance dates (effective dates) are not clearly excessive. We cannot expect a state to adopt regulations which depend upon the prior Federal regulations to alert sources to the steps needed for control, except in those cases where the state regulation is substantially identical to the Federal regulation which it replaces. On the other hand, granting of additional time must be done with care so as not to undermine the action-forcing role of firm deadlines in EPA efforts elsewhere. The use of a "good faith efforts" test will be appropriate in some circumstances

4. Conclusion

In concluding, I would like to reiterate the fact that the air quality standards are not being attained in many of these RACT areas. Therefore, we cannot relax the intensity of the air pollution control effort. We should ensure that all sources contributing to the nonattainment situation are required to implement restrictive available control measures even if it requires significant sacrifices.

cc:`Mr. Tuerk, Mr. Barber, Mr. Legro, Mr. Bonine, Mr. Hidinger.

Attachment 2

Proposed Houston-Galveston-Brazoria (HGB) Serious Classification Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambien Air Quality Standard (NAAQS),

Rule Project No. 2019-077-SIP-NR

TCEQ Docket No. 2019-0692-SIP

Proposed Sept. 11, 2019

Comments of Environmental and Community Groups:

ACHIEVING COMMUNITY TASKS SUCCESSFULLY

AIR ALLIANCE HOUSTON

EARTHJUSTICE

SIERRA CLUB

TEXAS ENVIRONMENTAL JUSTICE ADVOCACY SERVICES

October 28, 2019

Submitted via eComments at https://www6.tceq.texas.gov/rules/ecomments/

Comments of Environmental and Community Groups

These comments are submitted on behalf of Achieving Community Tasks Successfully, Air Alliance Houston, Coalition of Community Organizations, Earthjustice, Sierra Club, and Texas Environmental Justice Advocacy Services (collectively, "Commenters").

Achieving Community Tasks Successfully ("ACTS") is a grassroots community group working for social and environmental justice in the Pleasantville community of east Houston.

Air Alliance Houston is a non-profit environmental group that seeks to reduce air pollution and other health threats in the Houston region, and to protect public health and environmental integrity through applied research, education, and advocacy which includes actions to assist our constituents in the area facing this air pollution in their daily lives.

Earthjustice is the nation's largest nonprofit environmental law organization. It fights for a future where children can breathe clean air, no matter where they live, and where all communities are safer, healthier places to live and work.

Sierra Club is one of the oldest and largest national nonprofit grassroots environmental organizations in the country, with approximately 782,000 members nationwide dedicated to exploring, enjoying, and protecting the wild places and resources of the earth; practicing and promoting the responsible use of the earth's ecosystems and resources; educating and enlisting humanity to protect and restore the quality of the natural and human environment; and using all lawful means to carry out these objectives.

Texas Environmental Justice Advocacy Services ("t.e.j.a.s.") is a non-profit group whose mission is to create sustainable, healthy communities in the Houston Ship Channel region by educating individuals on health impacts from environmental pollution and empowering them to promote the enforcement of environmental laws. In furtherance of this mission, t.e.j.a.s. engages in advocacy and organizing around environmental issues in Texas, including pollution created by refineries and petrochemical facilities along the Houston Ship Channel.

INTRODUCTION

The Texas Commission on Environmental Quality ("TCEQ") must not finalize this proposal. Instead of perpetuating weak ozone protections in one of the most polluted areas of Texas, if not the entire country, TCEQ should be strengthening those protections. The communities and people who have borne the disproportionate burden of toxic ozone precursor emissions of carcinogenic volatile organic compounds ("VOCs") and oxides of nitrogen ("NO_X"), as well as the resulting ozone air pollution have the right to a healthy environment. And in the Houston nonattainment area, it is low resource communities and communities of color who bear the resulting disproportionate health harm from this pollution. The proposed action is a step away from realizing their right to breathe healthy air. As explained below, TCEQ cannot lawfully or rationally finalize the proposed action. In particular, TCEQ fails to demonstrate attainment by the serious area attainment date and the Proposed Rule[1] fails to adequately assess or adopt readily available control technology that is highly cost-effective and could be quickly installed or activated, favoring existing controls that are actually far inferior to reasonably available control technology already in place at other Texas facilities and throughout the nation.

I. The Proposed Rule Perpetuates the Ozone Problem in the Houston Nonattainment Area.

A. Ground-Level Ozone is Harmful to Human Health.

Ozone, the main component of smog, is a corrosive air pollutant that inflames the lungs and constricts breathing, and likely kills people. *See Am. Trucking Ass'ns v. EPA*, 283 F.3d 355, 359 (D.C. Cir. 2002); 80 Fed. Reg. 65,292, 65,308/3-09/1 (Oct. 26, 2015); EPA, *Integrated Science Assessment for Ozone and Related Photochemical Oxidants* 2-20 to -24 tbl.2-1, EPA-HQ-OAR-2008-0699-0405 (Feb. 2013) ("ISA"). It causes and exacerbates asthma attacks, emergency room visits, hospitalizations, and other serious health harms. *E.g.*, EPA, *Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards* 3-18, 3-26 to -29, 3-32, EPA-HQ-OAR-2008-0699-0404 (Aug. 2014) ("PA"); ISA 2-16 to -18, 2-20 to -24 tbl.2-1. Ozone-induced health problems can force people to change their ordinary activities, requiring children to stay indoors and forcing people to take medication and miss work or school. *E.g.*, PA 4-12.

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[1] Proposed Houston-Galveston-Brazoria (HGB) Serious Classification Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambien Air Quality Standard (NAAQS) ("Proposed Rule"), TCEQ Rule Project No. 2019-077-SIP-NR, TCEQ Docket No. 2019-0692-SIP (proposed Sept. 11, 2019).

Ozone can harm healthy adults, but others are more vulnerable. *See* 80 Fed. Reg. 65,310/1-3. Because their respiratory tracts are not fully developed, children are especially vulnerable to ozone pollution, particularly when they have elevated respiratory rates, as when playing outdoors. *E.g.*, *id.* 65,310/3, 65,446/1; PA 3-81 to -82. People living with lung disease and the elderly also have heightened vulnerability. *See* 80 Fed. Reg. 65,310/3. People living with asthma suffer more severe impacts from ozone exposure than healthy individuals and are more vulnerable at lower levels of exposure. *Id.* 65,311/1 n.37, 65,322/3.

Ozone exposure has been linked to the development of asthma, as well as its exacerbation. For individuals already diagnosed with asthma, evidence shows that ozone exposure increases the likelihood of having an asthma attack.[2] Ozone exposure has been shown to have especially significant effects on asthma exacerbation among children. Children living in areas with higher ambient ozone concentrations have been shown to be more likely to either have asthma or to experience asthma attacks compared with children living in areas having lower ambient ozone concentrations.[3]

Additionally, certain "sensitive" groups and individuals are found to have significantly greater susceptibility to ozone-related health impacts. In a 14-year study of 95 U.S. cities, links were found between short-term increases in ozone and premature mortality, even when excluding days exceeding 60 ppb, finding that that "daily changes in ambient O3 exposure are linked to premature deaths, even at very low pollution levels."[4] Other health impacts linked to ozone exposure are related to newborns and the developing fetus.[5] Prenatal exposure to ozone has been linked to reduced birth weight, premature delivery, and birth defects.[6]

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[2] *See, e.g.*, Franze et al., Protein nitration by polluted air, Enviro Sci Technol. 39: 1673-1678 (2005), http://dx.doi.org/10.1021/es0488737; U.S. Environmental Protection Agency, Air quality criteria for ozone and related photochemical oxidants, (EPA/600/R-05/004AF) (2006), http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=149923.

[3] Akinbami, The association between childhood asthma prevalence and monitored air pollutants in metropolitan areas, United States 2001-2004 (Environ. Res. Apr. 2010), 110(3):294-301, http://dx.doi.org/10.1016/j.envres.2010.01.001.

[4] Bell et al., The Exposure-Response Curve for Ozone and Risk of Mortality and Adequacy of Current Ozone Regulations, Environ Health Perspect. 114:532-536 (2006), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1440776/.

[5] ISA (2013) at 2-20.

[6] Salam et al., Birth Outcomes and Prenatal Exposure to Ozone, Carbon Monoxide, and Particulate Matter: Results from the Children's Health Study, Environ Health Perspec.113: 1638-1644 (2005), http://dx.doi.org/10.1289/ehp.8111.

Ozone also damages vegetation and forested ecosystems, causing or contributing to widespread stunting of plant growth, tree deaths, visible leaf injury, reduced carbon storage, and reduced crop yields. PA 5-2 to -3; ISA 9-1. By harming vegetation, ozone can also damage entire ecosystems, leading to ecological and economic losses. 80 Fed. Reg. 65,370/1-2, 65,377/3.

Currently, approximately half of Texans—over 12 million people—live in areas with air that EPA classified as unsafe to breathe under the 2008 ozone standard.[7] Even more communities violate the more protective 2015 ozone standard.[8] Recent D.C. Circuit decisions regarding the Clean Air Act's Good Neighbor provision mean that Texas is likely to come under obligations to restrict its significant contributions of ozone pollution on downwind states in the near future.[9]

B. Ozone Pollution is a Serious Health Problem in Houston.

Residents of the Houston area are consistently exposed to some of the highest ozone levels in the Central United States. Indeed, air quality monitors in the area consistently exceed the ozone levels current scientific research dictates as necessary to protect human health—especially for sensitive populations such as children, asthmatics, the elderly, and outdoor workers. In fact, the Houston area consistently ranks as one of the most polluted cities in the country for ozone.[10]

For decades, the eight counties making up the Houston area have struggled to attain federal NAAQS for ozone pollution, which are designed to protect human health and welfare. For more than forty years—throughout the implementation of the most recent 2015 ozone standard to the first 8-hour standard in 1997, and further back to the 1-hour standard, and then further back still to photochemical oxidant standards in the

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[7] *Compare* EPA's Greenbook, available at http://www.epa.gov/oaqps001/greenbk/ancl.html (listing Texas counties in nonattainment for the 2008 ozone standards), with U.S. Census Bureau, American FactFinder, 2010 Demographic Profile (search population for each county in the nonattainment areas and Texas population), https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. We incorporate by reference all cited documents into these comments

[8] http://www.epa.gov/oaqps001/greenbk/ancl.html (listing Texas counties in nonattainment for the 2015 ozone standard)

[9] *See Wisconsin v. EPA*, Nos. 16-1406, slip op. (D.C. Cir. Sept. 13, 2019) (finding Clean Air Act's Good Neighbor Provision requires upwind states to eliminate their significant contributions to downwind states' nonattainment problems by respective attainment dates); *see also New York v. EPA*, 2019 WL 4804419 (D.C. Cir. Sept. 30, 2019) (vacating EPA rule partially addressing interstate ozone transport obligations under 2008 NAAQS).

[10] American Lung Association, 2019 State of the Air Report, Most Polluted Cities (ranking the Houston area as the 9th most polluted area in the nation), https://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/most-polluted-cities.html.

early 1970's—the Houston area has consistently failed to meet ozone maximum air quality standards designed to protect human health and welfare. Indeed, the same eight counties in the Houston area—Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller—have been designated "nonattainment" under each of EPA's ozone NAAQS, meaning they have had, or have been contributing to, ozone pollution levels that violate health standards for ozone since the 1970s. 40 C.F.R. § 81.344. And air quality monitors throughout the Houston area regularly report exceedances of federal standards.

The Houston area has a long history of missing attainment dates and seeking extensions, even when the area's history and current data call for stronger ozone control measures. Under the 1-hour 1979 and the 1997 8-hour ozone standards, Houston was classified as "severe"—the second worst classification under the Act. 80 Fed. Reg. 12,264, 12,311 app.B (Mar. 6, 2015) ("Implementation Rule" for the 2008 ozone standard). At the time of the implementation of the 2008 ozone standard, the Houston area had still not complied with either the 1979 or the 1997 standards, though its attainment deadline under the 1979 standard passed in 2007. *Id.*; *see also* 42 U.S.C. § 7511(a)(1) tbl.1. At the time of initial classifications for the 2008 ozone standard, Houston was classified as "marginal" but due to persistent poor air quality, and after receiving a one-year extension and lodging a failing bid for a second one-year extension, EPA reclassified it to "moderate" with an attainment date of July 20, 2018. 80 Fed. Reg. 90,207 (Dec. 14, 2016) (reclassifying Houston area from marginal to moderate); *See also* 77 FR 30,160 (May 21, 2012) (setting moderate area attainment date); *see also* 80 FR 12,264, 12,267/3-68/2 (Mar. 6, 2015) (revising attainment deadlines in light of *NRDC v. EPA*, 777 F.3d 456 (D.C. Cir. Dec. 23, 2014)). Now, the Houston area misses yet another attainment date—the "moderate" area attainment date—and thus must be reclassified to "serious" for the 2008 ozone standard with a new attainment date of July 20, 2021. 84 Fed. Reg. 44,238, 44,244/2 (Aug. 23, 2019).

Texas's failing air quality has serious and well-documented health consequences for the nearly 6 million Texans that live in the Houston area. Scientific research continues to strengthen our understanding of the harm that ozone causes to public health. As discussed above, exposure to ozone is connected to a wide range of significant human health impacts including respiratory and cardiovascular harms, premature deaths, perinatal and reproductive impacts, and central nervous system and developmental harms. Serious health impacts have been demonstrated through controlled human exposure, epidemiologic, and toxicological studies.[11] The physiological impacts of ozone exposure are experienced even by healthy individuals

[11] *See* ISA (2013).

and even at relatively low concentrations of ozone. Moreover, there is a growing body of scientific evidence showing that repeated exposure over time causes additional health impacts, which may be more severe and less likely to be reversible.

For residents of Harris County alone, the consequences of smog are not trivial. Considering the health impacts of smog pollution from oil and gas operations in Harris County between 2016 and 2017, the Clean Air Task force found that children missed 9,954 days of school—over 27 years of education lost—and suffered from 13,600 asthma attacks. Seniors restricted their activities on 25,724 days.[12] These are just quantified examples the many ways quality of life is diminished by poor air quality for the millions of residents of the Houston nonattainment area. And these adverse health consequences are not evenly felt in the population, as discussed below, historically disenfranchised communities suffer the brunt of the health effects from this pollution.

C. Ozone Pollution Disproportionately Harms Low Resource Communities and Communities of Color in the Houston Nonattainment Area.

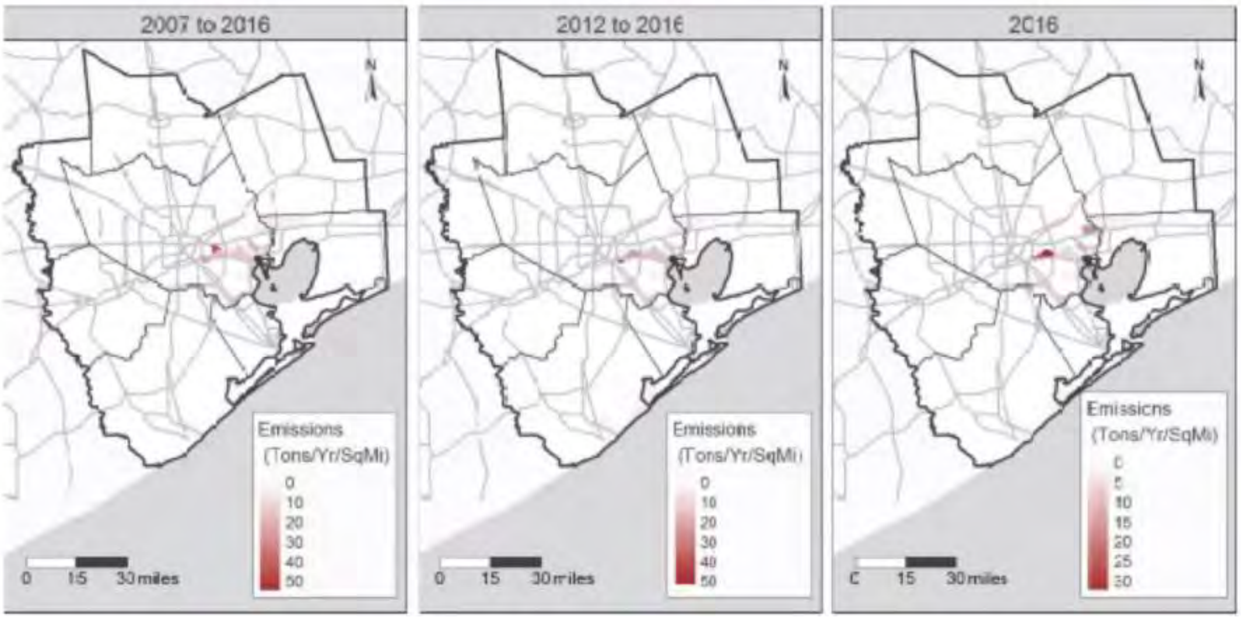
The acute harms of ozone pollution in the Houston nonattainment area are not felt evenly, numerous studies and data demonstrate that low resource communities and communities of color bear a higher burden. For example, in the historic Harrisburg and Manchester neighborhoods in east Houston, 97% of residents are people of color, 90% are low income, and 37% live in poverty.[13] Overall, there is a concentration of major industrial sources of air pollution in such communities. *Id.* at 3-6, 13. As of 2016, 26 Risk Management Plan industrial facilities—facilities that handle extremely hazardous substances and must report their emissions to the EPA's Toxic Release Inventory—operate in Manchester. *Id.* at 19. Major industrial sources, like those, are among the types of sources that are subject to requirements for Clean Air Act controls in the Texas SIP.

Focusing on unauthorized emissions of VOCs, a recent study finds that these environmental justice communities concentrated around the Houston Ship Channel are disproportionately affected by unauthorized emissions: "unauthorized VOC emissions…are most prevalent in the area around the Ship Channel," and "vulnerable populations experience greater emissions densities (on average) than their more

[12] The Oil and Gas Threat Map (search Harris County) (last visited October 28, 2019), https://oilandgasthreatmap.com/threat-map/.

[13] Center for Democracy at the Union of Concerned Scientists, *Double Jeopardy in Houston, Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities* 5-6 (Oct. 2016), https://www.ucsusa.org/sites/default/files/attach/2016/10/ucs-double-jeopardy-in-houston-full-report-2016.pdf (*Double Jeopardy*).

advantaged counterparts…due to the greater severity of emissions burdens that vulnerable populations bear when they live in tracts with emissions."[14] The maps below illustrate the existing disparity:



Unauthorized VOC Emission in the Eight County Houston Region. *Id.* at 25 fig. 5.

These VOCs include chemicals that are extremely dangerous on their own, like the listed hazardous air pollutants benzene, toluene, and formaldehyde. *See* 40 C.F.R. § 51.100(s) (defining VOC as "any compound of carbon, excluding [certain compounds], which participates in atmospheric photochemical reactions"); EPA, Technical Overview of Volatile Organic Compounds, http://www.epa.gov/indoor-air-quality-iaq/technical-overview-volatile-organic-compounds (discussing benzene, formaldehyde, and toluene as examples of VOCs); 42 U.S.C. § 7412(b)(1) (listing all three compounds as hazardous air pollutants). VOCs are also stored in above-ground storage tanks, the same kind of tanks that recently caught on fire within the nonattainment area at the Deer Park Intercontinental Terminal Company facility and darkened the sky over Houston in a cloud of smoke laced with toxic chemicals like toluene, benzene, and butane.[15]

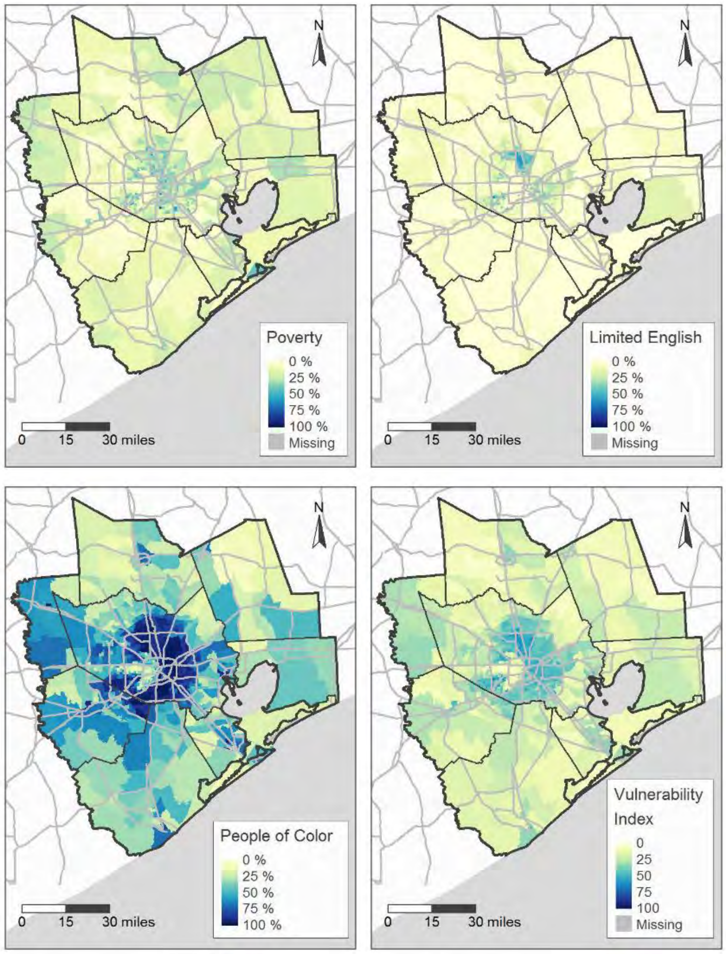
[14] Sustainable Systems Research, LLC, *Evaluation of Vulnerability and Stationary Source Pollution in Houston* ("2019 Houston Vulnerability Study") at 22 (Feb. 8, 2019), Attachment 1; *see also id.* at 23 tbl.5 (providing statistics).

[15] Letter, Toby Baker, Executive Director, TCEQ to Hon. Ron Reynolds, TX House of Representatives (Apr. 17, 2019), https://www.tceq.texas.gov/assets/public/response/smoke/correspondence/response-letter-to-Representative-Reynolds.pdf.

"The Houston Ship Channel is home to a number of environmental justice communities where long-term exposure to pollution already increases cancer risk by a factor of 1000. Levels of 1,3-butadiene and benzene, both carcinogenic VOCs and other precursor pollutants associated with formation of ground-level ozone, have been monitored for several years along the Houston Ship Channel. In the case of 1,3-Butadiene, a recent epidemiological investigation confirmed a trend of increased incidence of any type of leukemia in children living in parts of Harris County with higher average ambient air 1,3-butadiene concentrations compared to children living in areas of Harris County with lower concentrations of the pollutant. For children living near the Houston Ship Channel, there is a noted increase in the incidence rate of acute lymphocytic leukemia."[16]

And the disproportionate pollution harming Manchester and other Houston Ship Channel communities goes beyond ozone's toxic VOC precursors to particulate matter, and others. For example, spikes from so-called malfunctions of all types of air pollutants contribute to chronic health risks. 2019 Houston Vulnerability Study 22. In the Harrisburg and Manchester communities, "[l]ong-term daily exposures to air pollution can lead to health effects that go unaddressed due to residents' limited financial and health care resources." *Double Jeopardy* at 6. Today, Manchester experiences among the greatest vulnerability from air emissions by surrounding industrial polluters. 2019 Houston Vulnerability Study 25. Other communities of color, especially in eastern portions of Houston-Galveston-Brazoria ozone nonattainment area, bear a similar disproportionate emissions burden, including Pleasantville, Fifth Ward, Pasadena, Clinton Park, Galena Park, Deer Park, and Baytown. The map below illustrates high concentrations of people of color in eastern portions of the nonattainment area and their greater vulnerability to a variety of air pollutants discussed in the attached study.

[16] Brief of Caring for Pasadena Communities as Amicus Curiae p. 14, *Sierra Club v. EPA*, Nos. 15-1465 & 19-1024 (D.C. Cir. filed Jul 22, 2019) (internal citation omitted) (Commenters adopt amici's disproportionality arguments and supporting materials cited), Attachment 2.



Vulnerability in the Eight County Houston Region. *Id.* at 19.

II. THE PROPOSED RULE IS ILLEGAL AND ARBITRARY.

A. The Plan Fails to Demonstrate Timely Attainment as Required by the Clean Air Act.

The attainment demonstration SIP fails to show timely attainment of the 2008 ozone health standard by 2020 as required by the Clean Air and EPA rules. TCEQ's own model shows a 2020 design value of 76 ppb which does not meet the 2008 standard of 75 ppb. TCEQ attempts to use a "weight of evidence" analysis to overcome this modeling result, but that analysis is deficient and simply not credible. The actual monitored design value for the Houston-Galveston-Brazoria (HGB) area as of 2018 was 78 ppb, and monitoring data for 2019 shows continued high ozone levels. According to TCEQ data[17], multiple monitoring locations have already recorded fourth-highest 8-

[17] posted at https://www.tceq.texas.gov/cgi-bin/compliance/monops/8hr_exceed.pl.

hour ozone levels well in excess of 75 ppb this year, with the highest of these being 81 ppb.[18]

Trend data also refutes TCEQ's weight of evidence analysis. Design values show repeated violations of the 2008 NAAQS over recent years, with a value of 81 ppb as recently as the 2015-17 period. Contrary to TCEQ's assertions there is not a downward trend in the most recent years, but rather a repeated recurrence of levels in excess of the standard, alternating between higher and lower exceedances. Three of the past five design value periods have shown values of 80 ppb or higher. The following are design values reported for HGB for the periods 2007-09 through 2016-2018 respectively (in ppb):[19]

84	84	89	88	87	80	80	79	81	78

The data thus do not support a conclusion that the modeling is overpredicting ozone levels for 2020. If anything, the model is likely underpredicting ozone levels.
We also have concerns about TCEQ's use of outdated vehicle registration data to calculate mobile source emission inventories relied on in the model. The vehicle registration data used to calculate attainment and reasonable further progress in these SIPs are from the year 2014. Vehicle registration data is available to the public and is being updated daily by the Texas Department of Motor Vehicles. TCEQ must use the latest available data.

B. The Proposed Rule violates Title VI of the Civil Rights Act of 1964 and EPA's implementing civil rights regulations.

Finalizing a plan without stronger emission control measures where data demonstrate disproportionate harm and an area's air quality data models for NAAQS nonattainment by the attainment date is contrary to Title VI of the Civil Rights Act of 1964. Title VI of the Civil Rights Act of 1964 prohibits recipients of federal funds from discriminating against individuals on the basis of race, color, or national origin. 42 U.S.C. § 2000d. Title VI directs federal agencies granting federal assistance to issue regulations to achieve the statutory objectives. *Id*. § 2000d-1. EPA's implementing regulations state that "[n]o person shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving

[18] *See* attached summary sheet, Attachment 3.
[19] Data from EPA, Ozone Design Values, 2018 (XLSX) (973 K, 7/23/2019); https://www.epa.gov/air-trends/air-quality-design-values#report.

EPA assistance on the basis of race, color, [or] national origin[.]" 40 C.F.R. § 7.30. The regulations also provide a non-exclusive list of specific, prohibited discriminatory acts:

> (b) A recipient shall not use criteria or methods of administering its program or activity which have the effect of subjecting individuals to discrimination because of their race, color, national origin, or sex, or have the effect of defeating or substantially impairing accomplishment of the objectives of the program or activity with respect to individuals of a particular race, color, national origin, or sex.

Id. § 7.35. Federal-funding recipients cannot "[r]estrict a person in any way in the enjoyment of any advantage or privilege enjoyed by others receiving any service, aid, or benefit provided by the program or activity." *Id.* § 7.35(a)(3).

The Proposed Rule violates Title VI of the Civil Rights Act of 1964 and EPA's implementing regulations. By TCEQ's own data, the Houston area is set to fail its serious area attainment deadline because its current design value exceeds the 2008 ozone NAAQS.[20] As discussed above, studies and data demonstrate that air pollution, and specifically ozone pollution and ozone precursor pollution, disproportionally harm people of color in the Houston nonattainment area. TCEQ's foot-dragging in implementing stronger emission controls in the face of this persistent smog problem prolongs the disproportionate pollution burden people of color in the Houston area suffer. This means that people of color in the Houston area enjoy the outdoors less and suffer more the health consequences of persistent air quality when compared to white Houston area residents.[21]

There are several measures TCEQ could take through this SIP revision to ameliorate the historic disproportionate harm to people of color. TCEQ should require implementation of available Reasonably Available Control Measures and Reasonably Available Control Measures, as required by the Act and discussed below. The agency could also revoke Texas's affirmative defense provision for startup, shut down, and malfunction events prior EPA's finalization of the proposed withdraw of finding of substantial inadequacy (84 Fed. Reg. 17,986 (Apr. 29, 2019))—a policy that, when in use, allowed polluters to claim the defense and avoid enforcement for approximately 97% of

[20] Proposed Rule ES-1 ("The peak ozone design value for the HGB nonattainment area is projected to be 76 ppb in 2020…").

[21] *See Double Jeopardy* comparing Harrisburg/Manchester to predominantly white neighborhoods in Houston.

unauthorized releases.[22] This would help address some of the disproportionate VOC emissions burden borne by Houston Ship Channel communities, specifically discussed above.

Further, the Commission could extend the comment period, hold another public hearing, and provide *meaningful* opportunities for public participation for the most affected residents of the Houston nonattainment area. The Commission held a public hearing on Monday, October 14, 2019 at 2p.m. at the Houston Texas Department of Transportation office, and another in Arlington on October 17 under similar circumstances. This is hearing did not provide the public a meaningful opportunity to participate. For example, a government-issued identification card is required to enter this building and it is accessible only through very limited public transportation, creating unnecessary roadblocks for elderly residents, disabled persons, youth advocates who must attend school, and undocumented persons who may lack government-issued identification.[23] Using public transportation, it would take someone living in Manchester over an hour and a half to travel to this building. Further, by some measures, Houston has been named the most diverse city in the nation, with over 140 languages spoken by its residents[24], meaning, that TCEQ's English-only public hearing notice is wholly inept at garnering public participation in this part of Texas.[25]

Given the area's history of missing attainment dates and with modeled nonattainment for the serious area attainment deadline, TCEQ failure to implement enhanced emission control measures perpetuates the disproportionate harm borne by people of color in the Houston area in violation of Title VI and EPA's implementing regulations.

C. TCEQ's failure to implement Reasonably Available Control Measures in the Houston area is unlawful and arbitrary under Clean Air Act § 172(c)(1).

TCEQ's failure to implement all reasonably available control measures ("RACM") because it purportedly cannot implement measures by the next ozone

[22] *See* 84 Fed. Reg. 17,986, Docket No. EPA-R06-OAR-2018-0770, Comments of Environmental and Community Group Coalition 1-2.
[23] One's status in this country is irrelevant to participation in SIP revisions or any other environmental permitting or rulemaking action before the TCEQ.
[24] Bryan Kirk, Houston Named the Most Diverse City in the U.S. in Recent Survey (Apr. 10, 2019), https://patch.com/texas/houston/houston-named-most-diverse-city-u-s-recent-survey.
[25] TCEQ, Notice of Public Hearing on Proposed Revisions to 30 Texas Administrative Code Chapters 115 and 117 and to the State Implementation Plan, https://www.tceq.texas.gov/assets/public/legal/rules/hearings/19075115_phn_HGB.pdf.

season plainly violates the Act. Under Act requirements, Texas must implement all available RACM and RACT controls through this SIP revision.[26]

RACM are an independent requirement on all nonattainment areas that that imposes a duty to adopt **all** reasonable available control measures as expeditiously as practicable. 42 U.S.C. § 7502(c)(1); *see also Ober v. Whitman*, 243 F.3d 1190 (9th Cir. 2001). The RACM requirement is an overarching requirement on states to implement reasonable measures as a means of meeting and maintaining standards. *See Sierra Club v. EPA*, 291 F.3d 155, 162 (D.C. Cir. 2002).

RACM determinations submitted to EPA for review must be supported by adequate analysis and data. *See Ober,* 243 F.3d at 1195 (*quoting American Lung Ass'n v. EPA*, 134 F.3d 388, 392–93 (D.C. Cir. 1998)). States must "consider all available control measures and [] adopt and implement such measures as are reasonably available for implementation in the areas as components of the area's attainment demonstration." General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990, 57 Fed. Reg. 13,498, 13,560/2 (Apr. 16, 1992). EPA has provided guidance to states on what constitutes RACM. *See* 74 Fed. Reg. 2945, 2951/3 (Jan. 16, 2009) (for the 1997 ozone NAAQS). Here, TCEQ has failed to conduct a thorough review of all available RACMs. It has rejected stronger RACMs without reasoned explanation. TCEQ has also failed to consider all ozone controls adopted in the South Coast Air Quality management District in California, or recommended by the Ozone Transport Commission in the Northeast, or identified in EPA guidance. Nor has TCEQ fully evaluated the transportation control measures identified in Clean Air Act section 108(f) and in EPA guidance elaborating on those measures.

TCEQ's failure to implement even a single new RACM in the Houston area, despite modeling nonattainment, is contrary to the Clean Air Act. Quite simply, TCEQ does not have discretion to delay additional RACM that are needed to timely attain. TCEQ claims that RACM measures "would have to be in place no later than the beginning of ozone season in the attainment year to be considered RACM, or January 1, 2020." Proposed Rule 4-10. But TCEQ has not even tried to show it cannot implement additional RACM in time to produce attainment in the 2020 ozone season. Nor has it demonstrated that timely implementation of sufficient measures is impossible. Even if it could, the claim that Texas cannot implement any new RACM in Houston because of

[26] Dr. Ranajit Sahu, Comments on the Reasonably Available Control Technology (RACT) and Reasonably Available Control Measures (RACM) for the 2008 Ozone NAAQS Attainment SIP Modifications Proposed by the Texas Commission on Environmental Quality (TCEQ) for the Houston-Galveston-Brazoria (HGB) and Dallas-Fort Worth (DFW) Non-Attainment Areas (Oct. 28, 2019) ("Sahu Report"), Attachment 4.

TCEQ's "inability to implement control measures early enough to advance attainment of the 2008 eight-hour ozone NAAQS" impermissibly renders the RACM requirement void. *Id.* By this logic, TCEQ may perpetually short shrifts the Act's RACM requirement — even as the area stands to be reclassified to severe due to persistent smog pollution. Moreover, the claim is simply not credible. As documented in the Sahu Report filed herewith, there are numerous RACM and RACT measures that can be implemented in very short order to curb emissions of ozone precursors.

Texas must implement RACT and RACM as part of this reclassification because it is likely that Houston will fail to meet its serious area attainment date. The Houston area currently models nonattainment of the 2008 ozone NAAQS and there is a strong likelihood that it will fail to meet its serious area attainment deadline, as discussed above. Under this likely scenario, the Houston area is reclassified to severe, and its attainment date is extended by six years to July 20, 2027, 42 U.S.C. § 7511(a)(1) tbl.1, and the last set of air quality data that could be used to demonstrate attainment with this deadline is the ozone season ending on July 20, 2026. Within six months of the passage of the attainment date, or by January 20, 2022, EPA must determine whether the Houston area attained the 2008 ozone NAAQS by the serious area attainment date or reclassify the area to severe. *See* 42 U.S.C. § 7511(b)(2)(A), (B). But EPA is frequently tardy in carrying out this nondiscretionary duty. *See Center for Biological Diversity v. EPA*, 3:19-cv-2462-RS (N.D.C.A.) (case filed May 7, 2019) (lawsuit regarding EPA's failure to finalize attainment determinations by the Act's deadlines). At the time of Houston's serious area reclassification, the EPA Administrator used his discretion to set a SIP revision due date, including RACT measures, of August 3, 2020, approximately one year prior to the serious area attainment date of July 20, 2021 and one year after the effective date of the rule. 84 Fed. Reg. 44,245/3.[27] Without stronger RACM and RACT requirements in this SIP revision, the Houston area will fail to timely attain the serious area attainment deadline, and – under TCEQ's approach – may not see new control measures for the 2008 ozone NAAQS until 2024 or later—where any new measures would provide two-years' worth or less of emission reduction benefits to demonstrate severe area attainment. This outcome is absurd and runs contrary to the carefully designed framework for timely attainment prescribed by the Clean Air Act.

[27] EPA's discretion-based SIP submittal date does not excuse Texas from adopting all RACM and RACT necessary to attain the 2008 standard by the 2020 ozone season. There, Texas cannot wait until August 2020 to adopt and implement all the measures needed to ensure timely attainment in 2020.

D. TCEQ arbitrarily disregards Reasonably Available Control Technology.

TCEQ claims that, based on its flawed framework, RACT measures are simply not available – TCEQ's contentions lack support in the record. The agency claims that existing Texas Administrative Code provisions regarding NOx and VOC controls "continue to fulfill [] RACT requirements for the HGB serious ozone nonattainment area under the 2008 eight-hour ozone NAAQS" and that additional controls for "certain major sources were determined to be either not economically feasible or not technologically feasible." Proposed Rule 4-7 to -8. Yet, based on independent research and TCEQ's own appendices to the Proposed Rule, Commenters' expert was able to identify numerous cost effective RACT measures for NOx and VOC sources that are easily implementable before the next ozone season.[28] TCEQ's reluctance to implement any new RACT measures through this SIP revision arbitrarily disregards this Clean Air Act requirement.

Moderate and higher ozone nonattainment areas must develop plans that implement "reasonably available control technology under [42 U.S.C. §] 7502(c)(1)" for "all…major stationary sources of [volatile organic compounds]" and NO_x. 42 U.S.C. § 7511a(b)(2), (f). Revisions to SIPs must include EPA-issued control technique guidelines ("CTGs") and alternative control techniques ("ACTs") for major sources of VOCs and NOx. RACT "defines the lowest limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility." Memorandum from R. Strelow, Asst. Adm'r, EPA, Office or Air and Waste Management, to Reg'l Adm'rs, EPA Regions I-X, re: *Guidance for Determining Acceptability of SIP Regulations in Non-Attainment Areas* 2 (Dec. 9, 1976) ("Strelow Memo"). RACT "means devices, systems, process modifications, or other apparatus or techniques that are reasonably available taking into account: (1) [t]he necessity of imposing such controls in order to attain and maintain a national air quality standard; (2) [t]he social, environmental, and economic impact of such controls; and (3) [a]lternative means of providing for attainment and maintenance of such standard [for requests for deadline extensions]." 40 C.F.R. § 51.100(o).

"RACT encompasses stringent, or even 'technology forcing,' requirement[s]." Strelow Memo 2; *See also Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457, 492 (2001) (Breyer, J. concurring) (noting that technology forcing requirements "are still paramount in today's [Clean Air] Act"). "In every case RACT should represent the toughest controls considering technological and economic feasibility that can be applied to a specific situation. Anything less than this is by definition less than RACT and not

[28] Sahu Report at 9-20.

acceptable for areas where it is not possible to demonstrate attainment[.]" Strelow Memo 3.

In support of timely attainment, RACT determinations must be made and implemented quickly. *See Miss. Comm'n on Envtl. Quality v. EPA*, 790 F.3d 138, 146 (D.C. Cir. 2015). In SIP revisions, States must submit supporting evidence with their RACT determinations. *NRDC v. EPA*, 571 F.3d 1245, 1254 (D.C. Cir. 2009); *see, e.g.*, 80 Fed. Reg. 12, 264, 12,278/2-80/2 (Mar. 6, 2015). States cannot rely on RACT determinations for previous ozone standards without explanation as to the continued adequacy of the RACT measures. *See* 81 Fed. Reg. 58,010, 58,037/3 (Aug. 24, 2016). The Act provides states with "discretion to require beyond-RACT reductions from any source" because "it may be necessary in some cases for states to achieve 'beyond RACT' reductions in order to demonstrate attainment as expeditiously as practicable." 80 Fed. Reg. 12,279/3.

"Past experience has shown that due to ongoing innovation, cost-effective control technologies and processes alternatives for many sectors continue to be developed…." *Id.* EPA guidance requires states to use information available at the time the RACT SIPs are developed. For example, ACTs, public comments, other relevant information. *See, e.g.*, 80 Fed. Reg. at 12,279/2. Even where ACTs and CTGs may be dated, EPA says that there is other information that is current from which states can provide adequate analysis. *Id.*; 78 Fed. Reg. 34,178, 34,192/2-3 (June 6, 2013). Thus, ACTs and CTGs may not themselves set firm RACT requirements.

Texas must require new RACT in Houston now because the Act so requires, because the area is on track to fail the serious area attainment date and there are stronger RACT measures available. Commenters' expert, Dr. Ranajit Sahu, outlines numerous RACT measures available for implementation that could reduce NOx and VOC emissions, and address the disproportionate burden on environmental justice communities within the nonattainment area. The single largest source of NOx emissions (by a factor of 10) in the Houston area is the W.A. Parish power plant. At this plant, gas-fired units actually emit more NOx than the coal units. Dr. Sahu identifies additional controls, such as "low-NOx burners, or ultra low NOx burners, SNCR, and SCR [selective catalytic reduction]"[29] for these highly polluting units. At the W.A. Parish coal units, new RACT measures appear even more readily accessible, including "properly maintaining and operating already in-place SCIRs for these units" along with other measures.[30]

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[29] Sahu Report at 15.
[30] *Id.*

TCEQ must implement new RACT and RACM measures for refineries because these are readily available. Refineries are large contributors to the ozone problem in Houston and a source of significant disproportionate impacts for environmental communities in the area. Typical reasonably available controls for refineries include "a combination of ultra low NOx burners/FGR/SNCR or ultra low NOx burners/SCR"[31] yet TCEQ does not propose these as RACM or RACT. Measures that do not require long lead times include "better maintenance or proactive replacement of equipment" to prevent and detect leaks of VOCs, also not proposed by TCEQ.[32] There are also readily available RACM and RACT measures for storage tanks at these refineries . Among other things, TCEQ must require all high vapor products "stored in internal floating roof or fixed roof tanks –[be] connected to a vapor recovery or vapor control system with a specified (and verifiable) capture and/or control efficiency of at least 99%."[33] Dr. Sahu demonstrates that there are storage tanks permitted for operation by TCEQ that achieve this level of efficiency; also available are "carbon adsorbers and concentrators (for vapor recovery), and/or catalytic oxidizers and regenerative thermal oxidizers (RTOs) (for destruction of vapors)."[34] TCEQ's RACT and RACM analysis fails to address available NOx and VOC emission reductions available from refinery and storage tank sources.

Additional details for these and other RACT and RACM measures are identified and explained in Dr. Sahu's discussion.

In sum, the Act does not allow TCEQ to disregard and refuse to adopt additional RACM and RACT. Such additional measures are required by the Act, and are necessary to ensure attainment as expeditiously as practicable.

Sincerely,

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[31] *Id.* at 18.
[32] *Id.*
[33] *Id.* at 20.
[34] *Id.*

Attachment 3

Comments on the Reasonably Available Control Technology (RACT) and Reasonably Available Control Measures (RACM) for the 2008 Ozone NAAQS Attainment SIP Modifications Proposed by the Texas Commission on Environmental Quality (TCEQ)

for the

Houston-Galveston-Brazoria (HGB) and Dallas Fort Worth (DFW) Non-Attainment Areas

by

Dr. Ranajit (Ron) Sahu, Consultant[1]

A. Introduction

I have prepared these comments on the proposed Houston-Galveston-Brazoria (HGB) and Dallas Fort Worth (DFW) State Implementation Plan (SIP) modifications by Texas Commission on Environmental Quality (TCEQ) for the as a result of the Serious classification of these areas for the 2008 eight-hour ozone National Ambient Air Quality Standards (NAAQS).

As part of the SIP, the TCEQ was supposed to propose reductions in precursor pollutants NOx and VOCs (which, together with sunlight, form ozone in the atmosphere) in each of these areas pursuant to Reasonably Available Control Technology (RACT[2]) and Reasonably Available Control Measures (RACM[3]) analyses.

I have prepared these focused comments on behalf of Earthjustice and its clients. I focus on the TCEQ's RACT and RACM analyses provided in Appendix F (RACT) and Appendix (G) of the respective SIP modifications.

My focus in these comments pertain to stationary sources only. In summary, for reasons stated in its analyses, the TCEQ has proposed no additional reductions of NOx or VOC emissions

[1] Resume provided in Attachment A.

[2] As noted in the SIPs:

> "RACT is defined as the lowest emissions limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility….RACT requirements for moderate and higher classification nonattainment areas are included in the [Federal Clean Air Act] FCAA to assure that significant source categories at major sources of ozone precursor emissions are controlled to a reasonable extent…"

[3] As noted in the SIPs:

> "[W]hile RACT and reasonably available control measures (RACM) have similar consideration factors like technological and economic feasibility, there is a significant distinction between RACT and RACM. A control measure must advance attainment of the area towards the meeting the NAAQS for that measure to be considered RACM. Advancing attainment of the area is not a factor of consideration when evaluating RACT because the benefit of implementing RACT is presumed under the FCAA."

under either RACM or RACT from any stationary sources in each of these two non-attainment areas, whose ozone problems are clearly getting worse and not better. TCEQ claims, in its analyses that stationary sources, which are already subject to TCEQ's current rules and regulations, cannot provide additional emissions reductions.

In the case of RACM, relying on absurd EPA guidance, TCEQ could not find any additional reductions[4] because these reductions would need to advance the attainment date by one year.[5]

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[4] HGB SIP, Appendix G, Section 4.1

> "[T]he TCEQ determined that no potential control measures met the criteria to be considered RACM."

See also, Section 4.2:

> "[A]dditional NO_X control measures cannot be implemented in time to advance attainment of the 2008 eight-hour ozone NAAQS in the HGB area. For this reason and for the other reasons identified in Table G-1, no NOx control measures are included as RACM for this SIP revision."

See also Section 4.3:

> "Additional VOC control measures cannot be implemented in time to advance attainment of the 2008 eight-hour ozone NAAQS in the HGB area."

DFW SIP, Appendix G, Section 4.1

> "[B]ased on the RACM analysis, the TCEQ determined that no potential control measures met the criteria to be considered RACM. All potential control measures evaluated for stationary sources were determined to not be RACM due to technological or economic feasibility, enforceability, adverse impacts, or ability of the measure to advance attainment of the NAAQS. In general, the inability to advance attainment is the primary determining factor in the RACM analyses."

See also Section 4.2:

> "[A]dditional NO_X control measures will not advance attainment of the 2008 eight-hour ozone NAAQS in the DFW area because it is not possible to implement any significant and cost-effective control measure early enough to advance attainment."

See also Section 4.3:

> "…For this reason and for the other reasons identified in Table G-1, no VOC control measures are included as RACM for this SIP revision."

[5] The absurdity of this constraint is illustrated by the following TCEQ discussion relating to RACM for each non-attainment area. TCEQ first notes that among the criteria that a measure must meet in order to qualify as RACM, is the requirement that the "…control measure can advance the attainment date by at least one year." TCEQ then goes on to state:

> "[T]he EPA did not provide guidance in the *Federal Register* notice on how to interpret the criteria "advance the attainment date by at least one year." Considering the July 20, 2021 attainment date for this attainment demonstration, the TCEQ evaluated this aspect of RACM based on advancing the attainment date by one year, to July 20, 2020….For a control measure to "advance attainment," it would need to be implemented prior to the beginning of ozone season in the attainment year, so suggested control measures that could not be implemented by January 1, 2020 could not be

This is practically impossible, given the typical regulatory calendar. Thus, following EPA guidance for RACM means that RACM, as an emissions reduction tool for stationary sources, would never be applicable – an absurd result.

For RACT, TCEQ also did not find any additional emissions reductions beyond what is already on the books under its current regulations. In turn, some of these regulations reflect EPA's decades-old Control Technology Guidelines (CTG) documents and Alternative Control Technologies (ACT) documents.

TCEQs conclusions are unsupportable and irrational. In the comments below, I show that additional NOx and VOC emissions reductions are available from stationary sources in each of these non-attainment areas. My analysis, as noted above, is not meant to be comprehensive – i.e., I do not provide a detailed analysis of every single opportunity for emissions reductions at every single source of NOx and VOC in these non-attainment areas. Rather, it is focused. Its purpose is to show that additional reductions are available had TCEQ have made reasonable efforts to analyze current, reported emissions.

For all of my analyses below, in the categories I describe, I rely on reported actual emissions by sources in these two non-attainment areas (aggregating the various counties in each of these non-attainment areas) for the year 2017[6] – the most recent year for which actual emissions data are reported.[7] I do not have year 2018 data, which are expected to be released later this year or in early 2020.

> considered RACM because the measures would not advance attainment. To "advance the attainment date by at least one year" to July 20, 2020, suggested control measures would have had to be been fully implemented by January 1, 2019, which has already passed. In order to provide a reasonable amount of time to fully implement a control measure, the following must be considered: availability and acquisition of materials; the permitting process; installation time; and the availability of and time needed for testing."

Therefore, since the time for any measure to be considered as RACM "has already passed," TCEQ's rationale means no measure can be considered under RACM. Clearly, this completely guts RACM as a tool under the SIP. This is a patently absurd result.

[6] TCEQ also relied upon the 2017 inventory for its analysis.

See HGB SIP, Appendix F, Section 2.4. "[T]he TCEQ reviewed the 2017 point source emissions inventory, Title V databases, and NSR databases to identify all major sources of NO_X and VOC emissions….Since the point source emissions inventory database reports actual emissions rather than PTE, the TCEQ used reported actual emissions as low as 25 tpy of NO_X or VOC as the cutoff to develop a preliminary major source list…."

See also DFW SIP, Appendix F, Section2.2. "[T]he TCEQ reviewed the 2017 point source emissions inventory…"

[7] By using the reported actual emissions of NOx and VOC by various sources in these two non-attainment areas, I do not imply that I endorse the reliability or accuracy of the reported emissions. I am simply using the data, as reported.

Given the particular interests of my client, I focused my review of potential emissions reduction opportunities on the following types of sources: (i) reductions of NOx from large sources in each of the two non-attainment areas; (ii) reduction of NOx and VOC from selected refinery source in the HGB non-attainment area; and (iii) reduction of VOC (as associated air toxics) emissions from selected storage tanks located in selected refinery sources in the HGB area.[8] I reiterate that by using these example analyses, I do not mean to imply that the opportunities for emissions reductions are just limited to these sources. These are merely examples.

B. Documents Reviewed

In preparing these comments, I have reviewed the proposed SIP language for each non-attainment area as well as the various Appendices referenced in the SIPs.[9] These include Appendix F and Appendix G for each SIP, dealing, respectively, with the RACT and RACM analyses.

C. Comments – Large NOx Sources

NOx reductions are important in each of the two non-attainment areas. As the respective SIPs state:

> "[D]ue to the abundance of naturally occurring biogenic VOC emissions, the DFW area is primarily NO_X-limited with respect to ozone formation."[10]

and

> "…the HGB area is primarily NO_X-limited with respect to ozone formation due to the abundance of naturally occurring VOC emissions in the area, making additional VOC reductions much less effective than NO_X reductions at lowering ozone levels."[11]

Therefore, it is clear that NOx reductions will translate to lower ozone formation in the atmosphere in each of these areas.

C.1. DFW Non-Attainment Area

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[8] This is particularly relevant not just because of the opportunities for reduction of reactive VOCs from such tanks, which would, of course, assist in reaching ozone attainment. Reductions of such VOCs and associated air toxics would also lead to lower adverse impacts of these emissions on low-income neighboring communities located, in some case, literally adjacent to the selected refineries. Thus, such reductions serve multiple-purposes.

[9] Project Number 2019-077-SIP-NR for the HGB area and Project Number 2019-078-SIP-NR for the DFW area.

[10] DFW SIP Appendix G, Section 4.3.

[11] HGB SIP, Appendix G, Section 4.3.

Table 1 below shows the largest NOx emission sources in the DFW non-attainment area, per the 2017 emissions inventory. I have only included sources that reported actual emissions greater than 40 tons/year.

Table 1 – Large NOx Sources (Dallas Fort Worth Non-Attainment Area)

Company	Site	Source Type	Source Name	2017 Emissions (tpy)
TXI OPERATIONS	MIDLOTHIAN PLANT	KILN	#5 CEMENT KILN STACK	1185.8
HOLCIM TEXAS	MIDLOTHIAN PLANT	KILN	KILN NO. 2 MAIN BAGHOUSE, BYPASS BAGHOUSE, COAL MI	774.9
ASH GROVE CEMENT	MIDLOTHIAN PLANT	KILN	RECONSTRUCTED NO.3 CEMENT KILN SYSTEM	453.1
TEXAS LIME COMPANY	TEXAS LIME	KILN	LIME KILN #6	332.7
HOLCIM TEXAS	MIDLOTHIAN PLANT	KILN	KILN NO. 1 MAIN BAGHOUSE, BYPASS BAGHOUSE, AND SCR	261.4
TEXAS LIME COMPANY	TEXAS LIME	KILN	LIME KILN #5	248.9
LUMINANT	FORNEY POWER PLANT	TURBINE	COMBUSTION TURBINE 12	189.0
LUMINANT	FORNEY POWER PLANT	TURBINE	COMBUSTION TURBINE 21	186.9
LUMINANT	FORNEY POWER PLANT	TURBINE	COMBUSTION TURBINE 13	184.6
LUMINANT	FORNEY POWER PLANT	TURBINE	COMBUSTION TURBINE 22	182.7
LUMINANT	FORNEY POWER PLANT	TURBINE	COMBUSTION TURBINE 11	178.7
LUMINANT	FORNEY POWER PLANT	TURBINE	COMBUSTION TURBINE 23	175.3
ENNIS POWER	ENNIS PLANT	TURBINE	COMBUSTION TURBINE	88.2
ENLINK MIDSTREAM	HUGHES RANCH COMPRESSOR STATION	I.C. ENGINE	CATERPILLAR G3408TA "UNIT 303572"	81.2
CHAPARRAL STEEL	MIDLOTHIAN PLANT	FURNACE	ARC FURNACE "A"	80.5
CHAPARRAL STEEL	MIDLOTHIAN PLANT	FURNACE	ARC FURNACE "B"	80.5
ELK CORPORATION	ELK CORP	THERMAL OX.	RTO INCINERATOR 2	58.8
BRAZOS ELECTRIC POWER	JOHNSON COUNTY GENERATION	TURBINE	COMBUSTION TURBINE GENERATOR 1	55.6
SMURFIT KAPPA	FORTNEY MILL	BOILER	WOOD FIRED BOILER	49.8
MIDLOTHIAN ENERGY	MIDLOTHIAN ENERGY FACILITY	TURBINE	COMBINED CYCLE GAS COMBUSTION TURBINE	48.4
ENLINK MIDSTREAM	LATERAL H-14 COMPRESSOR STATION	I.C. ENGINE	CATERPILLAR 379NA	47.8
OWENS CORNING	WAXAHACHIE PLANT	FURNACE	"V-1" GLASS FURNACE	44.6
ENLINK MIDSTREAM	LATERAL F-G COMPRESSOR STATION	I.C. ENGINE	CATERPILLAR G3406NA	44.5
ENLINK MIDSTREAM	MEADOWS COMPRESSOR STATION	I.C. ENGINE	COMPRESSOR ENGINE	40.5

The largest sources of NOx, as clearly seen in Table 1 are cement kilns at three companies (TXI, Holcim, and Ash Grove). A lime kiln operated by the Texas Lime Company is also among the top 6 sources. Additional sources include combustion turbines, steel electric arc furnaces, and several engines. But none of these are as large as the cement kilns.

I therefore provide some additional discussions on the potential NOx reductions from the cement kilns. It is useful to start with TCEQ's discussion on the obviously large NOx emissions from these kilns. I quote below from the DFW SIP, Appendix G (RACM Analysis). A somewhat parallel discussion is also provided in Appendix F (RACT Analysis).

"…[T]hree companies currently operate four kilns in Ellis County. These kilns have been operating well under their ozone season NOx source cap due to low product demand and replacement of higher-emitting wet kilns with dry kilns. No additional rulemaking would be needed to realize these reductions.

TXI Operations, LP (TXI) currently operates one dry preheater/precalciner (PH/PC) kiln. This kiln has emitted…1.63 lb NOx/ton of clinker in 2017….The TCEQ entered into an Agreed Order with TXI to include the 1.95 lb NOx/ton of clinker permit limit as a federally-enforceable addition to the Texas SIP….

Ash Grove Cement Company operated three kilns in Ellis County. However, a 2013 consent decree with the EPA required by September 10, 2014 shutdown of two kilns and reconstruction of kiln #3 as a dry PH/PC kiln with continual SNCR operation, an emission limit of 1.5 lb NOx/ton of clinker…Emissions from this kiln in calendar year 2017 averaged 1.32 lb NOx/ton of clinker…

Holcim U.S., Inc. (Holcim) currently has two dry PH/PC kilns equipped with SNCR…Emissions from Line 1, with the SNCR+SCR-THC system, averaged…1.39 lb NOx/ton of clinker during the 2015 to 2017 ozone seasons. Line 2, with SNCR, emitted an average of 1.38 lb NOx/ton of clinker during the 2017 ozone season…The Holcim SCR-THC installation required more than 12 months from permit application to SCR operation, with additional design time prior to application submittal. Therefore, there is insufficient time to design, permit, construct, and commission an SCR system prior to the March 1, 2020 RACM deadline. For these reasons, SCR or hybrid SCR-SNCR are not RACM for the existing Ellis County cement kilns….

Although the source cap emission specification in §117.3123 could be altered to allow for modeling of lower NOx emissions, the estimated reduction of the source cap is unlikely to result in significant real NOx reductions beyond current operation and will therefore not advance attainment."[12] (emphasis added)

There are several significant issues with TCEQ's statements above.

First, relying on actual emissions staying below source caps "…due to low product demand…" does not provide any reassurance that, should demand increase in future years, that the caps would not be threatened. Counting on lower production in the future is not a proper basis for an attainment demonstration.

Second, as the statements above confirm, none of the kilns have the highest NOx controls (i.e., Selective Catalytic Reduction, SCR).[13] At best, the kilns have Selective Non-Catalytic Reduction (SNCR). Permit limits, as shown above range from around 1.5 to 1.95 lb/ton clinker

[12] DFW SIP, Appendix G, Section 4.2.1.

[13] By SCR, I mean SCR for NOx reduction. Holcim's SCR-THC, which uses a catalyst to reduce hydrocarbon emissions but not NOx, is different.

produced. Yet, as TCEQ is well aware, from its own studies as well as in repeated public comments provided by numerous local and national organizations, SCR technology for NOx reduction is widely applied in cement kilns, especially in Europe, and has been for many years.

Companies engaged in air pollution control have long recognized the application of SCR to cement kilns, via public comments. These include the trade organization, the Institute of Clean Air Companies:

> "Selective Catalytic Reduction (SCR) technology represents a mature NOx abatement technology and is an effective technology for reducing NOx emissions from cement kilns."[14]

Other state regulators have also said the same. This includes the National Association of Clean Air Agencies (NACAA):

> "NACAA believes that EPA's proposed NOx emission limit of 1.5 lb/ton clinker seriously underestimates the reductions that are achievable with SCR technology. <u>If SCR systems are installed, Portland cement facilities will achieve far greater reductions than the 1.5 lb/ton estimated to be achievable with SNCR. In fact, by EPA's own estimate, they will be able to achieve reductions of 0.5 lb/ton clinker with SCR, compared to the 1.5 lb/ton clinker that EPA estimates is achievable with SNCR.</u> Therefore, NACAA recommends that SCR be identified as BDT for this sector. This technology is 'the regulated future" for cement kilns."[15] (emphasis added)

Note the fact that NOx levels would be at 0.5 lb/ton clinker, with SCR – which is considerably lower than the current permit limits (and actual emissions) noted in the TCEQ discussion above.

The TCEQ itself, via a court-ordered study from 2005 (i.e., over 14 years ago) is well aware that SCR is eminently feasible on cement kilns. This study, mandated in 2005 by a court settlement, was conducted by an expert panel of five independent engineering and cement technology experts convened by the TCEQ. They studied the feasibility of a variety of cement plant control technologies, including SCR. The panel's final report, prepared by Eastern Research Group for TCEQ and published in July 2006 concluded:

> "SCR is an available technology for dry kilns," *i.e.* "commercially available and in use on similar types of cement plants" and "transferable technology," because it had been tested and implemented on a full-scale in Europe and had proven effective on similarly fired industrial and utility units in the U.S., like coal-fired power plants and waste incinerators."[16]

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[14] www.icac.com.

[15] NACAA comments on the Portland Cement New Source Performance Standards (NSPS), 2008.

[16] ERG, Inc., Assessment of NOx Emissions Reduction Strategies for Cement Kilns – Ellis County, Final Report,

Downwinders at Risk, a local group in the Midlothian area, in comments submitted in July 2014 to the TCEQ provided specific examples of high levels of NOx reduction that were being achieved, back then, using SCR.

> "[E]uropean cement plants using SCR report reductions from 80 to over 90%. The Solnhofer, Germany plant reported an 80% removal rate for NOx pollution when it operated its SCR unit in the early part of this century. The plant manager of the Monselice, Italy cement plant using SCR installed in 2006 has recorded a 95% removal rate of NOx pollution. The Mergelstetten, Germany cement plant reports an 85% removal rate for NOx pollution from an SCR unit installed in 2010. The Rohrdorf, Germany cement plant reports an 88-90% reduction in NOx pollution from an SCR unit installed in 2011. At the Holcim-owned Joppa, Illinois long dry kiln where an EPA pilot project is currently being conducted, operators report an 80% removal rate for a retrofitted SCR system. ("Is SCR Technology Coming (back) to Cement?" John Kline, World Cement, April 2013)."[17]

Engineering companies and SCR catalyst vendors who have experience with cement kilns include Elex, GEA Bischoff, Scheuch, CRI Catalyst Company, Haldor Topsoe, KWH, Lurgi, etc.

SCR has also been successfully demonstrated in the US. In 2015, EPA conducted and completed a pilot test of a full-scale commercial SCR unit on a long dry kiln in Joppa, Illinois. This is similar to the kilns in the DFW non-attainment area. Per the regional EPA office overseeing the test, "the SCR is operating, and results in an emission reduction of about 80%," and the kiln operator is permanently installing the new control technology and seeking a permit for its continued operation.[18]

Finally, additional catalyst-based NOx reduction approaches have also been used, most recently using catalyst-coated bags ("catalytic filter bags") in fabric filters, to reduce NOx.[19]

In other words, there are significant NOx reductions possible from the many cement kilns in the DFW non-attainment area. Dropping NOx rates from the over 1.2 to 1.95 lb/ton clinker to values less than 0.5 lb/ton clinker would result in dramatic reductions of NOx. The TCEQ, which has been well aware of this for over a decade, cannot simply ignore the benefits of the large NOx reduction, while claiming that its current rules and regulations are the best in the

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Cement Kiln Study for the Air Quality Planning Section, Chief Engineer's Office, Texas Commission on Environmental Quality, July 14, 2006.

[17] Comments to TCEQ on the Amendment to State Air Quality Permit Number 8996, Modification to Prevention of Significant Deterioration Air Quality Permit Number PSDTX454M4, July 11, 2014

[18] email from Kushal Som, Environmental Engineer, U.S. EPA Region 5 to Jim Schermbeck, July 21, 2015.

[19] See, Consent Decree lodged in US District Court, District of Nevada, USA v. Nevada Cement Company, Civil Action No. 3:17-cv-00302-MMD-WGC, August 14, 2018.

country – a statement simply at odds with the reality that ozone levels in this non-attainment area are increasing.

TCEQ needs to require SCR as RACT for the cement kilns in the DFW non-attainment area.

C.2. HGB Non-Attainment Area

Table 2 below shows the large (i.e., greater than 40 tons/year actual) NOx emitting sources in the HGB non-attainment area, based on the 2017 inventory.

Table 2 – Large NOx Sources (HGB Non-Attainment Area)

Company	Site	Source Type	Source Name	2017 Emissions (tpy)
NRG TEXAS	WA PARISH STATION	BOILER	UNIT 6 BOILER	1767.7
NRG TEXAS	WA PARISH STATION	BOILER	UNIT 5 BOILER	1140.5
NRG TEXAS	WA PARISH STATION	BOILER	UNIT 8 BOILER	807.9
NRG TEXAS	WA PARISH STATION	BOILER	UNIT 7 BOILER	733.3
NRG TEXAS	WA PARISH STATION	BOILER	UNIT 8 BOILER	404.6
NRG TEXAS	WA PARISH STATION	BOILER	UNIT 4 BOILER	373.5
NRG TEXAS	CEDAR BAYOU STATION	BOILER	UNIT 2 BOILER	271.5
NRG TEXAS	CEDAR BAYOU STATION	BOILER	UNIT 1 BOILER	265.2
EXXONMOBIL	BAYTOWN OLEFINS PLANT	BOILER	BOILER D	156.7
EXXONMOBIL	BAYTOWN REFINERY	FCCU	FCCU 2 FURNACE F1A FLUE GAS TO ATMOSPHER	153.5
NRG TEXAS	WA PARISH STATION	BOILER	UNIT 3 BOILER	148.8
NRG TEXAS	WA PARISH STATION	BOILER	UNIT 3 BOILER	148.8
FREEPORT POWER	OYSTER CREEK COGENERATION	TURBINE	PWR8_GTB_OC8P8GT82_GT-82 GAS TURBINE	139.3
PASADENA COGEN	PASADENA COGENERATION	TURBINE	TURBINE #2 & UNFIRED HRSC	135.6
FREEPORT POWER	OYSTER CREEK COGENERATION	TURBINE	PWR8_GTB_OC8P8GT83_GT-83 GAS TURBINE	127.7
EXXONMOBIL	BAYTOWN OLEFINS PLANT	TURBINE	GAS TURBINE NO. 4	122.8
INEOS	BAYPORT PLANT	HEATER	STEAM SUPERHEATER "HS-201/219"	121.7
TEXAS CITY	TEXAS CITY COGENERATION	TURBINE	G.T. "B" TRAIN	120.8
INEOS	CHOCOLATE BAYOU PLANT	BOILER	NO. 2 OLEFINS BOILER	117.9
INEOS	CHOCOLATE BAYOU PLANT	BOILER	NO. 2 OLEFINS BOILER	113.6
EXXONMOBIL	BAYTOWN REFINERY	TURBINE	GAS TURBINE GENERATOR	105.8
SWEENY COGENERATION	SWEENY COGENERATION FACILITY	TURBINE	GAS TURBINE & DUCT BURNER 1	103.3
ATLANTIC COFFEE	HOUSTON PLANT	BOILER	BOILER 6	100.1
FREEPORT POWER	OYSTER CREEK COGENERATION	TURBINE	PWR8_GTB_OC8P8GT81_GT-81 GAS TURBINE	99.8
SOUTH HOUSTON GREEN	SOUTH HOUSTON GREEN POWER SITE	TURBINE	GP-2 UNIT 801 (UNIT #3)	94.0
PASADENA COGEN	PASADENA COGENERATION	TURBINE	TURBINE #3 & UNFIRED HRSG	93.1
OXYVINYLS	BATTLEGROUND CHLOR-ALKALI PLANT	TURBINE	NO.2 GAS TURBINE (LINKD TO BOILER FIN BGU-005A)	92.6
ENTERGY	LEWIS CREEK PLANT	TURBINE	STEAM GENERATOR NO. 2	92.5
EXXONMOBIL	BAYTOWN OLEFINS PLANT	BOILER	BOILER C	91.1
INEOS	CHOCOLATE BAYOU PLANT	BOILER	NO. 1 OLEFINS BOILER DB 901B	90.4
INEOS	CHOCOLATE BAYOU PLANT	BOILER	NO. 1 OLEFINS BOILER DB 901A	87.9
SOUTH HOUSTON	SOUTH HOUSTON GREEN	TURBINE	GP-2 UNIT 803 (UNIT #1)	87.5

GREEN	POWER SITE			
SOUTH HOUSTON GREEN	SOUTH HOUSTON GREEN POWER SITE	TURBINE	GP-2 UNIT 802 (UNIT #2)	87.1
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE H	86.0
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	84.8
FLINT HILLS	HOUSTON	BOILER	WASTE HEAT BOILER	83.9
BLANCHARD REFINING	GALVESTON BAY REFINERY	FURNACE	ULTRAFORMER NO. 4	83.9
LYONDELL CHEMICAL	CHANNELVIEW PLANT	BOILER	BOILER NO. 1	83.3
AIR LIQUIDE	AIR LIQUIDE BAYPORT COMPL	TURBINE	COMBUSTION GAS TURBINE & H.R. STEAM GENERATOR	82.2
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H2_PYROLYSIS FURNACE 2	81.9
INEOS	BAYPORT PLANT	BOILER	"HB-301S"	80.5
EXXONMOBIL	BAYTOWN OLEFINS PLANT	HEATER	PYROLYSIS FURNACE XE	80.5
PASADENA COGEN	PASADENA COGENERATION	TURBINE	TURBINE & UNFIRED H.R.S.G.	80.2
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE XA	79.7
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE XD	79.1
PHILLIPS 66 COMPANY	SWEENY REFINERY PETROCHEM	FCCU	UNIT 3 PRECIPITATOR STACK	78.7
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE XC	78.2
ASCEND	CHOCOLATE BAYOU PLANT	BOILER	AN7 WASTE HEAT BOILER	78.1
BASF CORPORATION	FREEPORT SITE	INCINERATOR	AAE-3 WASTE LIQUIDS/GAS INCINERATOR	76.7
SWEENY COGENERATION	SWEENY COGENERATION FACILITY	TURBINE	GAS TURBINE & DUCT BURNER 3	76.5
CHANNEL ENERGY CENTER	CHANNEL ENERGY CENTER	TURBINE	TURBINE/HRSG#1	76.1
OPTIM ENERGY	ALTURA COGEN	TURBINE	TURBINE & BOILER SET	76.0
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE J	75.7
ENTERGY TEXAS INC	LEWIS CREEK PLANT	BOILER	STEAM GENERATOR NO. 1	75.3
AIR LIQUIDE	AIR LIQUIDE BAYPORT COMPL	TURBINE	COMBUSTION GAS TURBINE & H.R. STEAM GENERATOR	74.7
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE XB	74.3
BLANCHARD REFINING	GALVESTON BAY REFINERY	HEATER	PS3A-101BB	74.1
SHELL CHEMICAL	DEER PARK PLANT	HEATER	FP31050:F-P3-1050 FURNACE	74.1
BASF CORPORATION	FREEPORT SITE	OTHER	1260 TRAIN KETTLE	73.9
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC7_FUR_B72L7HH5_H5 FURNACE(TO B72SH5)	72.9
BLANCHARD REFINING	GALVESTON BAY REFINERY	FCCU	FCCU3 WET GAS SCRUBBER	72.4
EIF CHANNELVIEW	CHANNELVIEW COGENERATION FACILITY	TURBINE	GAS TURBINE	72.3
AIR LIQUIDE	AIR LIQUIDE BAYPORT COMPL	TURBINE	COMBUSTION GAS TURBINE & H.R. STEAM GENERATOR	72.2
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE 5	72.0
EXXONMOBIL	BAYTOWN REFINERY	HEATER	FCCU3 STEAM GENERATOR 501C TO FCCU3WGS	72.0
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H3_PYROLYSIS FURNACE 3	72.0
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE B	71.7
BLANCHARD REFINING	GALVESTON BAY REFINERY	HEATER	UU3-301BC	71.7
SHELL CHEMICAL	DEER PARK PLANT	HEATER	FP31130:F-P3-1130 FURNACE	71.6
SWEENY COGENERATION	SWEENY COGENERATION FACILITY	BOILER	UNIT 51 #8 BOILER	71.1
CLEAN HARBORS	CLEAN HARBORS DEER PARK	KILN	HAZARDOUS WASTE INCINERATOR - TRAIN 2	71.0
SHELL CHEMICAL	DEER PARK PLANT	HEATER	FP31140:F-P3-1140 FURNACE	70.7

EXXONMOBIL	BAYTOWN OLEFINS PLANT	BOILER	BOILER B	70.7
OXYVINYLS	BATTLEGROUND CHLOR-ALKALI PLANT	TURBINE	NO.1 GAS TURBINE/HRSG	70.6
SHELL CHEMICAL	DEER PARK PLANT	HEATER	FP31110:F-P3-1110 FURNACE	70.4
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE 4	70.4
PASADENA REFINING	PASADENA REFINING SYSTEM	HEATER	REFORMER #3 HEATERS	70.2
SWEENY COGENERATION	SWEENY COGENERATION FACILITY	BOILER	UNIT 51 #9 BOILER	70.0
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE A	69.2
BLANCHARD REFINING	GALVESTON BAY REFINERY	HEATER	PS3A-101BA	68.9
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H5_PYROLYSIS FURNACE 5	67.7
CHANNEL ENERGY CENTER	CHANNEL ENERGY CENTER	TURBINE	TURBINE GTG 2	67.7
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	INCINERATOR	KILN_INC_B33INS1_KILN FUEL/WASTEVENTGAS	67.6
EIF CHANNELVIEW	CHANNELVIEW COGENERATION FACILITY	TURBINE	GAS TURBINE	67.3
INEOS	CHOCOLATE BAYOU PLANT	TURBINE	TURBINE	67.0
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE 6	67.0
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H6_PYROLYSIS FURNACE 6	66.9
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H1_PYROLYSIS FURNACE 1	66.6
SHELL CHEMICAL	DEER PARK PLANT	HEATER	FP31120:F-P3-1120 FURNACE	66.3
SHELL CHEMICAL	DEER PARK PLANT	HEATER	FP31060:F-P3-1060 FURNACE	66.3
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC7_FUR_B72L7HH2_H2 FURNACE(TO B72SH2)	65.9
BASF CORPORATION	FREEPORT SITE	TURBINE	COGENERATION UNIT W/O DUCT BURNER	65.9
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H7_PYROLYSIS FURNACE 7	65.8
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H4_PYROLYSIS FURNACE 4	65.4
EXXONMOBIL	BAYTOWN REFINERY	FURNACE	PIPESTILL 8 FURNACE F801	65.3
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H10_PYROLYSIS FURNACE 10	64.5
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE I	64.3
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE Q	64.3
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC7_FUR_B72L7HH4_H4 FURNACE(TO B72SH4)	64.1
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE 8	63.5
DEER PARK ENERGY	DEER PARK ENERGY CENTER	TURBINE	COMBUSTION TURBINE 4	63.4
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	TURBINE	PWR9_GTB_B56P9GT96_GT-96 GAS TURBINE	63.3
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE 2	63.3
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE 3	63.2
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE 7	63.1
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE O	62.8
BAYTOWN ENERGY	BAYTOWN COGENERATION	TURBINE	TURBINE CTG1	62.8
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE XF	62.3
EIF CHANNELVIEW	CHANNELVIEW COGENERATION FACILITY	TURBINE	COGENERATION UNIT 4	62.2
EIF CHANNELVIEW	CHANNELVIEW COGENERATION FACILITY	TURBINE	GAS TURBINE	62.2
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE 1	61.5

CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	24F-1 CRACKING FURNACE	61.4
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	61.3
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	61.1
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	24F-3-CRACKING FURNACE	60.9
OPTIM ENERGY	ALTURA COGEN	TURBINE	TURBINE BOILER SET	60.9
SHELL CHEMICAL	DEER PARK PLANT	HEATER	H1000:PLATFORMER HEATER	60.8
AIR LIQUIDE	AIR LIQUIDE BAYPORT COMPL	TURBINE	COMBUSTOIN GAS TURBINE & H.R. STEAM GENERATOR	60.8
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC7_FUR_B72L7HH1_H1 FURNACE(TO B72SH1)	60.6
SHELL CHEMICAL	DEER PARK PLANT	HEATER	H600:CAT CRACKER HEATER STACK	60.3
BLUE CUBE	BLUE CUBE OPERATIONS FREEPORT	TURBINE	PWR6_GTB_B246PGT66_GT-66 GAS TURBINE	60.3
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	24F-6-CRACKING FURNACE	60.2
SHELL CHEMICAL	DEER PARK PLANT	BOILER	H87920:STEAM BOILER	60.0
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	59.9
DEER PARK ENERGY	DEER PARK ENERGY CENTER	TURBINE	COMBUSTION TURBINE 3	59.8
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	24F-7-STEAM SUPERHEATER	59.8
SHELL CHEMICAL	DEER PARK PLANT	HEATER	FP31080:F-P3-1080 FURNACE	59.5
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H8_PYROLYSIS FURNACE 8	59.2
DEER PARK ENERGY	DEER PARK ENERGY CENTER	TURBINE	COMBUSTION TURBINE 2	58.9
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	24F-5 CRACKING FURNACE	58.2
BLANCHARD REFINING	GALVESTON BAY REFINERY	HEATER	UU3-301BD	58.1
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	57.8
JACK A FUSCO	JACK A FUSCO ENERGY CENTER	TURBINE	TURBINE NO. 1	57.7
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNACE F	57.7
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	33F-3 CRACKING FURNACE	57.7
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	33F-4 CRACKING FURNACE	57.6
BLUE CUBE	BLUE CUBE OPERATIONS FREEPORT	TURBINE	PWR6_GTB_B246PGT63_GT-63 GAS TURBINE	57.6
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	57.4
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	57.2
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	24F-2-CRACKING FURNACE	57.1
EXXONMOBIL	BAYTOWN OLEFINS PLANT	BOILER	BOILER A	57.1
VALERO	TEXAS CITY REFINERY	FCCU	CATALYTIC CRACKING REGENERATOR VENT	57.0
BLUE CUBE	BLUE CUBE OPERATIONS FREEPORT	TURBINE	PWR6_GTB_B246PGT61_GT-61 GAS TURBINE	57.0
EXXONMOBIL	BAYTOWN REFINERY	FURNACE	PIPE STILL 8 FURNACE F802	56.7
LYONDELL CHEMICAL	CHANNELVIEW PLANT	BOILER	BOILER NO. 3	56.3
ASCEND	CHOCOLATE BAYOU PLANT	BOILER	AN3 INCINERATOR	56.2
SHELL CHEMICAL	DEER PARK PLANT	HEATER	FP31070:F-P3-1070 FURNACE	56.1
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	33F-1-CRACKING FURNACE	56.1
SWEENY	SWEENY COGENERATION	TURBINE	GAS TURBINE & H.R.S.G. 4	56.0

COGENERATION	FACILITY			
DEER PARK ENERGY	DEER PARK ENERGY CENTER	TURBINE	COMBUSTION TURBINE 1	56.0
PHILLIPS 66 COMPANY	SWEENY REFINERY PETROCHEM	HEATER	35 HEATER 1	55.9
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	24F-4-CRACKING FURNACE	55.8
ECO SERVICES	HOUSTON PLANT	INCINERATOR	SPENT ACID REGENERATION UNIT II	55.6
BAYTOWN ENERGY	BAYTOWN COGENERATION	TURBINE	TURBINE CTG2	55.5
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 1 OLEFINS FURNACE	55.1
EQUISTAR CHEMICALS	CHANNELVIEW COMPLEX	HEATER	"F-38304B" OP. 1 STEAM SUPERHEATER "B"	54.9
EQUISTAR CHEMICALS	CHANNELVIEW COMPLEX	HEATER	"F-38001A" OP. 1 STEAM SUPERHEATER "A"	54.8
LYONDELL CHEMICAL	CHANNELVIEW PLANT	BOILER	BOILER NO. 2	54.8
ASCEND	CHOCOLATE BAYOU PLANT	INCINERATOR	NTA INCINERATOR	54.6
NRG TEXAS	SAN JACINTO STATION	TURBINE	UNIT 1 COMBUSTION TURBINE GENERATOR (CTG)	54.5
BLANCHARD REFINING	GALVESTON BAY REFINERY	FURNACE	PREHEAT FURNACE	54.4
SWEENY COGENERATION	SWEENY COGENERATION FACILITY	TURBINE	GAS TURBINE & DUCT BURNER 2	54.0
INEOS	TEXAS CITY PLANT	HEATER	STEAM SUPERHEATER, STY., "HF-201"	53.8
NRG TEXAS	SAN JACINTO STATION	TURBINE	UNIT 2 COMBUSTION TURBINE GENERATOR (CTG)	53.5
EQUISTAR CHEMICALS	LA PORTE COMPLEX	FURNACE	PYROLYSIS FURNACE #9	53.3
JACK A FUSCO	JACK A FUSCO ENERGY CENTER	TURBINE	TURBINE NO. 2	53.2
BLANCHARD REFINING	GALVESTON BAY REFINERY	HEATER	UU3-301BB	53.0
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	52.9
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC7_FUR_B72L7HH3_H3 FURNACE(TO B72SH3)	52.9
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	33F-5-CRACKING FURNACE	52.8
GB BIOSCIENCES LLC	GREENS BAYOU PLANT	OTHER COMBUSTION	IPN - REOXIDIZER	52.4
ENTERPRISE	MONT BELVIEU COMPLEX	FLARE	NORTH PLANT FLARE	52.3
BLANCHARD REFINING	GALVESTON BAY REFINERY	FURNACE	ULTRAFORMER NO. 3	52.3
OPTIM ENERGY	ALTURA COGEN	TURBINE	TURBINE BOILER SET	52.0
EXXONMOBIL	BAYTOWN REFINERY	FURNACE	PIPE STILL 7-FURNACE F701B	51.7
EXXONMOBIL	BAYTOWN REFINERY	FCCU	FURNACE F2A FLUE GAS TO ATMOSPHERE	50.7
OPTIM ENERGY	ALTURA COGEN	TURBINE	TURBINE BOILER SET	50.6
ARKEMA	CLEAR LAKE OPERATIONS	INCINERATOR	INCN_INC_LTO-63IN460INC_COMBUST	50.4
BASF CORPORATION	FREEPORT SITE	TURBINE	COGENERATION UNIT WITH DUCT BURNER FIRE	50.3
DOW CHEMICAL	DOW TEXAS OPERATIONS FREEPORT	FURNACE	LHC8_FUR_OC6L8H9_F-9 PYROLYSIS(TO OC6S9)	50.3
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	OTHER COMBUSTION	22C-120-PROPYLENE TURBINE	50.3
BLUE CUBE	BLUE CUBE OPERATIONS FREEPORT	TURBINE	PWR6_GTB_B246PGT67_GT-67 GAS TURBINE	50.2
BLUE CUBE	BLUE CUBE OPERATIONS FREEPORT	TURBINE	PWR3_GTB_A123PGT37_GT-37 GAS TURBINE	50.0
ECO SERVICES	BAYTOWN PLANT	FURNACE	FURNACE	49.2
BASF CORPORATION	FREEPORT SITE	INCINERATOR	LIQUID WASTE INCINERATOR	49.0
LONGHORN GLASS	LONGHORN GLASS	FURNACE	GLASS MELTING FURNACE	48.9

TEXAS CITY COGENERATION	TEXAS CITY COGENERATION	TURBINE	G.T. "A" TRAIN	48.8
CHEVRON PHILLIPS	CEDAR BAYOU PLANT	BOILER	BOILER	48.4
BLANCHARD REFINING	GALVESTON BAY REFINERY	HEATER	UU3-301BA	48.0
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	47.8
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	33F-6-CRACKING FURNACE	47.6
BAYTOWN ENERGY	BAYTOWN COGENERATION	TURBINE	TURBINE CTG3	47.5
CHEVRON PHILLIPS	SWEENY OLD OCEAN FACILITIES	FURNACE	33F-2-CRACKING FURNACE	47.0
EXXONMOBIL	BAYTOWN OLEFINS PLANT	FURNACE	PYROLYSIS FURNANCE XG	46.3
EL DORADO NITROGEN	NITRIC ACID MFG FACILITY	OTHER	NITRIC ACID PROCESS UNIT	46.2
BLANCHARD REFINING	GALVESTON BAY REFINERY	HEATER	ULC-104BA	45.5
BLUE CUBE	BLUE CUBE OPERATIONS FREEPORT	BOILER	PHAC_BLR_OC3U3B901_B-901 BOILER	45.3
BLANCHARD REFINING	GALVESTON BAY REFINERY	HEATER	ULC-104BB	45.1
UNION CARBIDE	UCC TEXAS CITY PLANT	BOILER	UTIL_BLR_BOILER NO. 53-E02B53BLR	45.1
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 2 OLEFINS FURNACE	44.4
EXXONMOBIL	BAYTOWN REFINERY	FURNACE	HYDROFORMER 3-FURNACE F1	43.3
NRG TEXAS	CEDAR BAYOU GEN STATION	TURBINE	COMBUSTION TURBINE 41 (COMBINED CYCLE STACK)	43.1
ROHM AND HAAS	DEER PARK PLANT	THERMAL OX.	HT_THO_HT-3_HT-1 A/B TRAIN THOX	42.4
EXXONMOBIL	BAYTOWN OLEFINS PLANT	TURBINE	GAS TURBINE NO. 5	42.1
OPTIM ENERGY	ALTURA COGEN	TURBINE	TURBINE BOILER SET	41.0
INEOS	CHOCOLATE BAYOU PLANT	FURNACE	NO. 1 OLEFINS FURNACE	40.7
BLANCHARD REFINING	GALVESTON BAY REFINERY	FURNACE	ULTRAFORMER NO. 4	40.7

As the top several entries make abundantly clear, many of the largest NOx sources are associated with electric power generation. In particular, the various units at the W.A. Parish station account for either out of the top twelve sources. Collectively, the eight units at the W.A. Parish station collectively are the single largest NOx source in the HGB non-attainment area.

Yet, curiously, the TCEQ's HGB SIP RACT and RACM analysis did not contain any analysis of this large source. I provide some discussion below.

Table 3 below shows the annual NOx rate (in lb/MMBtu, highlighted in yellow) for various years for each of the W.A. Parish units.[20] Units 1-4 (WAP1 through WAP4) are natural gas fired boilers, equipped only with overfire air as the NOx control technology in each case. NOx rates for these gas-fired units are shown for years 2014-2018. Units 5 through 8 (WAP5 – WAP8) are coal-fired units, equipped with SCR, installed around 2003 or 2004 in these units. For the coal-fired units, I have shown the NOx emission rates for the first couple of years when SCR was installed and also the rates for the most recent 5 years (2014-2018). The column next to the individual, annual, NOx rates also shows the average NOx rates for the indicated years: averages for 2014-2018 for the gas-fired units, shown in red font in each case; averages for the two years

[20] Data for this table was obtained from US EPA's Clean Air Markets database, www.epa.gov/ampd. This is data reported by the power plant itself to EPA under Title IV of the FCAA.

right after SCR was installed for the coal units (shown in blue font); and averages for 2014-2018 for the coal-fired units (shown in purple font).

Table 3 also shows the actual NOx emissions (in tons) for each year. Several observations are in order.

First, the NOx rates for the gas-fired units, supposedly using cleaner natural gas are far greater than the coal-fired units. This is simply because gas-firing by itself does not result in lower NOx emissions. Additional controls (even low-NOx burners, or ultra low-NOx burners, SNCR, and SCR) need to be considered and applied in order to reduce NOx rates from these gas-fired units. The annual NOx emissions of these gas-fired units are substantial and rising for several units (see, WAP1 between 2017 and 2018; WAP2 between 2017 and 2018; and WAP3 between 2017 and 2018). Thus, RACT determinations for each of these gas-fired units is in order and would likely result in additional NOx controls. NOx reductions would be substantial.

Second, considering the coal units, even though each is equipped with SCR, note the deterioration in the SCR performance, as reflected in the higher NOx rates for the recent years as compared to the NOx rates in the years immediately after SCR installation. The percent deteriorations are shown below the current average NOx rates in each case. WAP7 had the least deterioration, at roughly 7%, while the others had dramatically lowered performance with levels ranging from 21.9% to 70.2%. This is likely because the SCR catalyst is not being replaced or re-activated in the SCRs for these units. By simply properly maintaining and operating these already in-place SCRs, substantial NOx reductions can be obtained for modest additional cost. The time required to replace and/or re-activate catalysts is also fairly quick. Therefore, I see this as a perfect opportunity for substantial additional NOx reductions, that can in fact be achieved in very little time (i.e., well before the 2020 ozone season), since the SCRs are already installed at units WAP5-WAP8. Replacing catalyst and obtaining post-SCR NOx levels that are similar to original performance is RACM and definitely RACT, even under the irrational constraints imposed on these analyses, as previously discussed.

In order to obtain a sense of the NOx reductions possible with just achieving proper SCR performance, consider WAP6. In 2017, the total NOx from just this unit alone was 1768 tons, as shown in the table below. The NOx rate for that year was 0.0807 lb/MMBtu, also shown in the Table 3. This means that the 2017 heat input for this unit was 43,816,605 MMBtus (i.e., 1768 tons * 2000 lb/ton / 0.0807 lb/MMBtu). Using the same heat input but the 2004 NOx rate (i.e., 0.0309 lb/MMBtu, which the SCR, which was installed in 2003, achieved when the catalyst was new and the SCR was being properly operated), the NOx emissions for 2017 should have been 677 tons instead of 1768 tons. This would have been a reduction of 1091 tons – just from this one unit alone. Of course similarly large reductions would be possible from the three other coal-fired units (or at least from WAP5 and WAP8).

Given the NOx-limited ozone formation in the HGB non-attainment area, previously noted, and these large NOx reductions easily possible at the W.A Parish station, it is clear that TCEQ's RACM and RACT analysis for the HGB is significantly deficient. RACM/RACT for WAP5-WAP8 should simply require SCR performance levels similar to when SCRs were installed for these units. And, for the gas-fired units WAP1-WAP4, RACM/RACT should require additional controls to lower their very high NOx rates, as shown in Table 3. The first NOx Rate column (fourth column from the left) shows the annual NOx rates (for the Year shown in the second column). The second NOx Rate column (fifth column from the left) shows the average of the NOx Rates over several years, as I discuss earlier. For example, for WAP1, 0.1564 lb/MMBtu in the second NOx Rate column is the average of the NOx Rates for years 2014-2018.

Table 3 – W.A. Parish Station Units NOx Analysis

Unit	Year	Load (MW-h)	NOx Rate (lb/MMBtu)		NOx (tons)	Unit Type	Fuel	NOx Control
WAP1	2014	21070	0.1524	0.1564	32	Wall-fired	Nat. Gas.	Overfire Air
WAP1	2015	42126	0.1520		52	Wall-fired	Nat. Gas.	Overfire Air
WAP1	2016	70805	0.1645		88	Wall-fired	Nat. Gas.	Overfire Air
WAP1	2017	49771	0.1444		62	Wall-fired	Nat. Gas.	Overfire Air
WAP1	2018	110983	0.1689		135	Wall-fired	Nat. Gas.	Overfire Air
WAP2	2014	33997	0.0858	0.0955	25	Wall-fired	Nat. Gas.	Overfire Air
WAP2	2015	55613	0.0933		42	Wall-fired	Nat. Gas.	Overfire Air
WAP2	2016	94556	0.1013		74	Wall-fired	Nat. Gas.	Overfire Air
WAP2	2017	51790	0.0903		40	Wall-fired	Nat. Gas.	Overfire Air
WAP2	2018	83396	0.1070		61	Wall-fired	Nat. Gas.	Overfire Air
WAP3	2014	82220	0.1154	0.1739	129	Wall-fired	Nat. Gas.	Overfire Air
WAP3	2015	192194	0.1752		356	Wall-fired	Nat. Gas.	Overfire Air
WAP3	2016	147434	0.1937		276	Wall-fired	Nat. Gas.	Overfire Air
WAP3	2017	172972	0.1808		297	Wall-fired	Nat. Gas.	Overfire Air
WAP3	2018	184226	0.2043		347	Wall-fired	Nat. Gas.	Overfire Air
WAP4	2014	302383	0.0758	0.0928	183	Tangentially-fired	Nat. Gas.	Overfire Air
WAP4	2015	511246	0.0904		334	Tangentially-fired	Nat. Gas.	Overfire Air
WAP4	2016	486987	0.1030		351	Tangentially-fired	Nat. Gas.	Overfire Air
WAP4	2017	452252	0.1082		373	Tangentially-fired	Nat. Gas.	Overfire Air
WAP4	2018	334348	0.0864		220	Tangentially-fired	Nat. Gas.	Overfire Air
WAP5	2004	5252817	0.0309	0.0369	836	Wall-fired	Coal	SCR (since 2003)
WAP5	2005	4926167	0.0429		1057	Wall-fired	Coal	SCR
WAP5	2014	4112463	0.0533	**0.0586 (58.8%)[1]**	993	Wall-fired	Coal	SCR
WAP5	2015	4491326	0.0603		1235	Wall-fired	Coal	SCR
WAP5	2016	3557125	0.0594		989	Wall-fired	Coal	SCR
WAP5	2017	4388738	0.0567		1141	Wall-fired	Coal	SCR
WAP5	2018	4624393	0.0631		1340	Wall-fired	Coal	SCR
WAP6	2004	4617340	0.0328	0.0379	736	Wall-fired	Coal	SCR (since 2003)
WAP6	2005	5519770	0.0430		1130	Wall-fired	Coal	SCR
WAP6	2014	4090727	0.0669	**0.0645 (70.2%)**	1458	Wall-fired	Coal	SCR
WAP6	2015	4105194	0.0520		1121	Wall-fired	Coal	SCR
WAP6	2016	3124670	0.0680		1146	Wall-fired	Coal	SCR
WAP6	2017	4087531	0.0807		1768	Wall-fired	Coal	SCR
WAP6	2018	3790839	0.0548		1086	Wall-fired	Coal	SCR
WAP7	2005	4600575	0.0443	0.0431	1018	Tangentially-fired	Coal	SCR (since 2004)

WAP7	2006	4432909	0.0419		876	Tangentially-fired	Coal	SCR
WAP7	2014	4143520	0.0487	**0.0463 (7.4%)**	941	Tangentially-fired	Coal	SCR
WAP7	2015	3479366	0.0417		668	Tangentially-fired	Coal	SCR
WAP7	2016	2986930	0.0449		604	Tangentially-fired	Coal	SCR
WAP7	2017	3848578	0.0473		733	Tangentially-fired	Coal	SCR
WAP7	2018	4032458	0.0487		756	Tangentially-fired	Coal	SCR
WAP8	2005	4650851	0.0413	0.0397	935	Tangentially-fired	Coal	SCR (since 2004)
WAP8	2006	5375894	0.0380		987	Tangentially-fired	Coal	SCR
WAP8	2014	4481612	0.0473	**0.0484 (21.9%)**	1032	Tangentially-fired	Coal	SCR
WAP8	2015	4046576	0.0472		888	Tangentially-fired	Coal	SCR
WAP8	2016	3792115	0.0450		856	Tangentially-fired	Coal	SCR
WAP8	2017	4297991	0.0560		1213	Tangentially-fired	Coal	SCR
WAP8	2018	3788225	0.0467		901	Tangentially-fired	Coal	SCR

[1] The numbers shown in () for this and each of the other three coal units represent the increase in the NOx Rate in recent years (i.e., 0.0586 lb/MMBtu in this example) as compared to the NOx Rate when the SCR for the unit was first installed (i.e., 0.0369 lb/MMBtu in this example).

As noted in the beginning, I have analyzed NOx emissions from the W.A. Parish station, simply as an example. TCEQ should similarly provide detailed analyses for the large NOx sources in Table 2, showing their current NOx rates as well as feasible NOx rates with various additional controls and work practices.

D. Comments – Large NOx and VOC Sources in Selected Refineries/Chemical Plants (HGB)

Table 4 below shows the large NOx and VOC sources (emissions greater than 40 tons/year) are three selected refineries and chemical plants (Exxon – Baytown Complex; Pasadena Refining; and Valero – Texas City).

As I have noted elsewhere in these comments, refineries and chemical plants, especially the ExxonMobil Baytown Complex, have low-income residential areas very close to the such plants. Reducing NOx and VOC emissions (which also invariably include many toxic pollutants as well) in order to reach ozone attainment from such plants also reduces the pollution on already-burdened populations nearby.

As Table 4 shows, all of the NOx emissions are from fuel-combustion sources such as boilers, heaters, furnaces, turbines, etc. But the HGB SIP RACM and RACT analyses do not, with any particularity at all, address these sources. The analyses simply note the various current TCEQ rules that apply to such sources or note that they are in compliance with decades-old CTG and ACT documents promulgated by EPA. That is insufficient in my opinion. What the SIP must do is: (a) identify the NOx rates for each such large source; (b) identify the current NOx controls if any (such as: low NOx burners, ultra-low NOx burners, flue gas recirculation (FGR), over-fire air, SNCR, or SCR, etc.) that each such source has; (c) identify, based on (a) and (b), the additional NOx reductions that can be obtained if additional or higher/better types of technically feasible NOx controls could be applied; (d) determine cost-effectiveness of the additional controls. Only then can an informed RACT (and RACM) analysis be complete. Typical (i.e., installed in such units at refineries and therefore technical feasible and cost-effective) NOx controls for boilers, furnaces, and heaters would be a combination of ultra-low NOx burners/FGR/SNCR or ultra-low NOx burners/SCR. Similarly, controls for turbines would typically be dry low NOx combustors followed by SCR. It is imperative that TCEQ's RACM/RACT for these combustion controls include these or equally effective NOx controls for the types of refinery NOx sources shown in Table 4.

Similarly, Table 4 below shows a few of the large VOC sources at refineries and chemical plants. Not unexpectedly, several of the large VOC emission sources are fugitive in nature. Here again, it is insufficient for the TCEQ to simply state the applicable TCEQ rule or regulation that applies to such sources. As part of the RACM/RACT analyses, the TCEQ should address each such large VOC source, with applicable options to reduce these VOC emissions. For example, cooling tower VOC emissions reductions can be achieved by enhanced surveillance to ensure that no hydrocarbons leak into cooling water (i.e., via better maintenance, or proactive replacement of equipment). Fugitive emissions from components such as valves, pumps, etc., will require optical gas imaging (OGI) or similar techniques to quickly identify and repair leakers. None of these work practice changes should require long lead times, qualifying them for RACM, even under the "pull forward" constraint imposed on the RACM analysis by poor EPA guidance. It is imperative that TCEQ's RACM/RACT analyses for the types of VOC sources shown in Table 4 include such controls and work practices.

Based on the above, I ask that TCEQ revisit its RACM/RACT analyses for not just these example sources at selected refineries, but for all large VOC sources in the HGB non-attainment area.

Table 4 – Large NOx and VOC Sources Located in Example Refineries and Chemical Plants (HGB Non-Attainment Area)

Company	Plant	Source Name	Source Type	Pollutant	2017 Emissions (tpy)
ExxonMobil	Baytown Olefins Plant	BOILER D	STACK	NOX	156.7
ExxonMobil	Baytown Refinery	FCCU 2 FURNACE F1A	STACK	NOX	153.5
ExxonMobil	Baytown Olefins Plant	GAS TURBINE NO. 4	STACK	NOX	122.8
ExxonMobil	Baytown Refinery	GAS TURBINE GENERATOR	STACK	NOX	105.8
ExxonMobil	Baytown Olefins Plant	BOILER C	STACK	NOX	91.1
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE H	STACK	NOX	86.0
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE XE	STACK	NOX	80.5
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE XA	STACK	NOX	79.7
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE XD	STACK	NOX	79.1
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE XC	STACK	NOX	78.2
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE J	STACK	NOX	75.7
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE XB	STACK	NOX	74.3
ExxonMobil	Baytown Refinery	FCCU3 STEAM GENERATOR 501C	STACK	NOX	72.0
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE B	STACK	NOX	71.7
ExxonMobil	Baytown Olefins Plant	BOILER B	STACK	NOX	70.7
Pasadena Ref.	Pasadena Refinery	REFORMER #3 HEATERS	STACK	NOX	70.2
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE A	STACK	NOX	69.2
ExxonMobil	Baytown Refinery	PIPESTILL 8 FURNACE F801	STACK	NOX	65.3
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE I	STACK	NOX	64.3
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE Q	STACK	NOX	64.3

ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE O	STACK	NOX	62.8
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE XF	STACK	NOX	62.3
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNACE F	STACK	NOX	57.7
ExxonMobil	Baytown Olefins Plant	BOILER A	STACK	NOX	57.1
Valero	Texas City Refinery	CATCRACKER REGEN VENT	STACK	NOX	57.0
ExxonMobil	Baytown Refinery	PIPE STILL 8 FURNACE F802	STACK	NOX	56.7
ExxonMobil	Baytown Refinery	PIPE STILL 7-FURNACE F701B	STACK	NOX	51.7
ExxonMobil	Baytown Refinery	FURNACE F2A	STACK	NOX	50.7
ExxonMobil	Baytown Olefins Plant	PYROLYSIS FURNANCE XG	STACK	NOX	46.3
ExxonMobil	Baytown Refinery	HYDROFORMER 3-FURNACE F1	STACK	NOX	43.3
ExxonMobil	Baytown Olefins Plant	GAS TURBINE NO. 5	STACK	NOX	42.1
ExxonMobil	Baytown Chem Plant	VARIOUS PROCESSES	FLARE	VOC-Butene	41.0
ExxonMobil	Baytown Refinery	COOLING TOWER NO. 58 FUGITIVES	STACK	VOC-Distillate	57.2
ExxonMobil	Baytown Refinery	MEK DEWAXING PLANT FUGITIVES	FUGITIVE	VOC-MEK	203.4
ExxonMobil	Baytown Refinery	TREATMENT LAGOONS	FUGITIVE	VOC-Methanol	59.1
ExxonMobil	Baytown Refinery	STORMWATER RETENTION BASIN	FUGITIVE	VOC-Methanol	58.7
ExxonMobil	Baytown Refinery	MEK DEWAXING PLANT FUGITIVES	FUGITIVE	VOC-Toluene	58.6

E. Comments – VOC Emissions from Storage Tanks at Selected Refineries (HGB)

Table 5 below shows some of the highest emitting tanks in selected refineries and chemical plants in the HGB non-attainment area. As noted earlier, reductions of VOC emissions from these tanks will not only reduce an ozone precursor but also benefit low-income communities that live very near these plants and are directly impacted by these emissions.

Specifically, each tank shown in Table 5 below contains a high vapor pressure product (as shown in the second to last column). These include gasoline, naphtha, distillates, as well as xylene. Yet, even though these products or intermediates have high vapor pressures, each of the tanks (see the column titled Tank Type) is either an external floating roof tank or a fixed roof tank. There are no indications that the vertical fixed roof tanks are connected to any control devices. External floating roof tanks cannot be connected to control devices.

Table 5 – Emissions from High-Emitting Tanks Located in Example Refineries and Chemical Plants (HGB Non-Attainment Area)

Company	Refinery/Plant	Tank Type	Tank Name	Product / Pollutant	2017 Emissions (tpy)
Valero	Texas City Refinery	EXT FL ROOF: PONTOON DBL SEAL	T-478	GASOLINE	11.7
Valero	Texas City Refinery	EXT FL ROOF: PONTOON DBL SEAL	T-563	GASOLINE	8.9
Valero	Texas City Refinery	EXT FL ROOF: PONTOON DBL SEAL	T-088	NAPHTHA	5.6
Valero	Texas City Refinery	EXT FL ROOF: PONTOON DBL SEAL	T-594	GASOLINE	5.2
ExxonMobil	Baytown Chem Plant	VERTICAL FIXED ROOF TANK	TK3014	META-XYLENE	5.5
ExxonMobil	Baytown Refinery	EXT FL ROOF: DBL DECK DBL SEAL	TK0863	GASOLINE	12.2
ExxonMobil	Baytown Refinery	EXT FL ROOF: DBL DECK DBL SEAL	TK0858	GASOLINE	12.1
ExxonMobil	Baytown Refinery	EXT FL ROOF: DBL DECK DBL SEAL	TK0856	GASOLINE	11.3
ExxonMobil	Baytown Refinery	EXT FL ROOF: DBL DECK DBL SEAL	TK0861	GASOLINE	11.2
ExxonMobil	Baytown Refinery	EXT FL ROOF: DBL DECK DBL SEAL	TK0860	GASOLINE	11.0
ExxonMobil	Baytown Refinery	VERTICAL FIXED ROOF TANK	TK0072	PARA-XYLENE	10.5
ExxonMobil	Baytown Refinery	VERTICAL FIXED ROOF TANK	TK0665	NAPHTHA, etc.	6.0
ExxonMobil	Baytown Refinery	VERTICAL FIXED ROOF TANK	TK1013	DISTILLATE	5.9
ExxonMobil	Baytown Refinery	EXT FL ROOF: DBL DECK DBL SEAL	TK0850	GASOLINE	5.6
ExxonMobil	Baytown Refinery	VERTICAL FIXED ROOF TANK	TK1084	XYLENE-U	5.4

ExxonMobil	Baytown Refinery	EXT FL ROOF: DBL DECK DBL SEAL	TK0849	GASOLINE	5.4
ExxonMobil	Baytown Refinery	VERTICAL FIXED ROOF TANK	TK1016	DISTILLATE	5.0

In its very generic discussion of tank emissions, the TCEQ states the following:

> "In 2016, 30 TAC Chapter 115, Subchapter B, Division 1, was revised (Rule Project No. 2016-039-115-AI) to increase the control efficiency of control devices, other than vapor recovery units or flares, from 90% to 95% for VOC storage tanks in the HGB area. In addition to increasing the control efficiency for all storage tanks, the rulemaking enhanced inspection, repair and recordkeeping requirements for major source fixed roof crude oil or condensate storage tanks with the uncontrolled VOC emissions of at least 25 tpy in the HGB area. The amendments also expanded the rule applicability to include the aggregate of crude oil and condensate fixed roof storage tanks at pipeline breakout stations in the HGB area. The EPA approved these rule revisions as addressing VOC RACT for both CTG and non-CTG major source storage tanks in the HGB 2008 eight-hour ozone nonattainment area on April 30, 2019 (84 FR 18145)."[21] (emphasis added)

While these rule improvements may be commendable, none of them (emphasized above) pertain to the specific tanks I have listed in Table 5 above – i.e., fixed or external floating roof tanks storing high vapor pressure products. That the TCEQ's current rules allow such storage undercuts its argument that it has some of the best regulations on the books and that no additional rules are required.

Simply, all high vapor pressure products (say, above a threshold vapor pressure) should only be stored in internal floating roof or fixed roof tanks – connected to a vapor recovery or vapor control system with a specified (and verifiable) capture and/or control efficiency of at least 99%. Technologies to achieve these are readily available and widely used, including in many Texas plants.[22] These technologies include carbon adsorbers and concentrators (for vapor recovery), and/or catalytic oxidizers and regenerative thermal oxidizers (RTOs) (for destruction of vapors). These would qualify as RACT in my professional opinion.

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[21] HGB SIP, Appendix F, Section 3.3.2.

[22] As an example, see the 2017 inventory. A vertical fixed roof tank # V1422 storing butyl acrylate at LBC Houston Bayport Terminal is connected to a vapor oxidizer.

There are numerous other vertical fixed roof tanks in the HGB 2017 inventory whose vapors are connected to flare systems. While a flare is not a preferred VOC control device, at least such vapors are not directly emitted to the atmosphere, as in the case of the tanks shown in Table 5.

ATTACHMENT A

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CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

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EXPERIENCE SUMMARY

Dr. Sahu has over twenty nine 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.

He has over twenty six years of project management experience and has successfully managed and executed numerous projects in this time period. 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.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past twenty five years include various trade associations as well as individual companies such as steel mills, petroleum refineries, cement manufacturers, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, and various entities in the public sector including EPA, the US Dept. of Justice, several states, various agencies such as the California DTSC, various municipalities, etc.). Dr. Sahu has performed projects in all 50 states, numerous local jurisdictions and internationally.

In addition to consulting, Dr. Sahu has taught numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management) for the past seventeen years. In this time period he has also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing 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 with project management, air quality consulting, waste remediation and management consulting, as well as regulatory and engineering support consulting services.

1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for** Air Quality/Geosciences/Hazardous Waste Groups, Pasadena. Responsible for the management of a group of approximately 24 air quality and environmental professionals, 15 geoscience, and 10 hazardous waste professionals providing full-service consulting, project management, regulatory compliance and A/E design assistance in all areas.

Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.

1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department. Responsibilities included multimedia regulatory compliance and permitting (including hazardous and nuclear materials), air pollution engineering (emissions from stationary and mobile sources, control of criteria and air toxics, dispersion modeling, risk assessment, visibility analysis, odor analysis), supervisory functions and project management.

1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department. Responsibilities included permitting, tracking regulatory issues, technical analysis, and supervisory functions on numerous air, water, and hazardous waste projects. Responsibilities also include client and agency interfacing, project cost and schedule control, and reporting to internal and external upper management regarding project status.

1989-1990 Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.

1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1984 M. S., Mechanical Engineering, Caltech, Pasadena, CA.

1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

“Thermodynamics and Heat Transfer,” Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

"Advanced Hazardous Waste Management" University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

"Environmental Risk Assessment," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1998.

"Hazardous Waste Remediation" Loyola Marymount University, Dept. of Civil Engineering. Various years since 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

"Environmental Planning and Management," 5 week program for visiting Chinese delegation, 1994.

"Environmental Planning and Management," 1 day program for visiting Russian delegation, 1995.

"Air Pollution Planning and Management," IEP, UCR, Spring 1996.

"Environmental Issues and Air Pollution," IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992-present.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-present.

Air and Waste Management Association, West Coast Section, 1989-present.

PROFESSIONAL CERTIFICATIONS

EIT, California (#XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, since 2000.

CEM, State of Nevada (#EM-1699). Expiration 10/07/2019.

PUBLICATIONS (PARTIAL LIST)

"Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).

"Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).

"On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).

"Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).

"Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).

"A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).

"Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R. Gavalas, *Combust. Flame*, **77**, 337-346 (1989).

"Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).

"Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.

"Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).

"HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).

"Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).

"Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).

"NOx Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

“From Purchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada,” with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.

“The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants,” with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

"Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).

"Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

Annex A

Expert Litigation Support

A. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

1. In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled "Hitting the Ethanol Blend Wall – Examining the Science on E15."

B. Matters for which Dr. Sahu has provided affidavits and expert reports include:

2. Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.

3. Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

4. Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

5. Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).

6. Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).

7. Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.

8. Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc.*, 5:04-cv-00034-KSF (Eastern District of Kentucky).

9. Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.

10. Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.

11. Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.

12. Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.

13. Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo's eight new proposed PRB-fired PC boilers located at seven TX sites.

14. Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of

Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).

15. Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.

16. Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

17. Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.

18. Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with *General Power Products, LLC v MTD Products Inc*., 1:06 CVA 0143 (Southern District of Ohio, Western Division) .

19. Expert Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.

20. Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.

21. Affidavits (May 2010/June 2010 in the Office of Administrative Hearings))/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).

22. Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).

23. Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.us

24. Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.

25. Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone's proposed Unit 3 in Texas.

26. Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*

27. Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper's proposed Pee Dee plant in South Carolina).

28. Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.

29. Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

30. Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

31. Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

32. Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

33. Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

34. Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.

35. Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (Eastern District of Michigan).

36. Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.

37. Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (District of Colorado).

38. Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

39. Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

40. Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. Public Service Company of New Mexico* (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE) (District of New Mexico).

41. Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

42. Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

43. Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Case No. 5:10-cv-00156-DF-CMC (Eastern District of Texas, Texarkana Division).

44. Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf

Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

45. Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.

46. Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

47. Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority,* Civil Action No. 4:11-cv-00791 (Southern District of Texas, Houston Division).

48. Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

49. Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

50. Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.,* Civil Action No. A-08-CA-648-LY (Western District of Texas, Austin Division).

51. Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.,* Case No. 3:10-cv-747 (TJM/DEP) (Northern District of New York).

52. Declaration (October 2011) on behalf of the Plaintiffs in the matter of *American Nurses Association et. al. (Plaintiffs), v. US EPA (Defendant)*, Case No. 1:08-cv-02198-RMC (US District Court for the District of Columbia).

53. Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association,* Case No. 11-417-MJP (Western District of Washington).

54. Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

55. Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency,* Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).

56. Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).

57. Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality,* Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261st Judicial District).

58. Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.,* Civil Action No. 07-CV-5298 (JKG) (Eastern District of Pennsylvania).

59. Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project.

60. Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.

61. Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.

62. Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.

63. Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

64. Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.

65. Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

66. Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.

67. Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

68. Declaration (April 2013) on behalf of Petitioners in the matter of *Sierra Club, et al., (Petitioners) v Environmental Protection Agency et al. (Resppondents),* Case No., 13-1112, (Court of Appeals, District of Columbia Circuit).

69. Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

70. Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of *A. J. Acosta Company, Inc., v. County of San Bernardino*, Case No. CIVSS803651.

71. Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.

72. Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.

73. Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

74. Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.

75. Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).

76. Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States*, Civil Action No. 13-1820 RC (District Court for the District of Columbia).

77. Declaration (April 2014) on behalf of Respondent-Intervenors in the matter of *Mexichem Specialty Resins Inc., et al., (Petitioners) v Environmental Protection Agency et al.,* Case No., 12-1260 (and Consolidated Case Nos. 12-1263, 12-1265, 12-1266, and 12-1267), (Court of Appeals, District of Columbia Circuit).

78. Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).

79. Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).

80. Direct Prefiled Testimony (August 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of Consumers Energy Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17317 (Michigan Public Service Commission).

81. Declaration (July 2014) on behalf of Public Health Intervenors in the matter of *EME Homer City Generation v. US EPA* (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).

82. Expert Report (September 2014), Rebuttal Expert Report (December 2014) and Supplemental Expert Report (March 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

83. Expert Report (November 2014) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

84. *Declaration (January 2015) relating to Startup/Shutdown in the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.*

85. Pre-filed Direct Testimony (March 2015), Supplemental Testimony (May 2015), and Surrebuttal Testimony (December 2015) on behalf of Friends of the Columbia Gorge in the matter of the Application for a Site Certificate for the Troutdale Energy Center before the Oregon Energy Facility Siting Council.

86. Brief of Amici Curiae Experts in Air Pollution Control and Air Quality Regulation in Support of the Respondents, On Writs of Certiorari to the US Court of Appeals for the District of Columbia, No. 14-46, 47, 48. *Michigan et. al., (Petitioners) v. EPA et. al., Utility Air Regulatory Group (Petitioners) v. EPA et. al., National Mining Association et. al., (Petitioner) v. EPA et. al.,* (Supreme Court of the United States).

87. Expert Report (March 2015) and Rebuttal Expert Report (January 2016) on behalf of Plaintiffs in the matter of *Conservation Law Foundation v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

88. Declaration (April 2015) relating to various Technical Corrections for the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.

89. Direct Prefiled Testimony (May 2015) on behalf of the Michigan Environmental Council, the Natural Resources Defense Council, and the Sierra Club in the matter of the Application of DTE Electric Company

for Authority to Increase its Rates, Amend its Rate Schedules and Rules Governing the Distribution and Supply of Electric Energy and for Miscellaneous Accounting Authority, Case No. U-17767 (Michigan Public Service Commission).

90. Expert Report (July 2015) and Rebuttal Expert Report (July 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

91. Declaration (August 2015, Docket No. 1570376) in support of "Opposition of Respondent-Intervenors American Lung Association, et. al., to Tri-State Generation's Emergency Motion;" Declaration (September 2015, Docket No. 1574820) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors for Remand Without Vacatur;" Declaration (October 2015) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors to State and Certain Industry Petitioners' Motion to Govern, *White Stallion Energy Center, LLC v. US EPA*, Case No. 12-1100 (US Court of Appeals for the District of Columbia).

92. Declaration (September 2015) in support of the Draft Title V Permit for Dickerson Generating Station (Proposed Permit No 24-031-0019) on behalf of the Environmental Integrity Project.

93. Expert Report (Liability Phase) (December 2015) and Rebuttal Expert Report (February 2016) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., Environmental Law and Policy Center, and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

94. Declaration (December 2015) in support of the Petition to Object to the Title V Permit for Morgantown Generating Station (Proposed Permit No 24-017-0014) on behalf of the Environmental Integrity Project.

95. Expert Report (November 2015) on behalf of Appellants in the matter of *Sierra Club, et al. v. Craig W. Butler, Director of Ohio Environmental Protection Agency et al.,* ERAC Case No. 14-256814.

96. Affidavit (January 2016) on behalf of Bridgewatch Detroit in the matter of *Bridgewatch Detroit v. Waterfront Petroleum Terminal Co., and Waterfront Terminal Holdings, LLC.*, in the Circuit Court for the County of Wayne, State of Michigan.

97. Expert Report (February 2016) and Rebuttal Expert Report (July 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

98. Direct Testimony (May 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

99. Declaration (June 2016) relating to deficiencies in air quality analysis for the proposed Millenium Bulk Terminal, Port of Longview, Washington.

100. Declaration (December 2016) relating to EPA's refusal to set limits on PM emissions from coal-fired power plants that reflect pollution reductions achievable with fabric filters on behalf of Environmental Integrity Project, Clean Air Council, Chesapeake Climate Action Network, Downwinders at Risk represented by Earthjustice in the matter of *ARIPPA v EPA, Case No. 15-1180.* (D.C. Circuit Court of Appeals).

101. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

102. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Backus Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

103. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Drakulic Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

104. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Deutsch Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

105. Affidavit (February 2017) pertaining to deficiencies water discharge compliance issues at the Wood River Refinery in the matter of *People of the State of Illinois (Plaintiff) v. Phillips 66 Company, ConocoPhillips Company, WRB Refining LP (Defendants)*, Case No. 16-CH-656, (Circuit Court for the Third Judicial Circuit, Madison County, Illinois).

106. Expert Report (March 2017) on behalf of the Plaintiff pertaining to non-degradation analysis for waste water discharges from a power plant in the matter of *Sierra Club (Plaintiff) v. Pennsylvania Department of Environmental Protection (PADEP) and Lackawanna Energy Center*, Docket No. 2016-047-L (consolidated), (Pennsylvania Environmental Hearing Board).

107. Expert Report (March 2017) on behalf of the Plaintiff pertaining to air emissions from the Heritage incinerator in East Liverpool, Ohio in the matter of *Save our County (Plaintiff) v. Heritage Thermal Services, Inc. (Defendant), Case No. 4:16-CV-1544-BYP*, (US District Court for the Northern District of Ohio, Eastern Division).

108. Rebuttal Expert Report (June 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight (Plaintiffs) v Coyote Creek Mining Company LLC (Defendant),* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

109. Expert Affidavit (August 2017) and Penalty/Remedy Expert Affidavit (October 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant,)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

110. Expert Report (August 2017) on behalf of Appellant in the matter of *Patricia Ann Troiano (Appellant) v. Upper Burrell Township Zoning Hearing Board (Appellee)*, Court of Common Pleas of Westmoreland County, Pennsylvania, Civil Division.

111. Expert Report (October 2017), Supplemental Expert Report (October 2017), and Rebuttal Expert Report (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

112. Declaration (December 2017) on behalf of the Environmental Integrity Project in the matter of permit issuance for ATI Flat Rolled Products Holdings, Breckenridge, PA to the Allegheny County Health Department.

113. Expert Report (Harm Phase) (January 2018), Rebuttal Expert Report (Harm Phase) (May 2018) and Supplemental Expert Report (Harm Phase) (April 2019) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

114. Declaration (February 2018) on behalf of the Chesapeake Bay Foundation, et. al., in the matter of the Section 126 Petition filed by the state of Maryland in *State of Maryland v. Pruitt (Defendant)*, Civil Action No. JKB-17-2939 (Consolidated with No. JKB-17-2873) (US District Court for the District of Maryland).

115. Direct Pre-filed Testimony (March 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of *NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC*, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

116. Expert Affidavit (April 2018) and Second Expert Affidavit (May 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power*

Company (Intervenor/Respondent), Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

117. Direct Pre-filed Testimony and Affidavit (December 2018) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

118. Expert Report (February 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

119. Declaration (March 2019) on behalf of Earthjustice in the matter of comments on the renewal of the Title V Federal Operating Permit for Valero Houston refinery.

120. Expert Report (March 2019) on behalf of Plaintiffs for Class Certification in the matter of *Resendez et al v Precision Castparts Corporation* in the Circuit Court for the State of Oregon, County of Multnomah, Case No. 16cv16164.

C. Occasions where Dr. Sahu has provided oral testimony <u>in depositions, at trial or in similar proceedings</u> include the following:

121. Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.

122. Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.

123. Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

124. Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

125. Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et* al. *v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).

126. Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia DEP.

127. Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.

128. Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.

129. Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.

130. Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.

131. Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

132. Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al*.

133. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coleto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

134. Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

135. Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

136. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).

137. Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

138. Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

139. Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

140. Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

141. Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

142. Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

143. Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

144. Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

145. Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

146. Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

147. Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

148. Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).

149. Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

150. Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

151. Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

152. Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

153. Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

154. Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

155. Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

156. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

157. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

158. Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

159. Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

160. Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

161. Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the *US Federal Trade Commission (FTC) v. ECM Biofilms* (FTC Docket #9358).

162. Deposition (February 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

163. Oral Testimony at Hearing (April 2015) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

164. Deposition (August 2015) on behalf of Plaintiff in the matter of *Conservation Law Foundation (Plaintiff) v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

165. Testimony at Hearing (August 2015) on behalf of the Sierra Club in the matter of *Amendments to 35 Illinois Administrative Code Parts 214, 217, and 225* before the Illinois Pollution Control Board, R15-21.

166. Deposition (May 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

167. Trial Testimony (October 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

168. Deposition (April 2016) on behalf of the Plaintiffs in *UNatural Resources Defense Council, Respiratory Health Association, and Sierra Club (Plaintiffs) v. Illinois Power Resources LLC and Illinois Power Resources Generation LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (Central District of Illinois, Peoria Division).

169. Trial Testimony at Hearing (July 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

170. Trial Testimony (December 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

171. Trial Testimony (July-August 2016) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

172. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

173. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Backus Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

174. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Drakulic Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

175. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Deutsch Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

176. Deposition Testimony (July 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight v Coyote Creek Mining Company LLC (Defendant)* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

177. Deposition Testimony (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

178. Deposition Testimony (December 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

179. Deposition Testimony (January 2018) in the matter of National Parks Conservation Association (NPCA) v. State of Washington Department of Ecology and British Petroleum (BP) before the Washington Pollution Control Hearing Board, Case No. 17-055.

180. Trial Testimony (January 2018) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

181. Trial Testimony (April 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

182. Deposition (June 2018) (harm Phase) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

183. Trial Testimony (July 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

184. Deposition (January 2019) and Trial Testimony (January 2019) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

185. Trial Testimony (March 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

Attachment 4

Double Jeopardy in Houston

Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities

{cSD 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.***

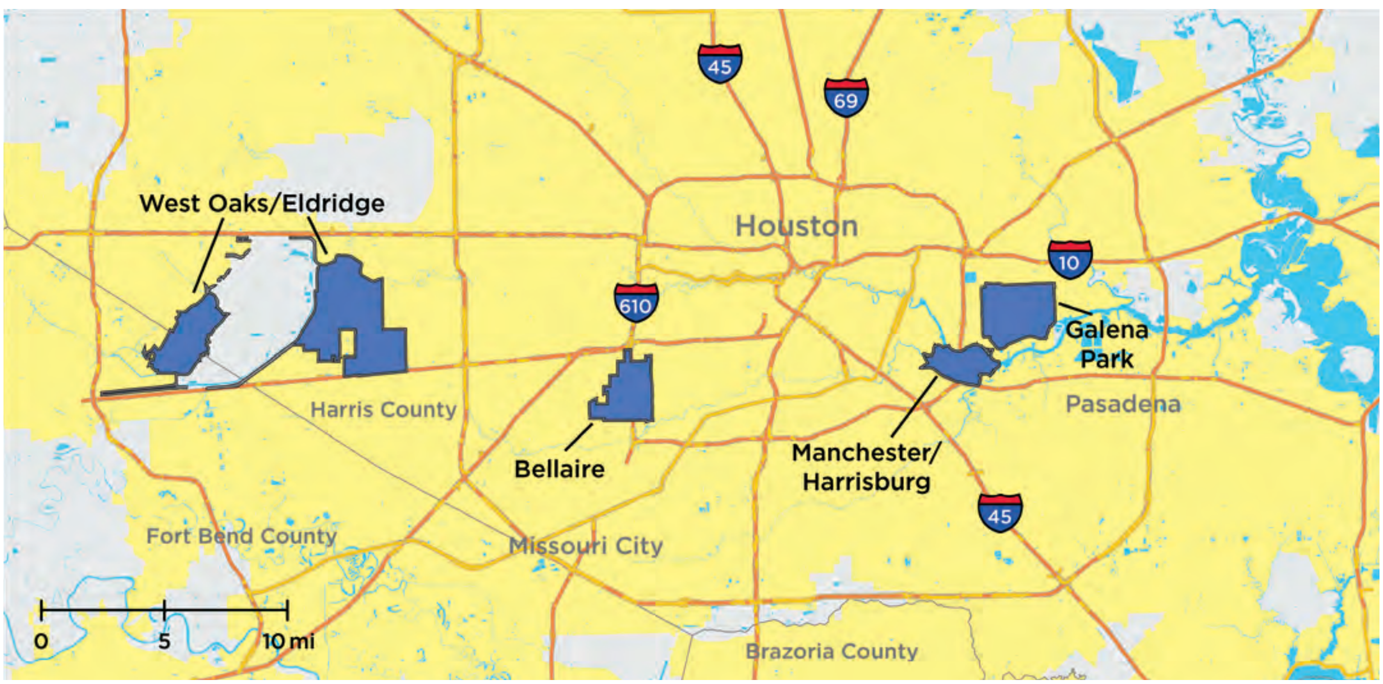
Eldridge has a vast amount of green space, including the Terry Hershey Park trail system that provides walking and bike trails, the George Bush Park west, and the Ray Miller Park with a butterfly garden. Along with several public school districts, several private schools service the area. West Oaks/Eldridge 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.

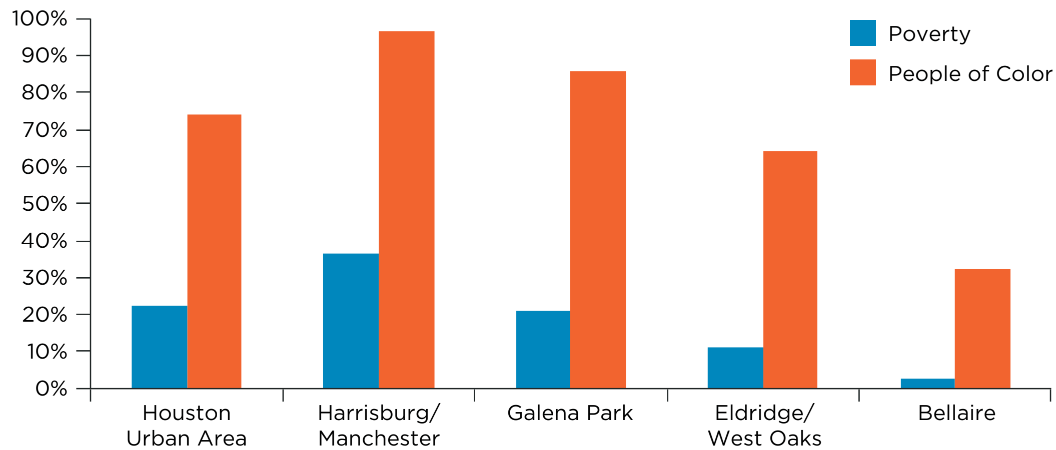
TABLE 1. Wide Demographic Differences Exist Among the Four Houston Communities, including those Populations Living within One Mile of an RMP Facility, and the Houston Urban Area

	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 communities 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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ATTACHMENT 6b

Evaluation of Vulnerability and Stationary Source Pollution in Houston

Revised September 2020

Prepared by Sustainable Systems Research, LLC

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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 is 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 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.

Sustainable Systems Research (SSR) has been asked to characterize the potential for environmental justice concerns associated with stationary source emissions in the Houston area. We first 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 in the Houston area.

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

[1] EPA, 2003. "Framework for Cumulative Risk Assessment," May 2003, EPA/630/P-02/001F

stressors interact. Additionally, cumulative risk assessment emphasizes actual 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 be 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[5] (HIAs), which have been conducted in a variety of jurisdictions and situations, often include an evaluation of cumulative risks.

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

[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

particularly vulnerable to exposure to pollution[7, 8]. Additionally, low-income 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 lens 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 populations, while environmental benefits are often unavailable to 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 of 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)?

[7] Morello-Frosch et al., Cumulative Impacts of Inequalities In Environmental Health, 2011.
[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.
[9] Morello-Frosch et al., Cumulative Impacts of Inequalities In Environmental Health, 2011.
[10] EPA, Concepts, Methods, and Data Sources for Cumulative Health Risk Assessment, 2007.
[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] Morello-Frosch et al., Cumulative Impacts of Inequalities In Environmental Health, 2011.

2. How do total stationary source emissions burdens and vulnerability in several communities of interest near the Ship Channel compare to the rest of the region?
3. Do unauthorized emissions burdens pose unique concerns (in addition to any concerns that may arise in relation to authorized emissions)?

The focus of this analysis is on pollution *emissions*. This analysis is intended to identify areas where there is potential for elevated and disproportionate pollution emissions in order to identify areas that may be of heightened concern and merit additional scrutiny. This analysis should not be interpreted as an analysis of pollution *exposures* or *health risks*, which would require more in-depth measurements and/or modeling of pollution fate and transport, toxicity, and exposure pathways.

This assessment focuses on where pollution emissions overlap with vulnerable populations. Our approach is similar to the approaches used in screening tools such as US EPA's EJScreen[14] and CalEnviroScreen[15] which overlay environmental burdens and various measures of vulnerability, although it is simplified in its focus on emissions only (rather than concentrations or health risks). Stationary source emissions rates are a result of regulatory and economic decision-making processes (industrial siting decisions, the permitting process, operational or enforcement decisions, etc.), so examining emissions directly may provide insights into patterns that arise in the current decision-making environment.

Emissions Data

All air pollution point sources in Texas 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[16]) are required to report their emissions. Emissions of any pollutant may be reported as *annual emissions*, *emissions events (EE)*, or *scheduled maintenance, startup, and* shutdown *(SMSS)* emissions, depending on how they occur. The Texas Commission on Environmental Quality (TCEQ) tracks reported emissions of over 2000 pollutants and pollutant categories in a point source emissions inventory (PSEI) and provides detailed data upon request.[17] This analysis draws from the TCEQ PSEI data.

TCEQ describes annual emissions as follows:

> "Annual emissions include all of a site's actual annual emissions associated with authorized (routine) operations, maintenance, startup, and shutdown

[14] https://www.epa.gov/ejscreen

[15] https://oehha.ca.gov/calenviroscreen

[16] 30 Tex. Admin. Code §101.10 (2019) (TCEQ, Emissions Inventory Requirements), available at https://texreg.sos.state.tx.us/public/readtac%24ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=101&rl=10

[17] Information about the PSEI is available at https://www.tceq.texas.gov/airquality/point-source-ei/psei.html. A full list of contaminants is available at http://www.tceq.texas.gov/assets/public/implementation/air/ie/pseiforms/contams.xlsx.

activities. It does not include emissions that are defined in 30 TAC Section 101.1 as emissions events or unauthorized scheduled maintenance, startup, and shutdown activities."[18]

We refer to annual emissions as *authorized emissions* in this report.

EE[19] and SMSS emissions [20] are reported for any quantity of emissions that is unauthorized [21]. We refer to EE and SMSS emissions together as *unauthorized emissions* in this report.

Demographic Data

Demographic data are obtained from the US Census[22]. Measures of vulnerability were identified by community partners, and include people of color (POC), people

[18] TCEQ (2017) "TCEQ 2016 Emissions Inventory Guidelines", Publication RG-360/16, p 60, available at https://www.tceq.texas.gov/assets/public/comm_exec/pubs/rg/rg360/rg360-16/rg-360.pdf

[19] According to 30 TAC § 101.1, an emissions event is

> "any upset event or unscheduled maintenance, startup, or shutdown activity, from a common cause that results in **unauthorized emissions [emphasis added]** of air contaminants from one or more emissions points at a regulated entity."

See 30 TAC § 101.1 for definitions of upset events and unplanned maintenance, startup, or shutdown activities. TCEQ also provides guidance on reporting emissions events as follows:

> "...Include the emissions in tons per year from all releases due to emissions events, regardless of whether those releases represent reportable or nonreportable quantities and regardless of whether an affirmative defense is claimed for those emissions...." (TCEQ, 2017, TCEQ 2016 Emissions Inventory Guidelines, page 64).

[20] TCEQ provides guidance on reporting SMSS emissions as follows:

> "Report the emissions in tons from all releases due to scheduled maintenance, startup, and shutdown activities that are **not** authorized by a new source review permit or permit by rule in the "SMSS" category, regardless of whether those releases represent reportable or nonreportable quantities and regardless of whether an affirmative defense is claimed for those emissions..." (TCEQ, 2017, TCEQ 2016 Emissions Inventory Guidelines, page 64-65).

30 TAC § 101.1 defines SMSS activity as follows:

> "For activities with **unauthorized emissions [emphasis added]** that are expected to exceed a reportable quantity (RQ), a scheduled maintenance, startup, or shutdown activity is an activity that the owner or operator of the regulated entity whether performing or otherwise affected by the activity, provides prior notice and a final report as required by §101.211 of this title (relating to Scheduled Maintenance, Startup, and Shutdown Reporting and Recordkeeping Requirements); the notice or final report includes the information required in §101.211 of this title; and the actual **unauthorized emissions [emphasis added]** from the activity do not exceed the emissions estimates submitted in the initial notification by more than an RQ. For activities with **unauthorized emissions [emphasis added]** that are not expected to, and do not, exceed an RQ, a scheduled maintenance, startup, or shutdown activity is one that is recorded as required by §101.211 of this title. Expected excess opacity events as described in §101.201(e) of this title (relating to Emissions Event Reporting and Recordkeeping Requirements) resulting from scheduled maintenance, startup, or shutdown activities are those that provide prior notice (if required), and are recorded and reported as required by §101.211 of this title."

[21] 30 TAC § 101.1 defines unauthorized emissions as

> "Emissions of any air contaminant except water, nitrogen, ethane, noble gases, hydrogen, and oxygen that exceed any air emission limitation in a permit, rule, or order of the commission or as authorized by Texas Health and Safety Code, §382.0518(g)."

[22] https://www.census.gov/

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 (in which no one age 14 and over speaks English "very well" or speaks English only) are obtained from the 2016 five-year American Community Survey (ACS) data. The total population estimate is also from the 2016 five-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 eight-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. The eight-county area includes Brazoria, Chambers, Fort Bend, 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 encompasses 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 29 air pollutants in the region that were identified by community partners based on their potential to pose a risk to human health. These include 16 EPA prioritized polycyclic aromatic hydrocarbons (PAHs) and 12 other pollutants identified as of concern based on a recent Union of

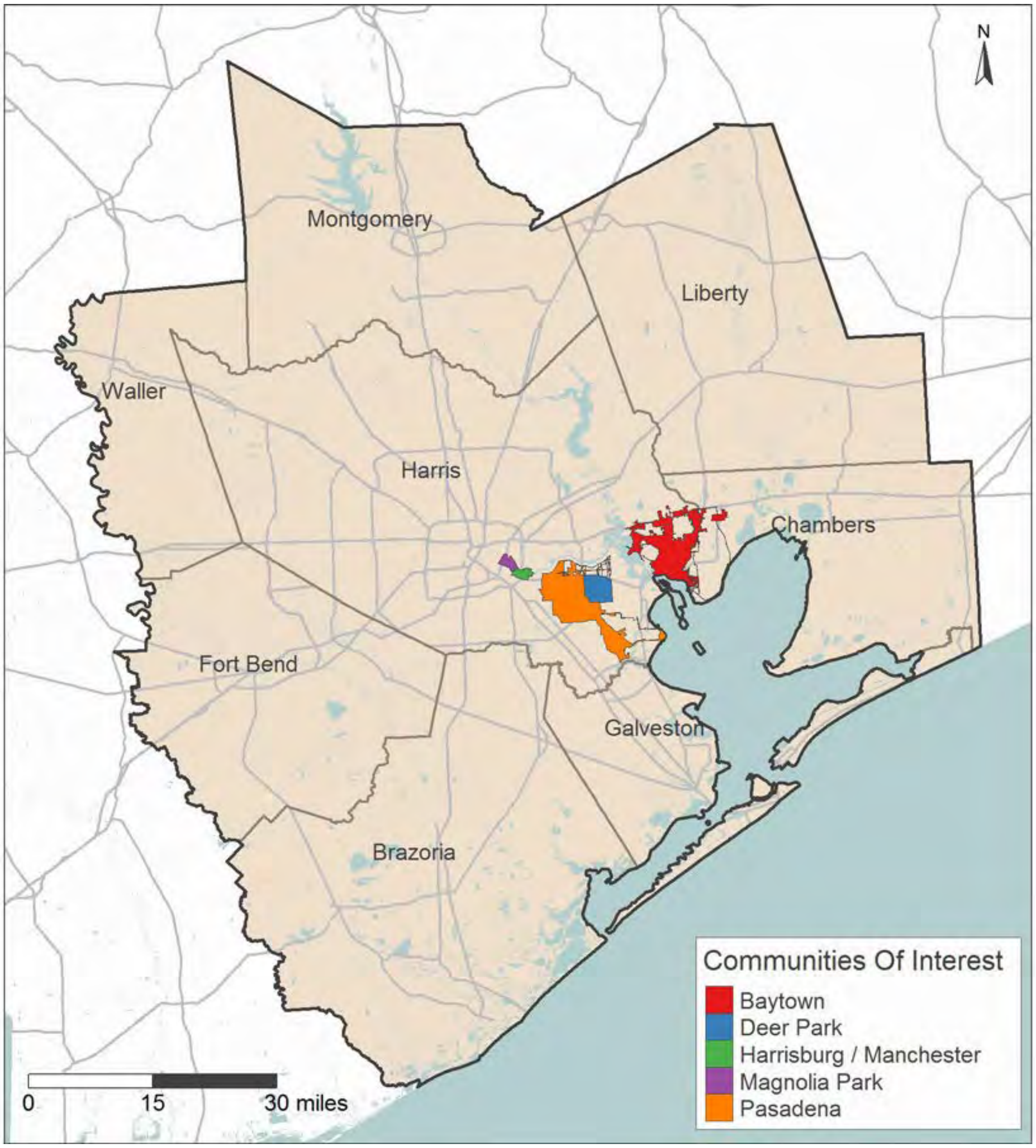

Figure 1: Map of the Eight-County Houston, Texas Region and Communities of Interest

Concerned Scientists / Texas Environmental Justice Advocacy Services Report[23]. One additional pollutant (hydrogen sulfide) was also identified by community partners. Of this list of 29 pollutants, our evaluation includes the 19 pollutants for which PSEI data are available. In order to characterize 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.

[23] See Union of Concerned Scientists, "Double Jeopardy in Houston: Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities," October 2016, https://www.ucsusa.org/resources/double-jeopardy-houston. 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.

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.

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 emissions 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 on each of the 19 pollutant is provided in the Appendices.

We first evaluate each pollutant's emissions density (annual quantity emitted divided by land area) at the census 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 of varying sizes.

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.[24] The purpose of the index is to identify areas where emission densities of multiple pollutants of interest are relatively high in order to highlight potential patterns in elevated emissions densities for the 19 pollutants. The index does not capture all pollutants, nor does it indicate pollution concentrations (which depend on the fate and transport of pollutants), pollution exposures, or the magnitude of health risks[25].

[24] We first use a min-max normalization approach to scale the tract-level emissions density of each of the 19 pollutants from 0 to 1. For each pollutant the minimum tract-level emissions density (zero in all cases) is set to 0 and the maximum tract-level emissions density is set equal to 1, with intermediate values scaled by dividing by the maximum tract-level emissions density. These scaled values are estimated for each pollutant and then summed across the 19 pollutants to arrive at the pollution index value for each tract.

[25] The focus of this index is on the density of emissions in each tract rather than the health risk. Because the pollutants of concern were selected based on concerns communities of interest, we also include pollution categories, which reflect a broader number of pollutants. This index does not weight the potential health impacts of each pollutant individually so it does not reflect the magnitude of health risks. A more complex analysis that accounts for the fate and transport of pollution, its toxicological properties, exposures, and population vulnerability would be required to turn emissions data into health risks.

Table 1: Air Pollutants of Interest[26]

Pollutants of interest in study area	Available in TCEQ PSEI data?
Broad pollution categories	
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 Particulate Matter	
Formaldehyde	✓
Hydrogen Chloride	✓
Hydrogen Cyanide	✓
Hydrogen Sulfide	✓

[26] Pollutants that are available in TCEQ PSEI data (https://www.tceq.texas.gov/airquality/point-source-ei/psei.html) 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.

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 (people living in poverty, people of color, and limited-English households), we compare emissions densities to the corresponding advantaged populations (people living above poverty, non-Hispanic white people, and English proficient households). We evaluate the emissions density burdens for each population using three metrics:

1. **Average emissions density for the entire population.** This is the average emissions density experienced by the population living in each tract. 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.

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.[27] 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.[28] As part of the

[27] 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.

[28] 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.

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 region and Harris County vulnerability estimates are obtained by aggregating 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. This analysis does not represent an evaluation of health risks. The health risks experienced by different groups is a function of the magnitude of emissions in their area (which is presented here), in combination with several other factors that were not evaluated here, including each pollutant's fate and transport, toxicity, the location of potentially exposed populations, and the vulnerability of the population.

Regionwide

We first compare the emissions burdens of vulnerable populations (versus their advantaged counterparts) across the eight-county region.

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 highlighting 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, and 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 indicates emissions burdens that disproportionately fall on advantaged populations.

For example, on average, 11% 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 households 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 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 per 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 (the average emissions densities experienced by people living in tracts with emissions), we see that people of color, people living in poverty, and limited-English households living in tracts with emissions experience higher average emissions densities when compared with 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, and 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 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	0.670	0.331	103%	0.683	0.455	50%	0.845	0.424	99%
	2012 - 2016	0.651	0.322	102%	0.656	0.446	47%	0.828	0.410	102%
	2016	0.625	0.328	90%	0.634	0.436	45%	0.811	0.403	101%
PM10	2007 - 2016	1.02	0.458	122%	1.06	0.665	60%	1.33	0.621	114%
	2012 - 2016	0.953	0.419	127%	0.986	0.617	60%	1.27	0.572	121%
	2016	0.808	0.404	100%	0.831	0.548	52%	1.06	0.512	107%
Total VOCs	2007 - 2016	3.07	1.38	122%	3.07	2.09	47%	3.46	1.91	81%
	2012 - 2016	2.87	1.26	128%	2.83	1.94	46%	3.21	1.76	82%
	2016	2.48	1.17	113%	2.56	1.68	52%	2.90	1.55	87%
19-pollutant index	2007 - 2016	0.0232	0.0198	17%	0.0270	0.0193	40%	0.0278	0.0188	48%
	2012 - 2016	0.0218	0.0170	28%	0.0240	0.0179	34%	0.0274	0.0166	64%
	2016	0.0262	0.0240	9%	0.0279	0.0237	17%	0.0317	0.0222	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	17.2	18.9	-9%	17.5	18.2	-4%	15	18	-17%
	2012 - 2016	14.8	16.7	-11%	15.2	15.7	-3%	13	15	-14%
	2016	12.6	13.2	-5%	13.1	12.9	2%	11	12	-8%
PM10	2007 - 2016	17.6	19.3	-9%	17.7	18.7	-5%	15	18	-17%
	2012 - 2016	15.4	17.1	-10%	15.6	16.3	-4%	13	16	-15%
	2016	12.8	13.5	-5%	13.4	13.1	2%	12	13	-9%
Total VOCs	2007 - 2016	19.4	21.1	-8%	19.9	20.4	-2%	17	20	-13%
	2012 - 2016	16.8	18.7	-10%	17.5	17.7	-1%	15	17	-12%
	2016	14.7	15.4	-5%	15.4	14.9	3%	13	14	-6%
19-pollutant index	2007 - 2016	14.5	17.6	-18%	14.9	16.4	-9%	12	16	-23%
	2012 - 2016	12.1	15.4	-22%	12.6	13.6	-8%	10	13	-24%
	2016	9.1	11.9	-23%	9.8	10.5	-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	3.89	1.75	123%	3.89	2.49	56%	5.75	2.40	140%
	2012 - 2016	4.40	1.93	128%	4.32	2.84	52%	6.39	2.71	136%
	2016	4.95	2.48	100%	4.83	3.38	43%	7.15	3.26	119%
PM10	2007 - 2016	5.78	2.37	144%	6.00	3.56	69%	8.88	3.43	159%
	2012 - 2016	6.17	2.45	152%	6.31	3.79	67%	9.51	3.66	160%
	2016	6.31	2.99	111%	6.22	4.18	49%	9.18	4.05	127%
Total VOCs	2007 - 2016	15.9	6.57	141%	15.4	10.3	50%	20.3	9.7	109%
	2012 - 2016	17.0	6.72	153%	16.2	11.0	48%	21.6	10.4	108%
	2016	16.9	7.57	124%	16.6	11.3	47%	21.6	10.8	100%
19-pollutant index	2007 - 2016	0.160	0.113	42%	0.181	0.118	53%	0.229	0.119	93%
	2012 - 2016	0.181	0.111	63%	0.190	0.131	45%	0.272	0.126	116%
	2016	0.286	0.202	42%	0.284	0.226	26%	0.396	0.217	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 2016 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.

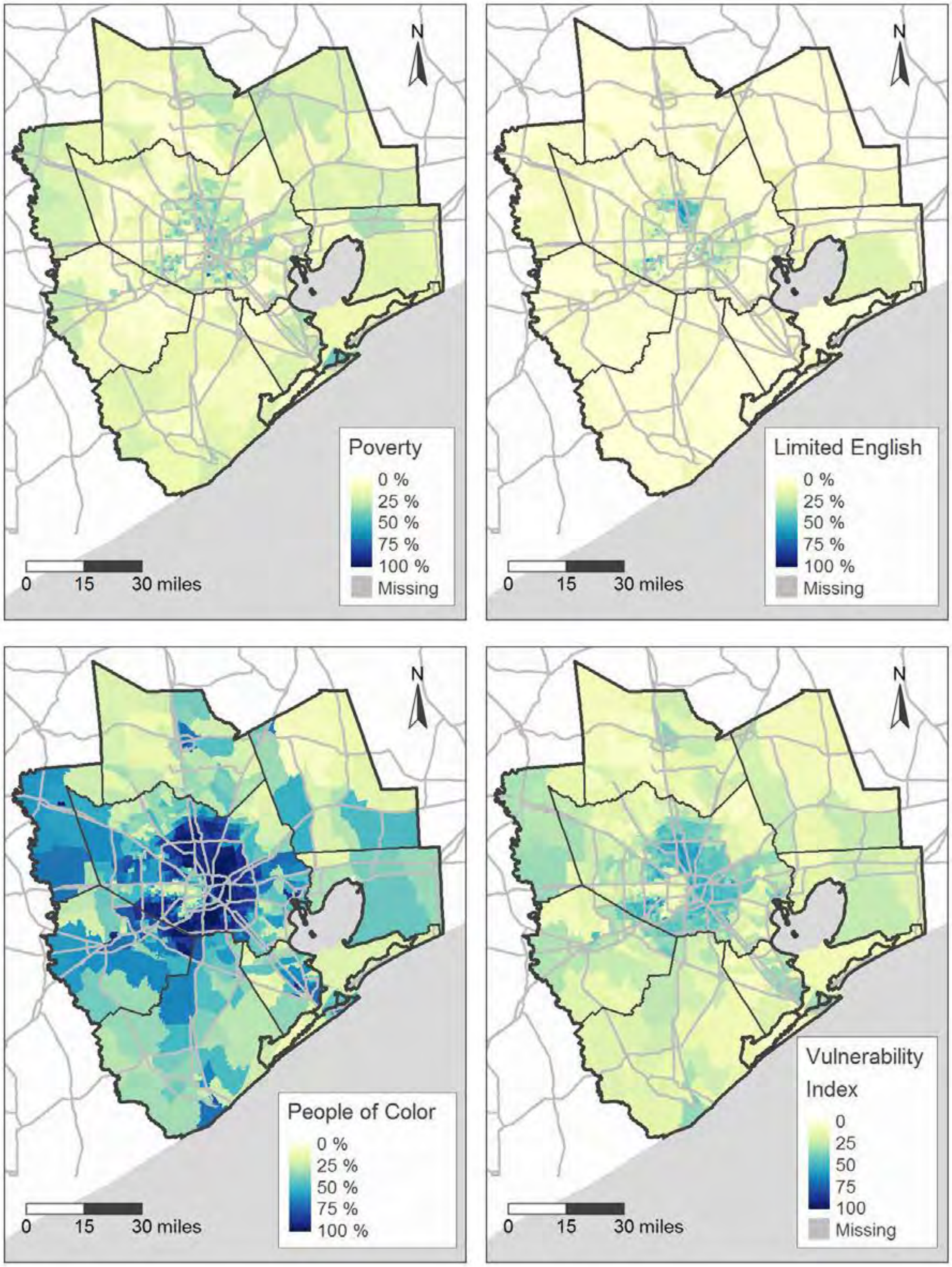

Figure 2: Vulnerability in the Eight-County Houston Region[29]

[29] The Vulnerability Index is an average of % Poverty, % Limited English, and % People of Color.

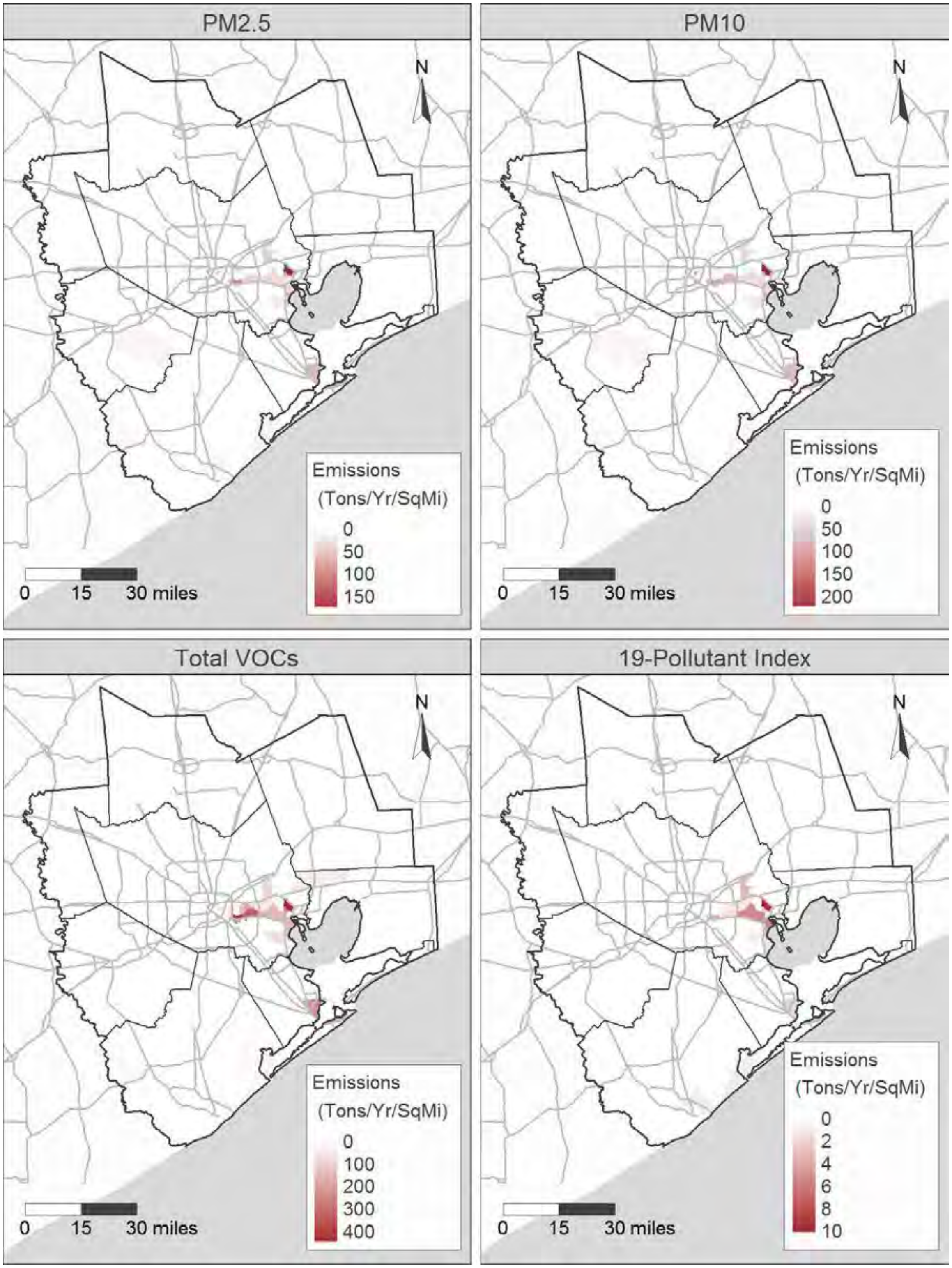

Figure 3: 2007 to 2016 Emissions in the Eight-County Houston Region

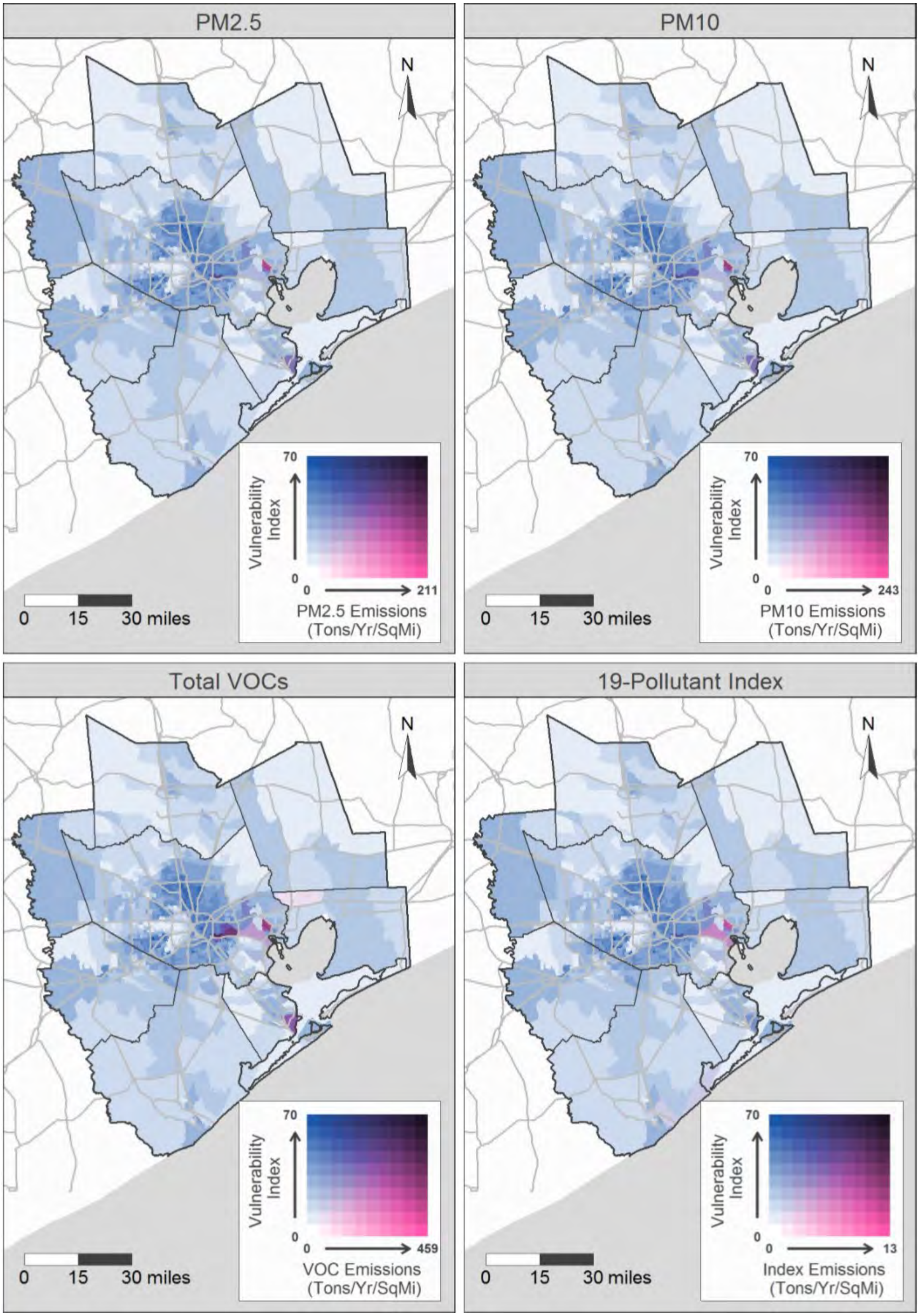

Figure 4: 2007 to 2016 Emissions and Vulnerability in the Eight-County Houston Region

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 which have the potential to contribute 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 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 households 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 prevalent 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	0.192	0.0719	167%	0.170	0.132	29%	0.250	0.103	143%
	2012 - 2016	0.135	0.0587	130%	0.115	0.094	22%	0.175	0.078	126%
	2016	0.106	0.0539	97%	0.103	0.079	30%	0.098	0.071	38%
Emissions Scope: Share of Population Living in Tracts with Emissions (%)										
VOCs (unauthorized emissions only)	2007 - 2016	9.07	11.6	-22%	10.2	9.86	3%	7.82	9.77	-20%
	2012 - 2016	6.90	8.93	-23%	7.90	7.68	3%	5.92	7.60	-22%
	2016	4.97	6.06	-18%	5.73	5.33	8%	4.50	5.27	-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	2.11	0.621	241%	1.67	1.34	25%	3.19	1.05	203%
	2012 - 2016	1.96	0.658	198%	1.45	1.22	19%	2.96	1.02	190%
	2016	2.14	0.890	140%	1.80	1.49	21%	2.19	1.35	62%

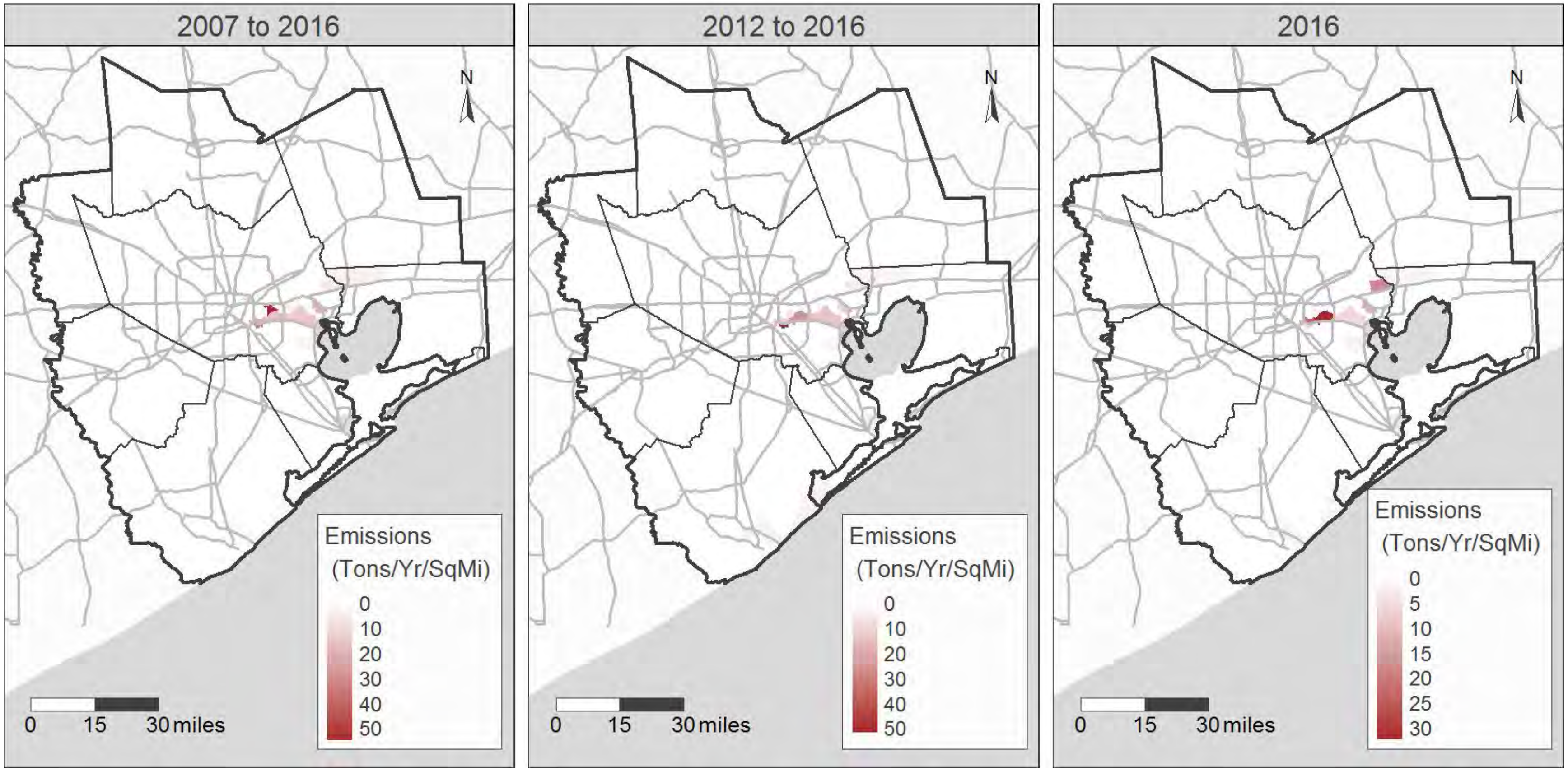

Figure 5: Unauthorized VOC Emissions in the Eight-County Houston Region

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 the 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 for the period from 2007 to 2016.

We then summarize vulnerability and the 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).[30] 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 reference 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). Detailed tables are provided in Appendix G.

[30] The 19-pollutant index is not included in this part of the analysis because it is not comparable across analysis scales.

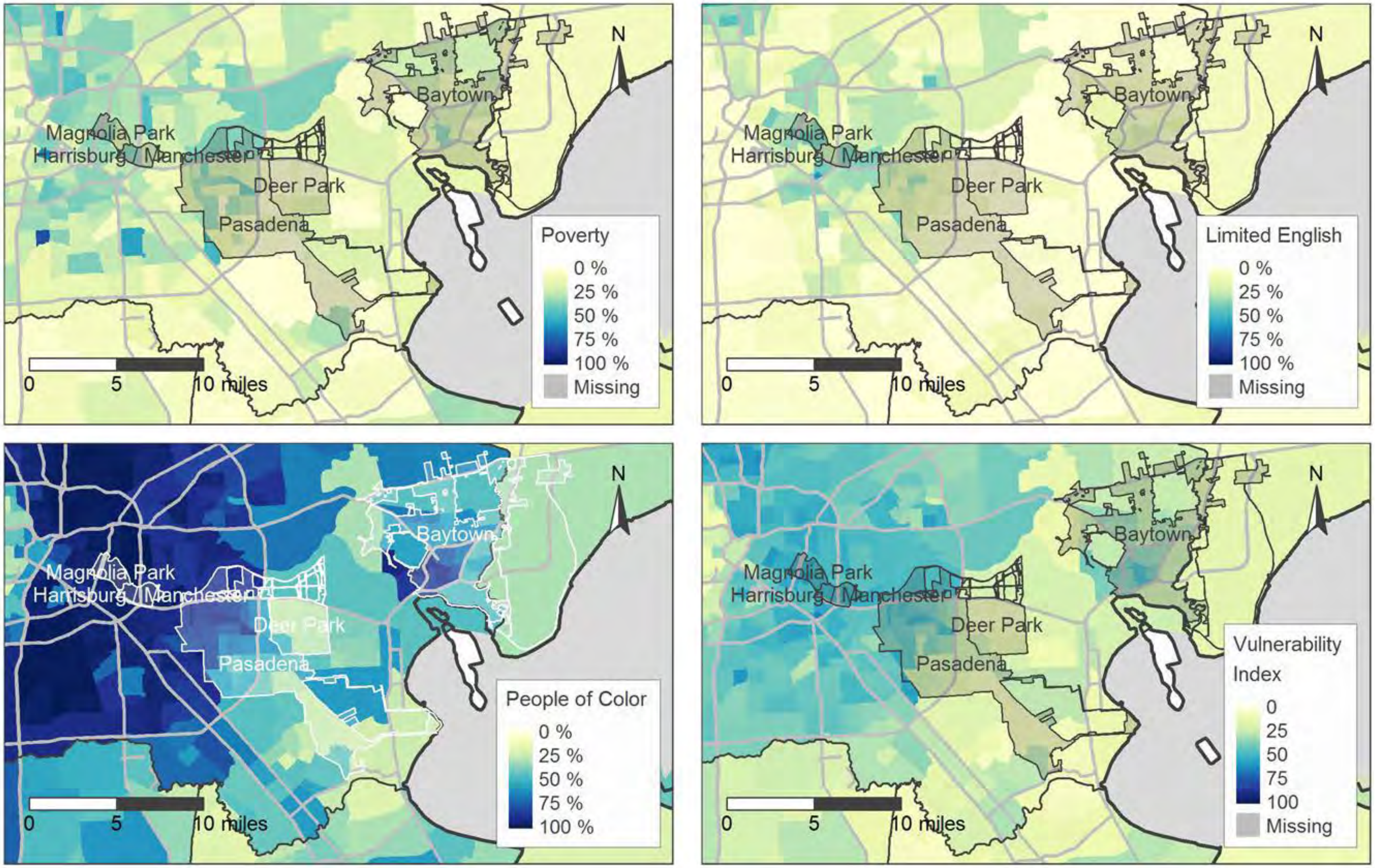

Figure 6: Vulnerability in the Ship Channel Area

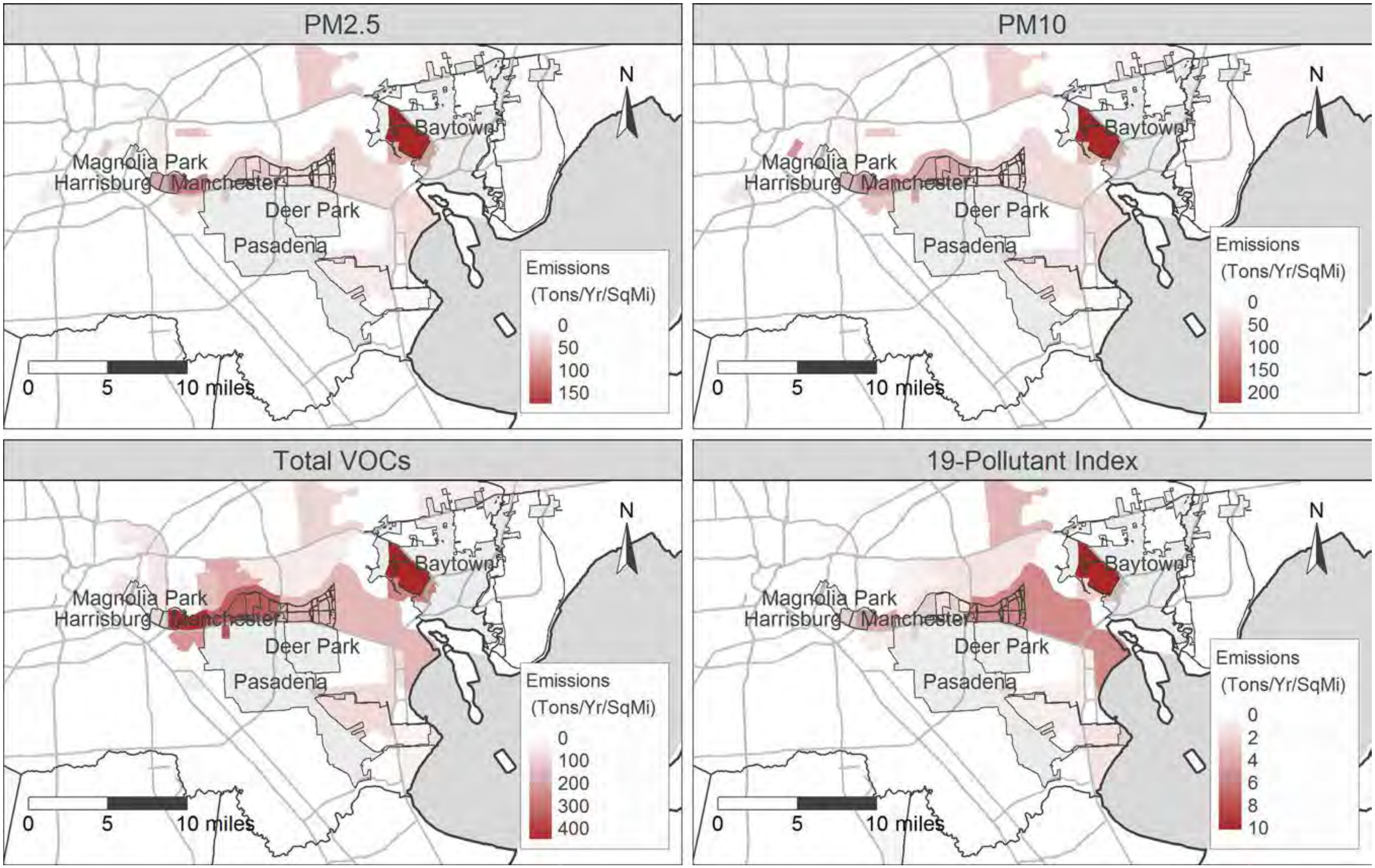

Figure 7: 2007 to 2016 Emissions in the Ship Channel Area

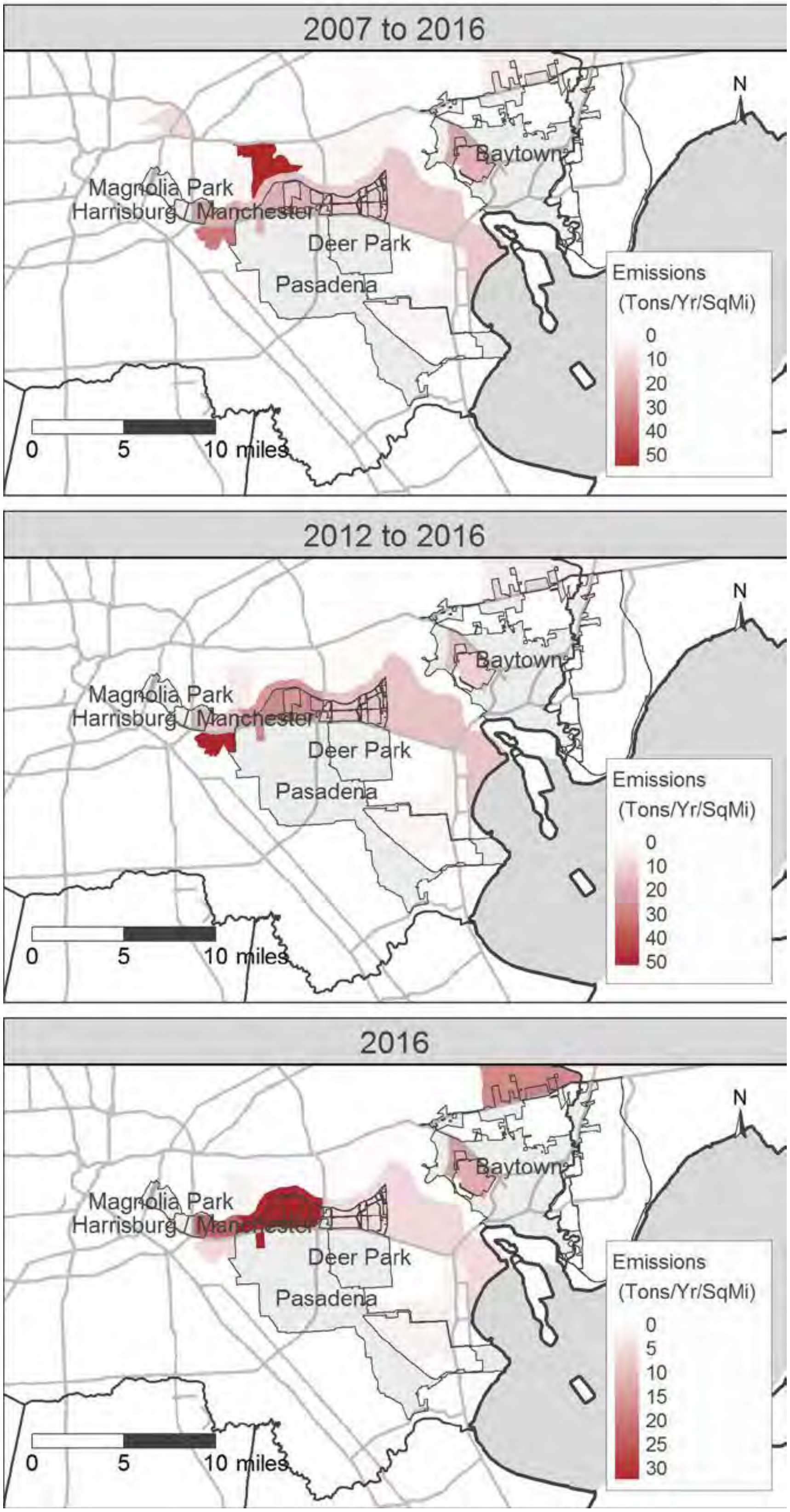

Figure 8: Unauthorized VOC Emissions in the Ship Channel Area

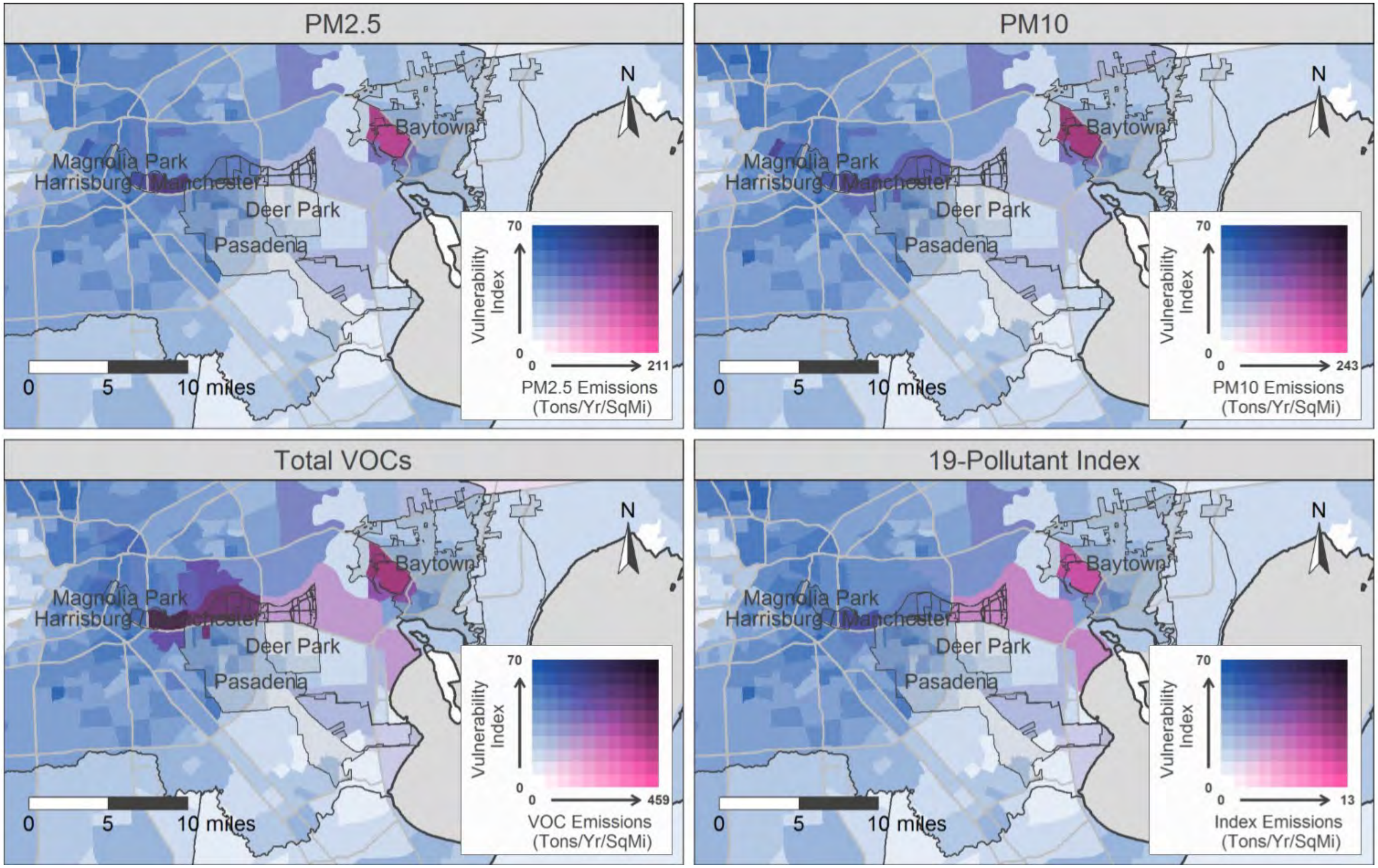

Figure 9: 2007 to 2016 Emissions and Vulnerability in the Ship Channel Area

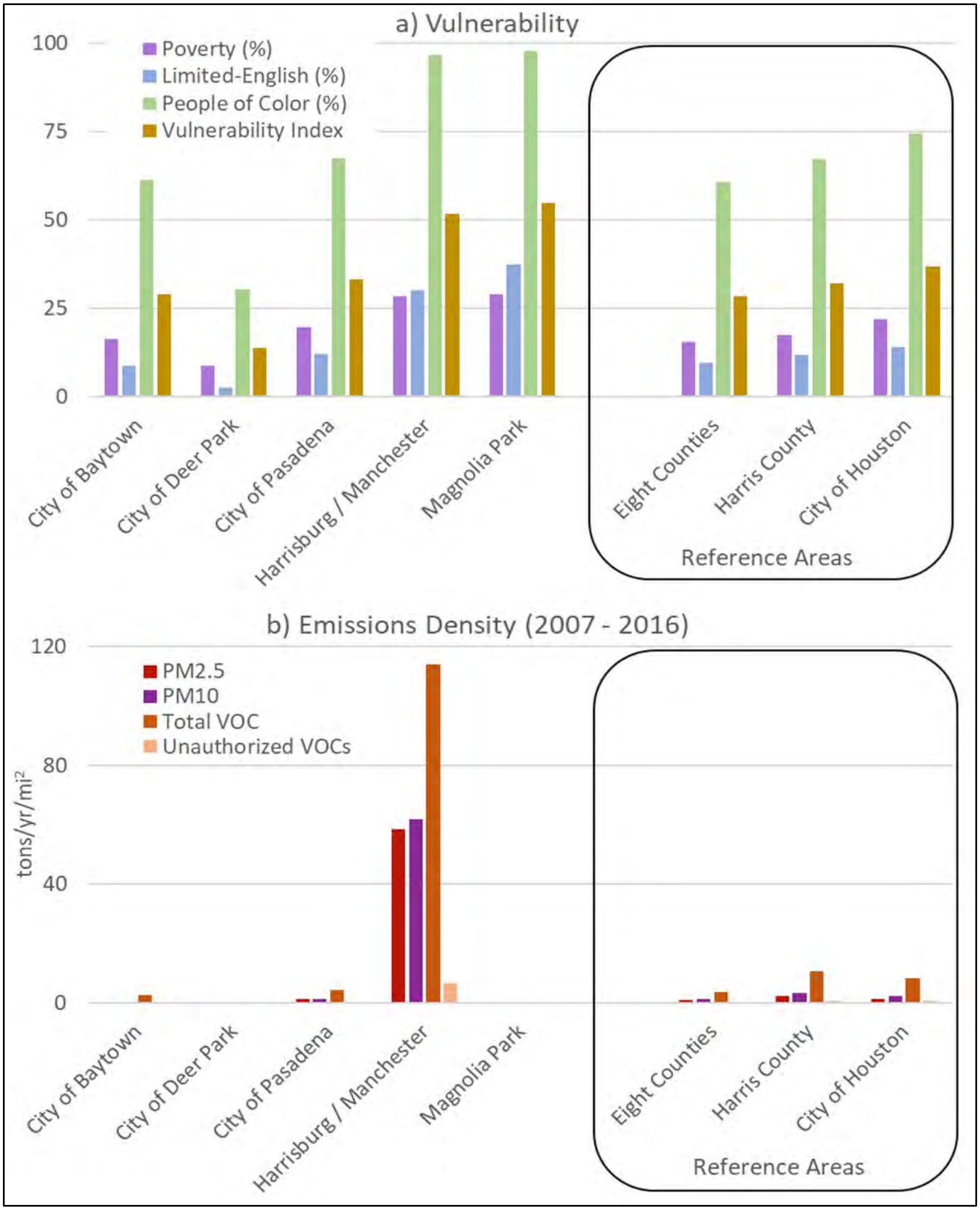

Figure 10: Vulnerability and Emissions in Communities of Interest

Discussion

This analysis evaluates vulnerability and stationary source emissions in the Houston region. Emissions burdens are estimated at the census-tract level, represented as the quantity of pollution emitted per land area. Vulnerability is also evaluated at the tract level, and is estimated based on the share of households that are living in poverty, the share of limited-English households, and the share of the population that are people of color.

The regional-level analysis indicates that the share of vulnerable populations living in tracts where pollution is emitted is modestly smaller than that of more advantaged populations. However, vulnerable populations living in tracts where emissions occur are in proximity to greater densities of pollution emissions 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 those of more advantaged populations. These findings are consistent for most 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 densities 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.

By examining the density of emissions of different pollutants and pollutant categories experienced by different communities and populations live, we are able to bring attention to areas where emissions burdens and vulnerability intersect. Where and when stationary sources emit different types of pollution is of interest both because of the potential for health risks and because it may provide insight into the regulatory and decision-making 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 and economic decisions.

Limitations

This study focuses on average emissions burdens for different populations and communities. As with any study, this analysis is limited in scope. We evaluated emissions densities but did not evaluate pollution fate and transport in the environment (including chemical reactions that might change the chemical composition of pollutants and the movement of pollutants), residents' exposures to pollution, residents' vulnerability to pollution exposure, or the health risks associated with pollution exposure. Note that this analysis does not account for movement of pollution from adjacent tracts, and it did not include statistical tests of the differences in pollution burdens experienced by different populations and communities.

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. Additional analysis could also include modeling the fate and transport of pollution in the environment, the population's exposure and vulnerability to pollution, and the health risks borne in different communities and populations.

Conclusions

In this memo we have evaluated demographic vulnerability and point source emissions in the Houston region. This analysis focuses on pollution emissions densities and their relationship with vulnerability in order to identify areas with potential for disparities that may merit additional scrutiny. This analysis should not be interpreted as an analysis of pollution *exposures* or *health risks*, which would require more in-depth measurements and/or modeling of pollution fate and transport, toxicity, vulnerability, and exposure.

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 are 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 for the period from 2007 to 2016.

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 to 2016, 2012 to 2016, and 2016).

Appendices

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Appendix B: Additional Regionwide Maps of Four Pollution Categories

Appendix C: Regionwide Maps of 19 Pollutants of Concern

Appendix D: Additional Ship Channel Maps of Four Pollution Categories

Appendix E: Ship Channel Maps of 19 Pollutants of Concern

Appendix F: Emissions for 2012 to 2016 and 2016 in Communities of Interest

Appendix G: Vulnerability Index and Emissions in Communities of Interest

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%

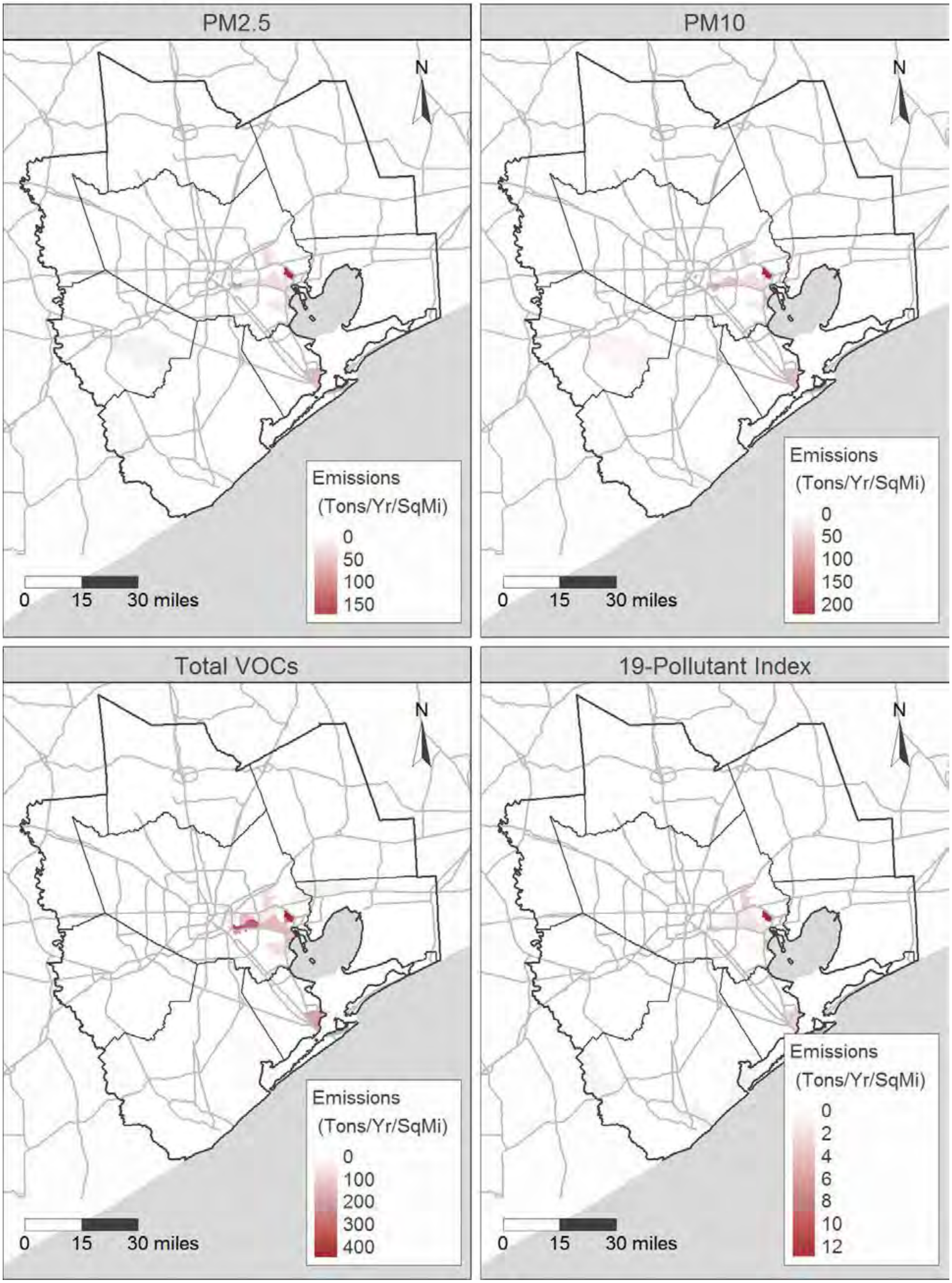
Average Emissions Density for People Living in Tract with Emissions (2 of 3) (tons / year / sq mile estimated at the census tract level)										
Pollutant	**Year range**	**People of Color (POC)**	**Non POC**	**% Difference (POC - NonPOC) / NonPOC**	**People Living in Poverty (POV)**	**Non POV**	**% 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%

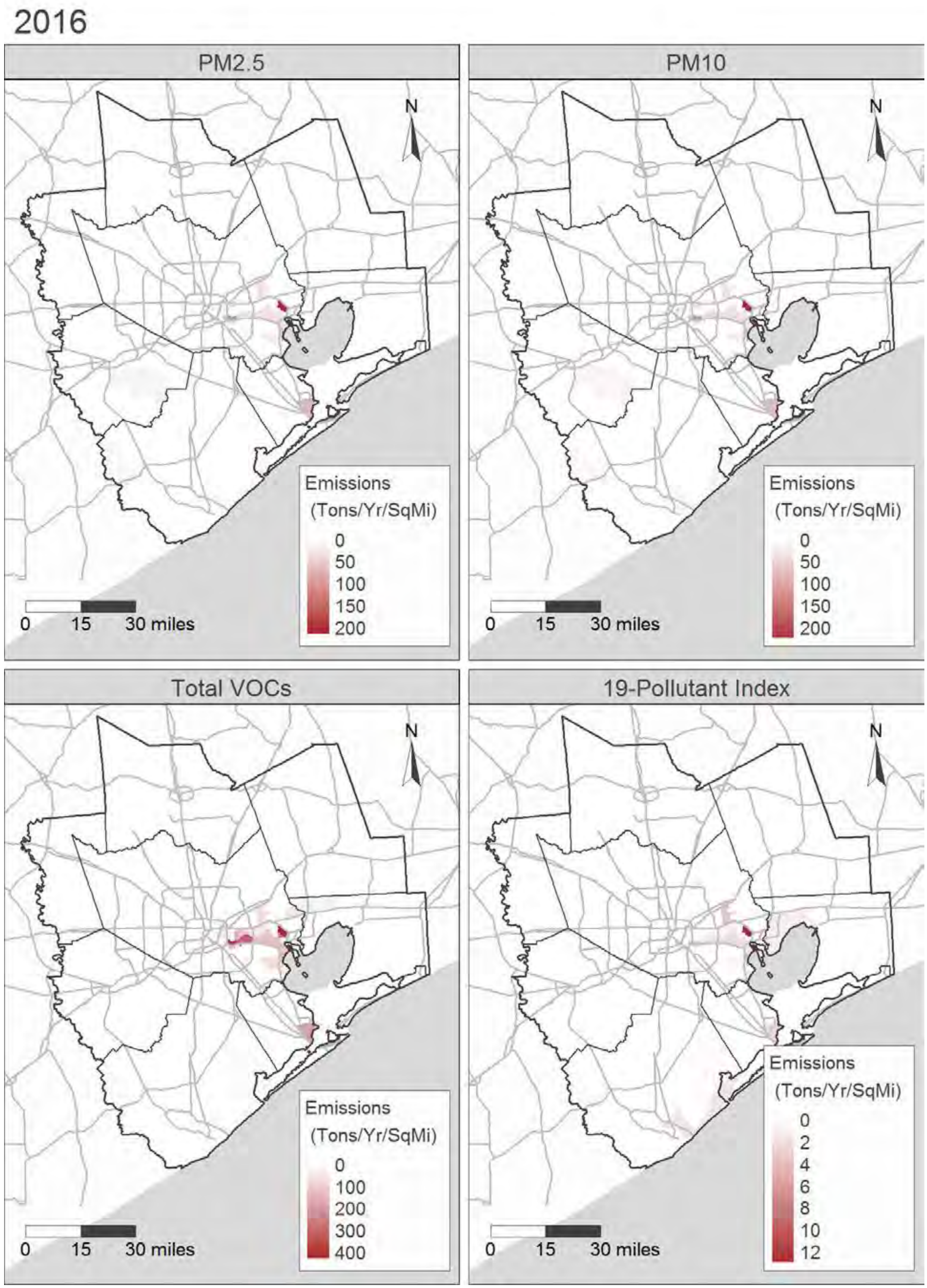
ATTACHMENT 6c

Appendix B: Additional Regionwide Maps of Four Pollution Categories

2012 to 2016

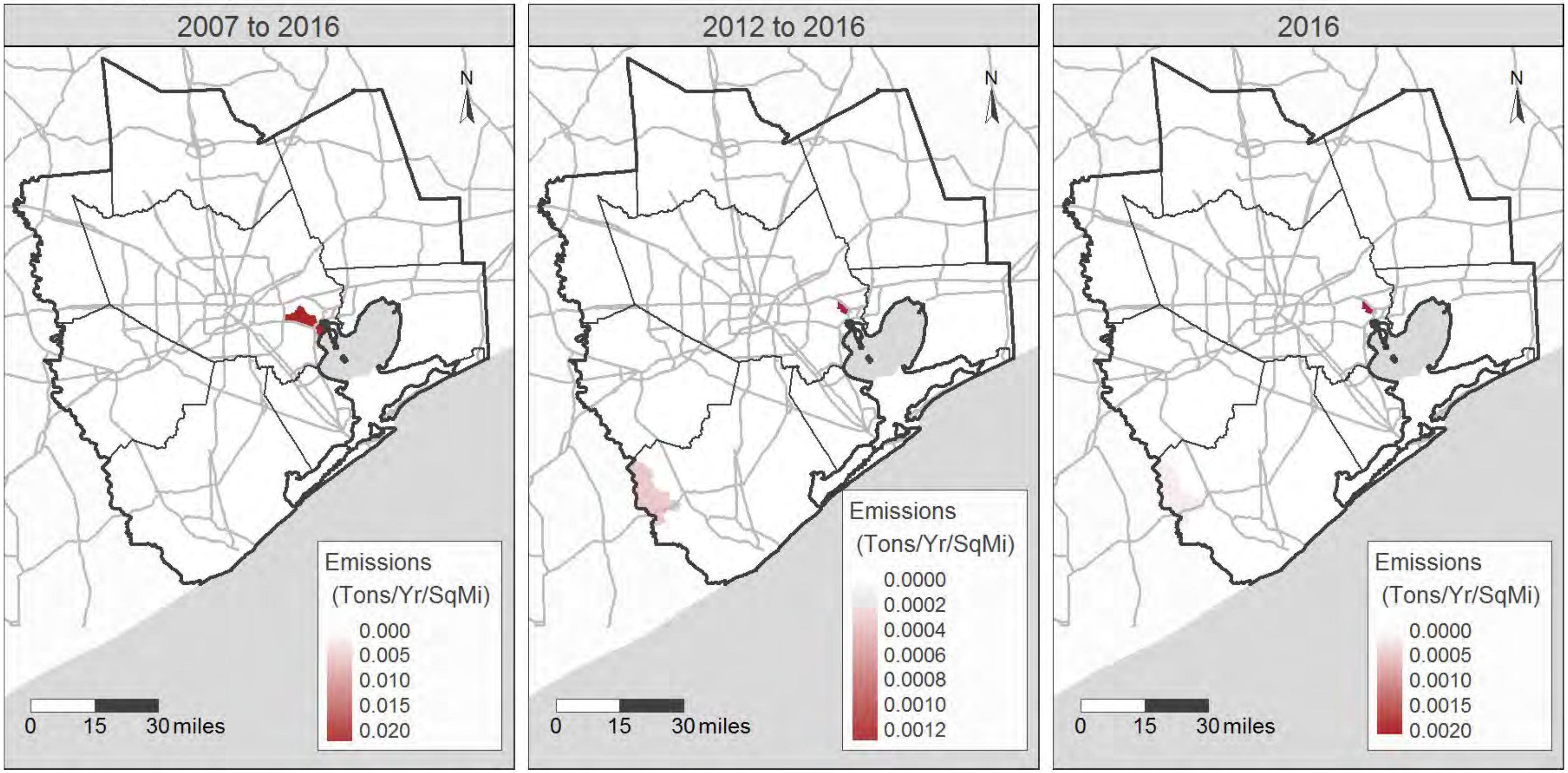


PM2.5
PM10
Total VOCs
19-Pollutant Index
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
300
400
2
4
6
8
10
12
0 15 30 miles

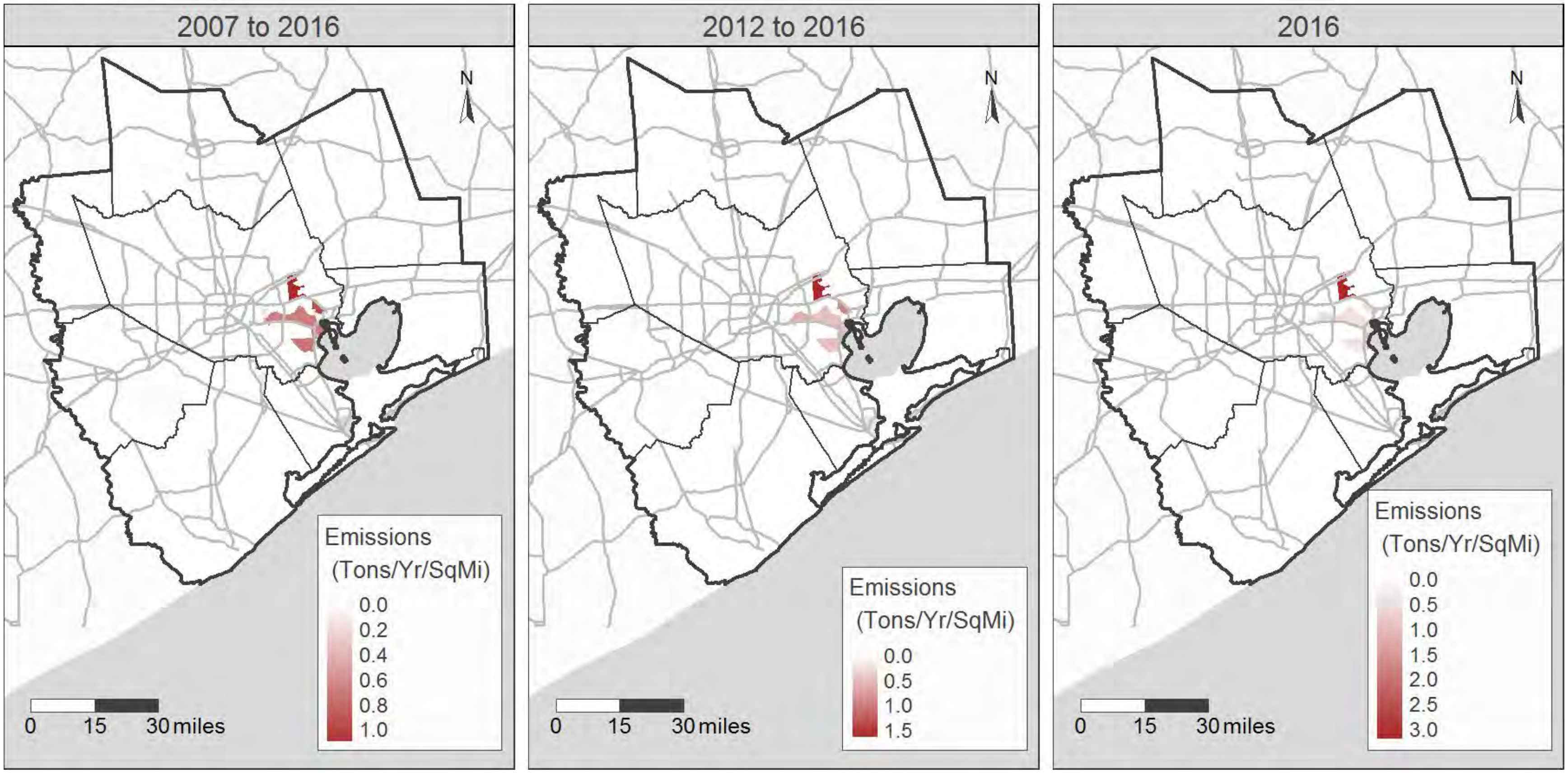

2016
PM2.5
PM10
Total VOCs
19-Pollutant Index
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
0
100
200
300
400
0
2
4
6
8
10
12
0 15 30 miles

Appendix C: Regionwide Maps of 19 Pollutants of Concern

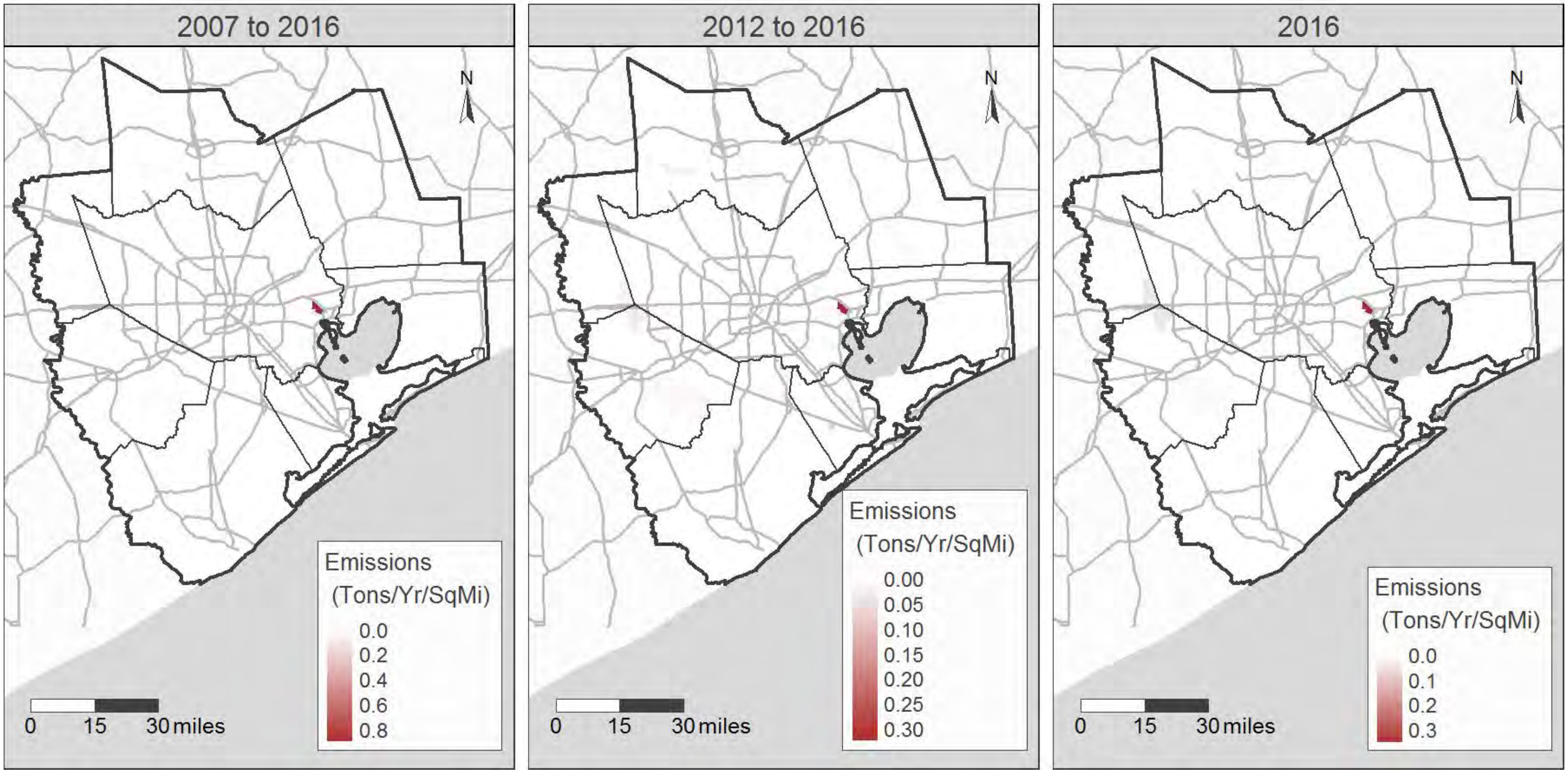
Acenaphthylene



Acetaldehyde

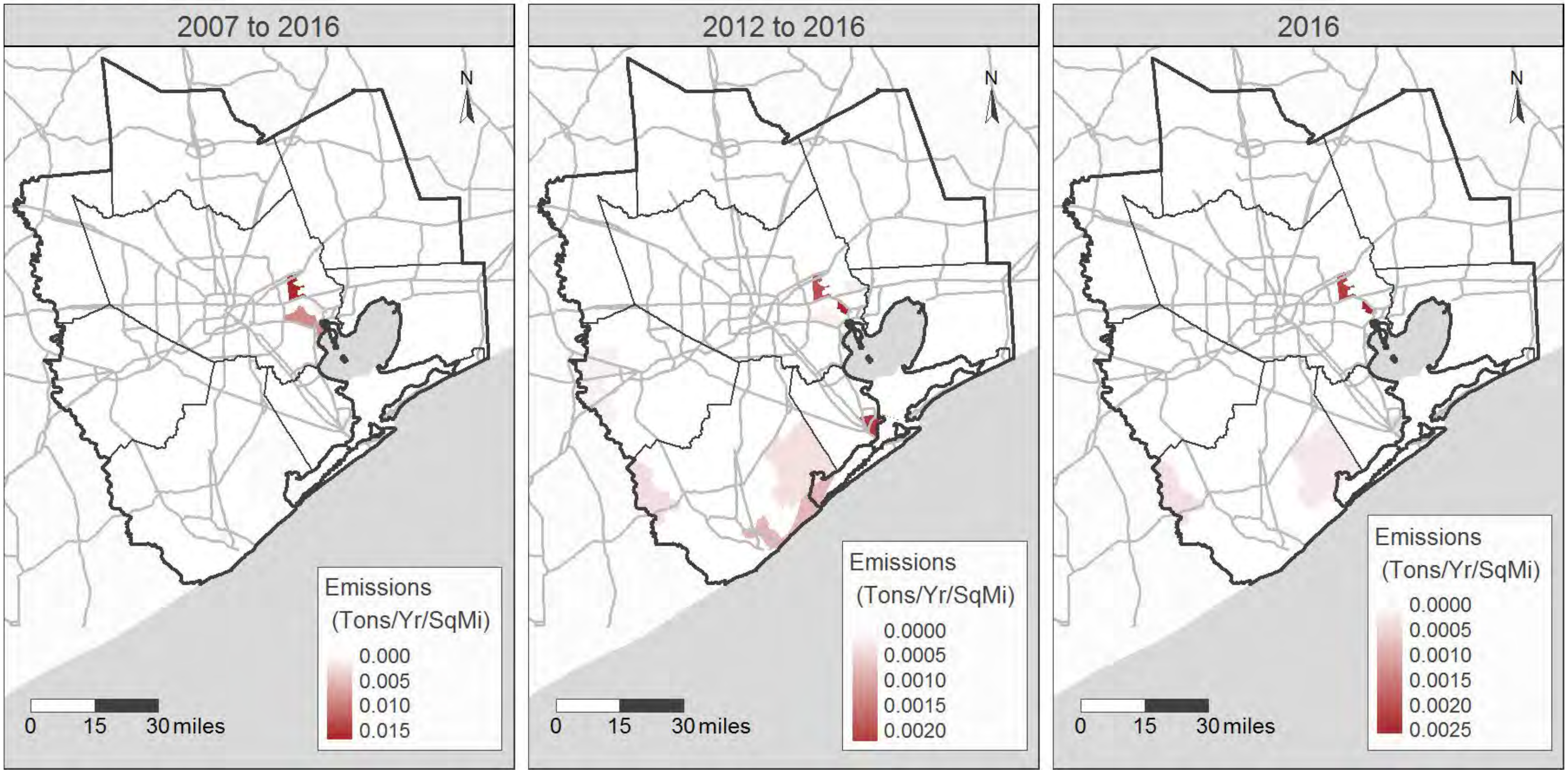


Acrolein



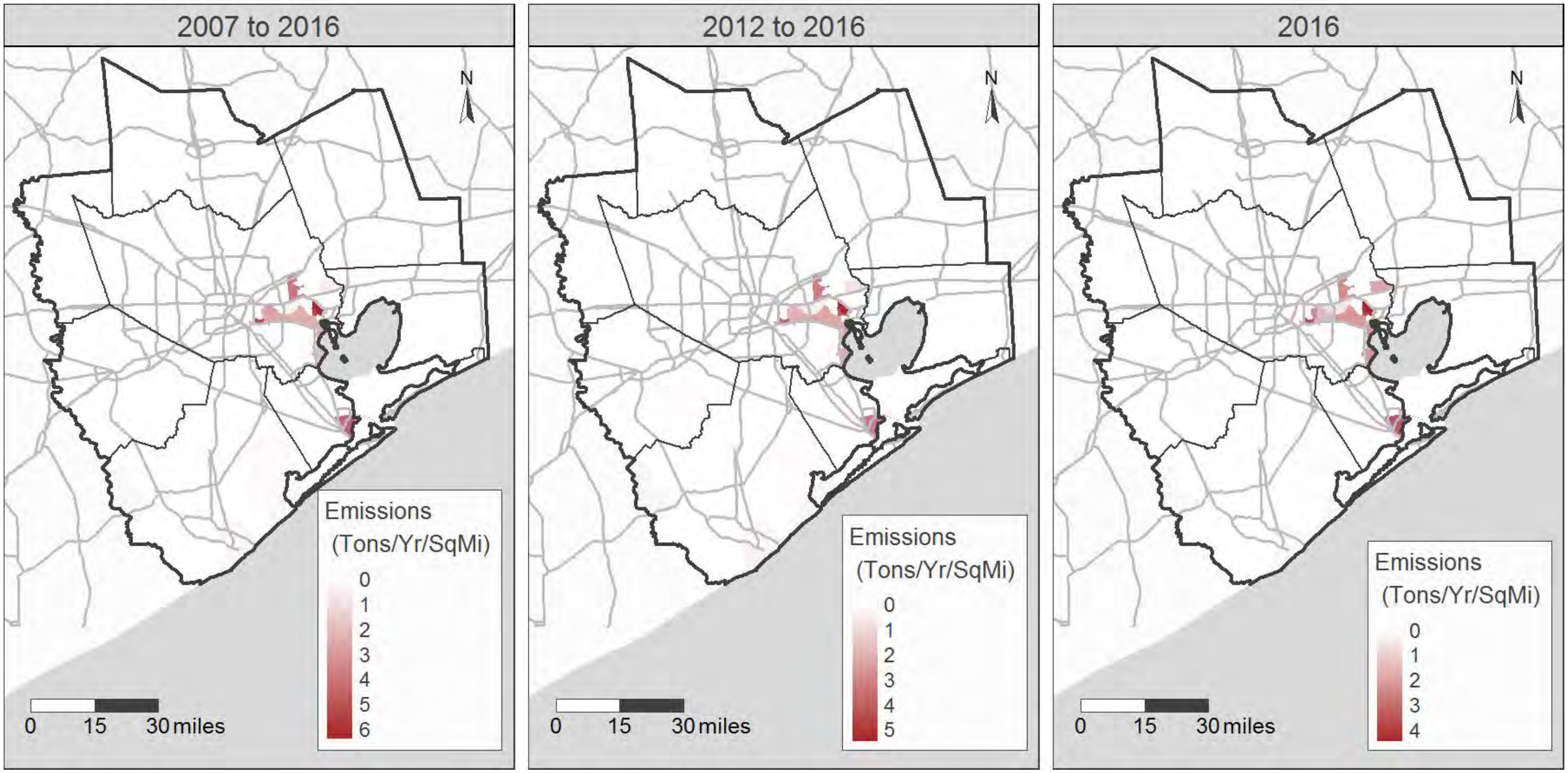
2007 to 2016
2012 to 2016
2016
N
Emissions
(Tons/Yr/SqMi)
0.0
0.2
0.4
0.6
0.8
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.0
0.1
0.2
0.3
0
15
30 miles

Anthracene

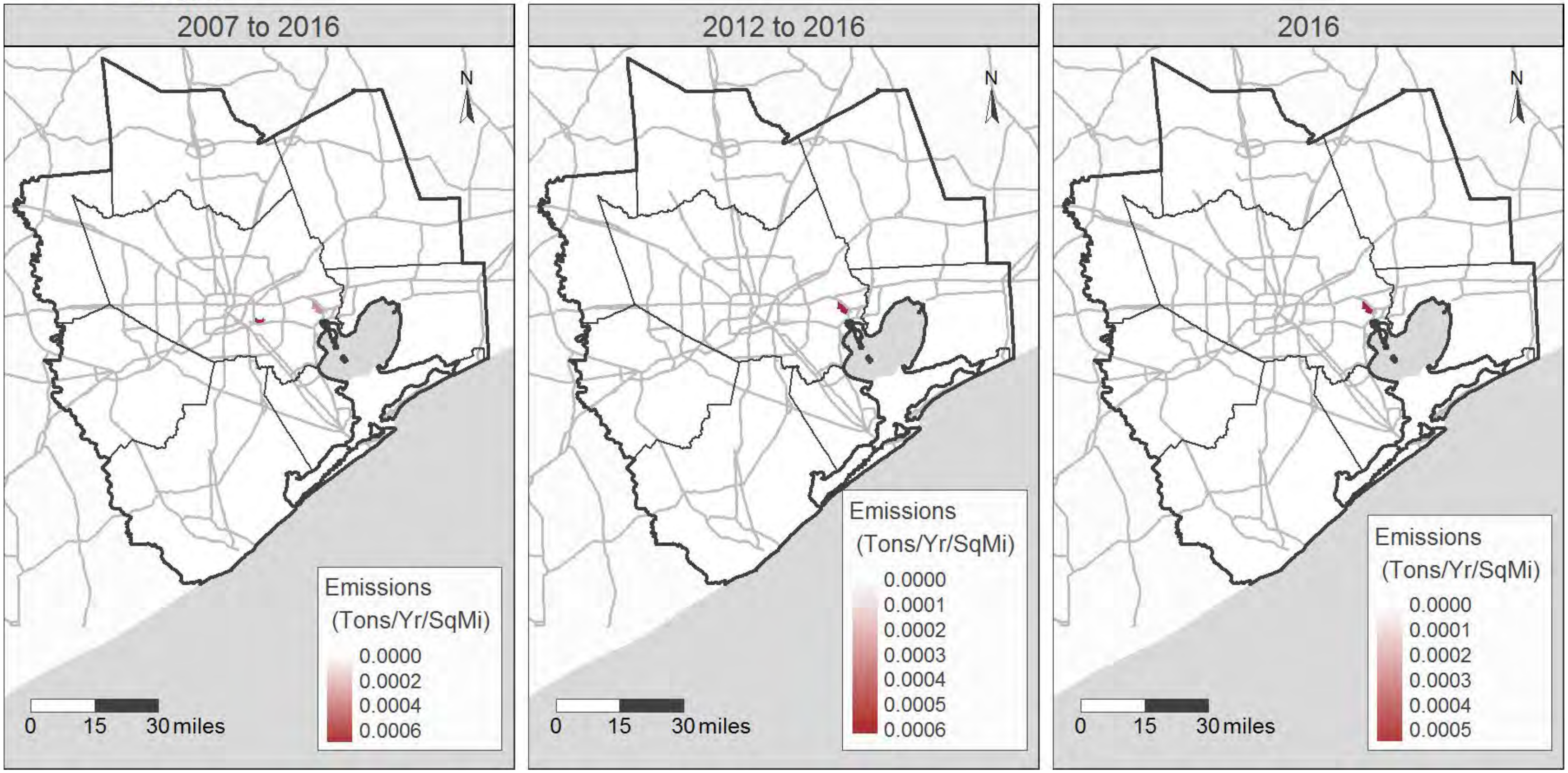


2007 to 2016
2012 to 2016
2016
N
N
N
Emissions
(Tons/Yr/SqMi)
0.000
0.005
0.010
0.015
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
0.0025
0 15 30 miles
0 15 30 miles
0 15 30 miles

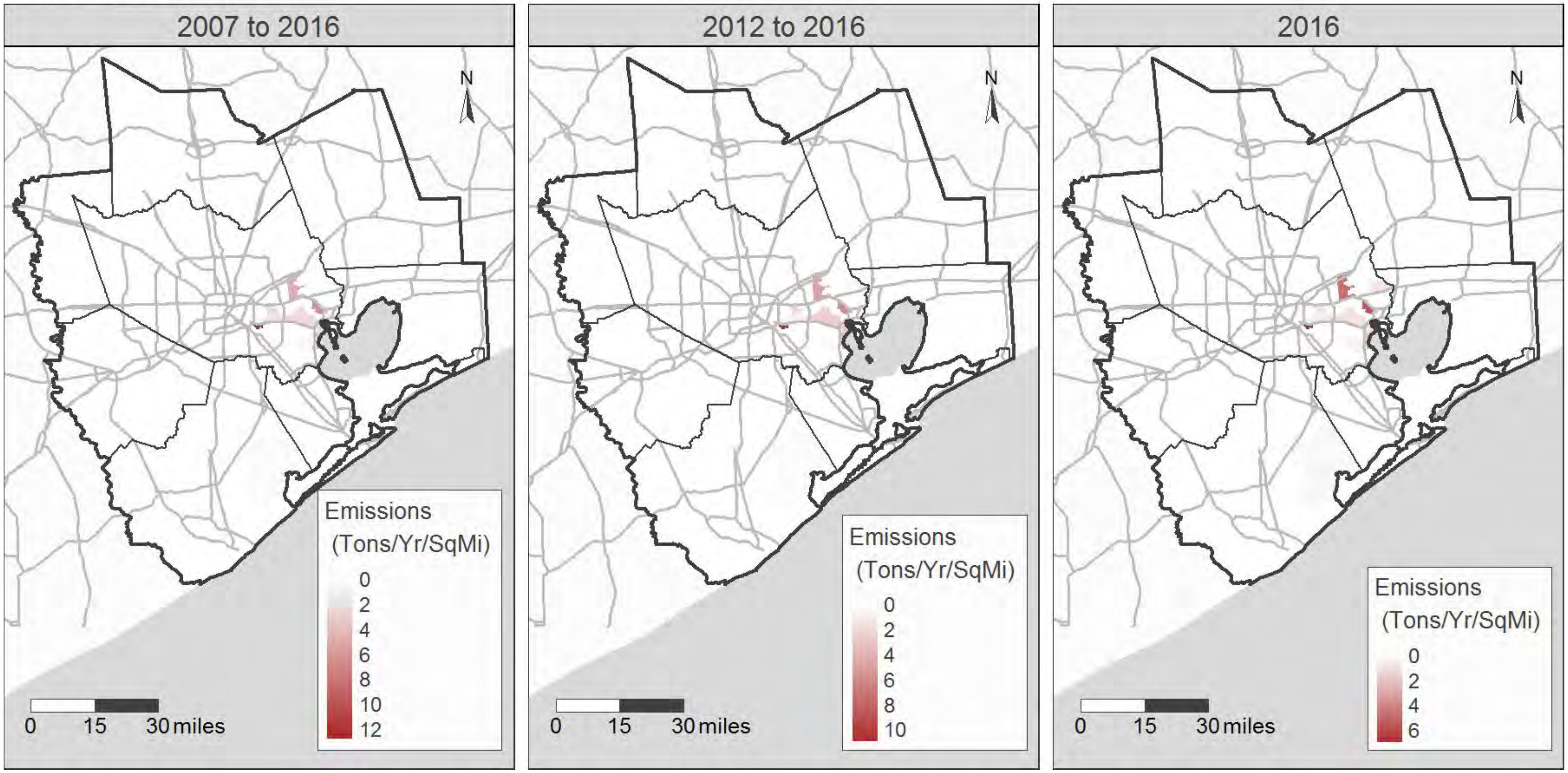
Benzene


2007 to 2016
2012 to 2016
2016
N
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
5
6
0
15
30 miles
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
5
0
15
30 miles
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
0
15
30 miles

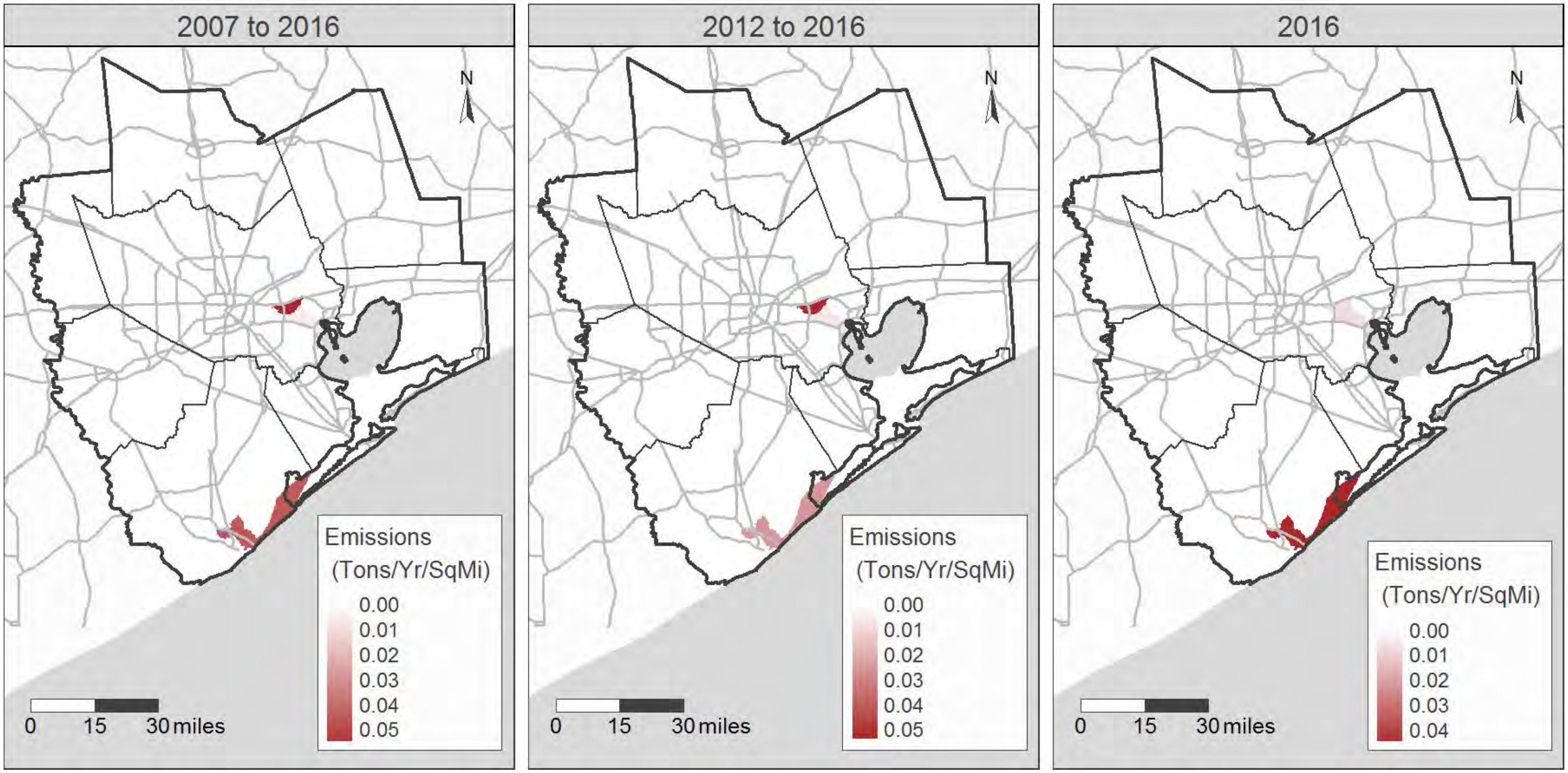
Benzo[a]pyrene

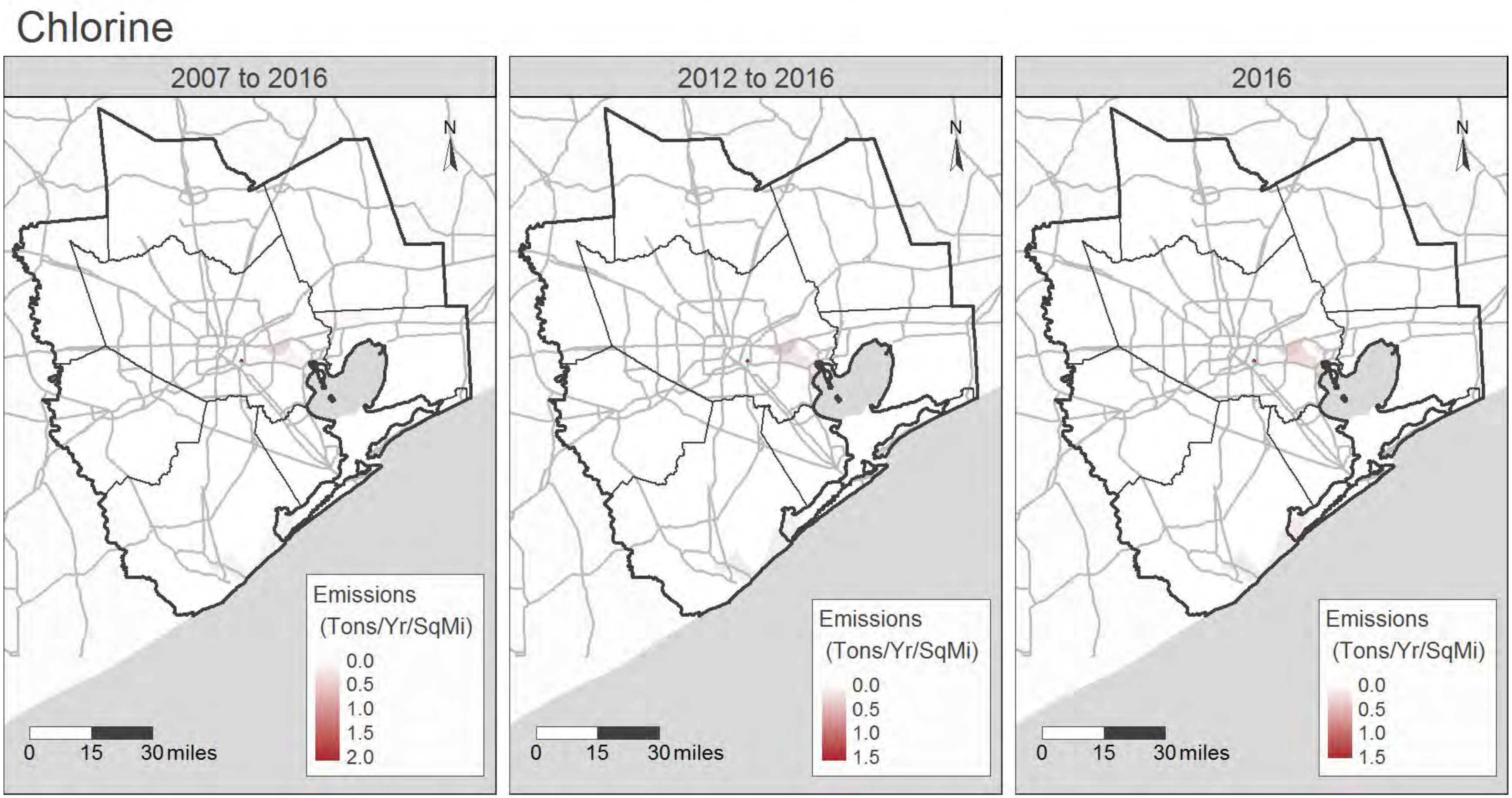


1,3-Butadiene

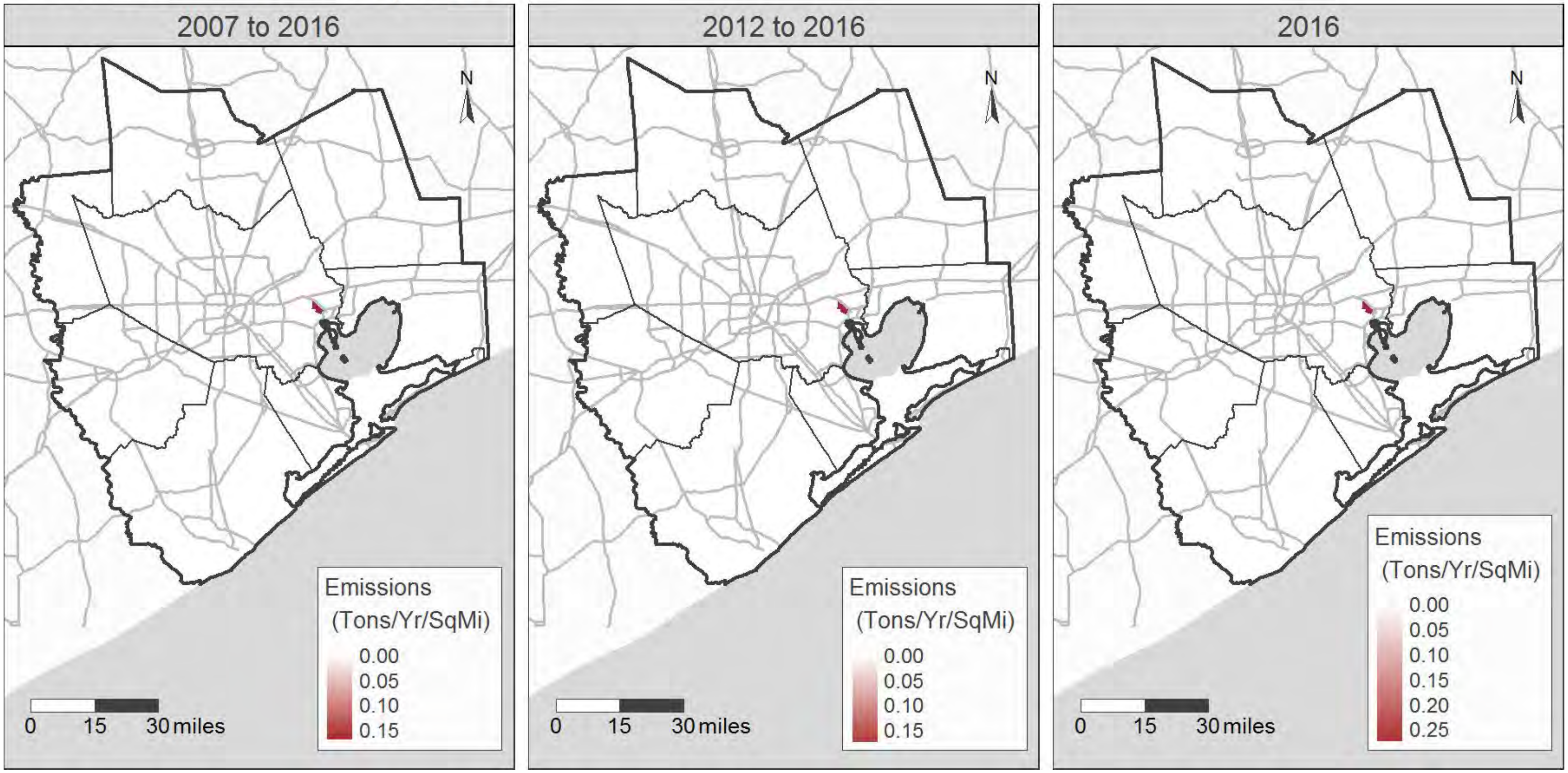


Carbon tetrachloride

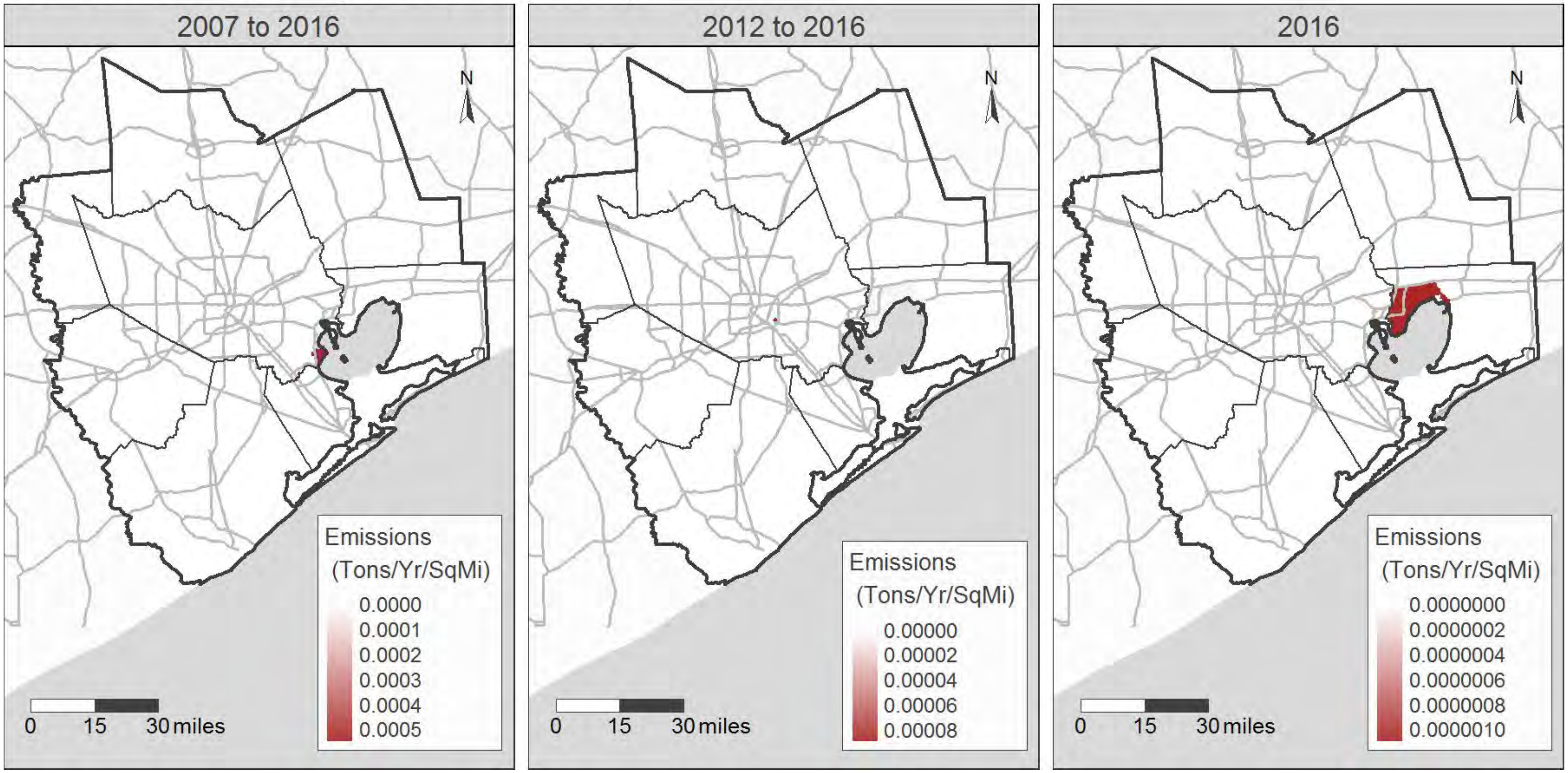



Chlorine
2007 to 2016
2012 to 2016
2016
N
Emissions
(Tons/Yr/SqMi)
0.0
0.5
1.0
1.5
2.0
0 15 30 miles

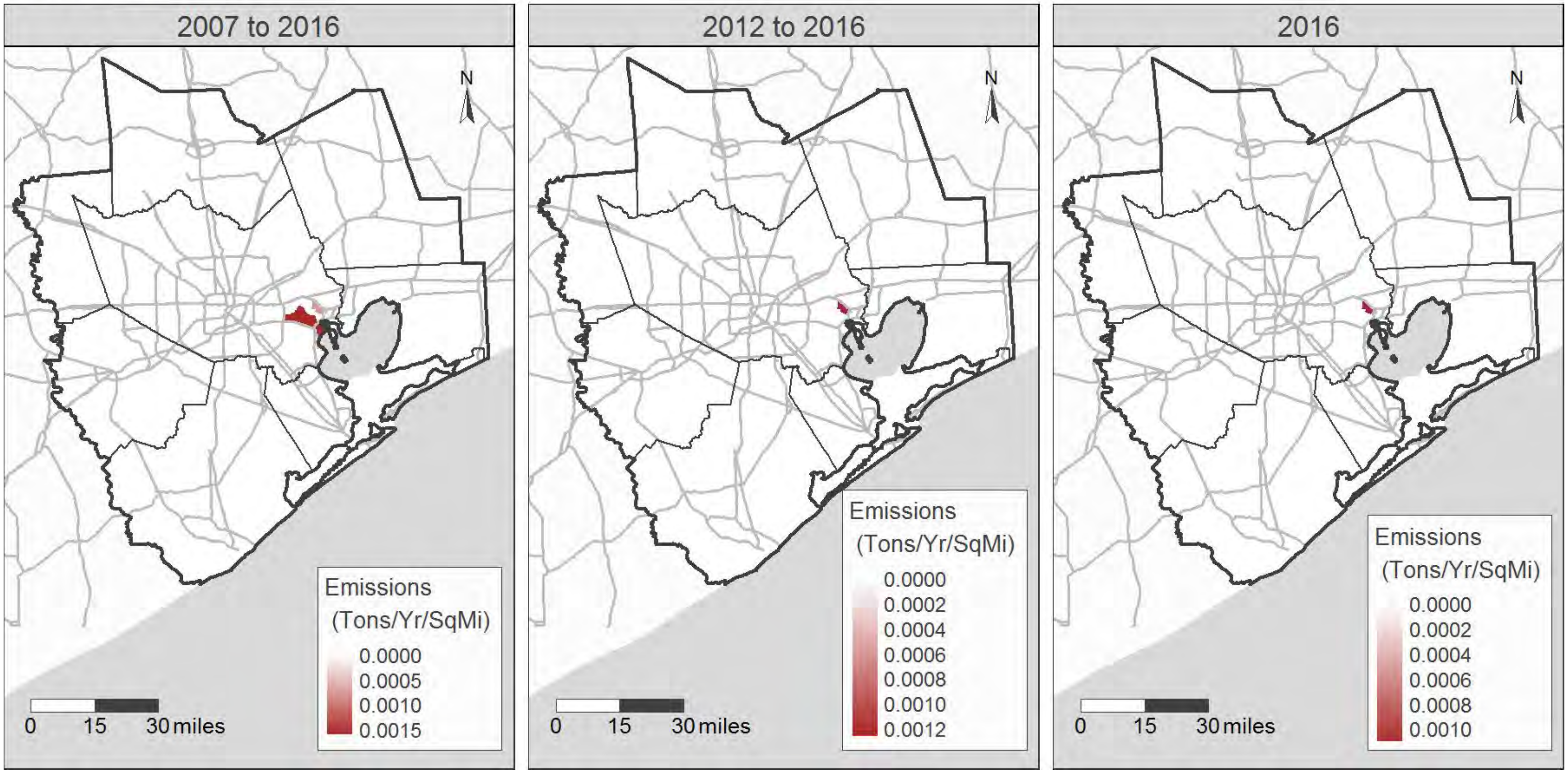
Chromium and compounds

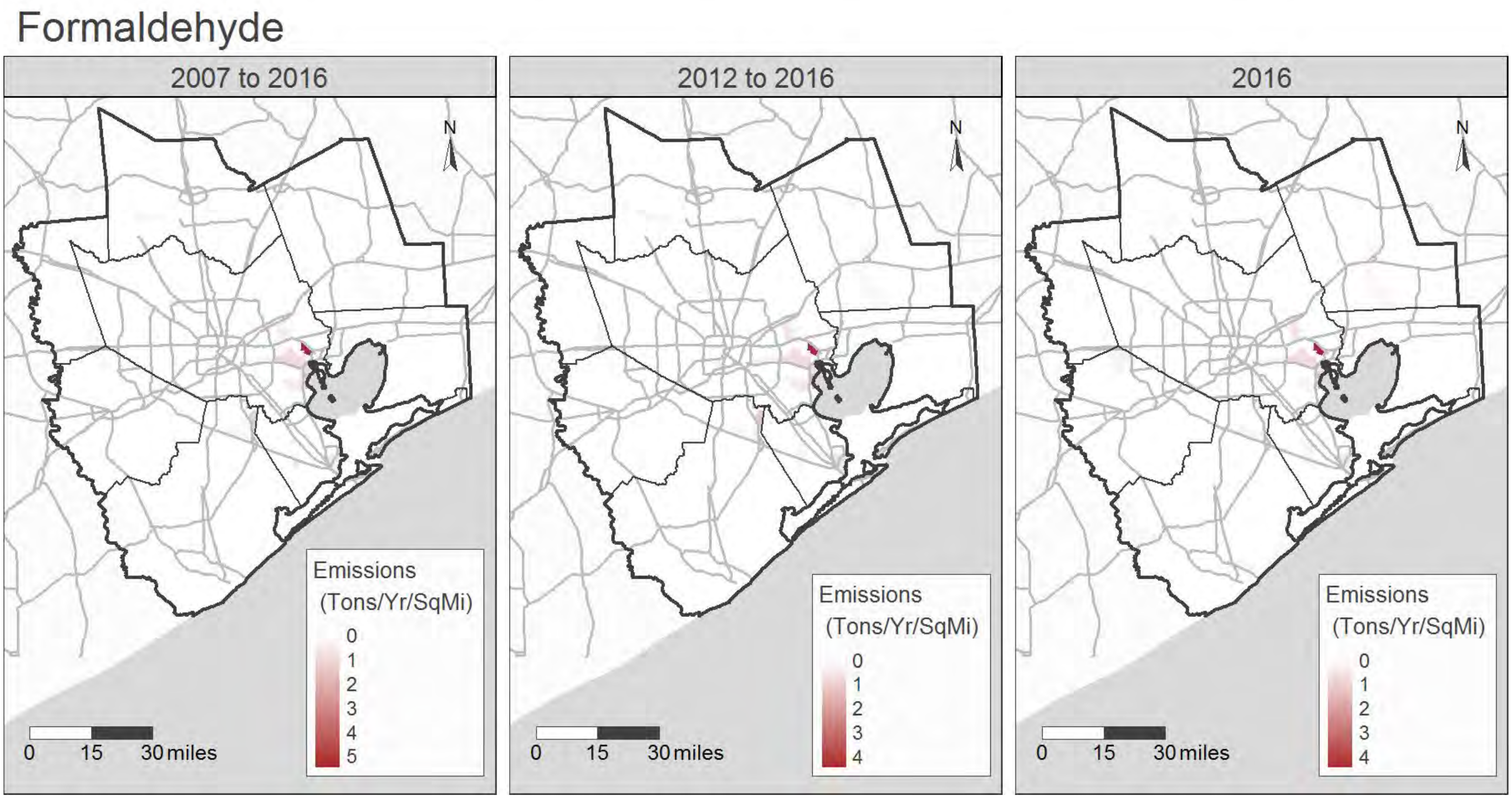


Diaminotoluene (mixed isomers)

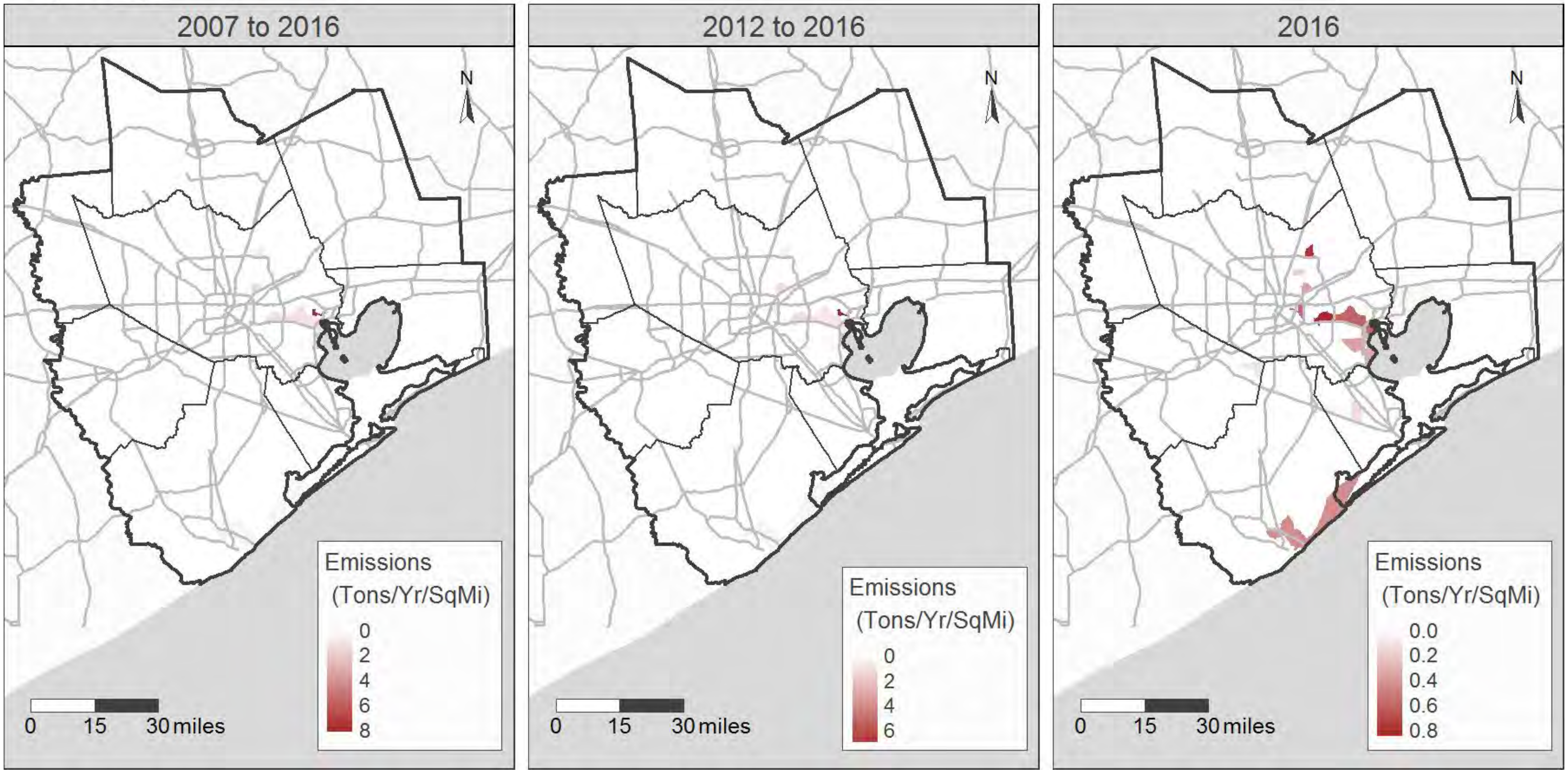


Fluoranthene

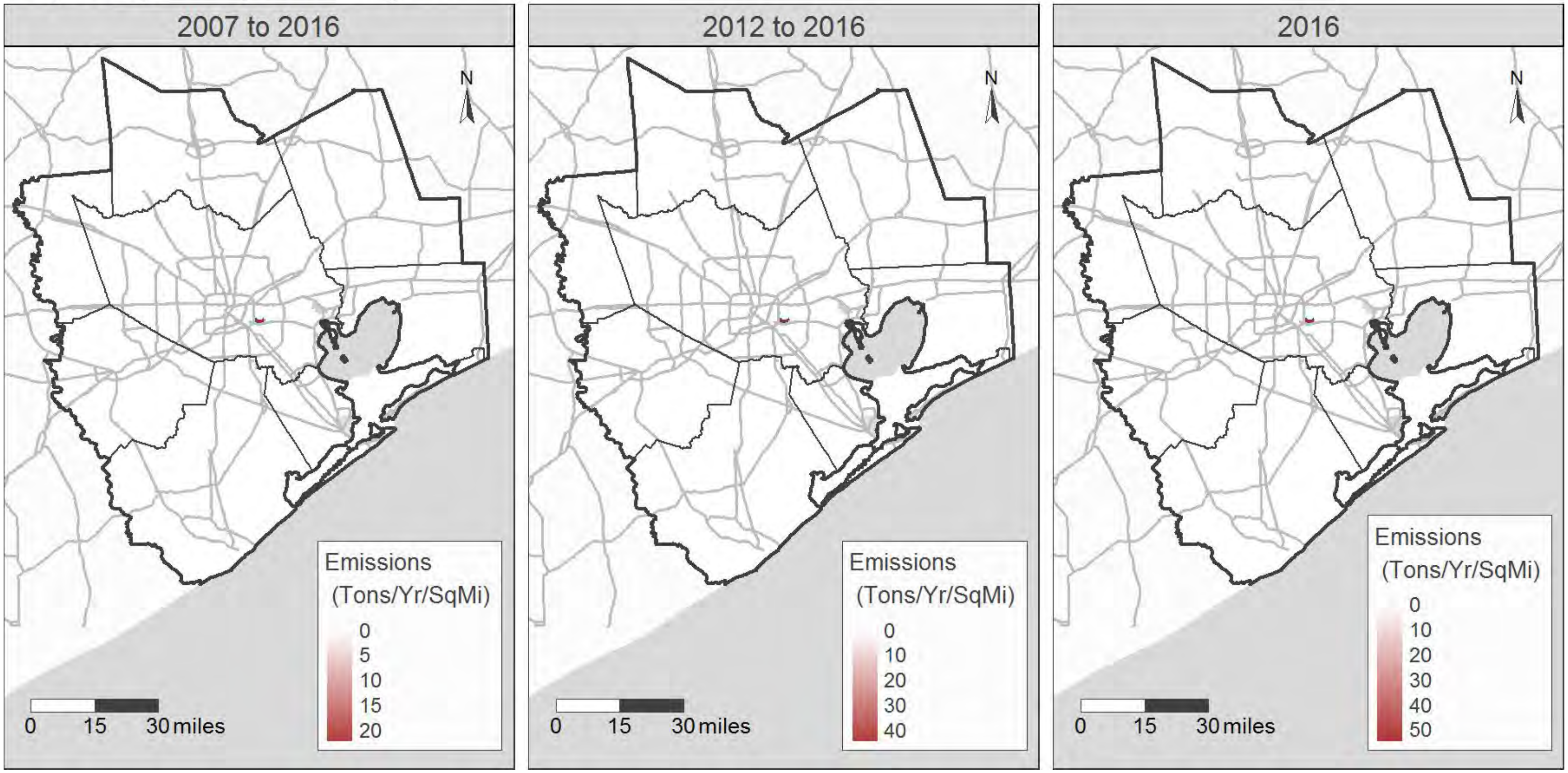



Formaldehyde
2007 to 2016
2012 to 2016
2016
N
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
5
0 15 30 miles

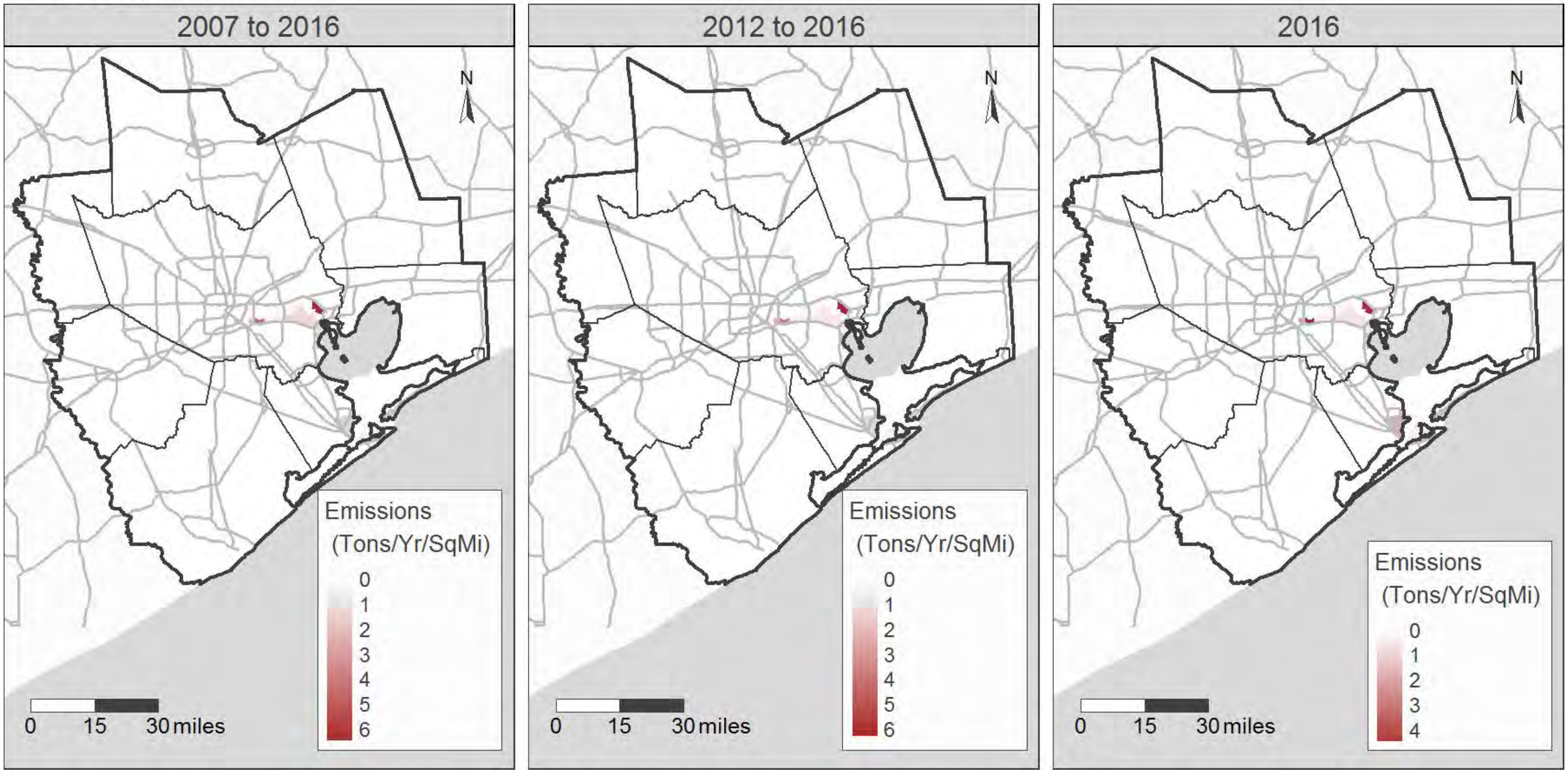
Hydrogen chloride



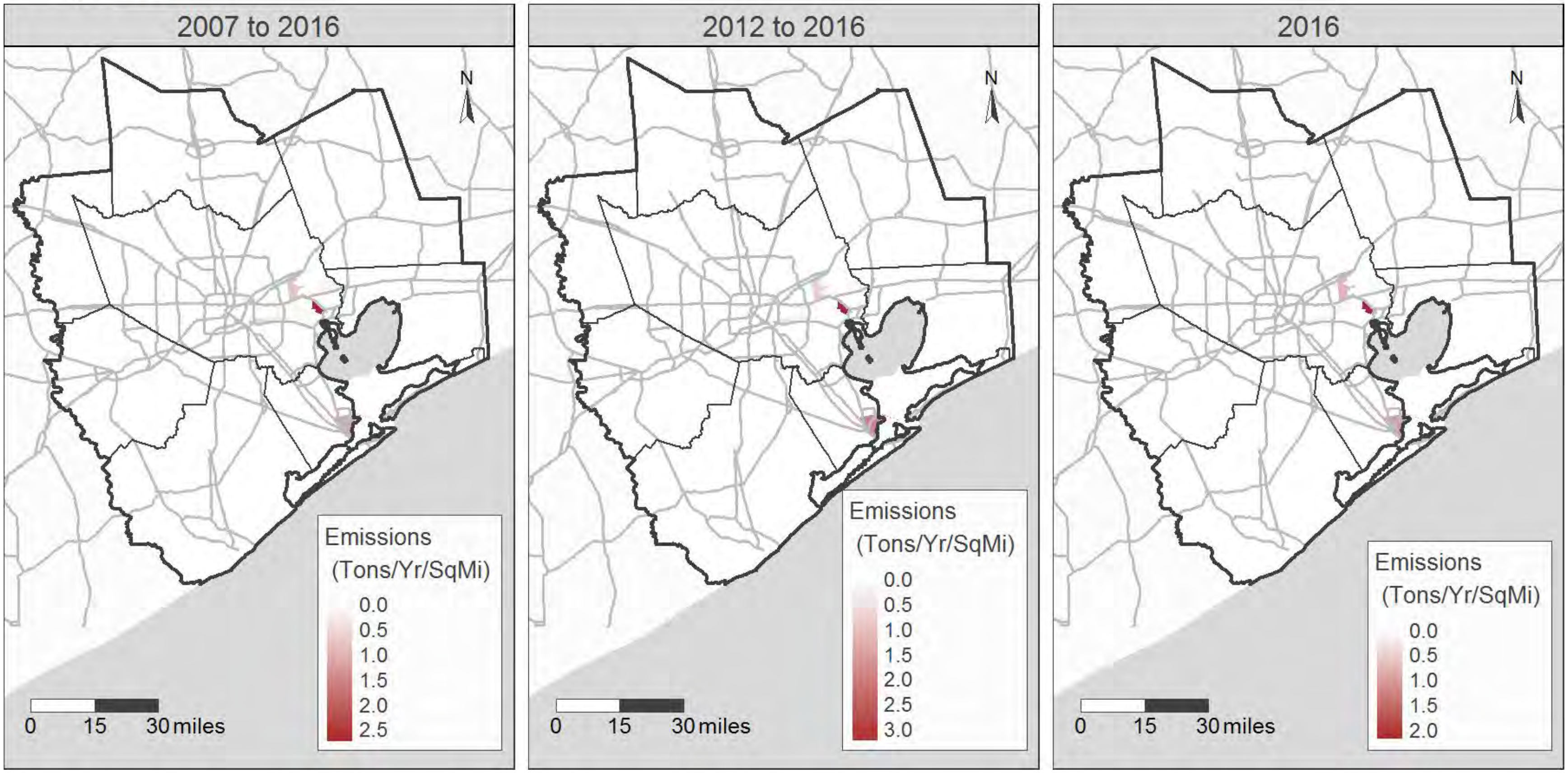
Hydrogen cyanide gas



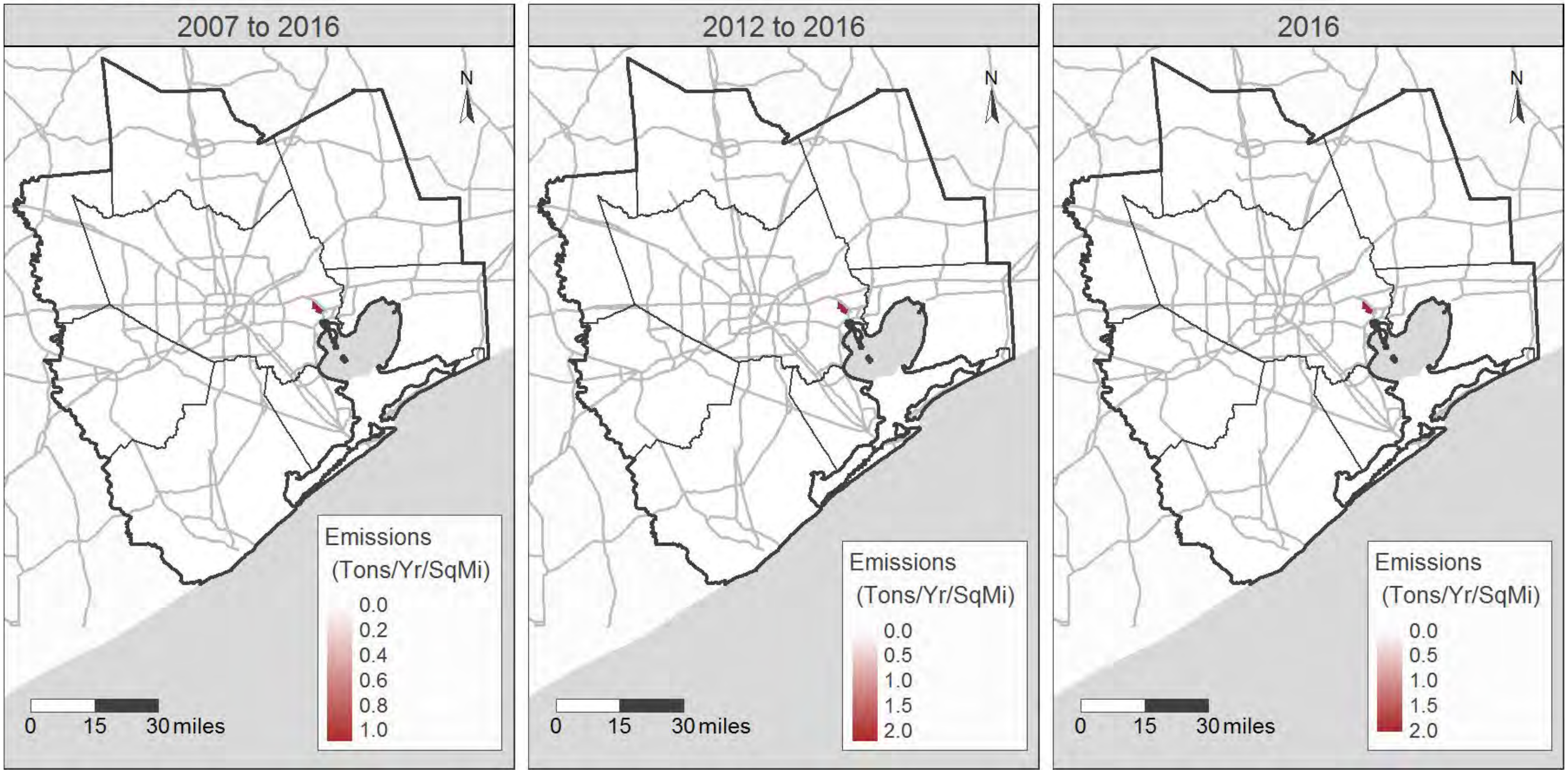
Hydrogen sulfide



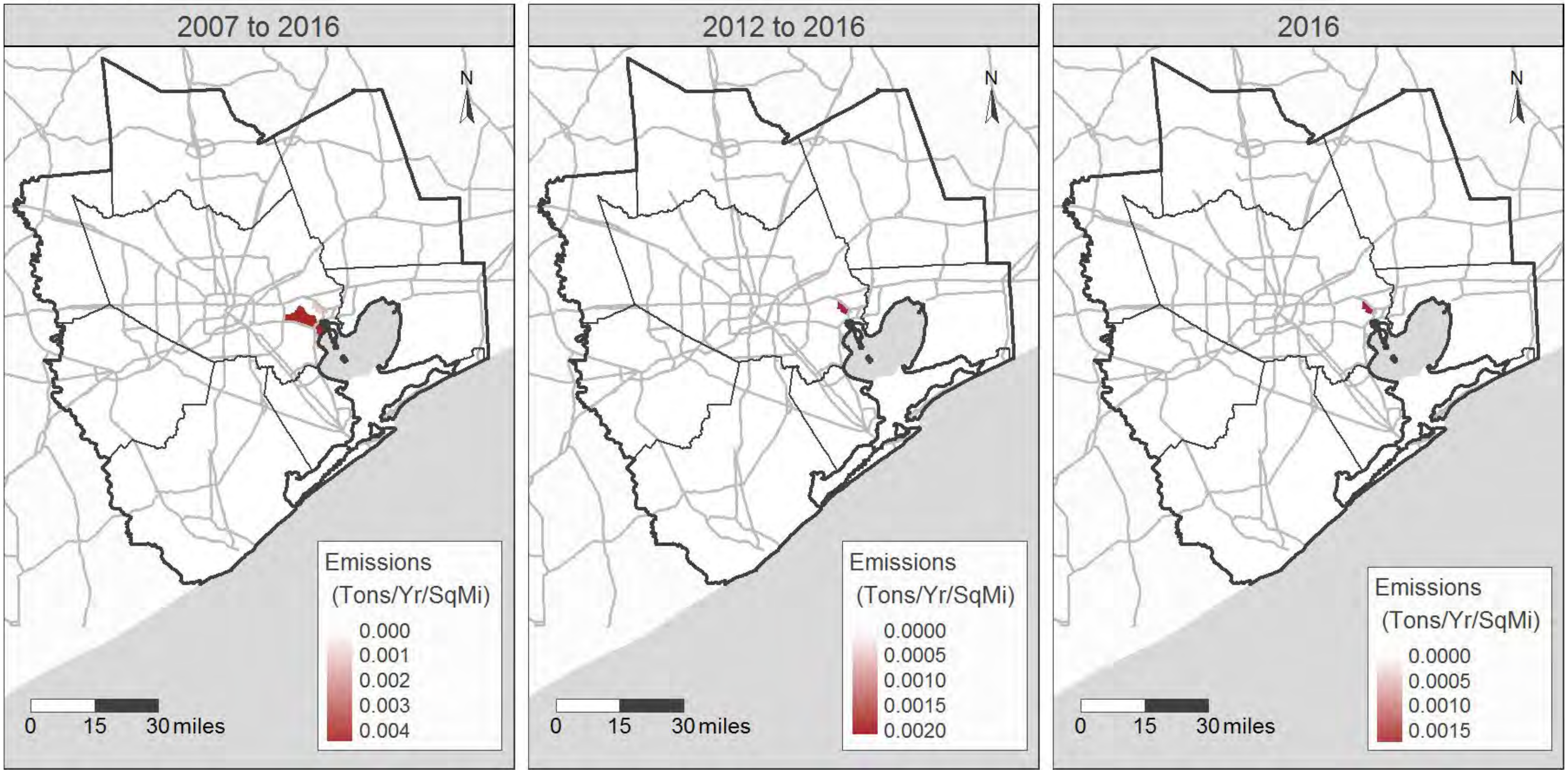
Naphthalene



Phenanthrene



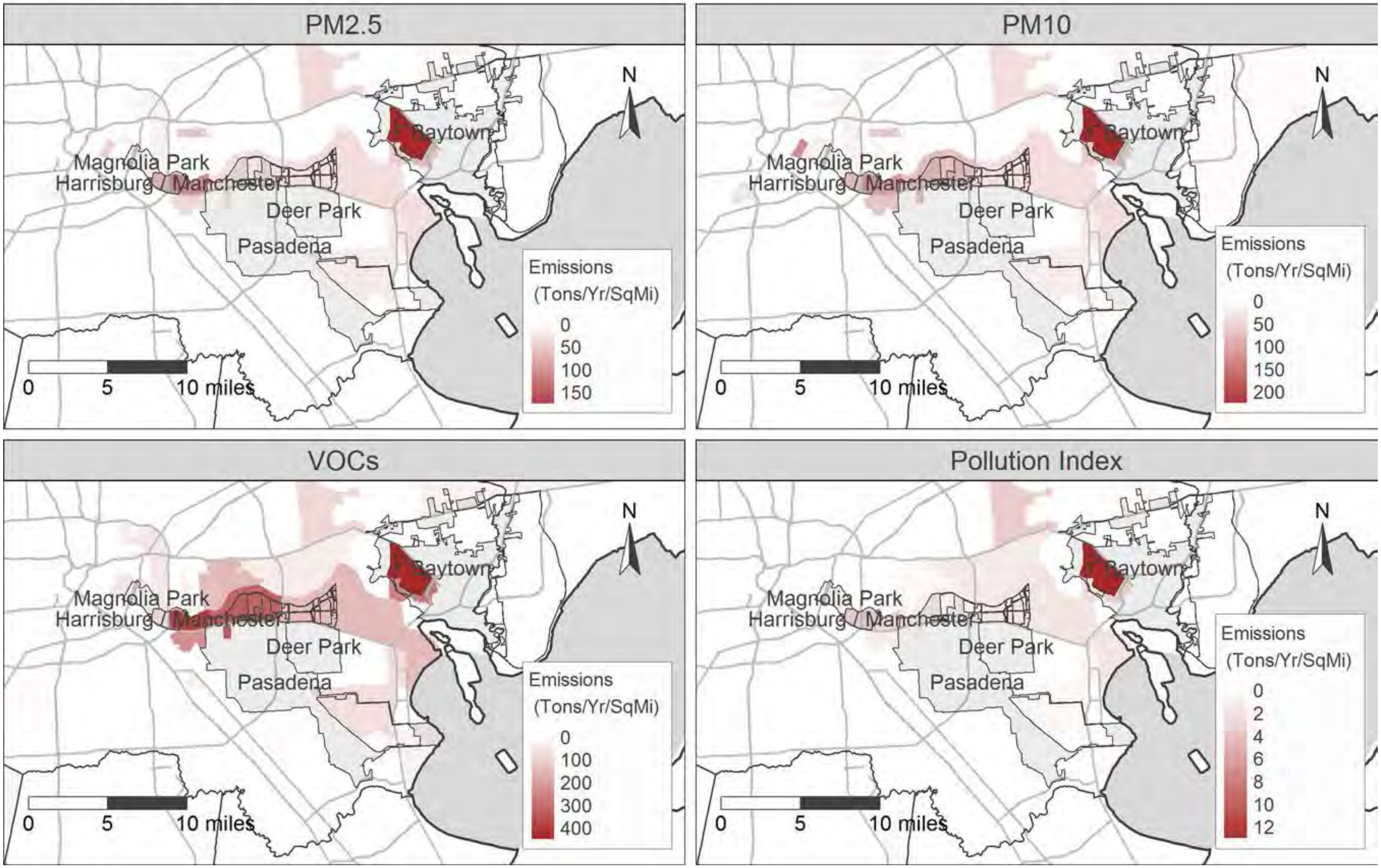
Pyrene



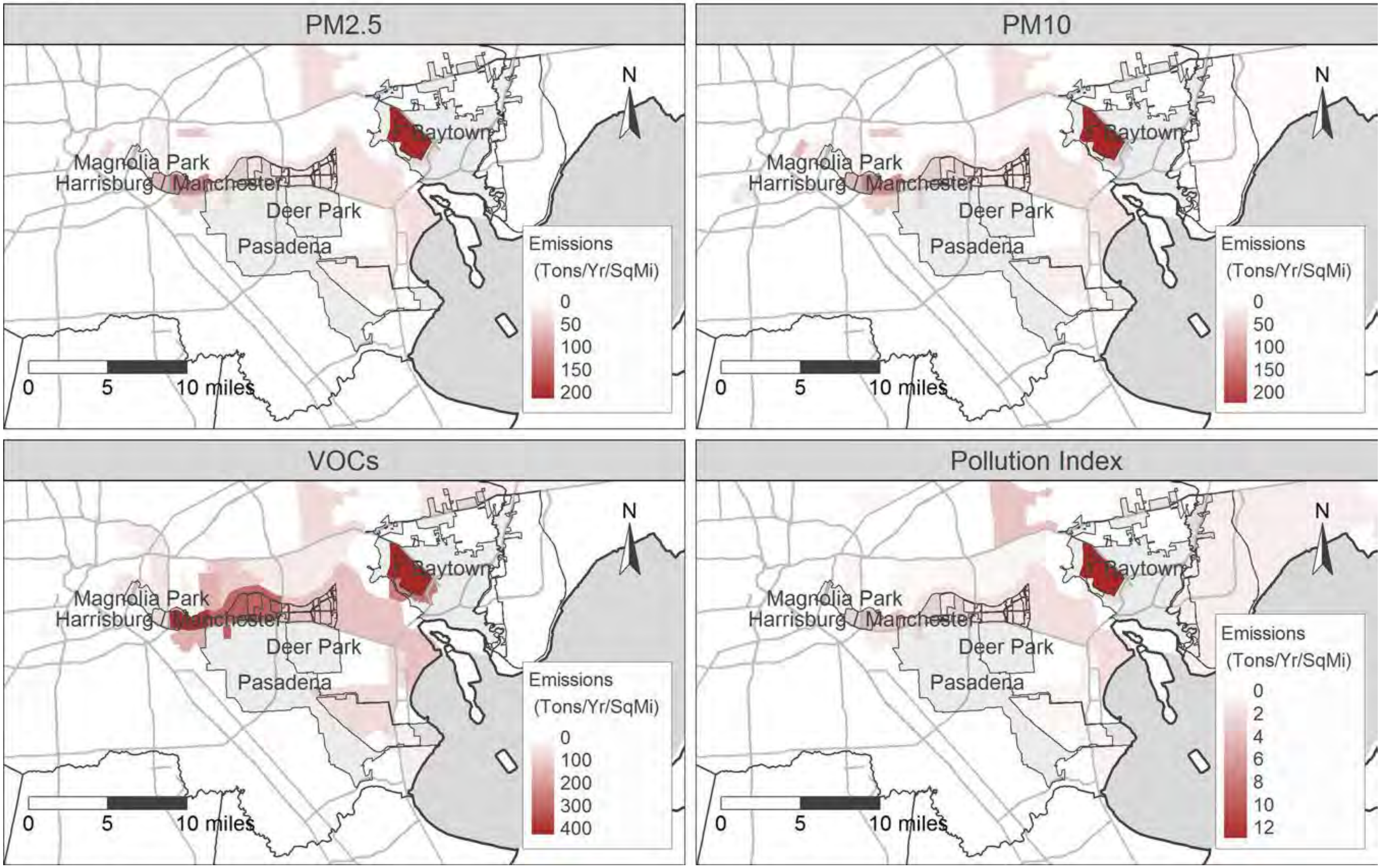
2007 to 2016
N
Emissions
(Tons/Yr/SqMi)
0.000
0.001
0.002
0.003
0.004
0 15 30 miles
2012 to 2016
N
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
0 15 30 miles
2016
N
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0 15 30 miles

Appendix D: Additional Ship Channel Maps of Four Pollution Categories

2012 to 2016


PM2.5
PM10
VOCs
Pollution Index
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
0 5 10 miles
Emissions
(Tons/Yr/SqMi)
0
50
100
150
0
50
100
150
200
0
100
200
300
400
0
2
4
6
8
10
12

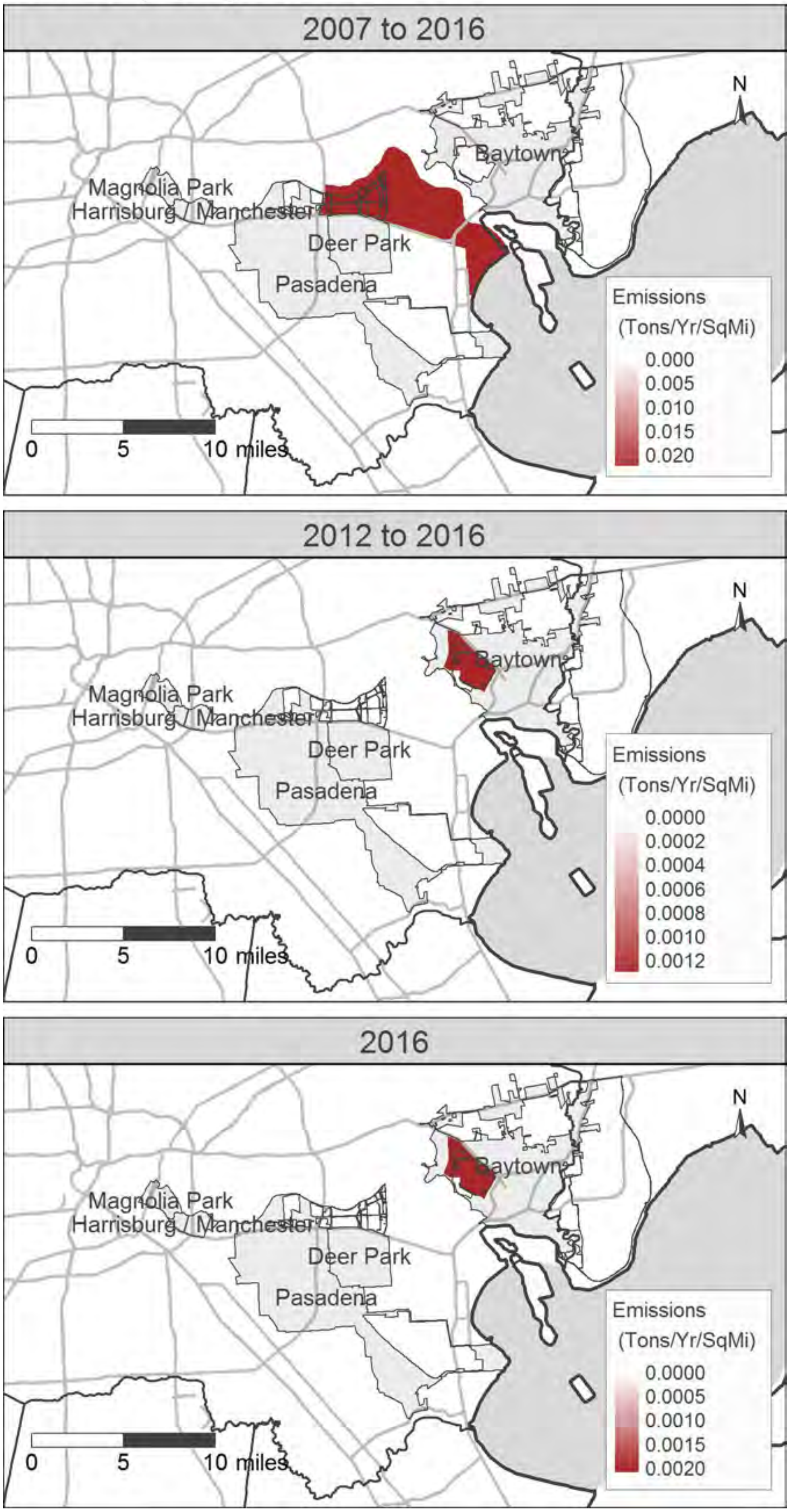
2016


PM2.5
PM10
VOCs
Pollution Index
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Baytown
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
0
100
200
300
400
0
2
4
6
8
10
12
0
5
10 miles

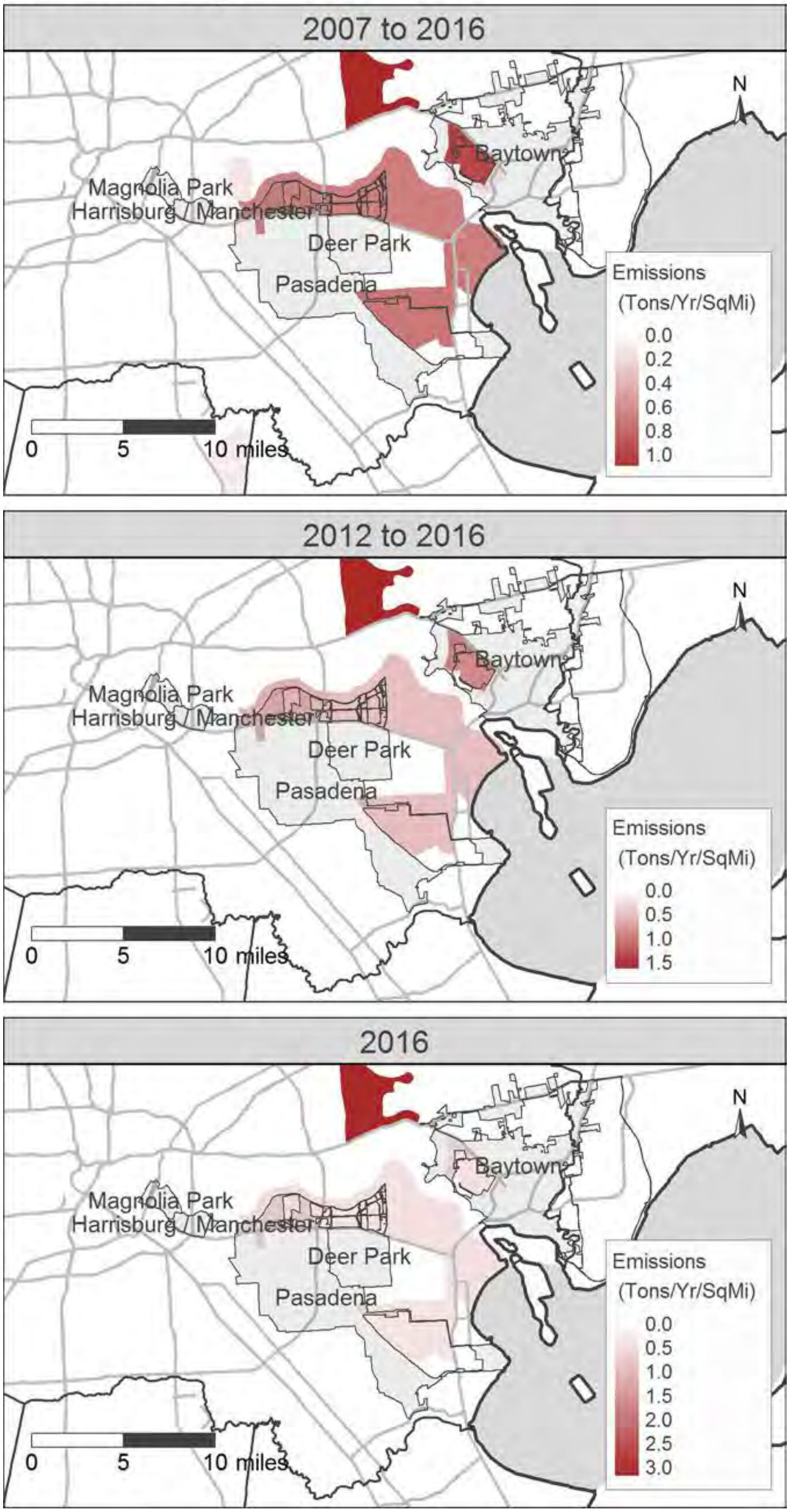
ATTACHMENT 6d

Appendix E: Ship Channel Maps of 19 Pollutants of Concern

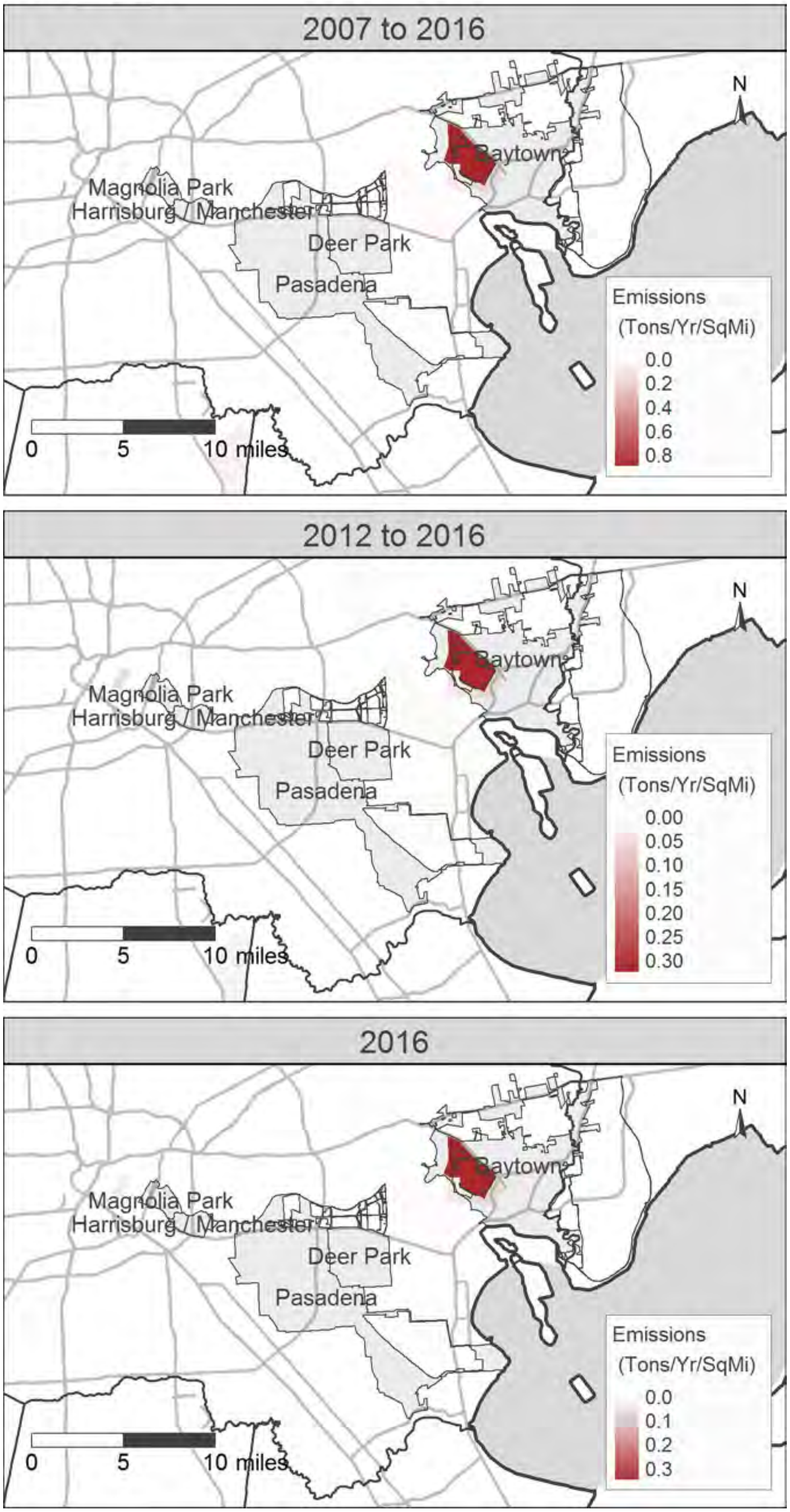
Acenaphthylene



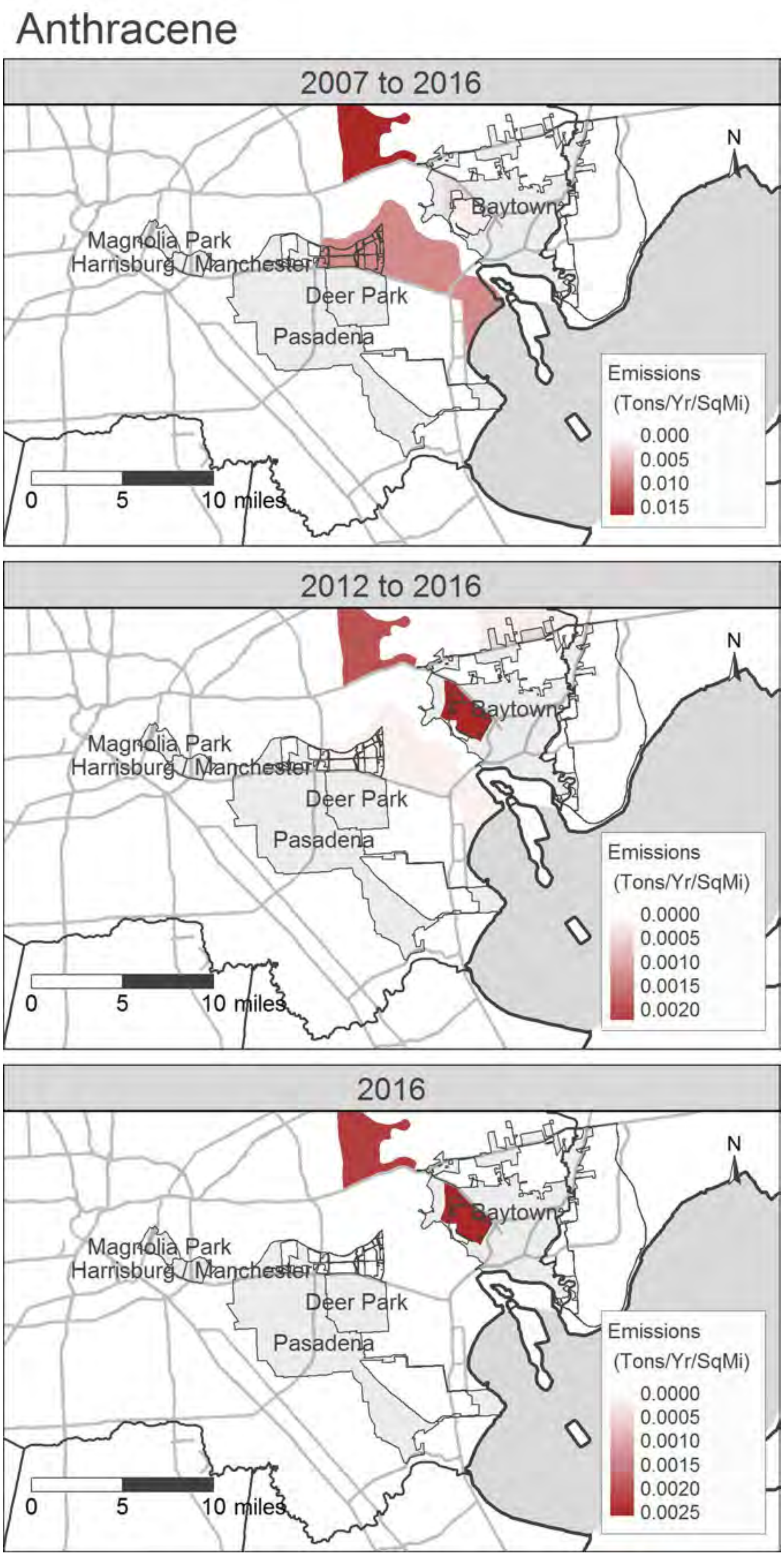
Acetaldehyde



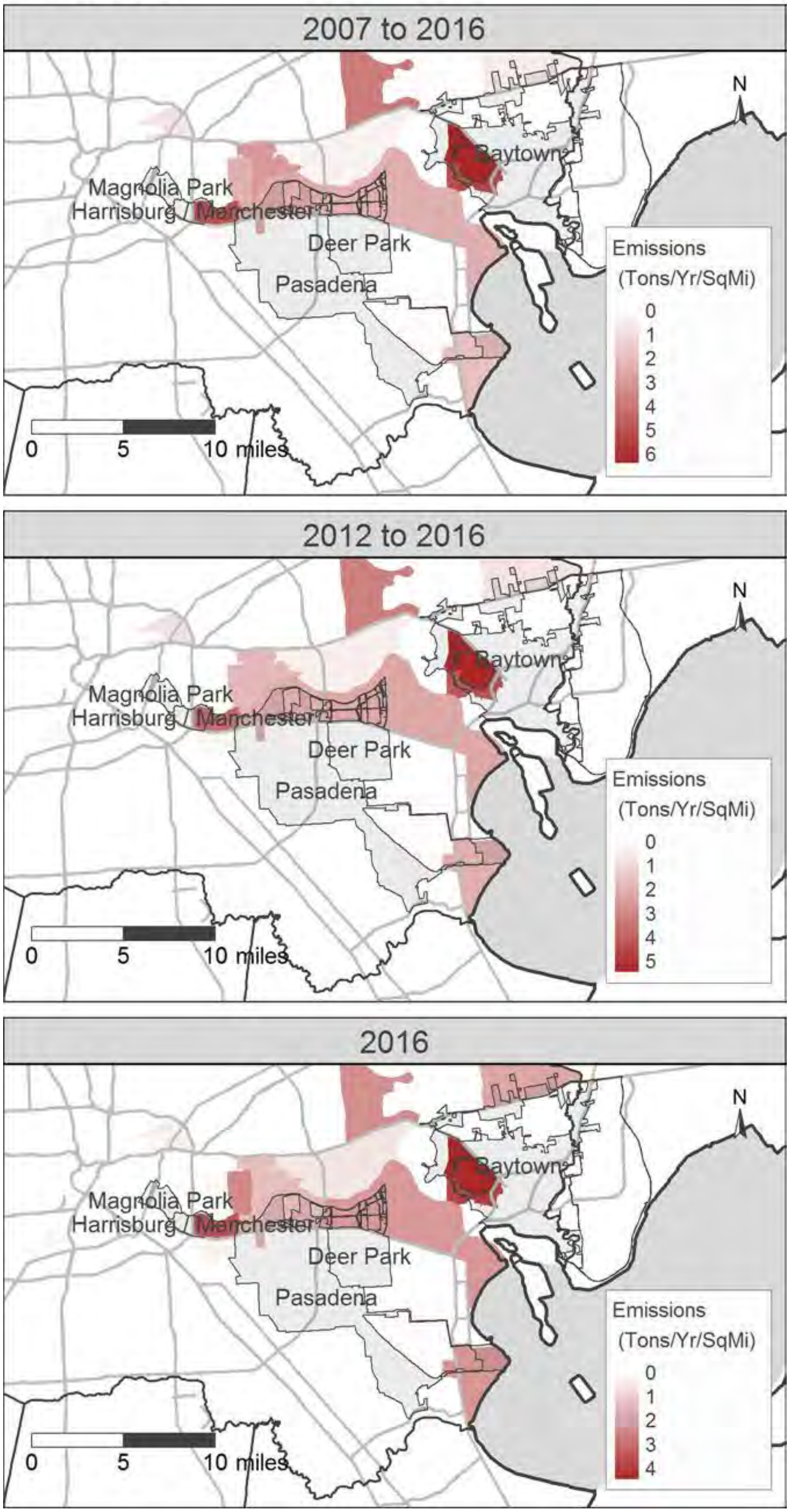
Acrolein



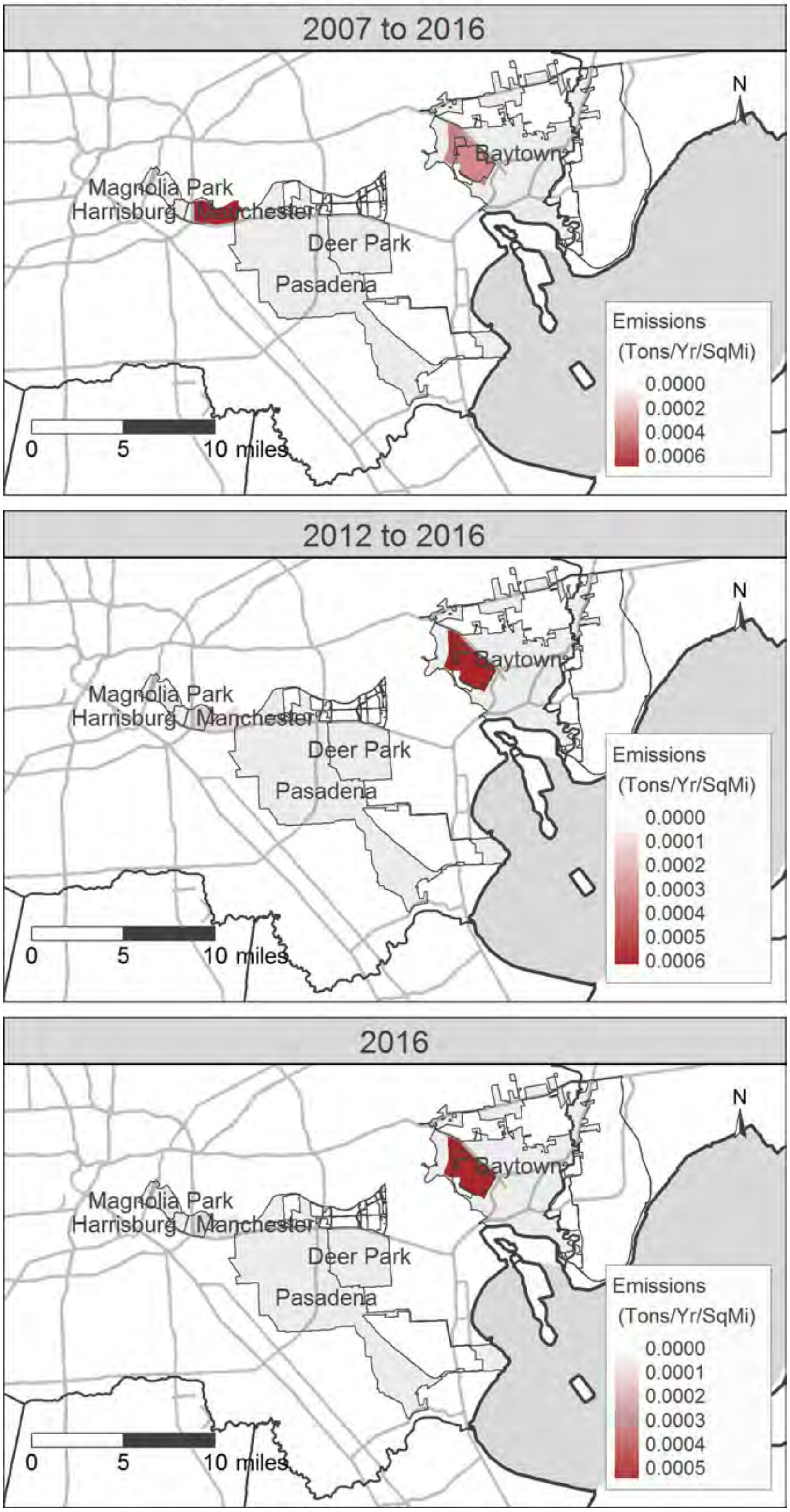
2007 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0
0.2
0.4
0.6
0.8
0
5
10 miles
2012 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0
5
10 miles
2016
N
Baytown
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

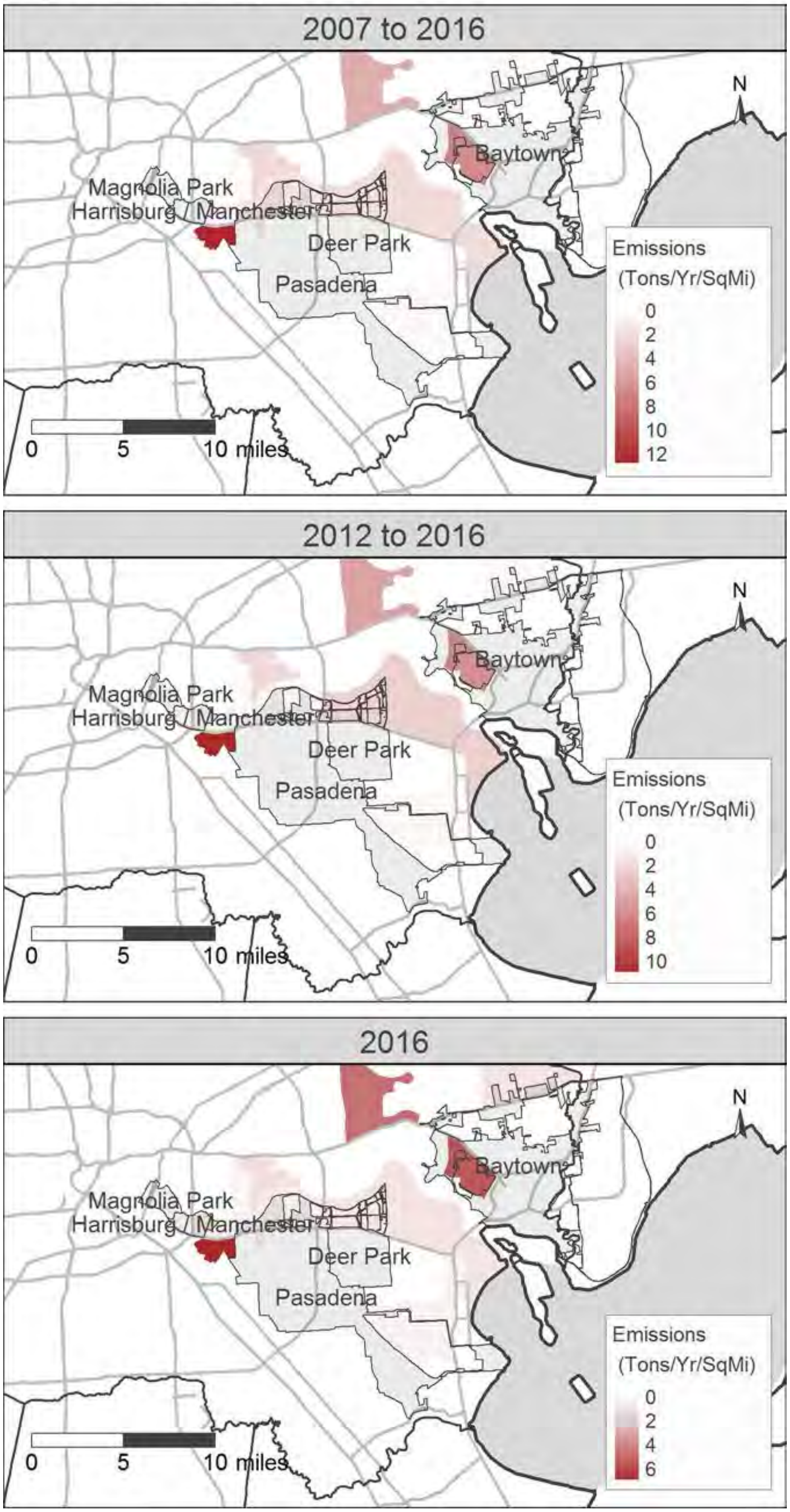
Benzene


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

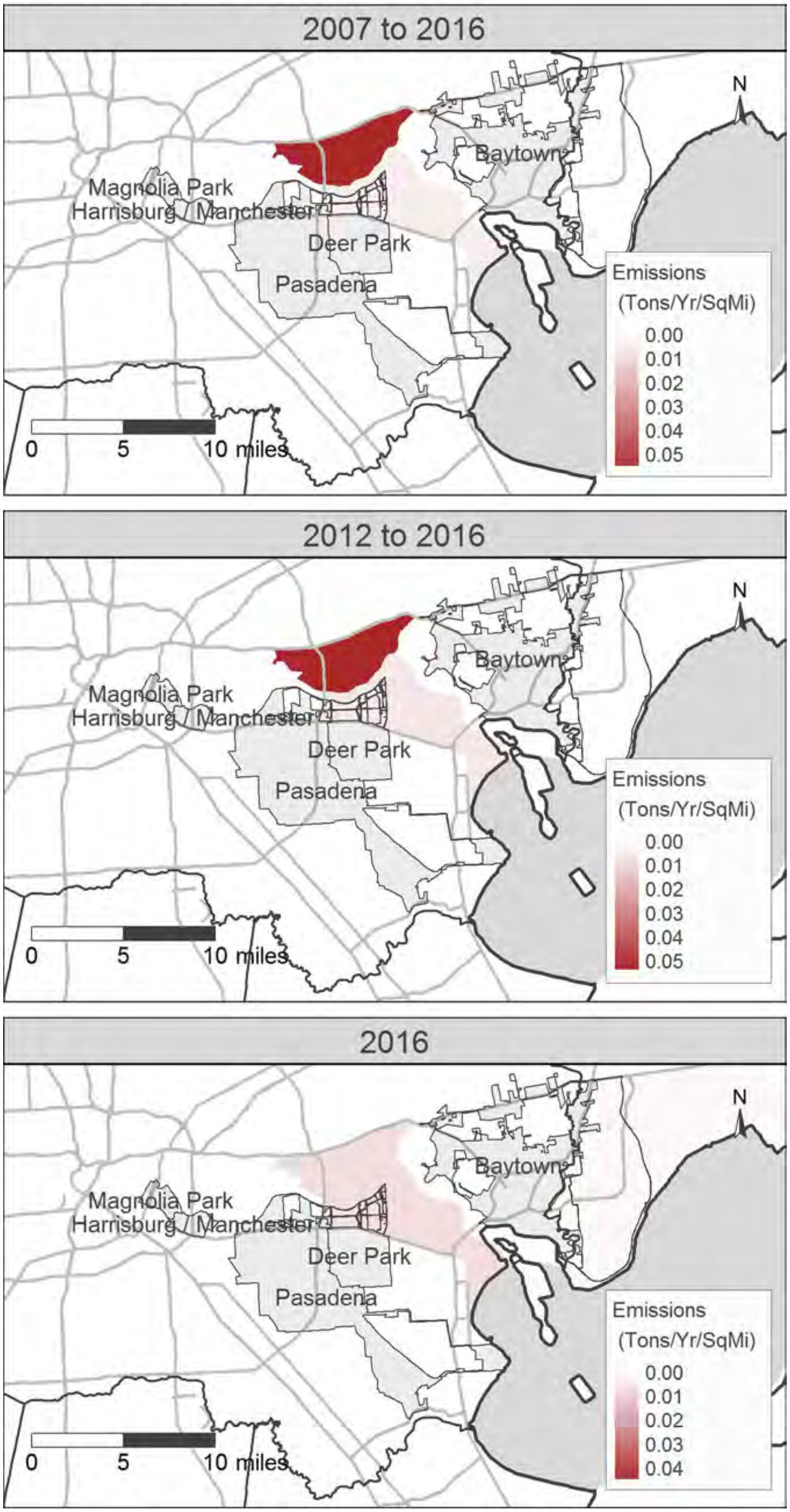
Benzo[a]pyrene



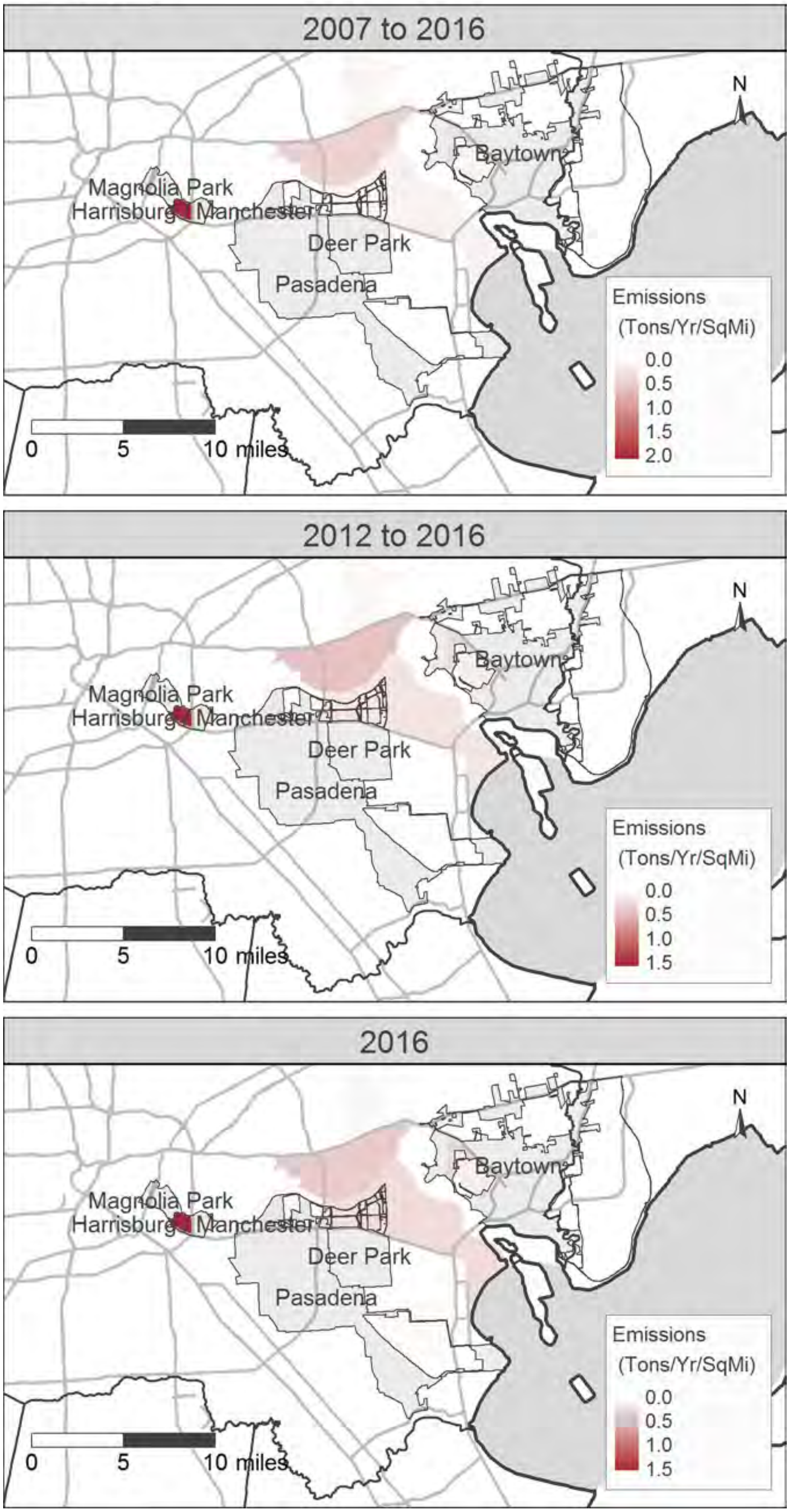
1,3-Butadiene



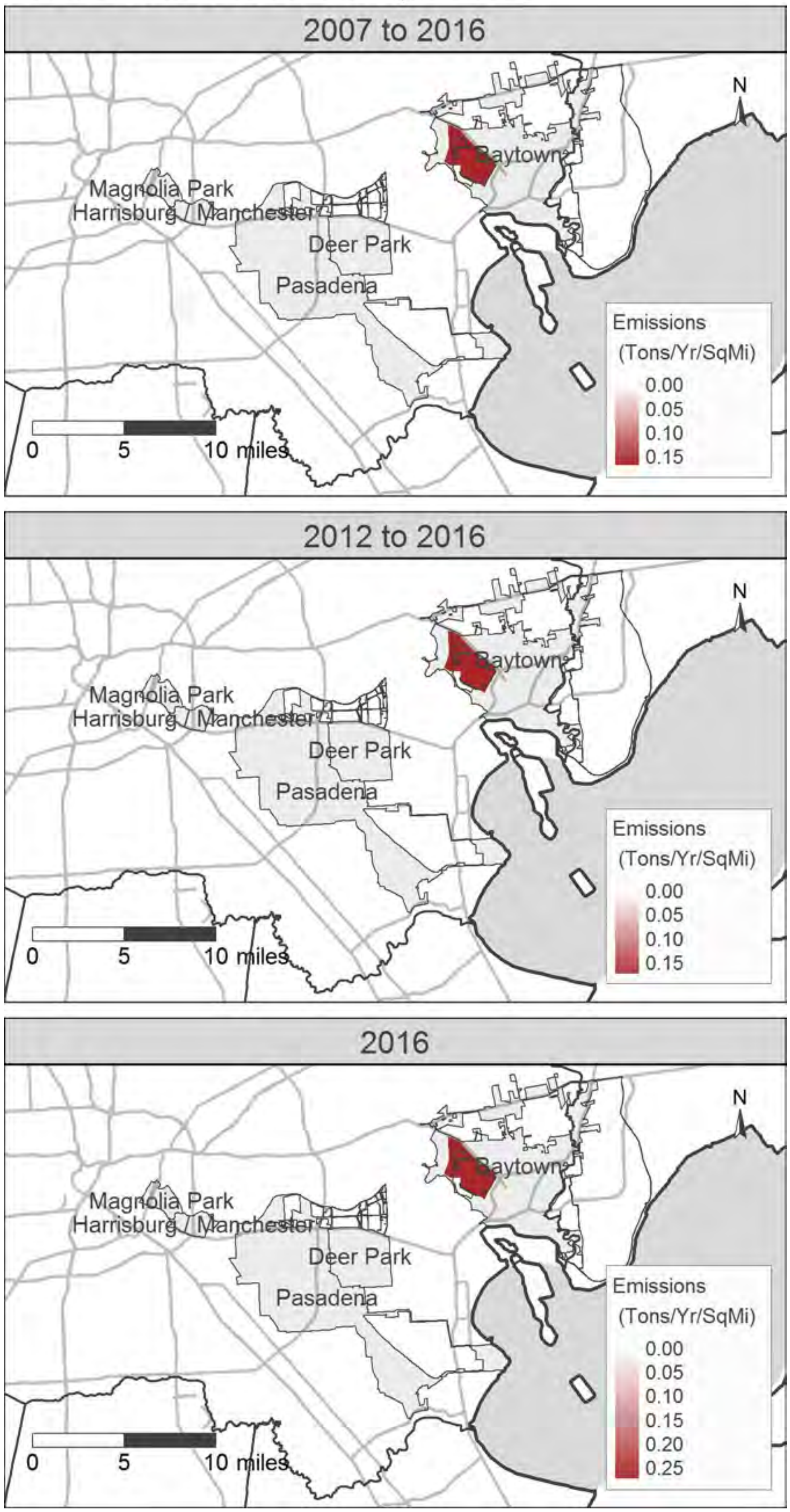
Carbon tetrachloride



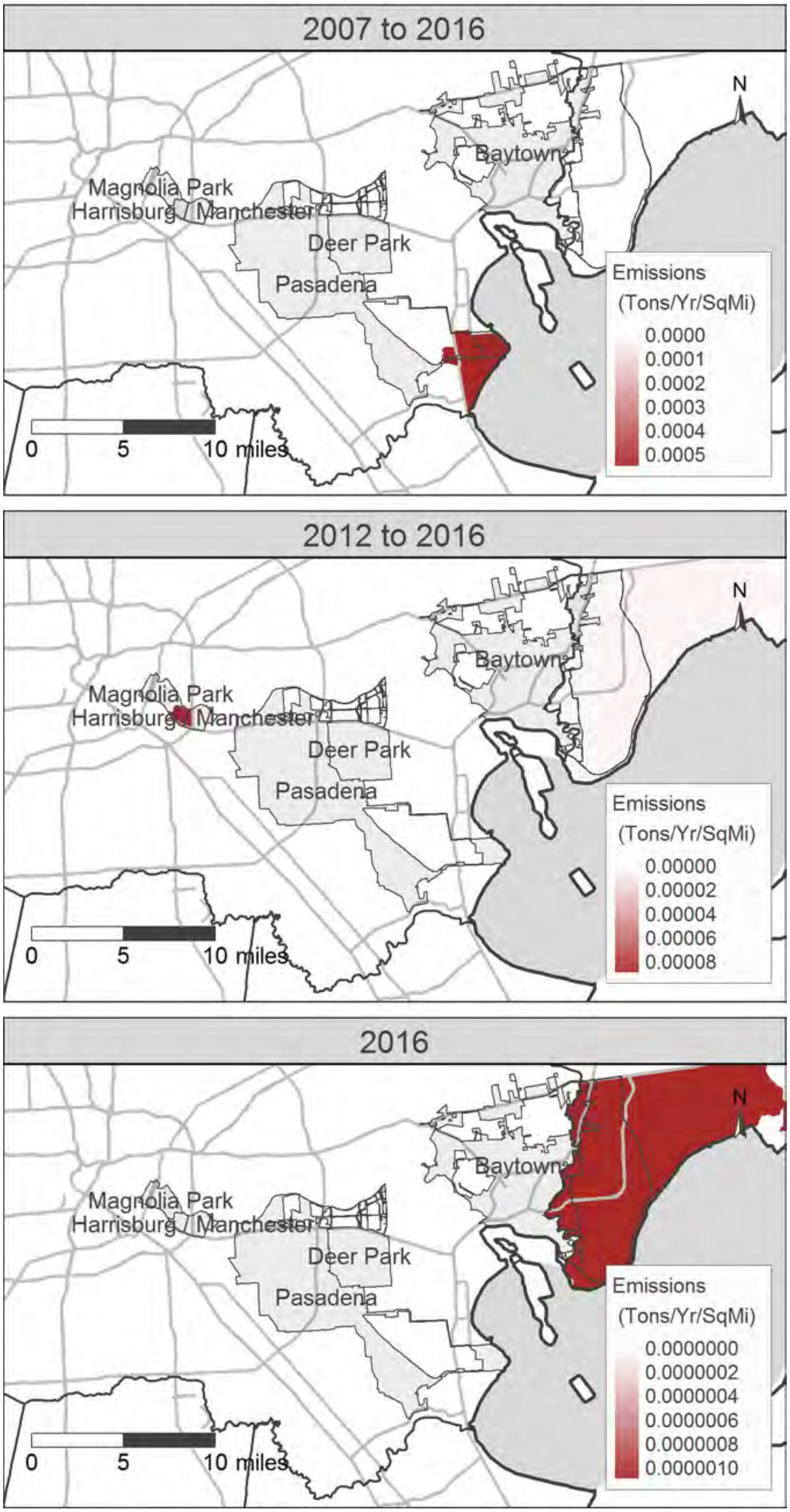
Chlorine


2007 to 2016
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
N
Emissions
(Tons/Yr/SqMi)
0.0
0.5
1.0
1.5
2.0
0
5
10 miles
2012 to 2016
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
N
Emissions
(Tons/Yr/SqMi)
0.0
0.5
1.0
1.5
0
5
10 miles
2016
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
N
Emissions
(Tons/Yr/SqMi)
0.0
0.5
1.0
1.5
0
5
10 miles

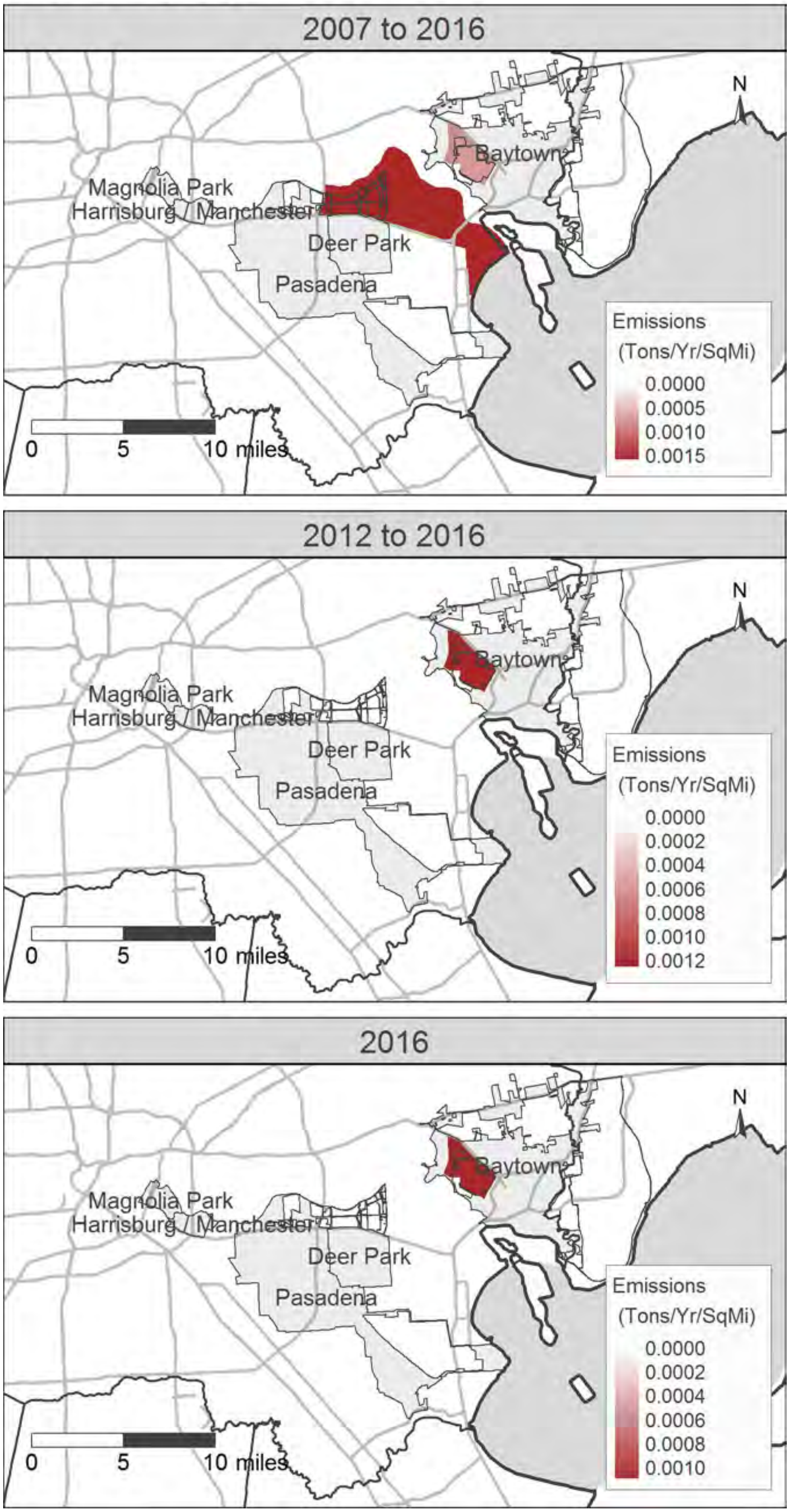
Chromium and compounds



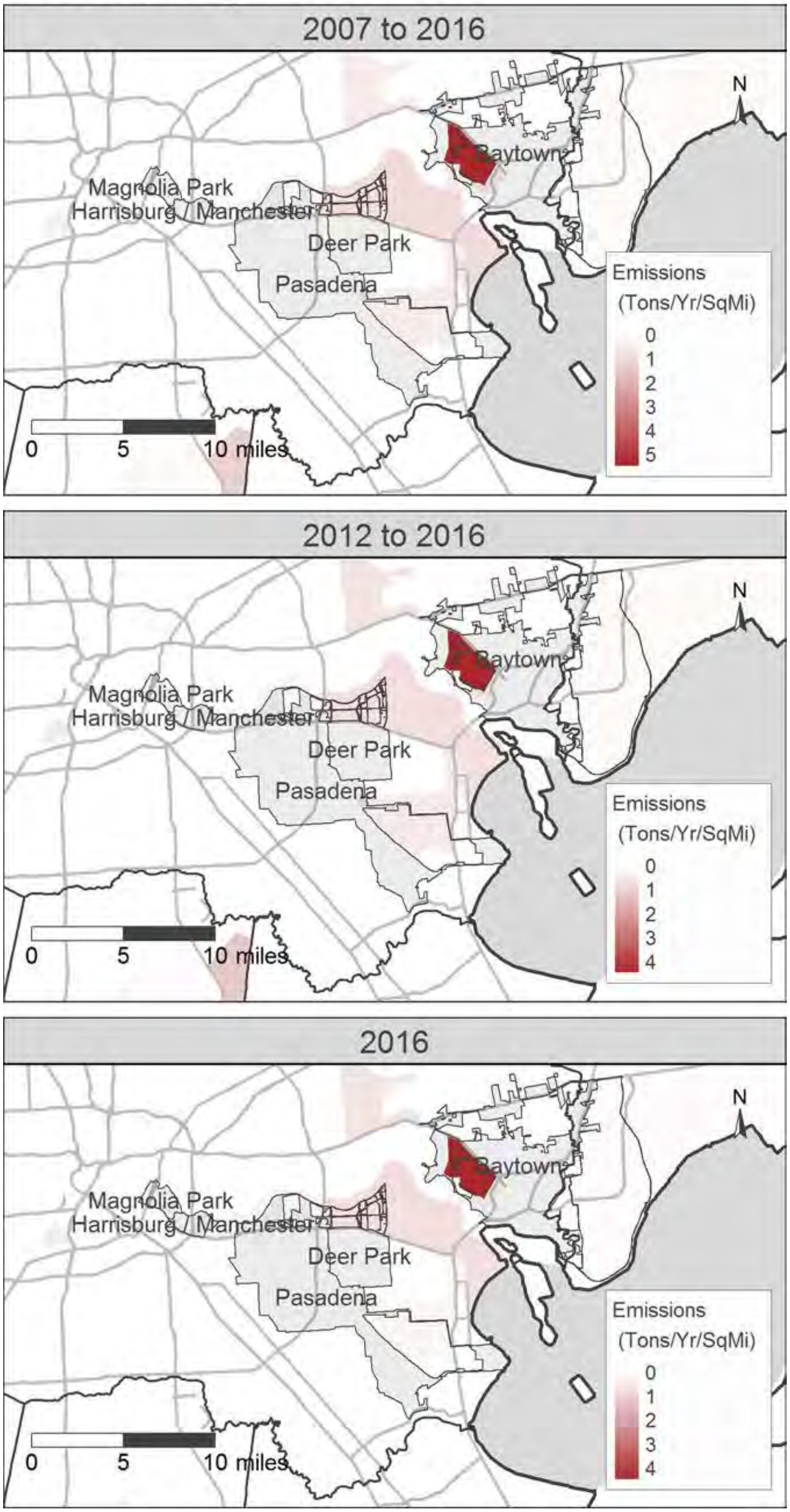
Diaminotoluene (mixed isomers)



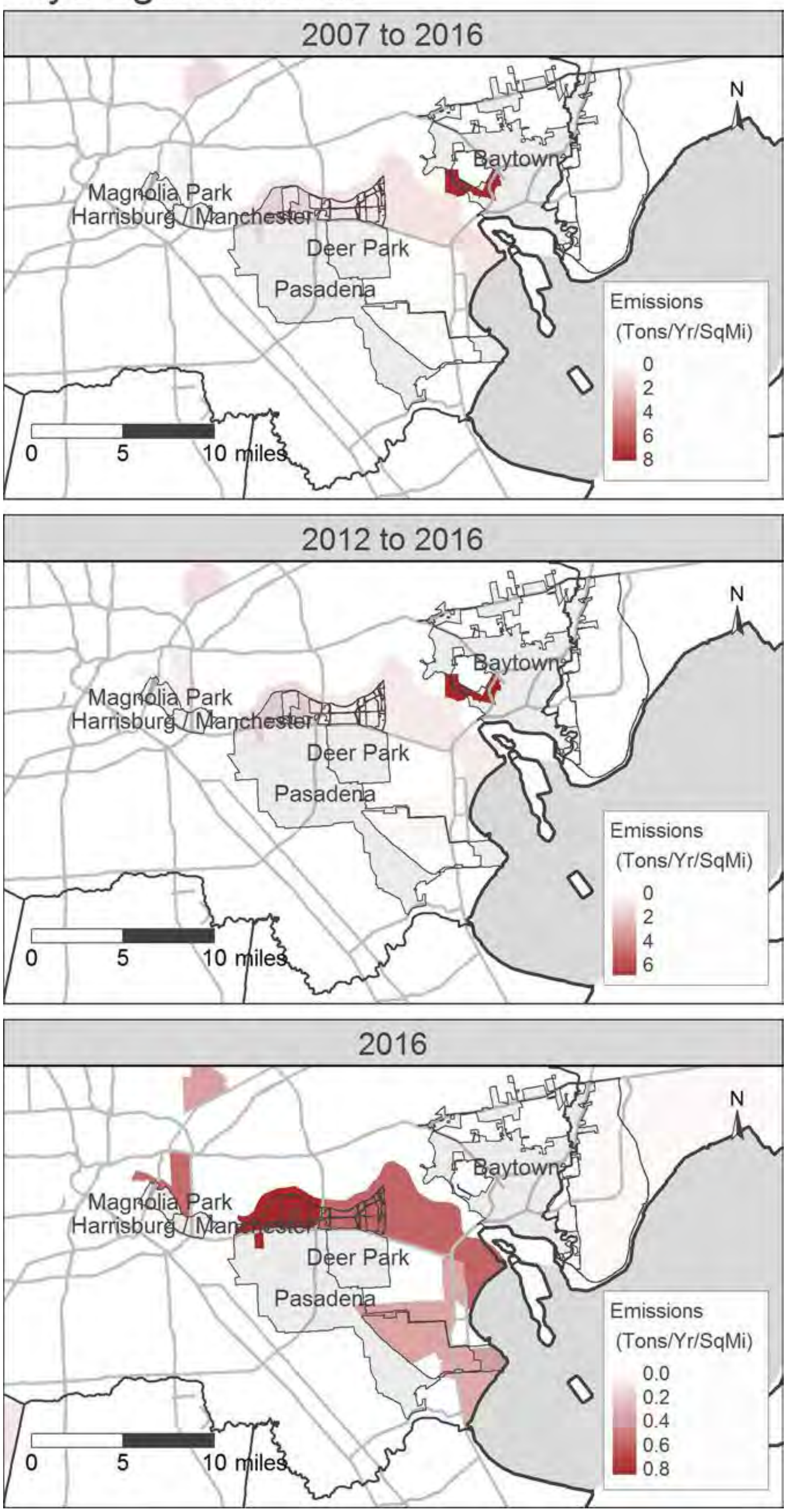
Fluoranthene



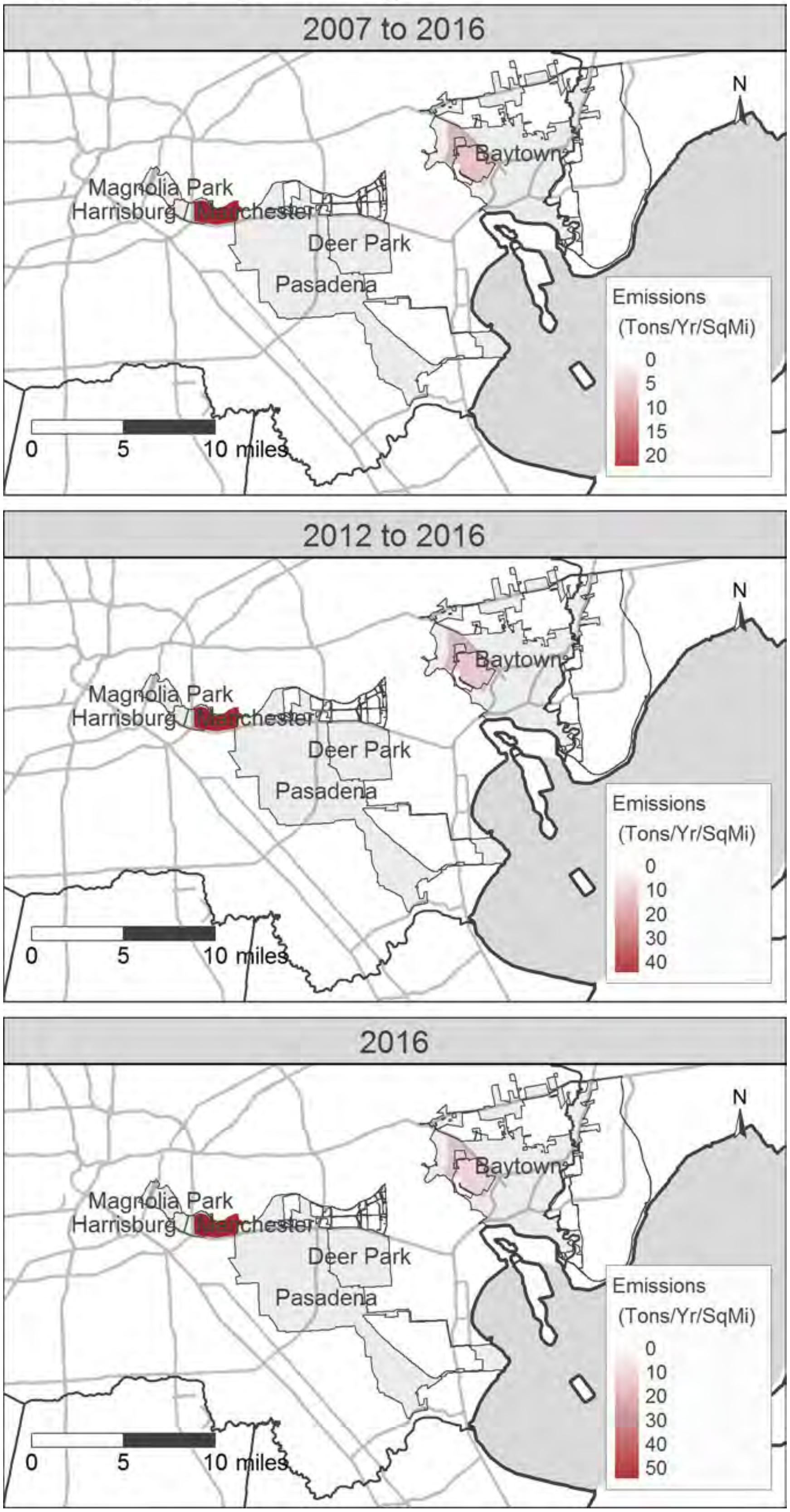
Formaldehyde



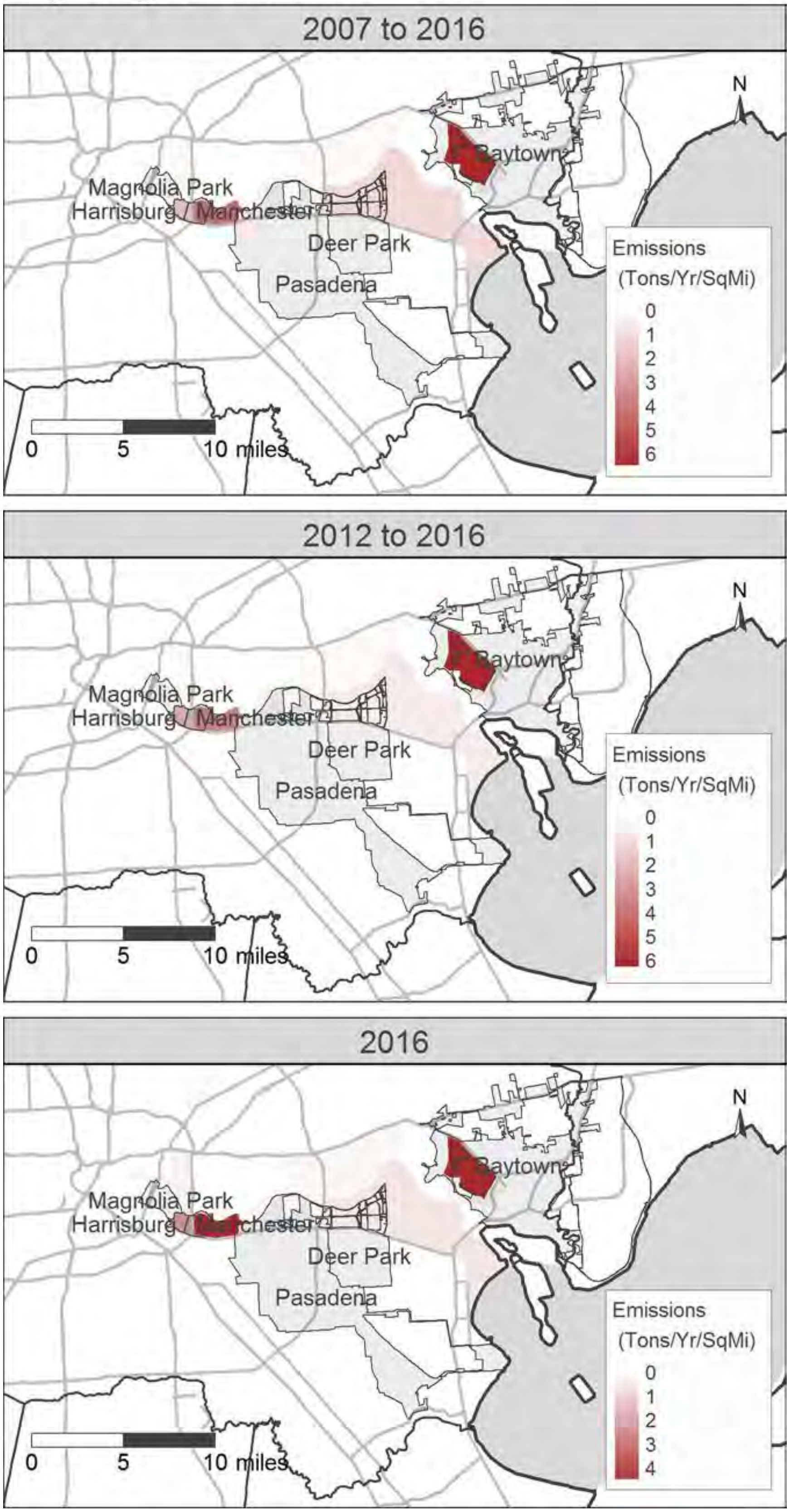
Hydrogen chloride



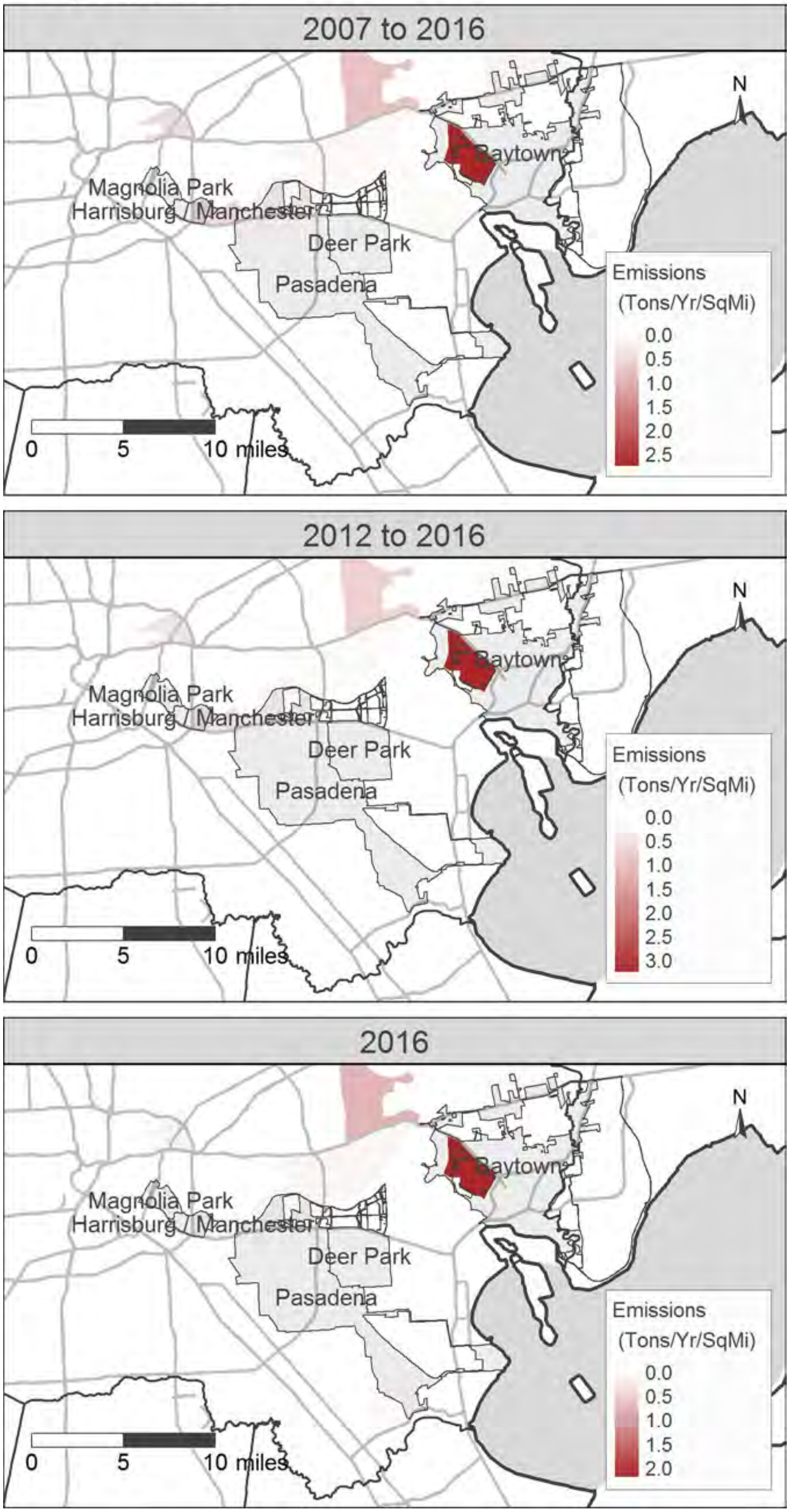
Hydrogen cyanide gas



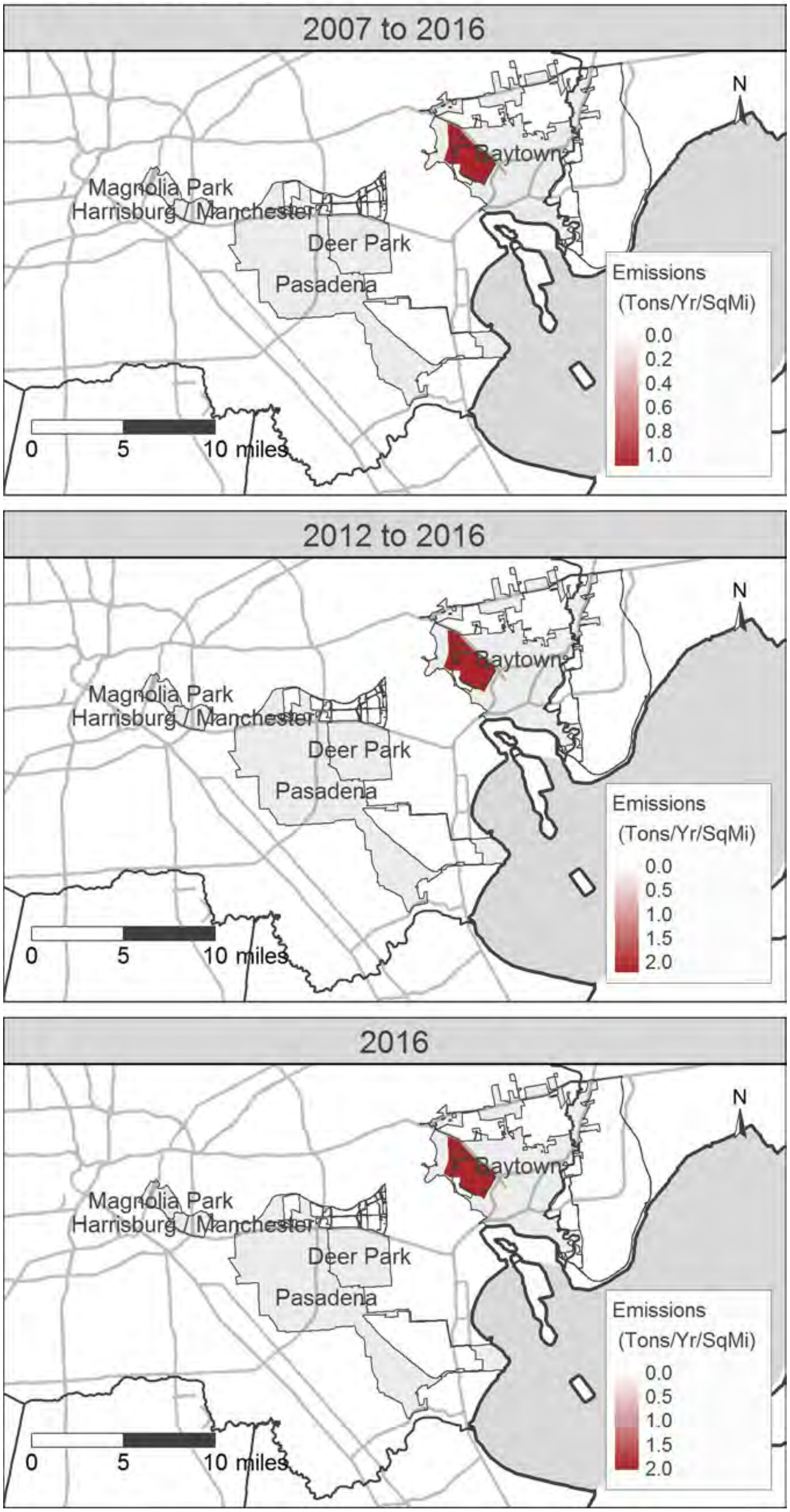
Hydrogen sulfide



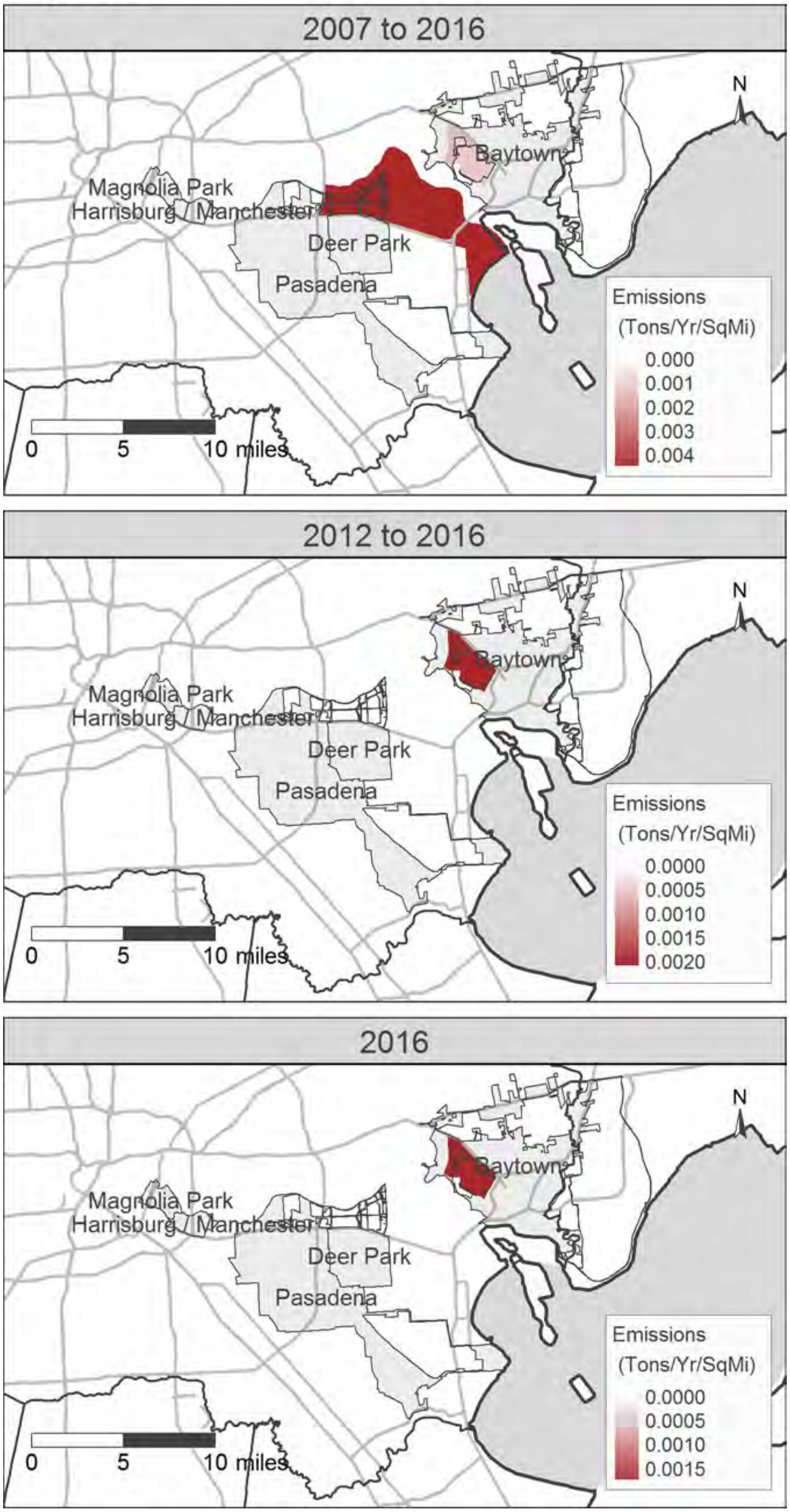
Naphthalene



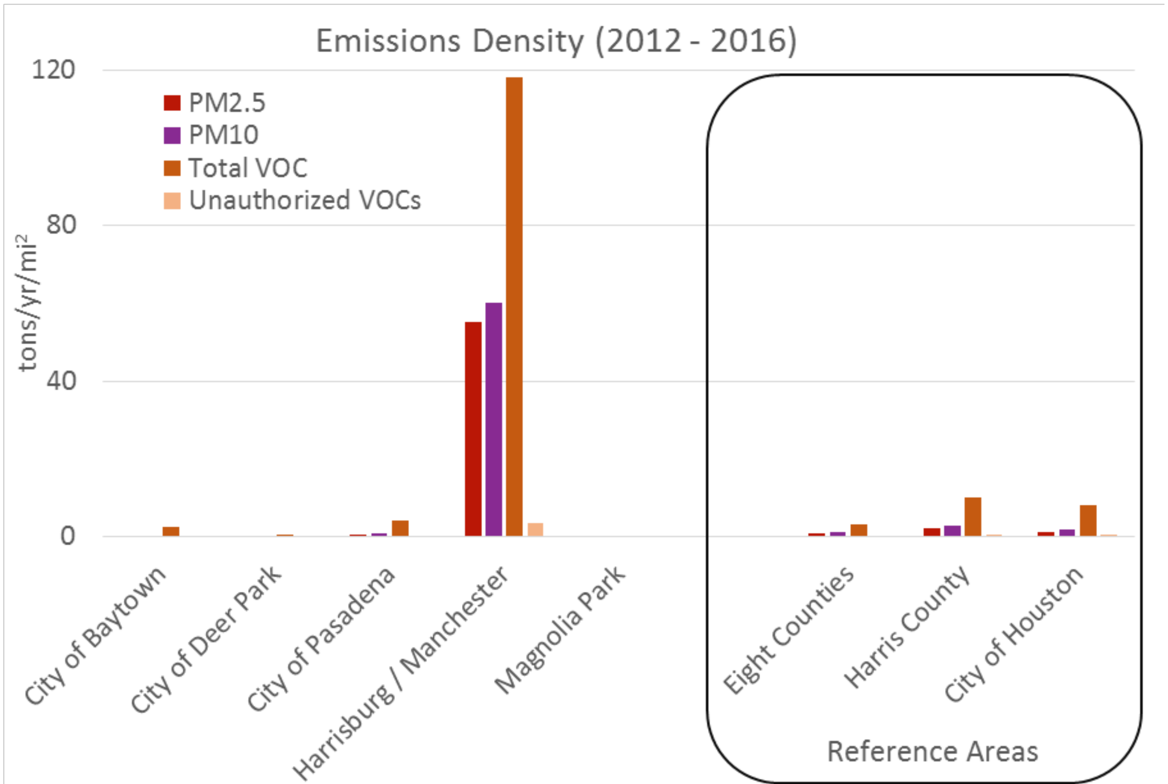
Phenanthrene

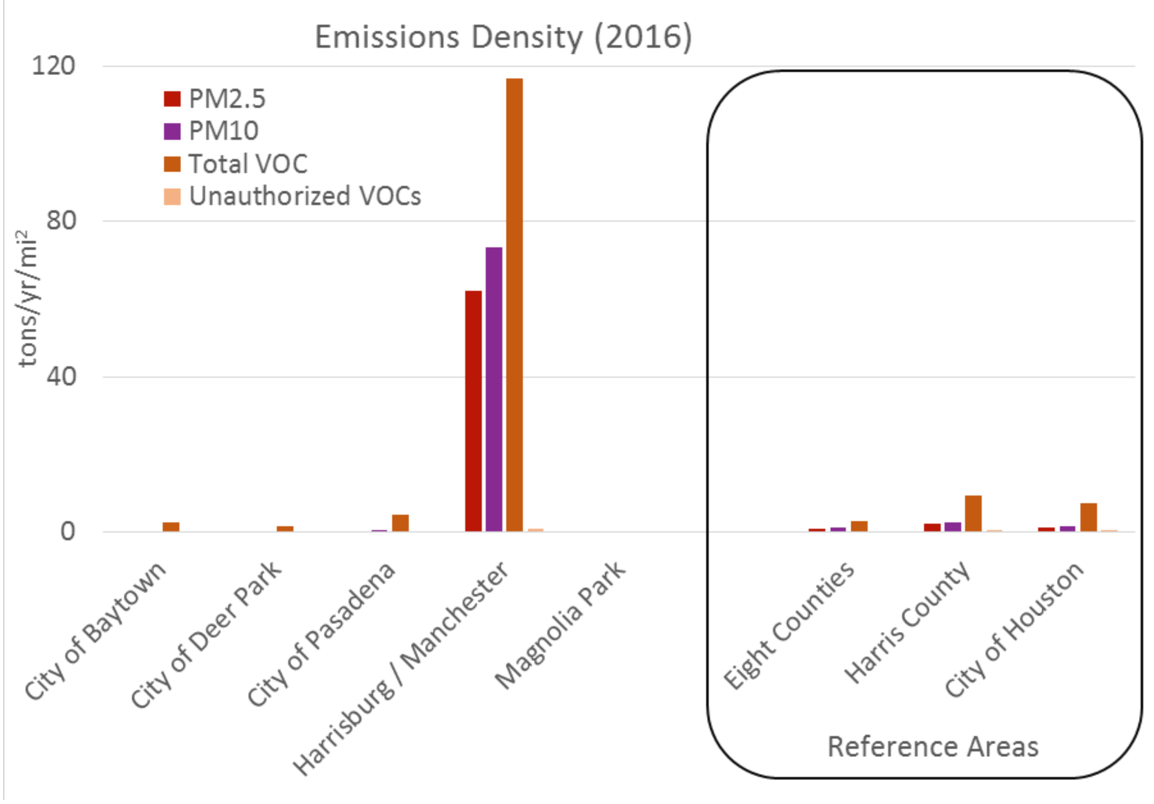


Pyrene


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

Appendix G: Vulnerability Index and Emissions in Communities of Interest

Demographics and Vulnerability Index in Communities of Interest				
Location	**Poverty (%)**	**Limited-English (%)**	**People of Color (%)**	**Vulnerability Index**
City of Baytown	16.4	8.7	61.3	28.8
City of Deer Park	8.6	2.4	30.5	13.8
City of Pasadena	19.6	12.2	67.3	33.0
Harrisburg / Manchester	28.4	30.1	96.6	51.7
Magnolia Park	28.9	37.2	97.8	54.7
Eight Counties	15.3	9.6	60.6	28.5
Harris County	17.4	11.8	67.0	32.1
City of Houston	21.9	14.0	74.4	36.8

Emissions in Communities of Interest (tons / year / sq mile estimated at the census tract level)												
	2007 to 2016				2012 to 2016				2016			
Location	**PM2.5**	**PM10**	**Total VOC**	**Unauthorized VOCs**	**PM2.5**	**PM10**	**Total VOC**	**Unauthorized VOCs**	**PM2.5**	**PM10**	**Total VOC**	**Unauthorized VOCs**
City of Baytown	0.11	0.14	2.5	0.052	0.12	0.15	2.6	0.06	0.13	0.16	2.6	0.00022
City of Deer Park	0.000010	0.000010	0.31	NA	0.000021	0.000021	0.62	NA	0.000095	0.000095	1.4	NA
City of Pasadena	1.1	1.31	4.1	0.16	0.58	0.83	4.1	0.2	0.37	0.38	4.4	0.066
Harrisburg / Manchester	58	62	114	6.5	55	60	118	3	62	73	117	0.72
Magnolia Park	0.15	0.15	0.12	NA	0.16	0.16	0.11	NA	0.17	0.17	0.13	NA
Eight Counties	1.0	1.3	3.7	0.24	1.0	1.2	3.3	0.20	0.95	1.1	3.0	0.14
Harris County	2.4	3.4	11	0.71	2.3	3.0	10	0.56	2.3	2.6	9.4	0.49
City of Houston	1.1	2.1	8.1	0.45	1.1	1.9	8.0	0.56	1.2	1.5	7.3	0.53

*NA indicates no reported emissions of this type in this location.

ATTACHMENT 7

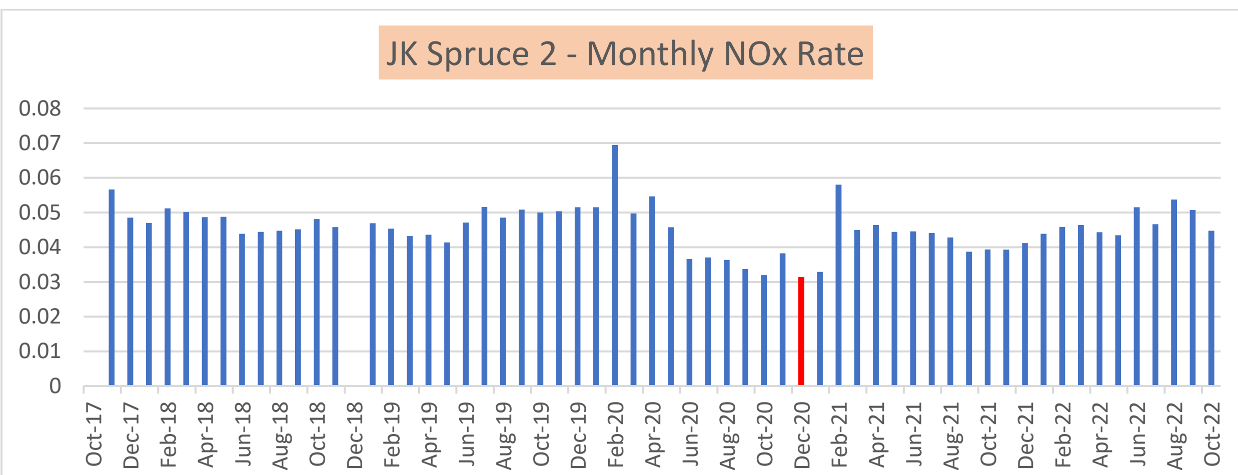
ATTACHMENT 3

NOx Emission Rates at Selected Coal Fired Electricity Generating Units with SCR

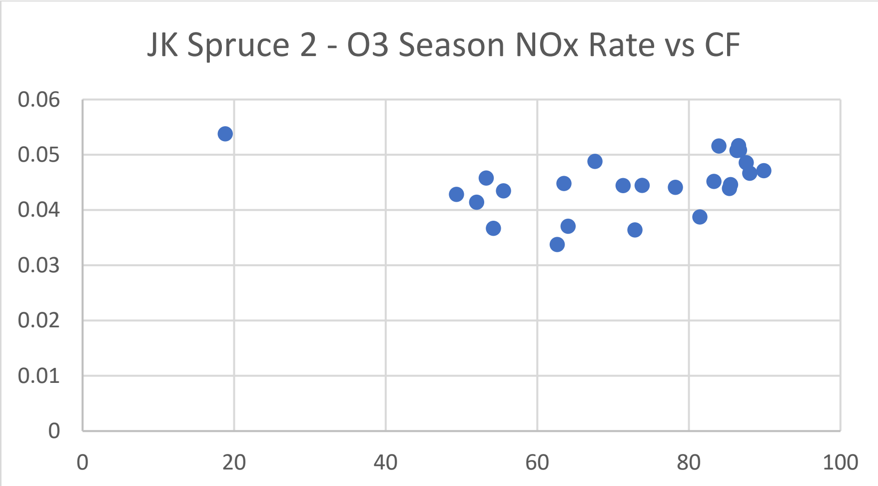
Texas

JK Spruce Unit 2: Unit 2 (878 MW) at the JK Spruce plant was analyzed. This unit has SCR installed. It can reliably achieve NOx emission rates of below 0.04 lb/MMBtu. This unit is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
JK Spruce	2	878	0.0313	0.0695	0.0537

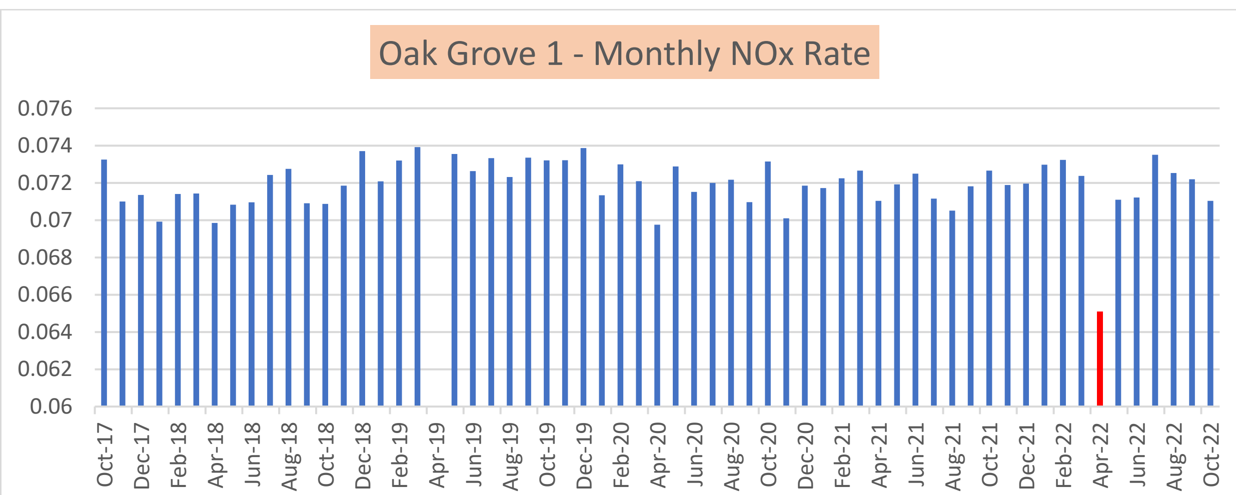


The chart above confirms that JK Spruce Unit 2 has achieved levels below 0.04 lb/MMBtu, with a low of 0.0313 lb/MMBtu, shown in red. The chart below shows that JK Spruce Unit 2 has achieved less than 0.04 lb/MMBtu over a range of ozone-season operating capacity factors.

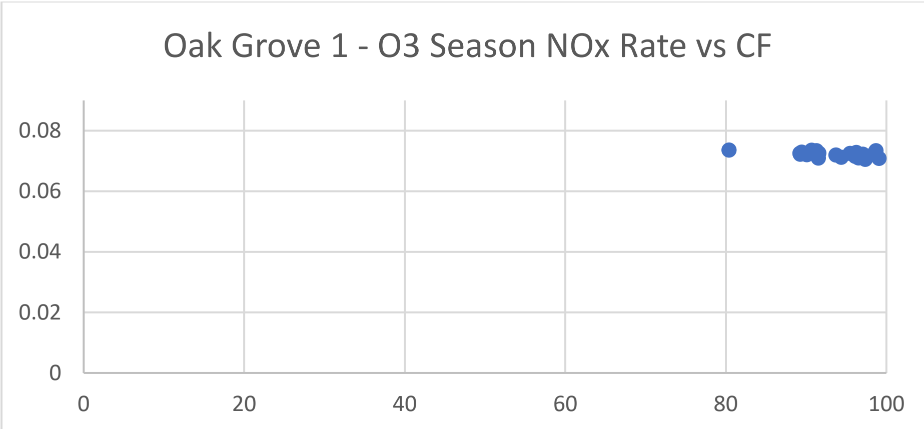


Oak Grove 1: Unit 1 (917 MW) at the Oak Grove plant was analyzed. This unit has SCR installed. It can achieve slightly lower NOx emission rates. It is not operating its SCR consistently according to the SCR's NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Oak Grove	1	917	0.0651	0.0739	0.0736
Oak Grove	2	879	0.0690	0.1117	0.0753

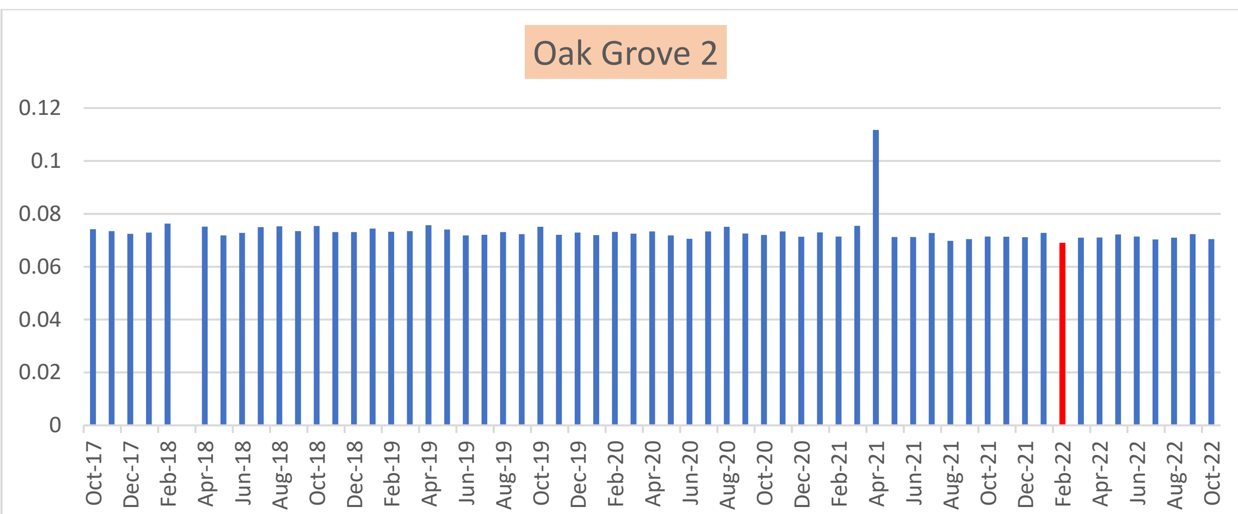


The chart above confirms that Oak Grove Unit 1 has achieved levels below 0.07 lb/MMBtu on several months of recent operation, with a low of 0.0651 lb/MMBtu, shown in red. The chart below shows that Oak Grove Unit 1 has achieved approximately 0.07 lb/MMBtu over a range of ozone-season operating capacity factors.

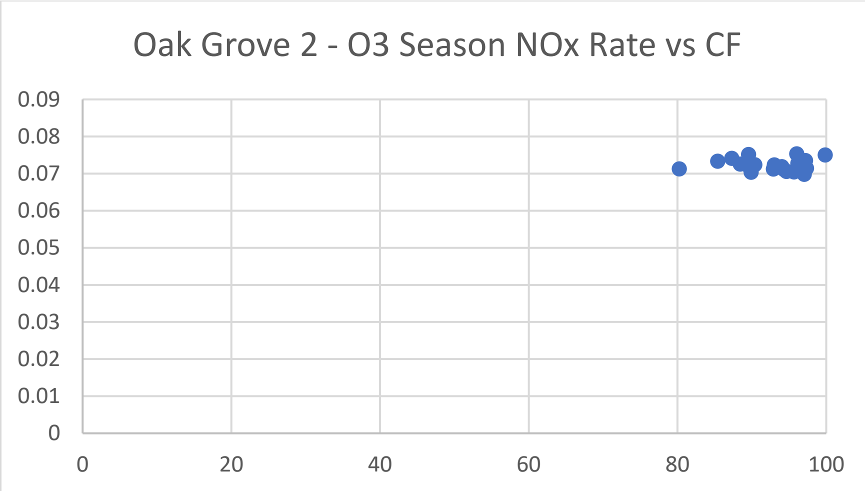


Oak Grove 2: Unit 2 (879 MW) at the Oak Grove plant was analyzed. This unit has SCR installed. It may be able to achieve slightly lower NOx emission rates.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Oak Grove	1	917	0.0651	0.0739	0.0736
Oak Grove	2	879	0.0690	0.1117	0.0753

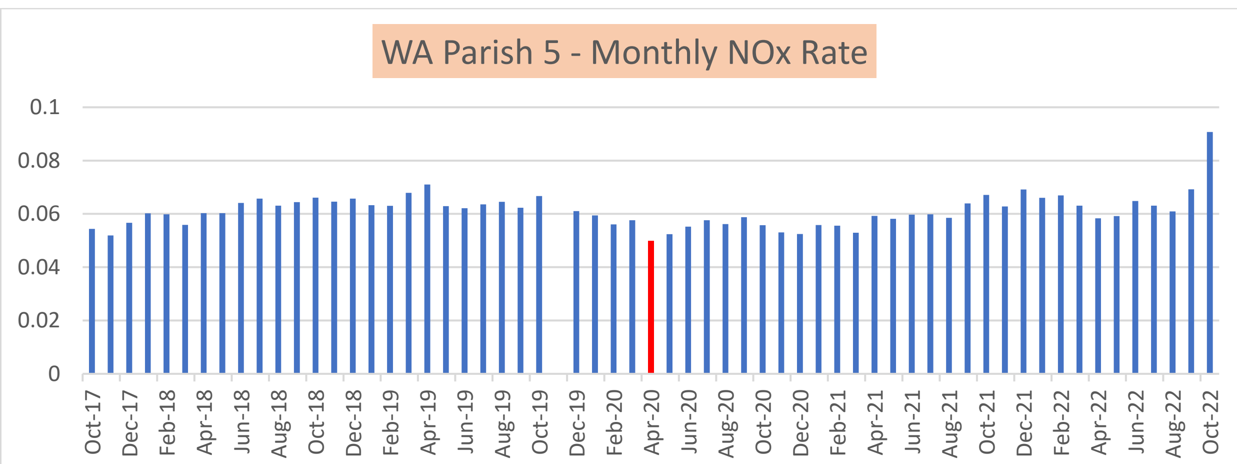


The chart above confirms that Oak Grove Unit 2 regularly achieves NOx emissions rates of approximately 0.07 lb/MMBtu, with a low of 0.0690 lb/MMBtu, shown in red.

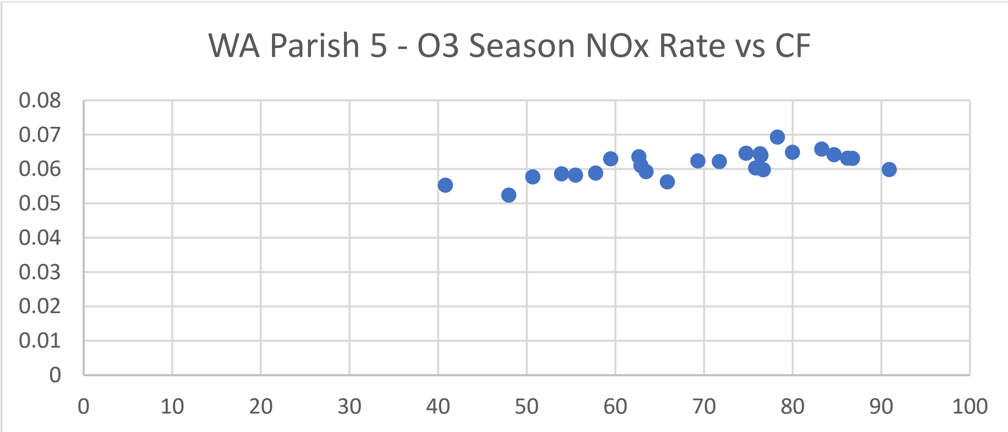


WA Parish Unit 5: Unit 5 (734 MW) at the WA Parish plant was analyzed. This unit has SCR installed. It can reliably achieve NOx emission rates below 0.06 lb/MMBtu. It is not operating its SCR consistently in accordance with the lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Parish	5	734	0.0499	0.0908	0.0692

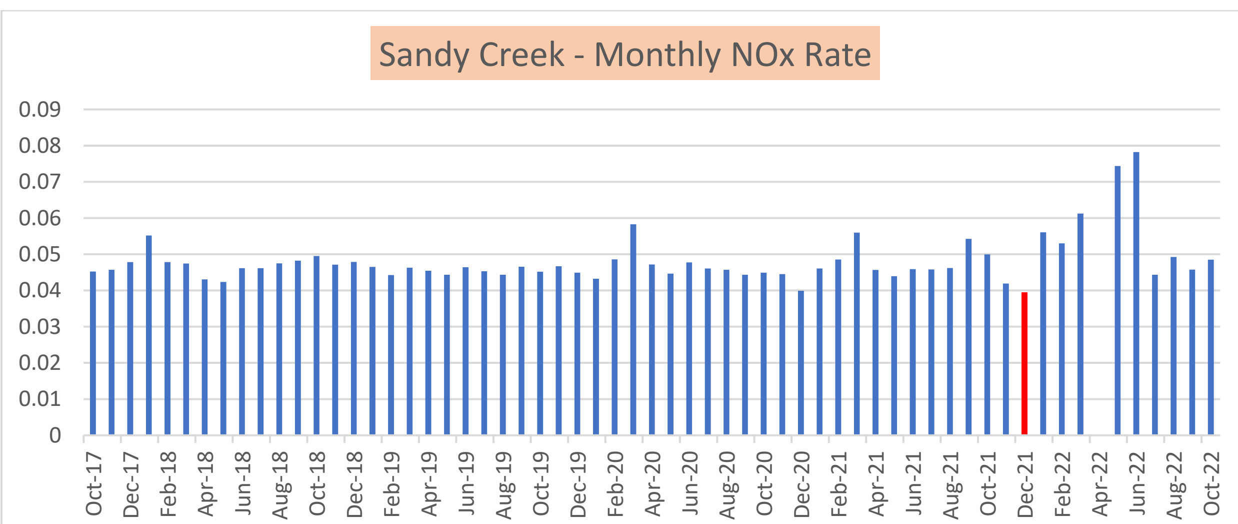


The chart above confirms that WA Parish Unit 5 has achieved levels below 0.06 lb/MMBtu on many months of recent operation, with a low of 0.0499 lb/MMBtu, shown in red. The chart below shows that WA Parish Unit 5 has achieved less than 0.06 lb/MMBtu over a wide range of ozone-season operating capacity factors.

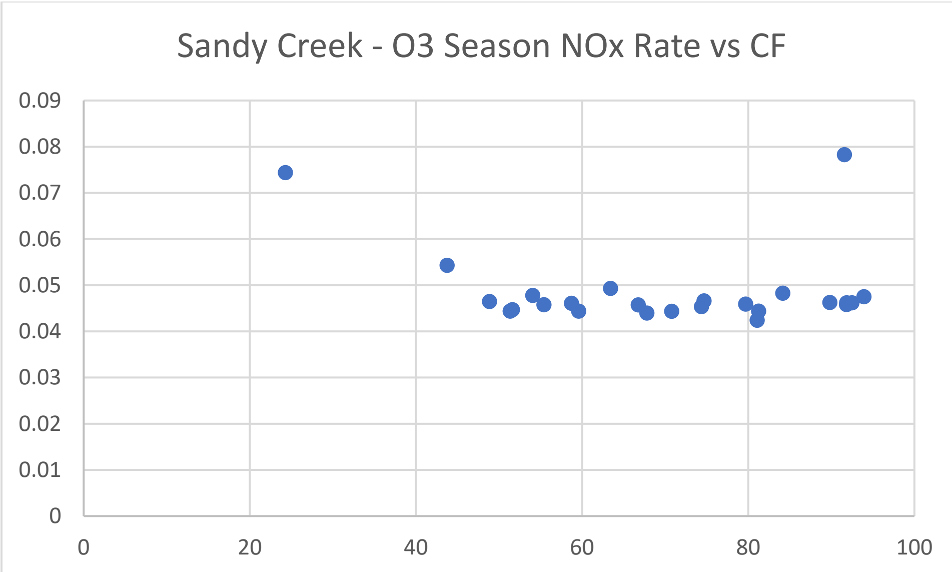


Sandy Creek Unit 1: Sandy Creek Unit 1 (1008 MW) was analyzed. This unit has SCR installed. It can reliably achieve NOx emission rates below 0.05 lb/MMBtu. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Sandy Creek	1	1008	0.0395	0.0782	0.0782



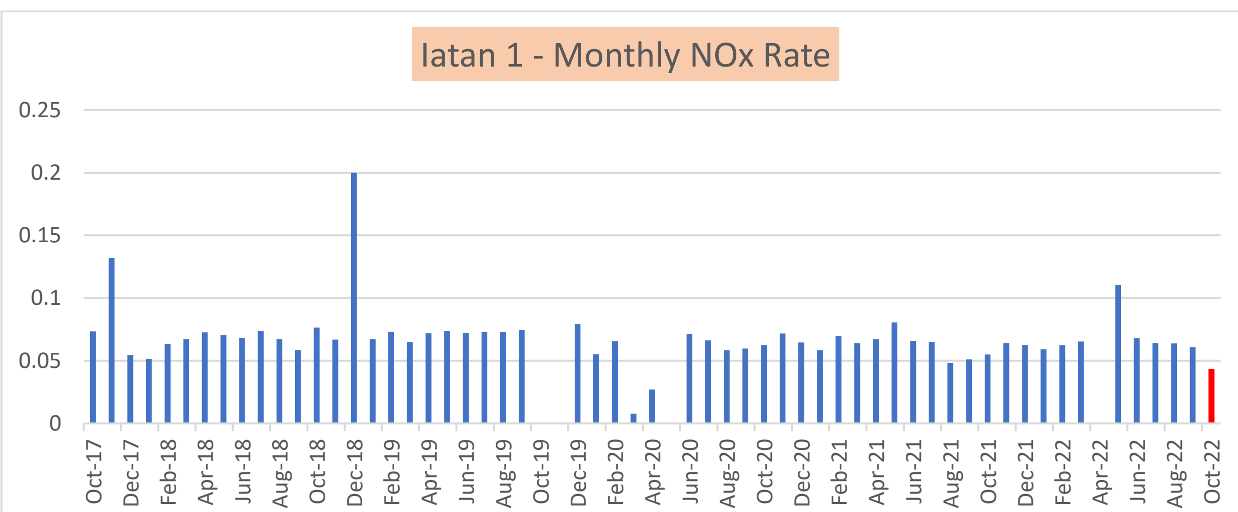
The chart above confirms that Sandy Creek 1 has achieved levels well below 0.05 lb/MMBtu on many months of recent operation, with a low of 0.0395 lb/MMBtu, shown in red. The chart below shows that Sandy Creek 1 has achieved less than 0.05 lb/MMBtu over a wide range of ozone-season operating capacity factors.



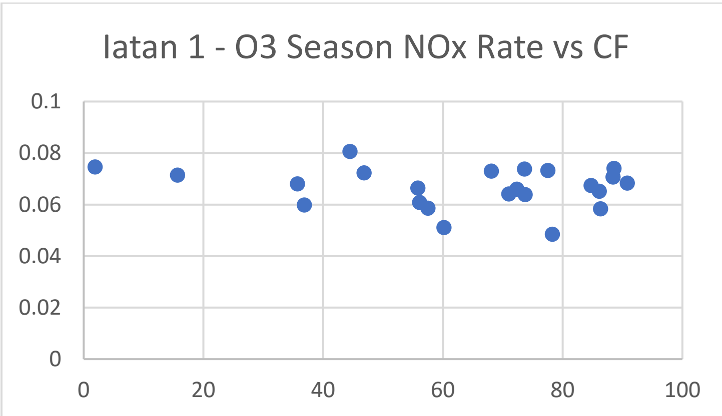
Missouri

Iatan 1: Unit 1 (726 MW) at the Iatan plant was analyzed. This unit has SCR installed. It can achieve reliably lower NOx emission rates below 0.06 lb/MMBtu. It is not operating its SCR consistently in accordance with the SCR's demonstrated NOx reduction capacity. It is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Iatan	1	726	0.0435	0.2000	0.0805
Iatan	2	914	0.0454	0.0595	0.0595

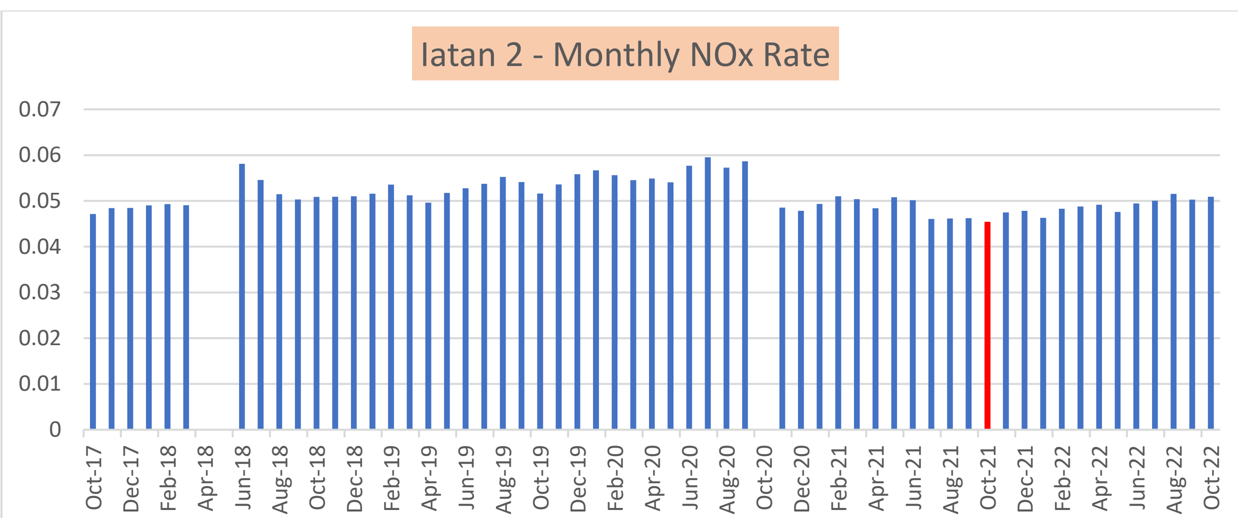


The chart above confirms that Iatan Unit 1 has achieved levels below 0.06 lb/MMBtu on several months of recent operation, with a low of .0435 lb/MMBtu, shown in red. The chart below shows that Iatan Unit 1 has achieved less than 0.06 lb/MMBtu over a wide range of ozone-season operating capacity factors.

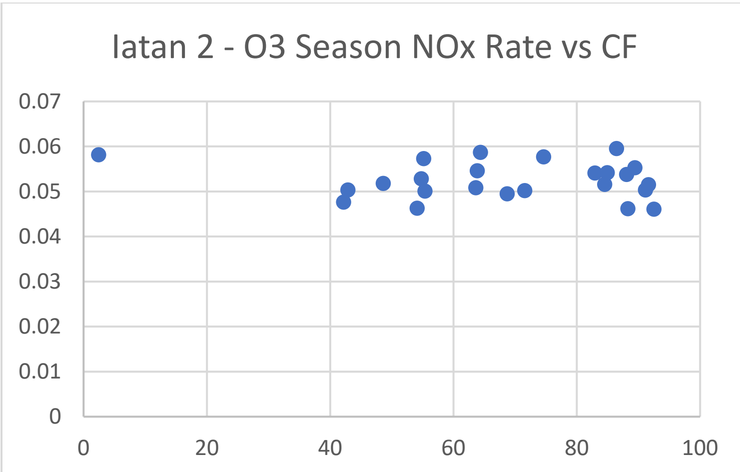


Iatan 2: Unit 2 (914 MW) at the Iatan plant was analyzed. This unit has SCR installed. It can reliably achieve NOx emission rates below 0.05 lb/MMBtu and has consistently done so from November 2020 through July 2022 excepting two months. It is not operating its SCR consistently in accordance with the SCR's lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Iatan	1	726	0.0435	0.2000	0.0805
Iatan	2	914	0.0454	0.0595	0.0595

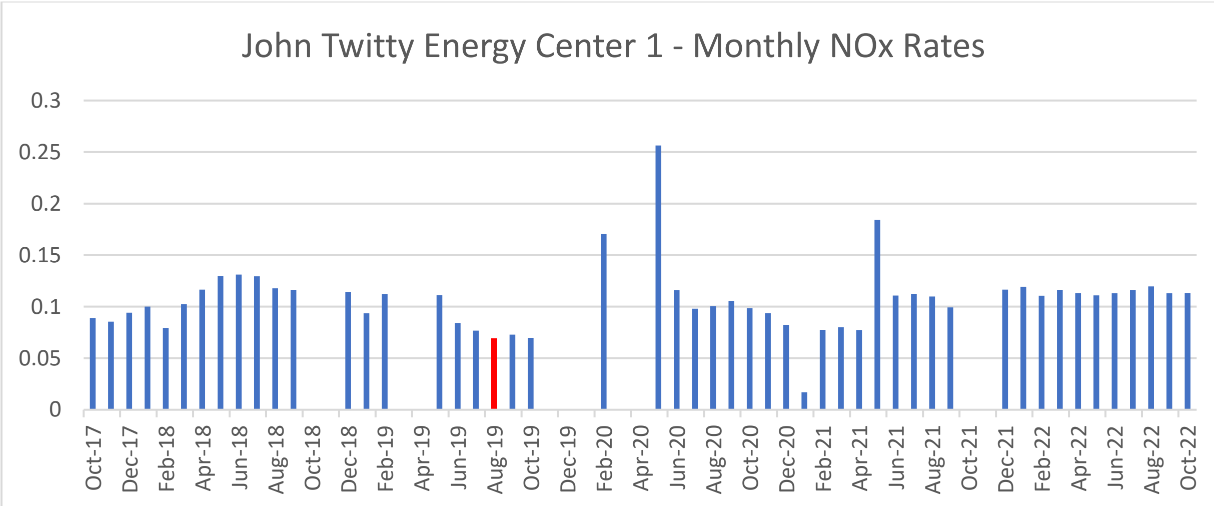


The chart above confirms that Iatan Unit 2 has achieved levels below 0.05 lb/MMBtu on many months of recent operation, with a low of 0.0454 lb/MMBtu, shown in red. The chart below shows that Iatan Unit 2 has achieved less than 0.05 lb/MMBtu over a wide range of ozone-season operating capacity factors.

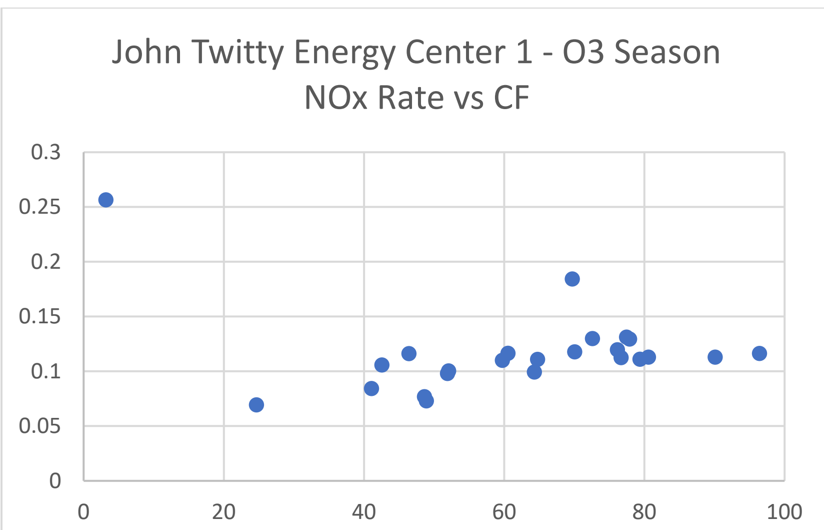


JTEC 1: Unit 1 (194 MW) at the John Twitty Energy Center plant was analyzed. This unit has SCR installed. It can reliably achieve NOx emission rates below 0.08 lb/MMBtu as demonstrated by its operation in 2019. It has wildly variable monthly NOx emission rates, ranging from above 0.25 lb/MMBtu at a high to 0.069 lb/MMBtu at a low. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity. Indeed, it reliably emitted above 0.1 lb/MMBtu in late 2021 and 2022, significantly above its lowest demonstrated NOx reduction capacity achieved in 2019 of below 0.08 lb/MMBtu.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
John Twitty Energy Center	1	194	0.0693	0.2564	
John Twitty Energy Center	2	300	0.0637	0.0899	

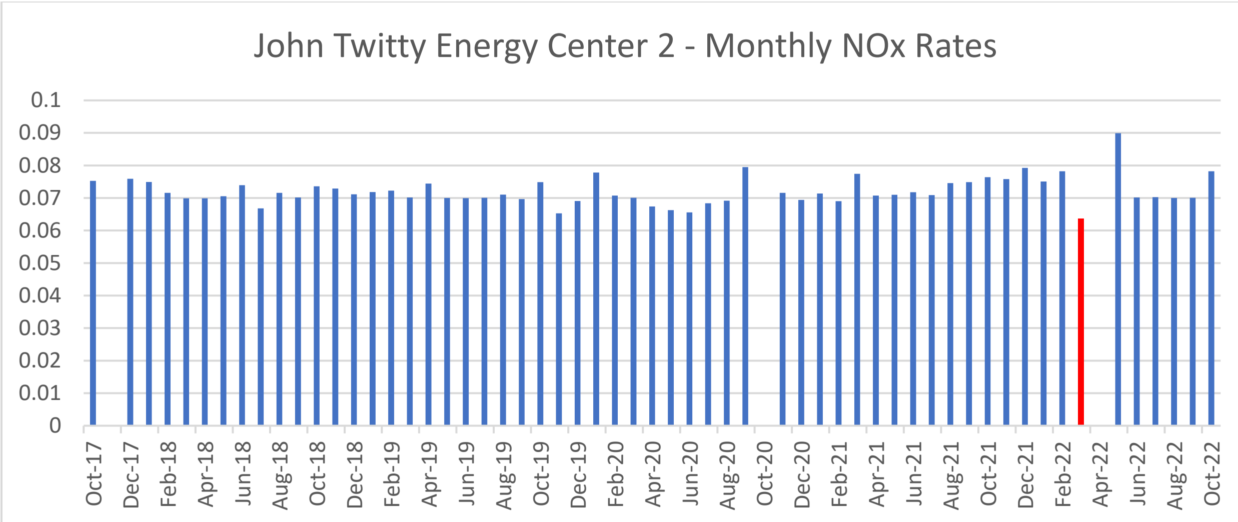


The chart above confirms that John Twitty Energy Center Unit 1 has consistently achieved levels below 0.08 lb/MMBtu on several months of recent operation, with a low of .0693 lb/MMBtu, shown in red. The chart below shows that John Twitty Energy Center Unit 1 has achieved less than 0.08 lb/MMBtu over a range of ozone-season operating capacity factors.

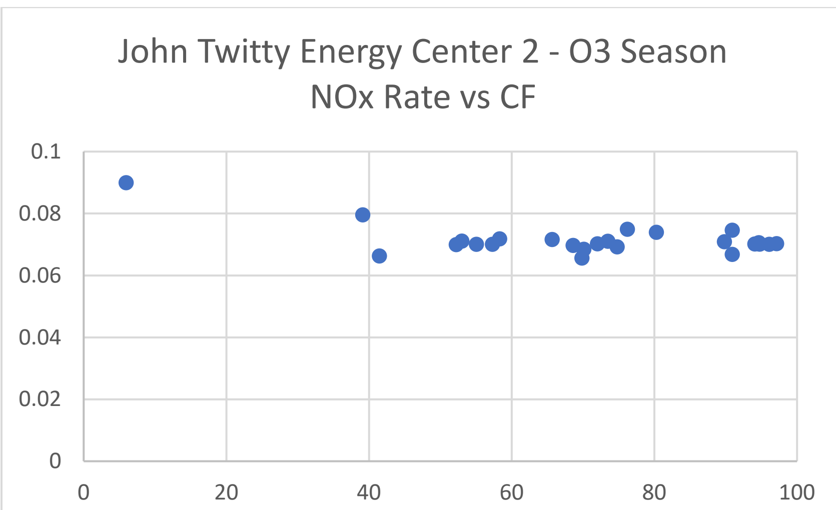


JTEC 2: Unit 2 (300 MW) at the John Twitty Energy Center plant was analyzed. This unit has SCR installed. It can reliably achieve NOx emissions rates at or below 0.07 lb/MMBtu. It is not operating consistent with its lowest demonstrated NOx reduction capacity.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
John Twitty Energy Center	1	194	0.0693	0.2564	
John Twitty Energy Center	2	300	0.0637	0.0899	

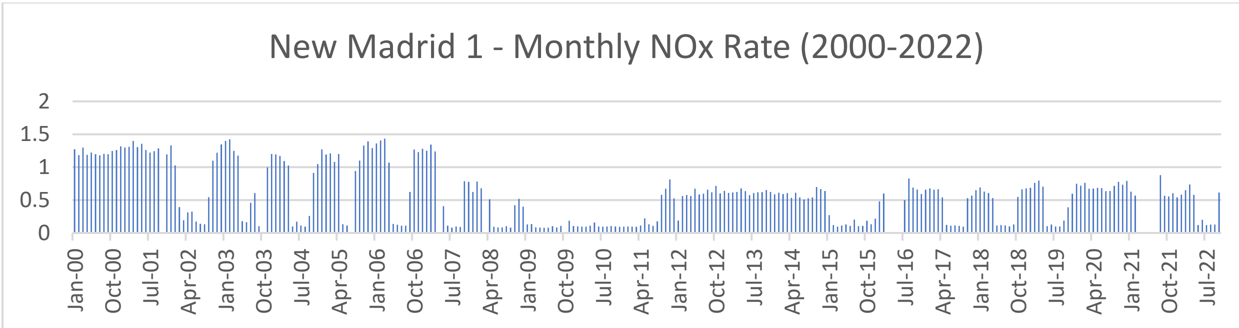


The chart above confirms that John Twitty Energy Center Unit 2 has achieved levels below 0.07 lb/MMBtu on several months of recent operation, with a low of .0637 lb/MMBtu, shown in red. The chart below shows that John Twitty Energy Center Unit 2 has achieved less than 0.07 lb/MMBtu over a range of ozone-season operating capacity factors.

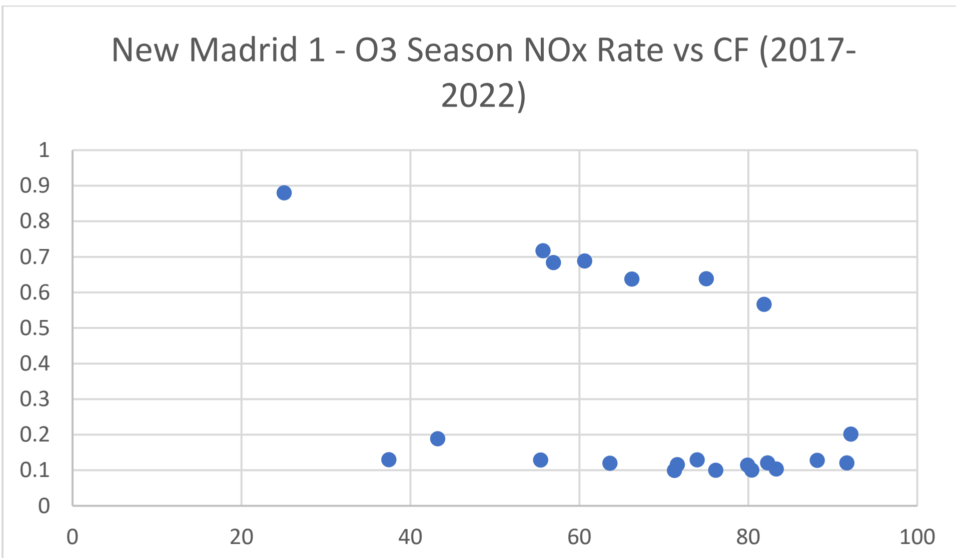


New Madrid 1: Unit 1 (600 MW) at the New Madrid plant was analyzed. This unit has SCR installed. Its NOx emissions rates are wildly variable. The unit can reliably achieve NOx emission rates below 0.10 lb/MMBtu. It is clearly not operating its SCR according to the SCR's NOx reduction capacity. During some ozone seasons, it is emitting at 0.87 lb/MMBtu, over 800% of its lowest demonstrated NOx reduction capacity. It is not because of low capacity factor nor MOT issues as the charts below demonstrate.

Plant	Unit	MW	NOx, Min	Nox, Min (Historical)*	NOx, Max	NOx, Max 03 Months
New Madrid	1	600	0.0991	0.08	0.8797	0.8797
New Madrid	2	600	0.1007	0.0764	1.0742	0.6420

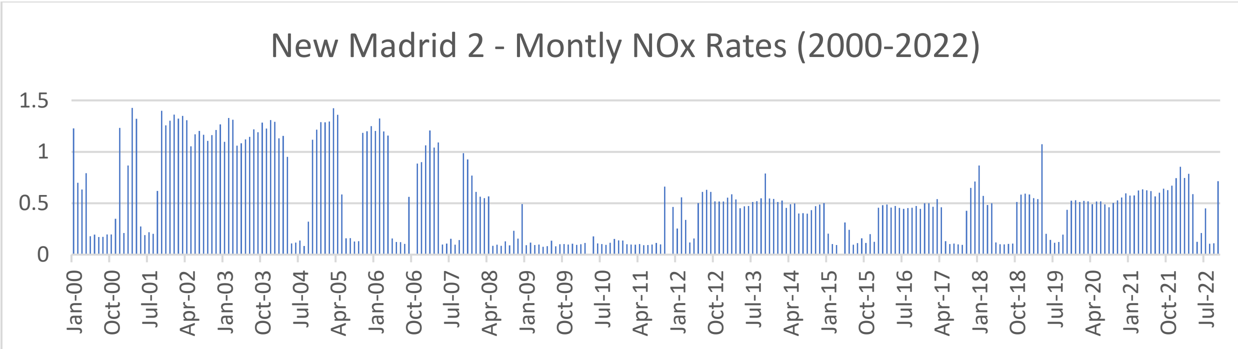


The chart above confirms that New Madrid 1 has reliably achieved levels below 0.10 lb/MMBtu, with a low of .0991 lb/MMBtu. The chart below shows that New Madrid Unit 1 has achieved levels less than approximately 0.10 lb/MMBtu over a range of ozone-season operating capacity factors.

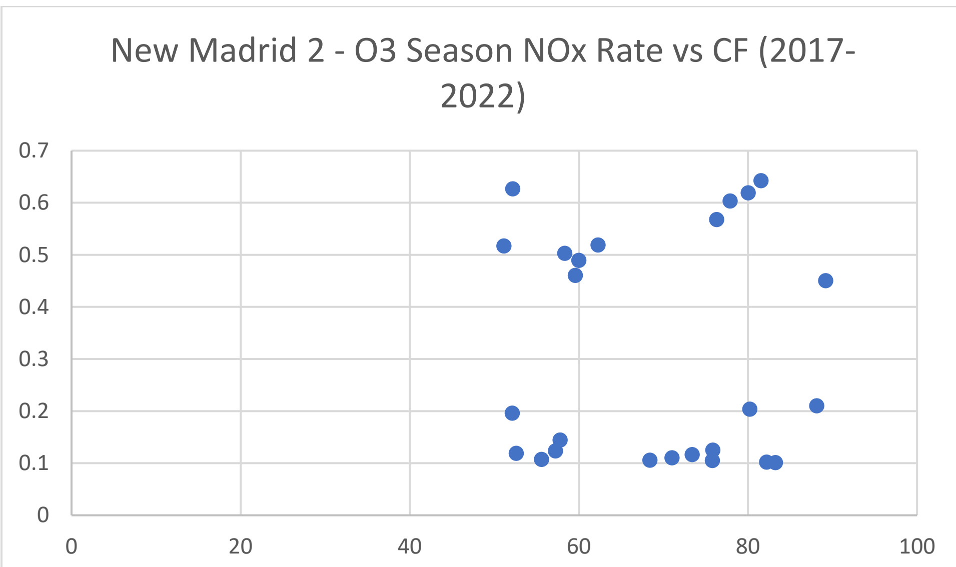


New Madrid 2: Unit 2 (600 MW) at the New Madrid plant was analyzed. Its NOx emissions rates are wildly variable. The unit can reliably achieve NOx emission rates below approximately 0.10 lb/MMBtu. It is clearly not operating its SCR according to the SCR's NOx reduction capacity. During some ozone seasons, it is emitting at 0.64 lb/MMBtu, over 600% of its lowest demonstrated NOx reduction capacity. It is not because of low capacity factor nor MOT issues as the charts below demonstrate.

Plant	Unit	MW	NOx, Min	Nox, Min (Historical)*	NOx, Max	NOx, Max 03 Months
New Madrid	1	600	0.0991	0.08	0.8797	0.8797
New Madrid	2	600	0.1007	0.0764	1.0742	0.6420

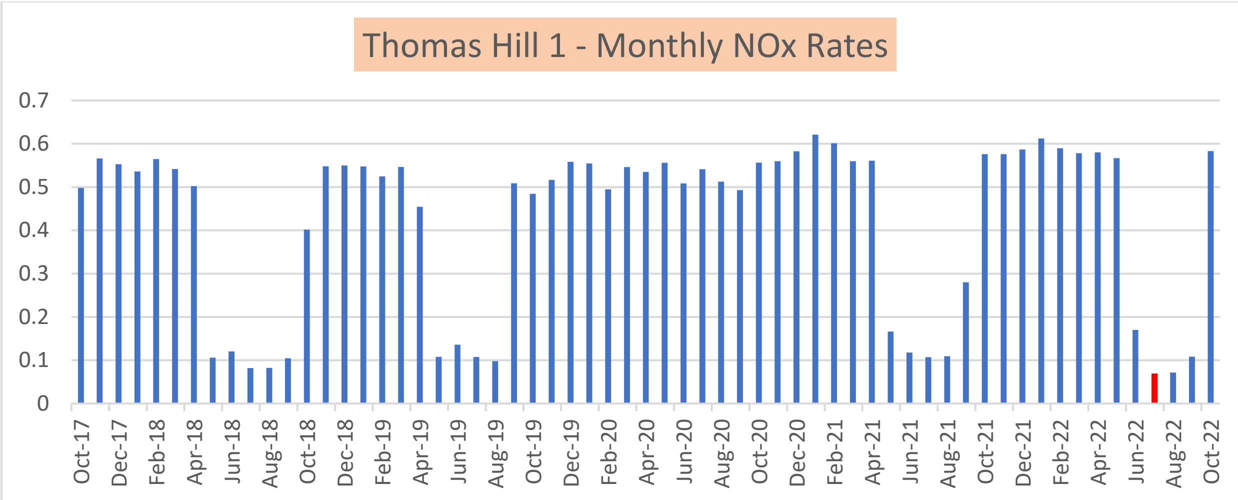


The chart above confirms that New Madrid 2 has reliably achieved levels of approximately 0.10 lb/MMBtu, with a low of .1007 lb/MMBtu. The chart below shows that New Madrid Unit 2 has achieved levels of approximately 0.10 lb/MMBtu over a range of ozone-season operating capacity factors.

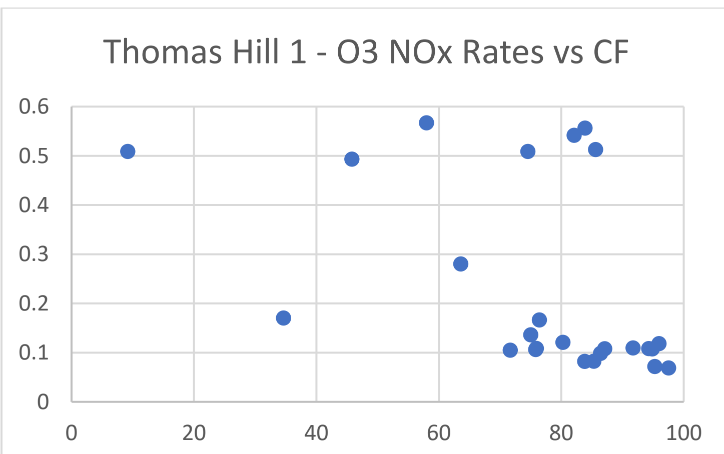


TH 1: Unit 1 (180 MW) at the Thomas Hill plant was analyzed. It has SCR installed. It can clearly achieve reliably lower NOx emission rates. The unit can reliably achieve NOx emission rates of 0.10 lb/MMBtu and below. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity. It is not because of low capacity factor nor MOT issues as the charts below make clear. Indeed, its operation of its SCR is wildly erratic, including between ozone seasons.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Thomas Hill	1	180	0.0686	0.6209	0.5668
Thomas Hill	2	285	0.0825	0.6374	0.5628
Thomas Hill	3	670	0.0775	0.2832	0.2832

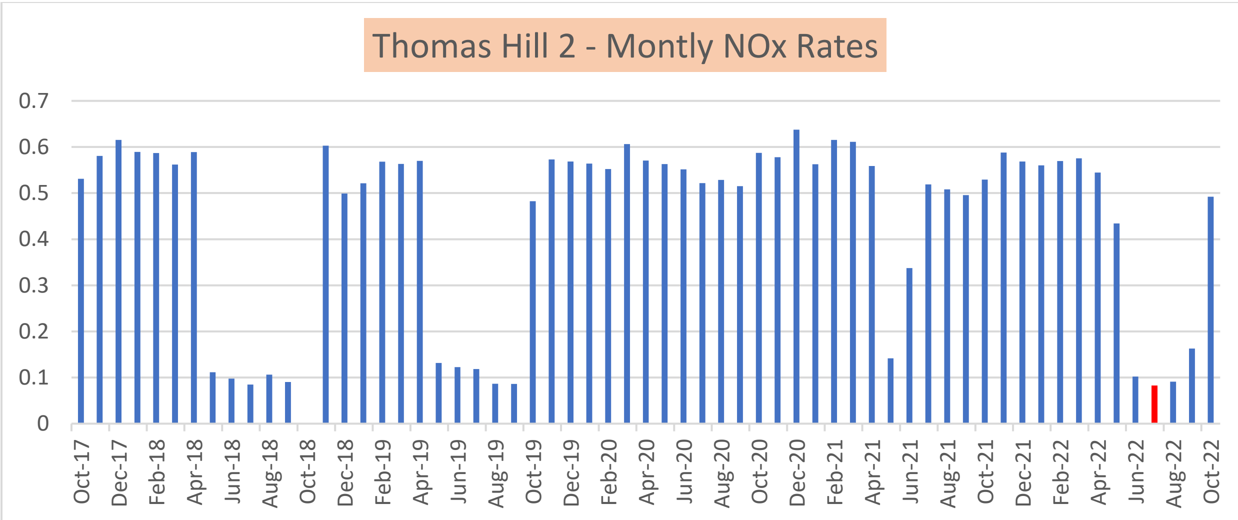


The chart above confirms that Thomas Hill 1 has reliably achieved levels below 0.10 lb/MMBtu, with a low of .0686 lb/MMBtu, shown in red. The chart below shows that Thomas Hill 1 has achieved less than 0.10 lb/MMBtu over a wide range of ozone-season operating capacity factors.

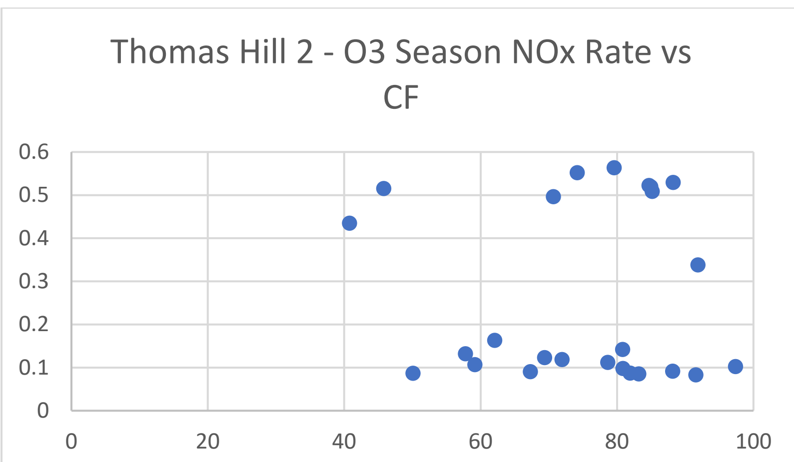


TH 2: Unit 2 (285 MW) at the Thomas Hill plant was analyzed. It has SCR installed. It can clearly achieve reliably lower NOx emission rates. The unit can reliably achieve NOx emission rates of 0.10 lb/MMBtu and below. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity. It is not because of low capacity factor nor MOT issues as the charts below make clear. Indeed, its operation of its SCR is wildly erratic, including between ozone seasons.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max O3 Months
Thomas Hill	1	180	0.0686	0.6209	0.5668
Thomas Hill	2	285	0.0825	0.6374	0.5628
Thomas Hill	3	670	0.0775	0.2832	0.2832

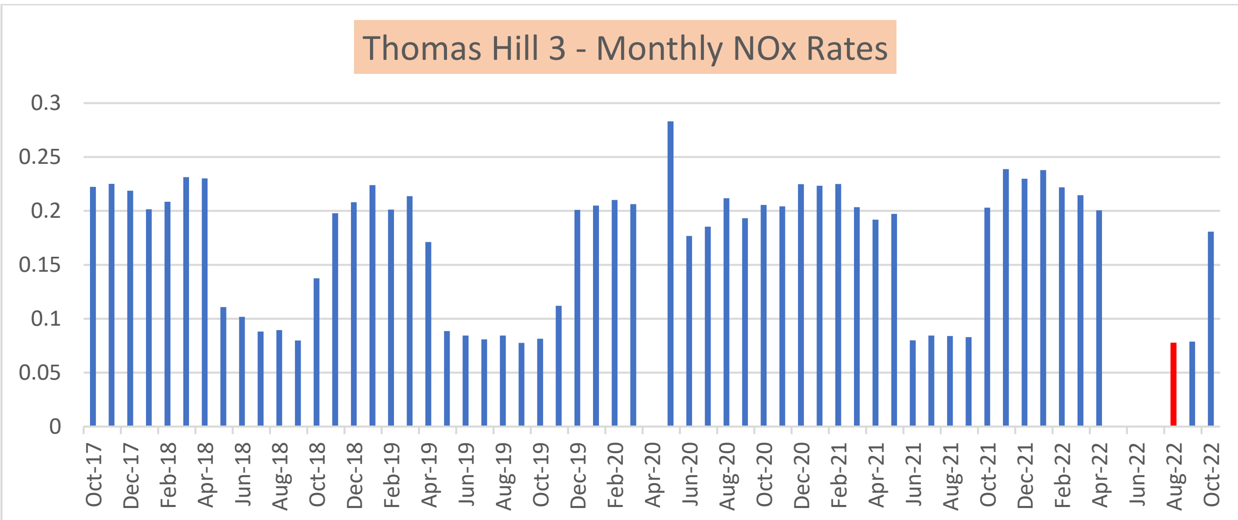


The chart above confirms that Thomas Hill 2 has achieved levels below 0.10 lb/MMBtu, with a low of .0825 lb/MMBtu, shown in red. The chart below shows that Thomas Hill 2 has achieved less than 0.10 lb/MMBtu over a wide range of ozone-season operating capacity factors.

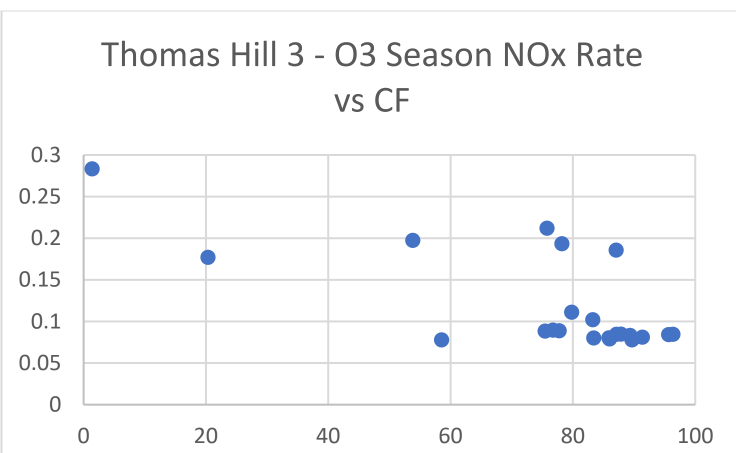


TH 3: Unit 3 (670 MW) at the Thomas Hill plant was analyzed. It has SCR installed. It can clearly achieve reliably lower NOx emission rates. The unit can reliably achieve NOx emission rates of 0.10 lb/MMBtu and below. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity. It is not because of low capacity factor nor MOT issues as the charts below make clear. Indeed, its operation of its SCR is wildly erratic, including between ozone seasons.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Thomas Hill	1	180	0.0686	0.6209	0.5668
Thomas Hill	2	285	0.0825	0.6374	0.5628
Thomas Hill	3	670	0.0775	0.2832	0.2832

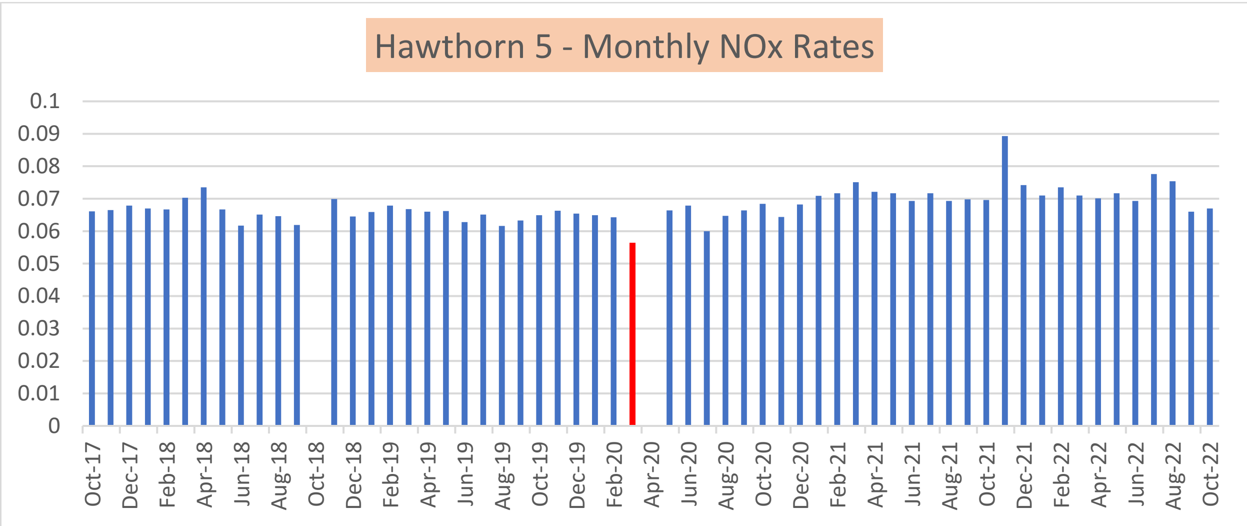


The chart above confirms that Thomas Hill 3 has achieved levels below 0.10 lb/MMBtu, with a low of .0775 lb/MMBtu, shown in red. The chart below shows that Thomas Hill 3 has achieved less than 0.10 lb/MMBtu over a wide range of ozone-season operating capacity factors.

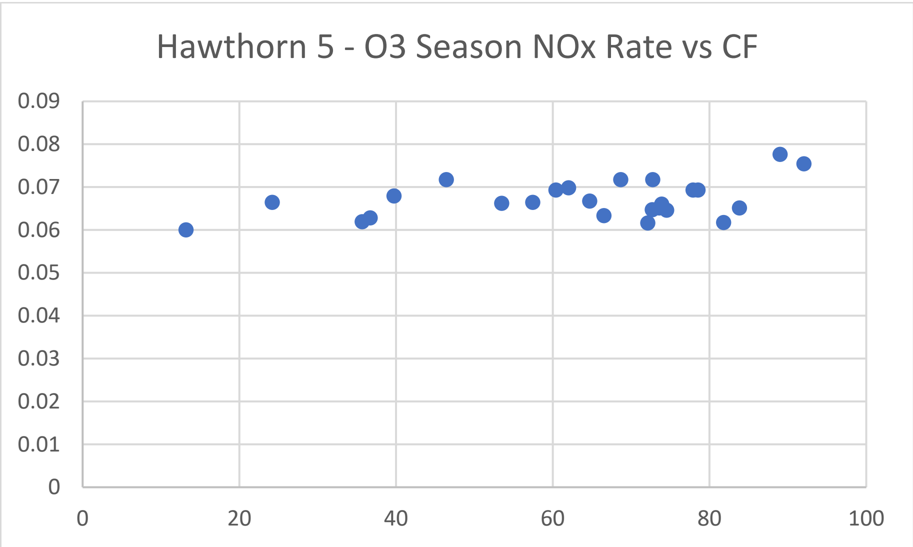


Hawthorn 5: Unit 5 (594 MW) at the Hawthorn plant was analyzed. It has SCR installed. The unit can reliably achieve NOx emissions rates of below 0.07 lb/MMBtu. It is not operating its SCR consistent with its lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Hawthorn	5	594	0.0563	0.0893	0.0776



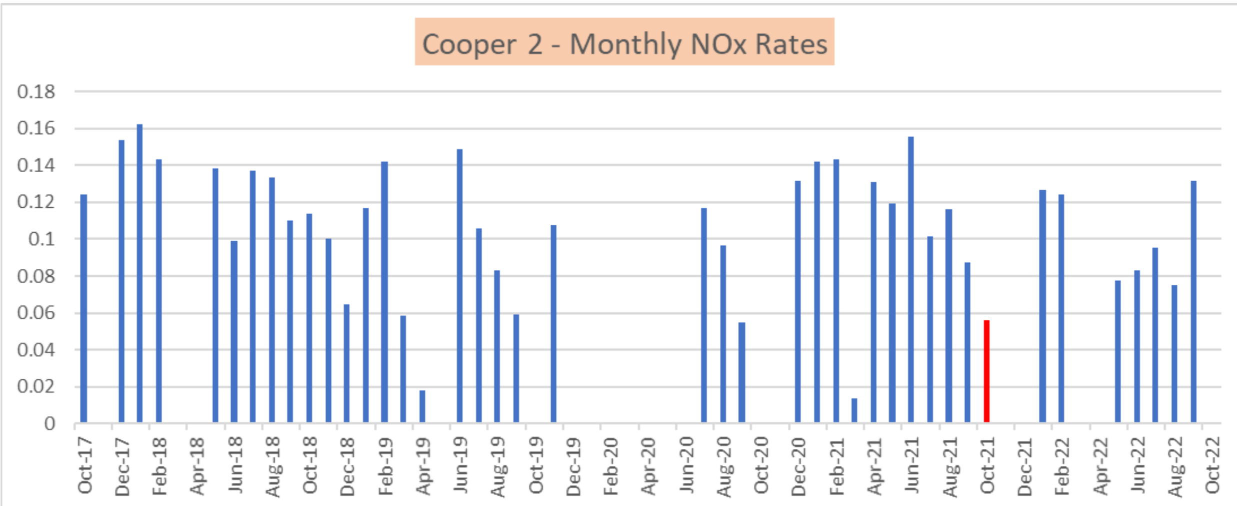
The chart above confirms that Hawthorn Unit 5 has achieved levels below 0.07 lb/MMBtu on many months of recent operation, with a low of 0.0563 lb/MMBtu, shown in red. The chart below shows that Hawthorn Unit 5 has achieved less than 0.07 lb/MMBtu over a range of ozone-season operating capacity factors.



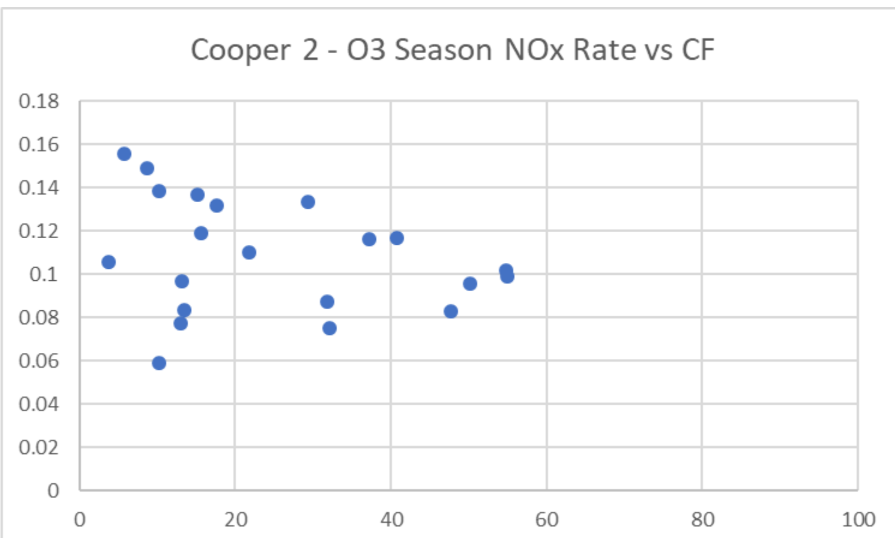
Kentucky

Cooper 2: Unit 2 (230 MW) at the Cooper plant was analyzed. It has SCR installed. It can achieve reliably lower NOx emission rates. The unit can reliably achieve NOx emissions rates of 0.10 lb/MMBtu and below. It is not operating its SCR consistently according to the SCR's lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Cooper	2	230	0.0563	0.1625	0.1554

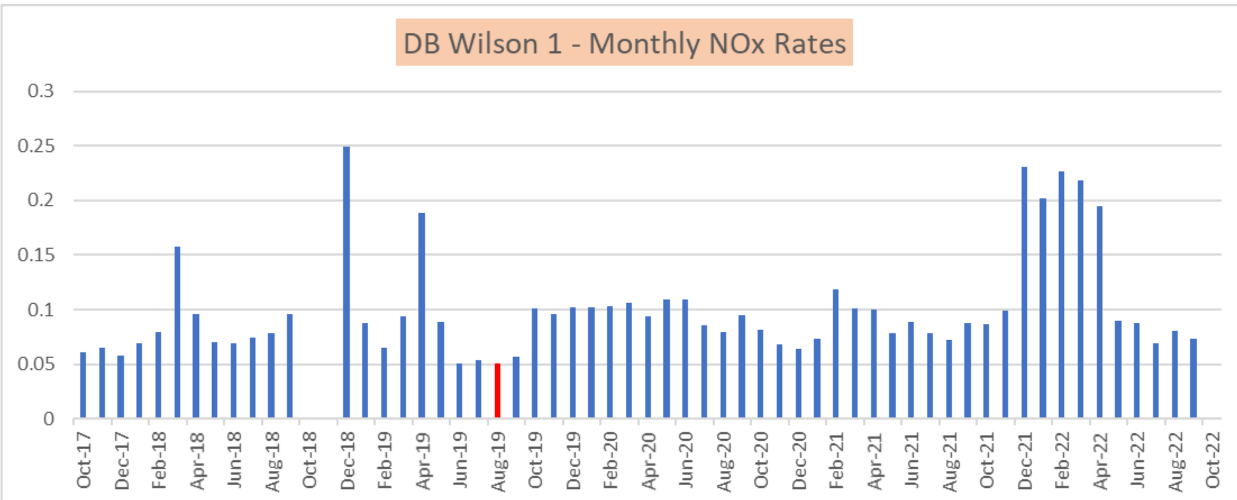


The chart above confirms that Cooper Unit 2 has achieved levels below 0.10 lb/MMBtu on many months of recent operation, with a low of 0.0563 lb/MMBtu, shown in red.

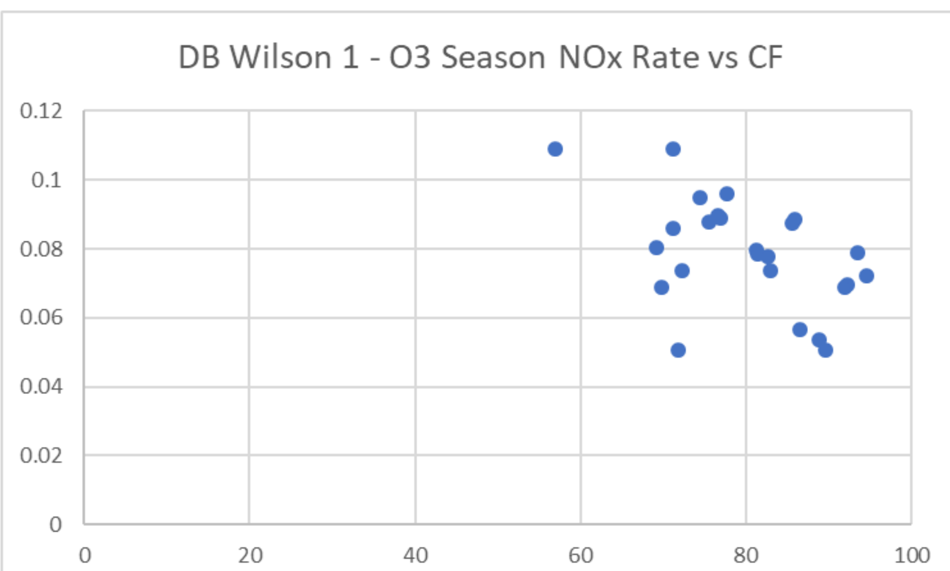


DB Wilson 1: Unit 1 (566 MW) at the DB Wilson plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates of below 0.07 lb/MMBtu. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
DB Wilson	1	566	0.0505	0.2491	0.1091

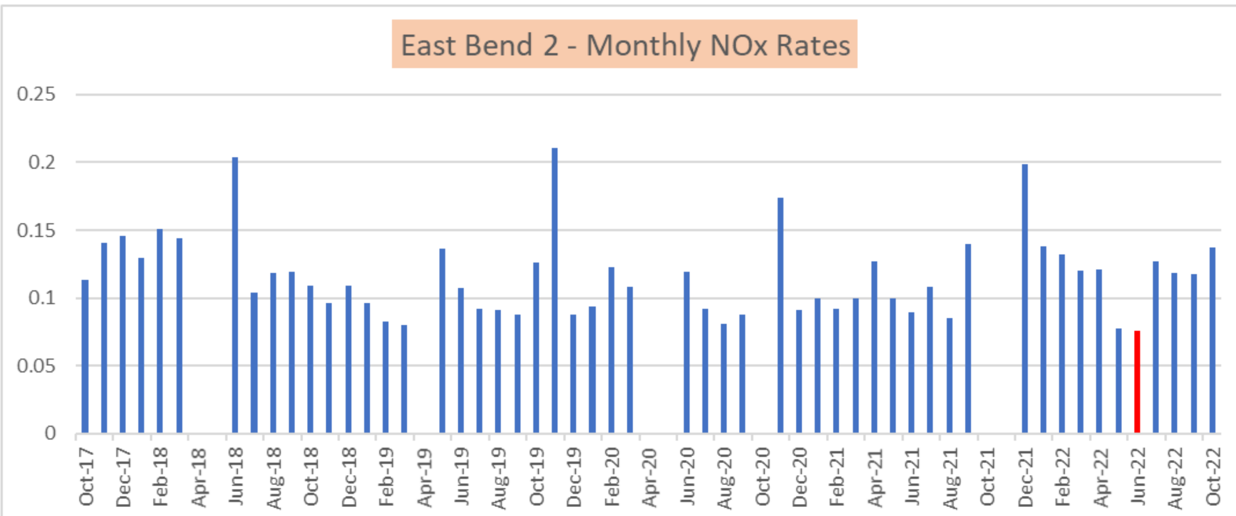


The chart above confirms that DB Wilson Unit 1 can reliably achieve levels below 0.07 lb/MMBtu on several months of operation, with a low of 0.0505 lb/MMBtu, shown in red. The chart below shows that DB Wilson Unit 1 has achieved less than 0.07 lb/MMBtu over a range of ozone-season operating capacity factors.

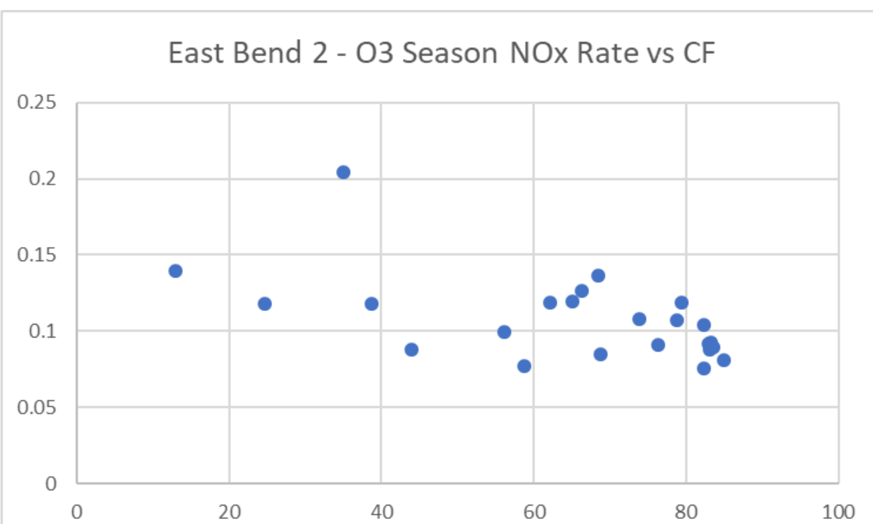


East Bend 2: Unit 2 (669 MW) at the East Bend plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates of 0.10 lb/MMBtu and below. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
East Bend	2	669	0.0758	0.2110	0.2041

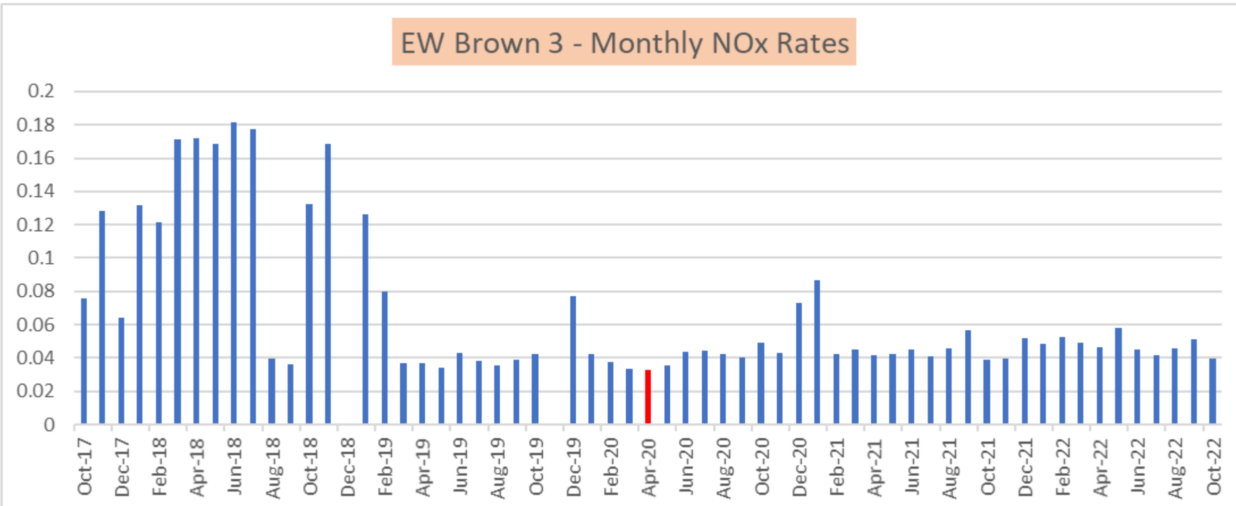


The chart above confirms that East Bend Unit 2 has regularly achieved levels of below 0.10 lb/MMBtu, with a low of 0.0758 lb/MMBtu, shown in red. The chart below shows that East Bend 2 has achieved less than 0.10 lb/MMBtu over a wide range of ozone-season operating capacity factors.

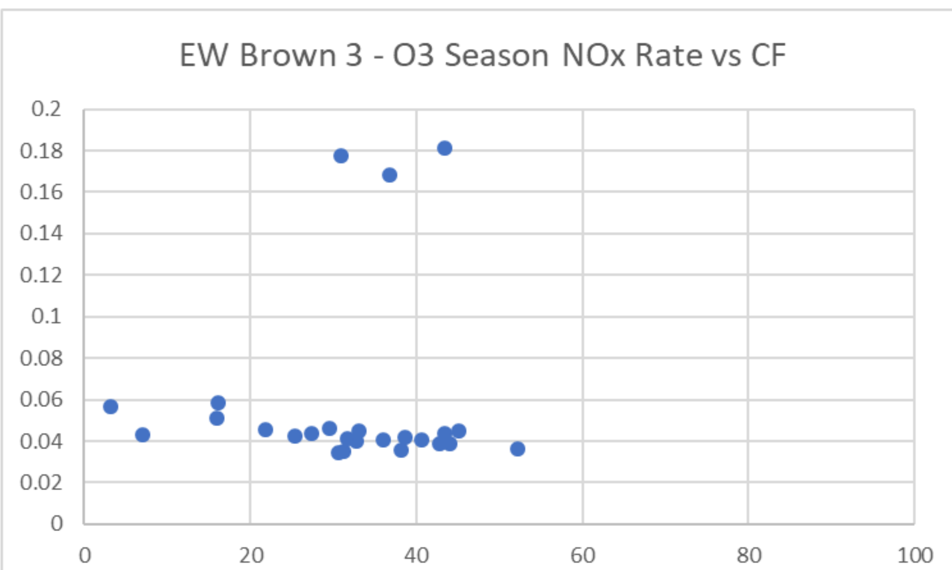


EW Brown 3: Unit 3 (464 MW) at the EW Brown plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates of approximately 0.04 lb/MMBtu.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
EW Brown	3	464	0.0326	0.1813	0.1813

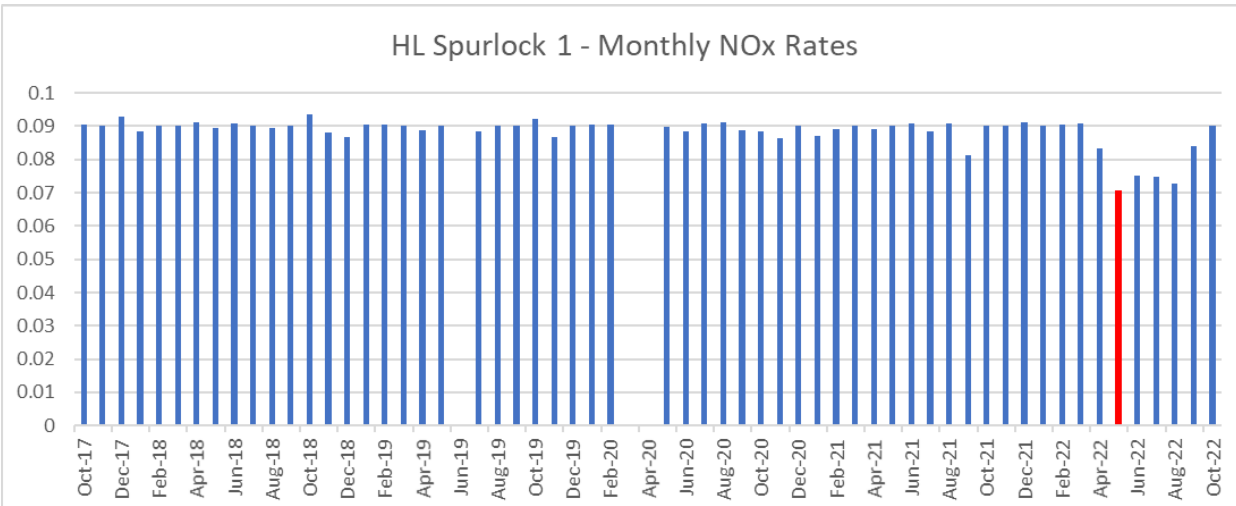


The chart above confirms that EW Brown Unit 3 has regularly achieved levels of approximately 0.04 lb/MMBtu, with a low of 0.0326 lb/MMBtu, shown in red. The chart below shows that EW Brown Unit 3 has achieved less than 0.04 lb/MMBtu over a wide range of ozone-season operating capacity factors.

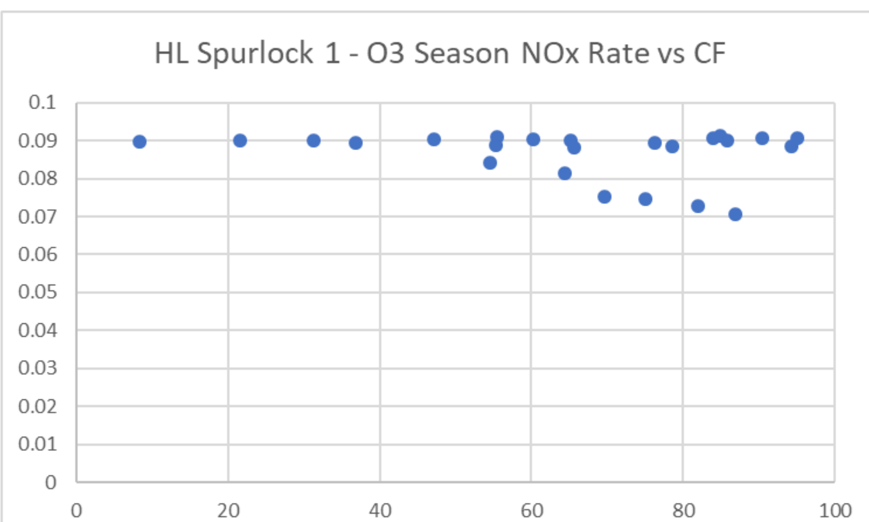


HL Spurlock 1: Unit 1 (385 MW) at the HL Spurlock plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates of 0.09 lb/MMBtu.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
HL Spurlock	1	358	0.0707	0.0936	0.0912
HL Spurlock	2	592	0.0604	0.1290	0.0921

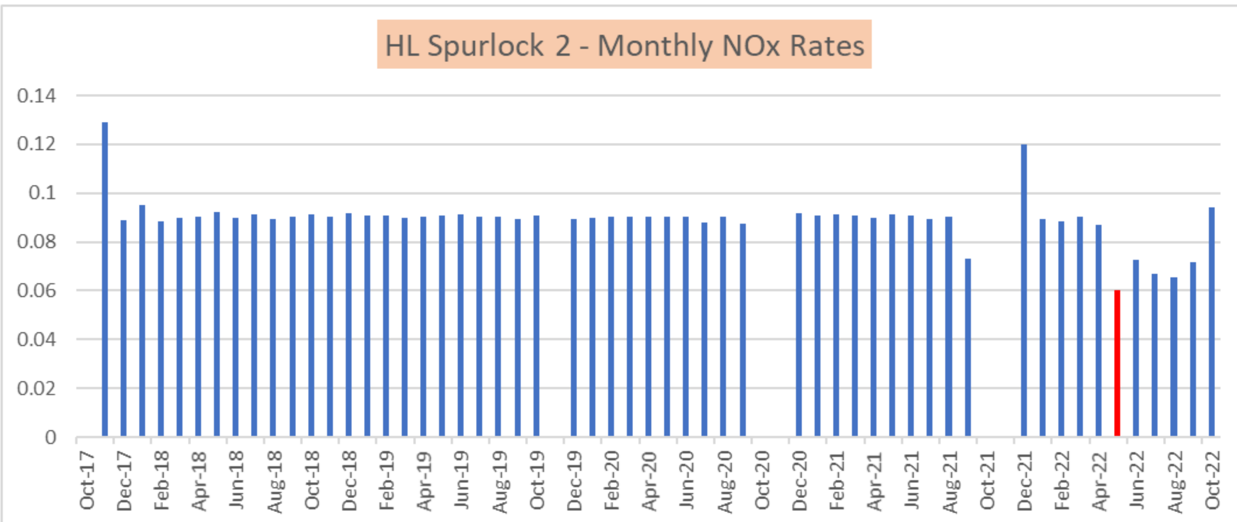


The chart above confirms that Spurlock Unit 1 reliably achieves NOx emissions of below 0.09 lb/MMBtu, and has maintained NOx emissions of below 0.08 lb/MMBtu during the 2022 ozone season, with a low of 0.0707 lb/MMBtu, shown in red. The chart below shows that Spurlock 1 has achieved less than 0.09 lb/MMBtu and below over a wide range of ozone-season operating capacity factors.

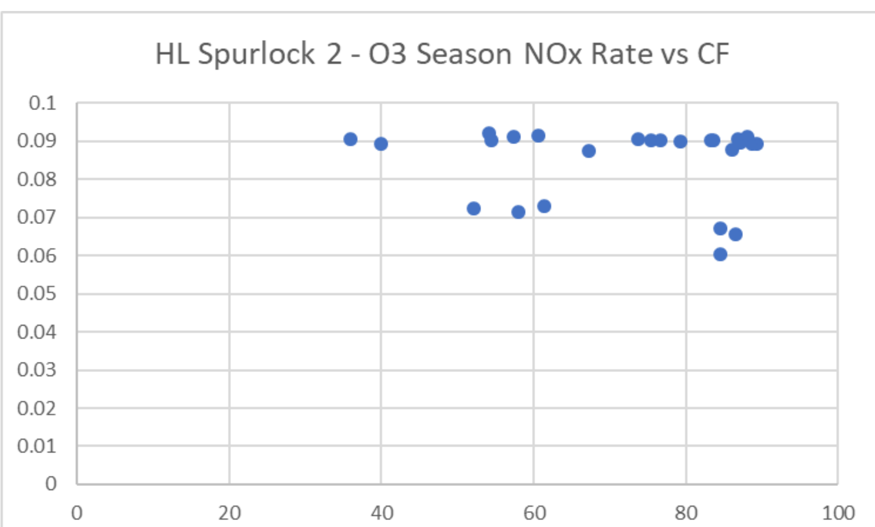


HL Spurlock 2: Unit 2 (592 MW) at the Spurlock 2 plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates of 0.09 lb/MMBtu.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
HL Spurlock	1	358	0.0707	0.0936	0.0912
HL Spurlock	2	592	0.0604	0.1290	0.0921

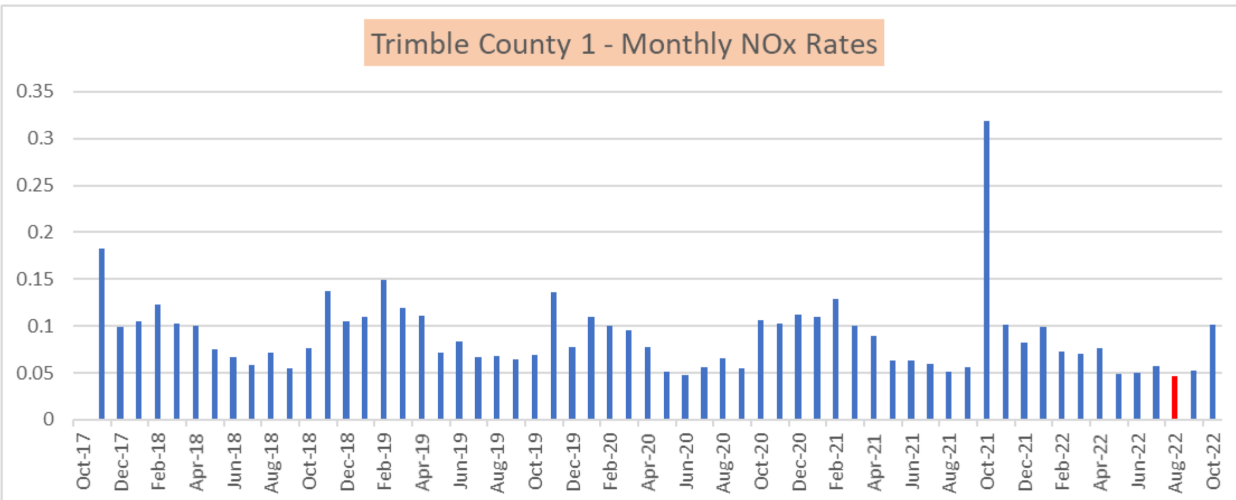


The chart above confirms that Spurlock Unit 2 reliably achieves NOx emissions of below 0.09 lb/MMBtu, and has maintained NOx emissions of below 0.08 lb/MMBtu during the 2022 ozone season, with a low of 0.0604 lb/MMBtu, shown in red. The chart below shows that Spurlock 2 has achieved less than 0.09 lb/MMBtu and below over a range of ozone-season operating capacity factors.

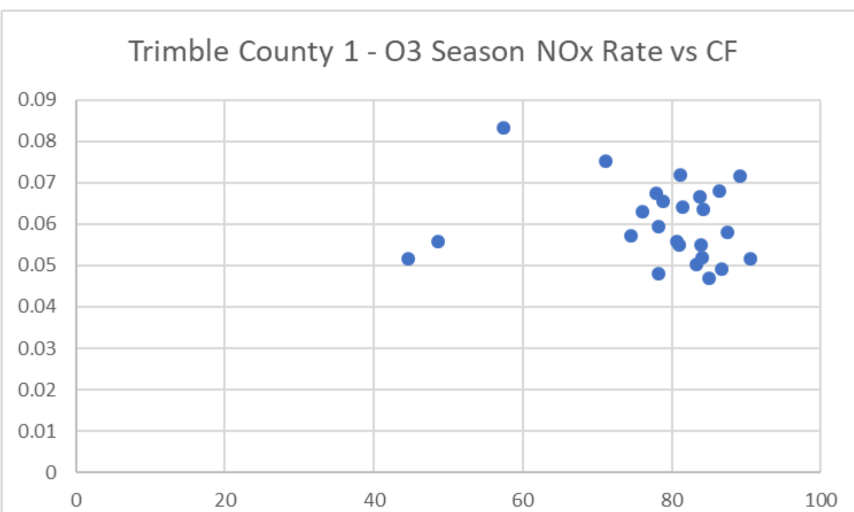


TC 1: Unit 1 (566 MW) at the Trimble County plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates of 0.07 lb/MMBtu and below, regularly achieving approximately 0.05 lb/MMBtu during ozone seasons 2022, 2021, and 2020. It is clearly not operating its SCR according to the SCR's NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Trimble County	1	566	0.0470	0.3192	0.0832
Trimble County	2	834	0.0257	0.3788	0.0757

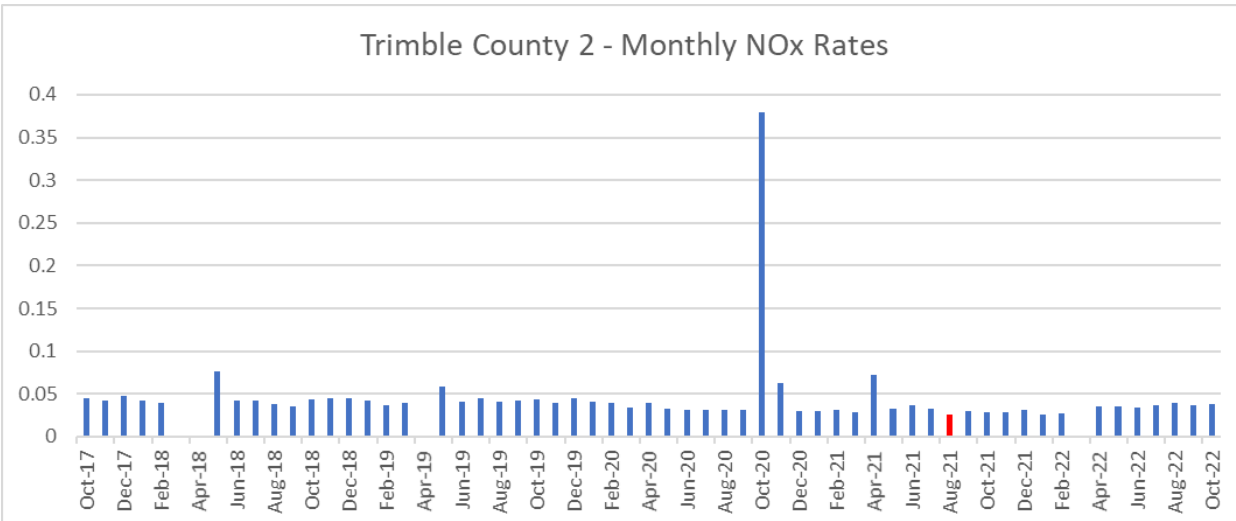


The chart above confirms that Trimble County 1 has achieved levels below 0.05 lb/MMBtu, with a low of .0470 lb/MMBtu, shown in red. The chart below shows that Trimble County 1 has achieved less than 0.05 lb/MMBtu over a range of ozone-season operating capacity factors.

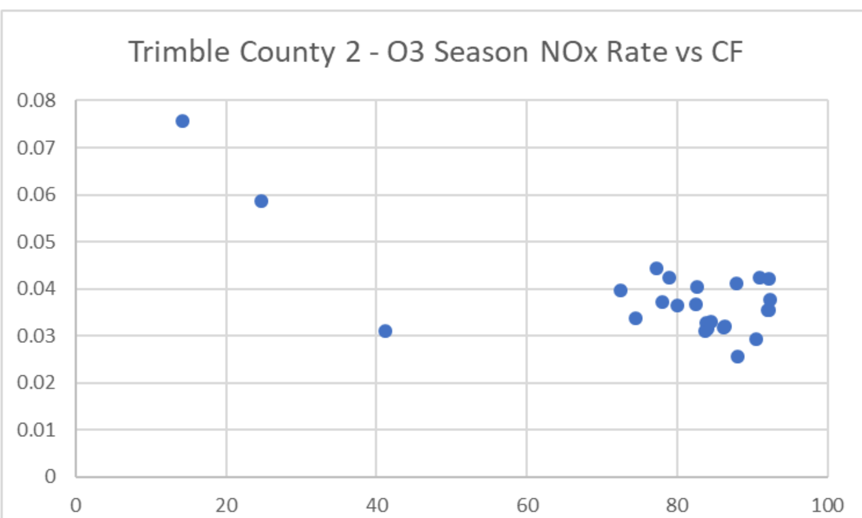


TC 2: Unit 2 (834 MW) at the Trimble County plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates below 0.05 lb/MMBtu.

Plant	Unit	MW	NOx, Min	NOx, Max	NOx, Max 03 Months
Trimble County	1	566	0.0470	0.3192	0.0832
Trimble County	2	834	0.0257	0.3788	0.0757

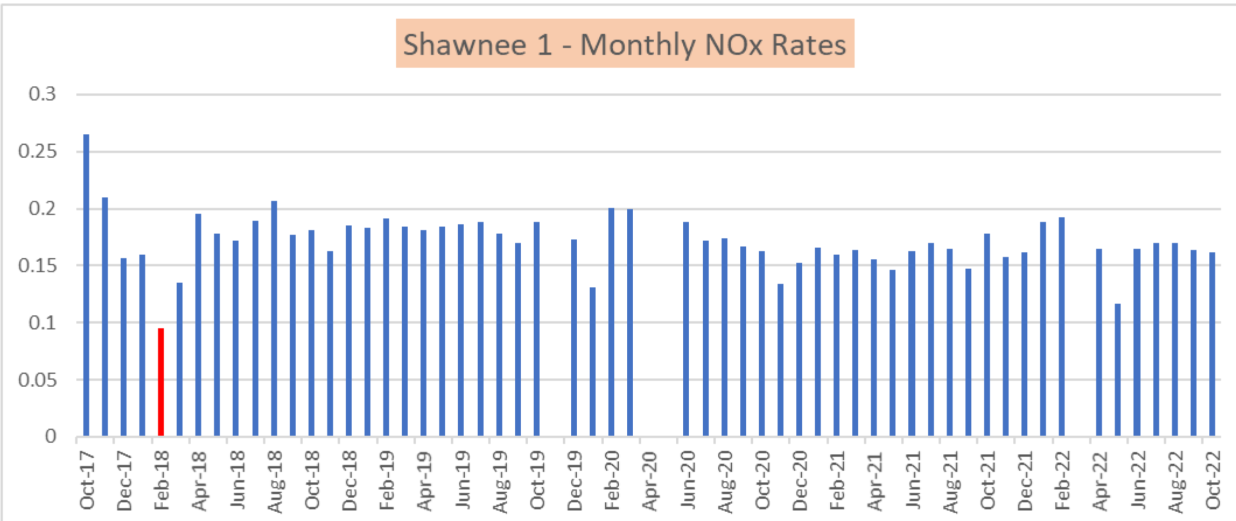


The chart above confirms that Trimble County 2 has often achieved levels well below 0.05 lb/MMBtu, with a low of .0257 lb/MMBtu, shown in red. The chart below shows that Trimble County 2 has achieved less than 0.05 lb/MMBtu over a range of ozone-season operating capacity factors.

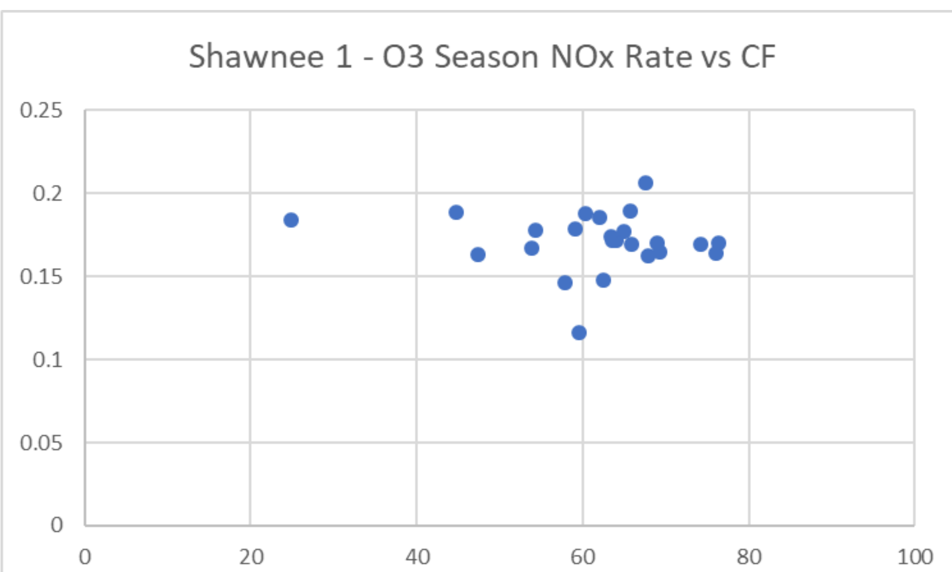


Shawnee 1: Unit 1 (175 MW) at the Shawnee plant was analyzed. It has SCR installed. Its NOx emissions rates, which are regularly above 0.15 lb/MMBtu, are inconsistent with the capabilities of SCR technology.

Plant	Unit	MW	NOx, Min	Nox, Min (Historical)*	NOx, Max	NOx, Max 03 Months
Shawnee	1	175	0.0954	N/A	0.2655	0.2063
Shawnee	4	175	0.1045	0.1045	0.2517	0.2057

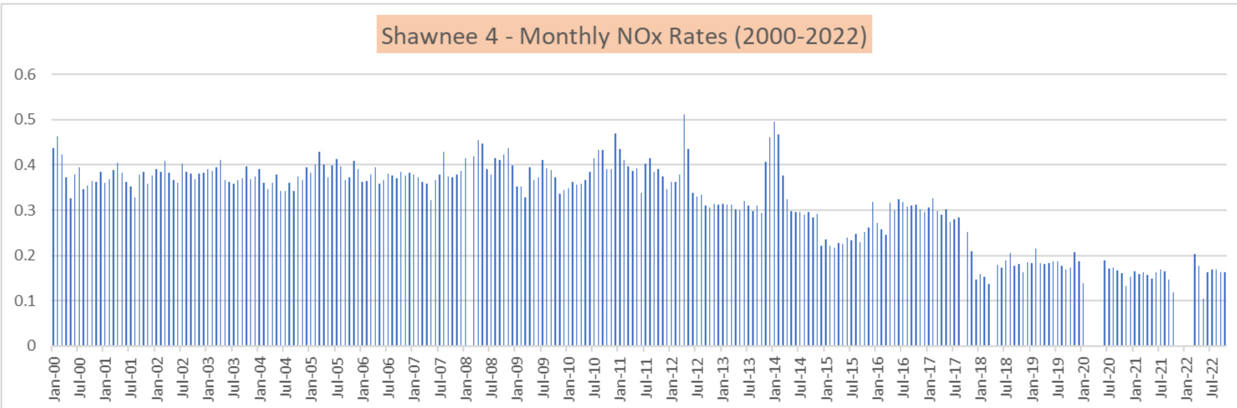


The chart above confirms that Shawnee 1 has consistently exceeded 0.15 lb/MMBtu, and on occasion has been shown to reduce NOx emissions rates to below 0.10 lb/MMBtu, with a low of .0954 lb/MMBtu, shown in red. The chart below shows that Shawnee 1's high emission rates are consistent over a wide range of ozone-season operating capacity factors.

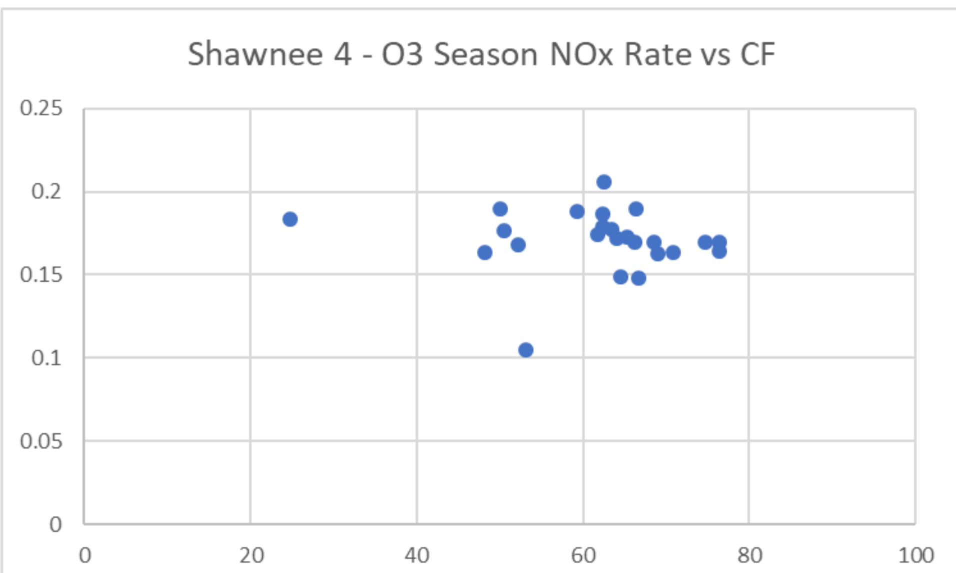


Shawnee 4: Unit 4 (175 MW) at the Shawnee plant. It has SCR installed. Its NOx emissions rates, which are regularly above 0.15 lb/MMBtu, are inconsistent with the capabilities of SCR technology.

Plant	Unit	MW	NOx, Min	Nox, Min (Historical)*	NOx, Max	NOx, Max 03 Months
Shawnee	1	175	0.0954	N/A	0.2655	0.2063
Shawnee	4	175	0.1045	0.1045	0.2517	0.2057

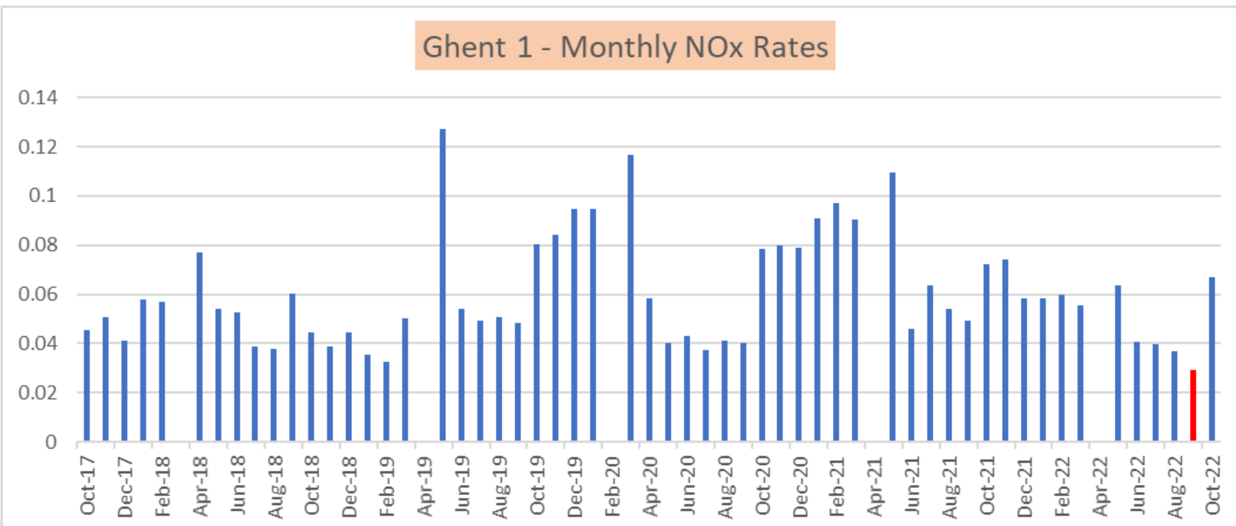


The chart above confirms that Shawnee 4 consistently emits at very high NOx emissions rates, often in excess of 0.15 lb/MMBtu, even during ozone seasons, with a low of .1045 lb/MMBtu, shown in red. The chart below shows that Shawnee 4's high emission rates are consistent over a wide range of ozone-season operating capacity factors.

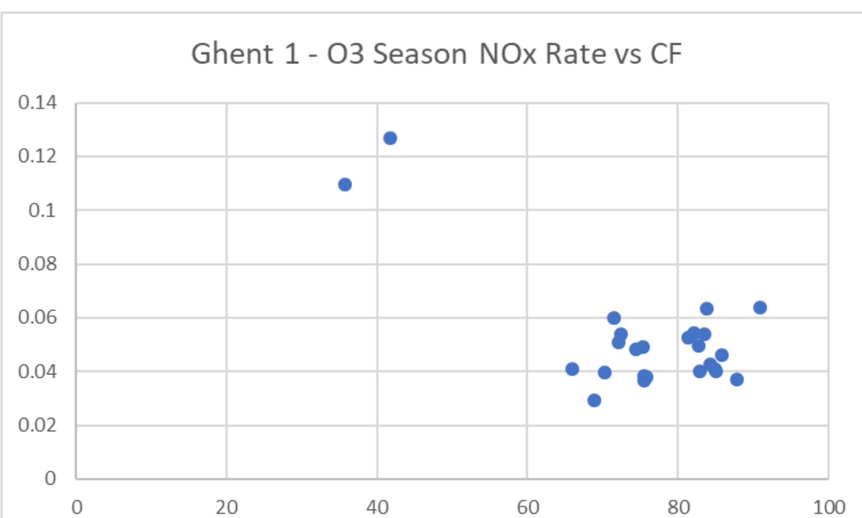


Ghent 1: Unit 1 (557 MW) at the Ghent plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates of below 0.04 lb/MMBtu. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capabilities, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	Nox, Min (Historical)*	NOx, Max	NOx, Max 03 Months
Ghent	1	557	0.0292	N/A	0.1271	0.1271
Ghent	2	556	0.1383	0.1362	0.3045	0.2192
Ghent	3	557	0.0627	N/A	0.3012	0.2059
Ghent	4	556	0.0268	N/A	0.1504	0.0842

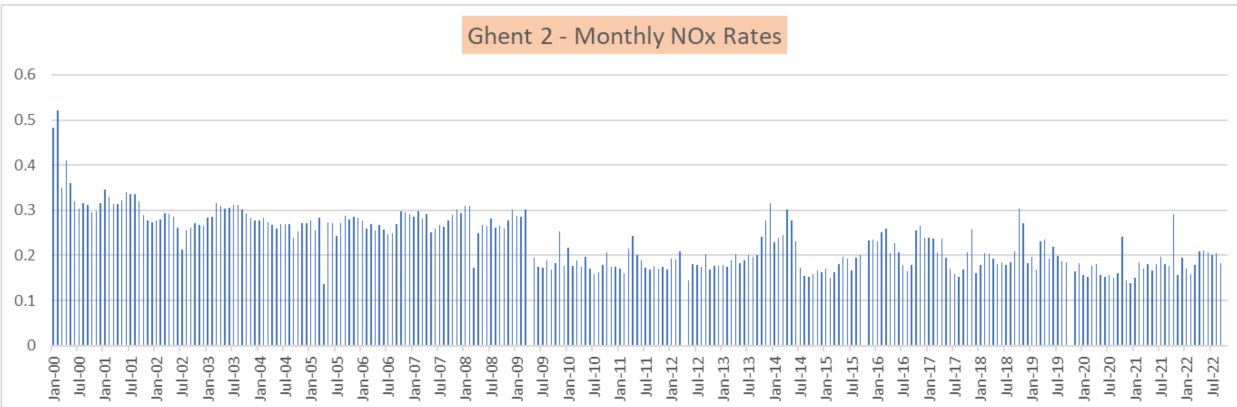


The chart above confirms that Ghent 1 has achieved levels below 0.04 lb/MMBtu, with a low of .0292 lb/MMBtu, shown in red. The chart below shows that Ghent 1 has achieved less than 0.04 lb/MMBtu over a range of ozone-season operating capacity factors.

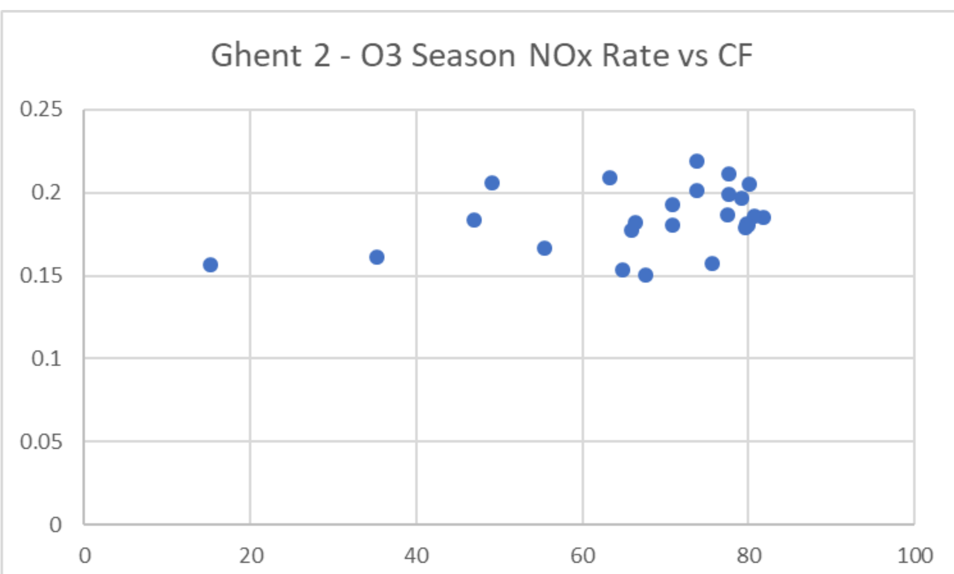


Ghent 2: Unit 2 (556 MW) at the Ghent plant was analyzed. It has SCR installed. Its NOx emissions rates, which are regularly above 0.15 lb/MMBtu, are inconsistent with the capabilities of SCR technology.

Plant	Unit	MW	NOx, Min	Nox, Min (Historical)*	NOx, Max	NOx, Max 03 Months
Ghent	1	557	0.0292	N/A	0.1271	0.1271
Ghent	2	556	0.1383	0.1362	0.3045	0.2192
Ghent	3	557	0.0627	N/A	0.3012	0.2059
Ghent	4	556	0.0268	N/A	0.1504	0.0842

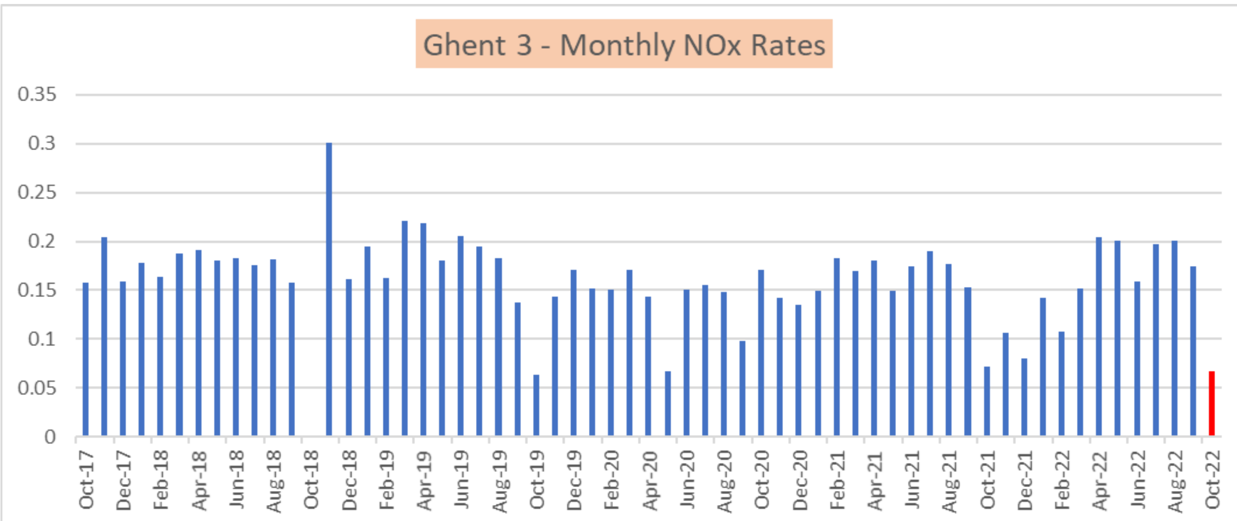


The chart above confirms that Ghent 2 consistently emits at very high NOx emissions rates, often in excess of 0.15 lb/MMBtu, even during ozone seasons, with a low of .1383 lb/MMBtu, shown in red. The chart below shows that Ghent 2's high emission rates are consistent over a wide range of ozone-season operating capacity factors.

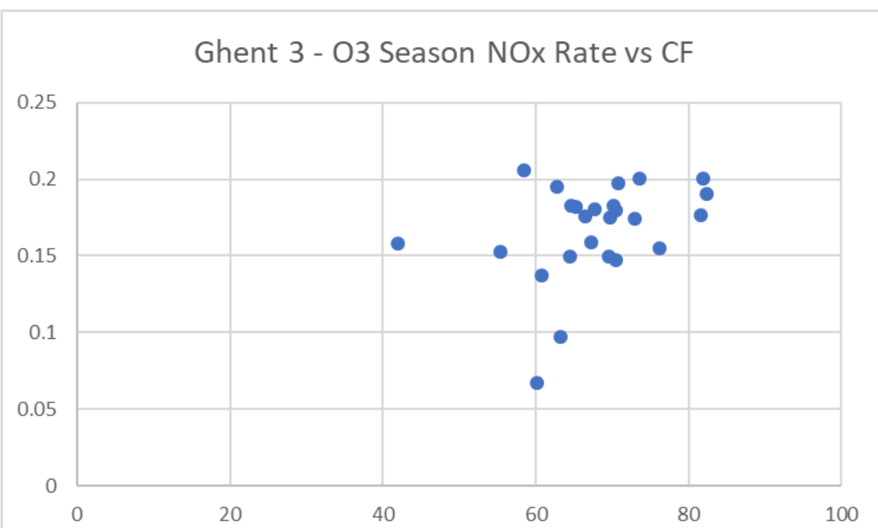


Ghent 3: Unit 3 (557 MW) at the Ghent plant was analyzed. It has SCR installed. Its NOx emissions rates, which are regularly above 0.15 lb/MMBtu, are inconsistent with the capabilities of SCR technology.

Plant	Unit	MW	NOx, Min	Nox, Min (Historical)*	NOx, Max	NOx, Max 03 Months
Ghent	1	557	0.0292	N/A	0.1271	0.1271
Ghent	2	556	0.1383	0.1362	0.3045	0.2192
Ghent	3	557	0.0627	N/A	0.3012	0.2059
Ghent	4	556	0.0268	N/A	0.1504	0.0842

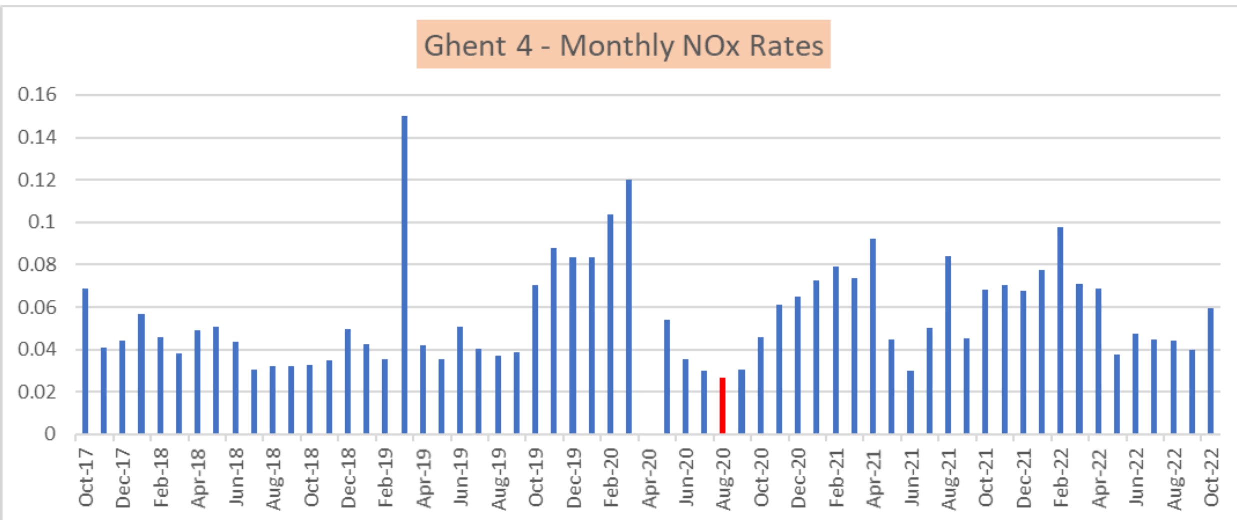


The chart above confirms that Ghent 3 consistently emits at very high NOx emissions rates, often in excess of 0.15 lb/MMBtu, even during ozone seasons, with a low of .0627 lb/MMBtu, shown in red. The chart below shows that Ghent 3's high emission rates are consistent over a wide range of ozone-season operating capacity factors.

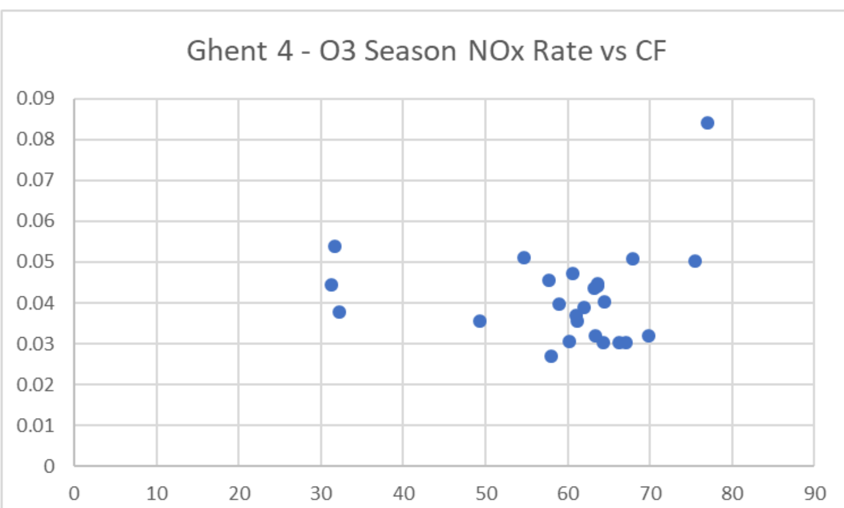


Ghent 4: Unit 3 (556 MW) at the Ghent plant was analyzed. It has SCR installed. It can reliably achieve NOx emission rates below 0.04 lb/MMBtu. It is not operating its SCR consistently in accordance with its lowest demonstrated NOx reduction capacity, and it is not because of low capacity factor nor MOT issues as the charts below make clear.

Plant	Unit	MW	NOx, Min	Nox, Min (Historical)*	NOx, Max	NOx, Max 03 Months
Ghent	1	557	0.0292	N/A	0.1271	0.1271
Ghent	2	556	0.1383	0.1362	0.3045	0.2192
Ghent	3	557	0.0627	N/A	0.3012	0.2059
Ghent	4	556	0.0268	N/A	0.1504	0.0842



The chart above confirms that Ghent 4 has often achieved levels below 0.04 lb/MMBtu, with a low of .0268 lb/MMBtu, shown in red. The chart below shows that Ghent 4 has achieved less than 0.04 lb/MMBtu over a wide range of ozone-season operating capacity factors.



ATTACHMENT 8

BUSINESS

Texas regulators often downplay major pollution sources as companies sidestep permitting process

By **Dylan Baddour**, **Martha Pskowski**, **Alejandra Martinez**, *Inside Climate News, Texas Tribune*
Dec 26, 2023

Gift Article

An air monitor being installed in 2021 at San Pedro Episcopal Church in Pasadena. A study found than an ITC facility never underwent the process required by federal law for major pollution sources, which is aimed at preventing current air pollution hazards in places like Pasadena from getting worse.
Jon Shapley, Houston Chronicle / Staff photographer

When the Intercontinental Terminals Co. sought a permit to expand its Pasadena tank farm and terminal on the Houston Ship Channel in 2014, a reviewer with Texas' environmental regulator expressed a long list of concerns.

ITC, the reviewer for the Texas Commission on Environmental Quality wrote, appeared to be evading core provisions of federal environmental law by dividing its "major" facility among nominally separate "minor" permits, which have less stringent pollution standards requirements and require far less review.

In Greater Houston, federal authorities had set a threshold at 25 tons per year of volatile organic compound emissions. Any company wanting to release more was required to undergo a tedious, expensive application process, established in the Clean Air Act, as a so-called “major source.”

ITC had already obtained permits for its first group of chemical tanks in 2012 for 24.9 tons per year of volatile organic compound emissions in 2014. Now it was asking to permit a second group for another 24.9 tons per year. Because both groups fell conveniently just under the EPA’s threshold, neither were subject to a federal program called New Source Review, or NSR.

“We have concerns about NSR circumvention,” wrote the permit reviewer, Jesse Lovegren, in a July 2014 email to other agency staff.

Nevertheless, ITC got its permit the next year. And in 2017, it got another for an even larger expansion, bringing its authorized emissions of volatile organic compounds up to 147 tons per year — almost six times Houston’s current major source threshold.

Yet the facility never underwent the process required by federal law for major sources, which is aimed at preventing current air pollution hazards in places such as

Greater Houston from getting worse.

It wasn't an isolated error, according to attorneys and regulatory experts in Texas and beyond, but an example of a systemic problem with emissions permitting in the Lone Star State, seat of the nation's largest oil, gas and petrochemical sectors. By exploiting the legal distinction between major and minor pollution sources, lawyers have argued repeatedly in court papers, companies can dodge pillars of the country's landmark environmental laws.

"This is sort of a foundational problem with Texas permitting, and it's leading to a lot of harm," said Gabriel Clark-Leach, a former staff attorney for the Environmental Integrity Project, a nonprofit law firm based in Austin. "It's so important for sources to be considered minor because it makes the whole permitting process less expensive and it makes operation of the plant less expensive."

Inside Climate News compiled 10 recent cases involving allegations that the TCEQ characterized major pollution sources as minor. An investigation by ICN and the Texas Tribune, based on hundreds of pages of government and court records and dozens of interviews, revealed numerous ways in which large companies sidestep major source permitting:

They may, like ITC, characterize different parts of their facilities as independent minor sources; they may dramatically underestimate the amount of pollution they say they will emit; they may classify their emissions in unregulated categories; or they may use retroactive amendments to change the conditions of original permits after facilities are built.

'A total pass'

Clark-Leach said he saw companies use these tactics during each of his 13 years with EIP but that legal challenges were rarely successful. He and other public interest attorneys have alleged in legal filings that the TCEQ often acts to facilitate the maneuvers.

They also named another, unexpected agency as complicit in lax permitting: the Environmental Protection Agency.

While regulators in many other states also neglect to stop companies from evading major permits, said Ryan Maher, an attorney who has studied the problem for two years on a grant from the Funder Collaborative on Oil and Gas, what sets Texas apart is the EPA's unwillingness to intervene, especially in application and enforcement of nonattainment limits.

“Texas is given a total pass,” said Maher, who works for the Center for Biological Diversity in Maine. “Texas oil and gas is getting a huge handout relative to the rest of the country.”

In September, Clark-Leach filed a petition with the EPA denouncing TCEQ's handling of ITC, then left the Environmental Integrity Project, frustrated and discouraged. Now Clark-Leach is writing a play while he contemplates his future.

"It's been really tough trying to attack the TCEQ's abuses. That's one of the reasons why I threw my hands up and left. I didn't see any way forward on this issue, which is a major issue," he said.

The TCEQ, headed by three appointees of Gov. Greg Abbott, grants thousands of pollution permits each year, including hundreds for major sources. The 10 cases analyzed in this investigation constitute a tiny fraction of those permits. In most of them, nonprofit watchdogs or federal regulators alleged improper use of minor source permits to authorize major sources; in others, companies utilized legal loopholes to avoid more stringent pollution controls.

In one case, the EPA rejected Texas' proposed permit for a seawater desalination plant at the Port of Corpus Christi, saying the TCEQ had mischaracterized it as a minor source; TCEQ issued the permit anyway.

In another, a Gulf Coast gas liquefaction plant received a minor source permit to annually emit 6 tons of nitrogen oxides, then released more than 120 tons during its first year of operation.

In another, an 80-year-old West Dallas shingles plant faced community outrage and EPA objections over its major source permit renewal, so it voided its application and applied as a minor source, which doesn't require public input or federal oversight.

In another, a gas booster station and emergency gas flaring operation in West Texas with a minor source permit to release 0.01 tons per year of sulfur dioxide emitted more than 250 tons per year, the major source threshold, in “excess” emissions each year from 2017 to 2020.

EPA Region 6 spokesperson Jennah Durant, responding to criticism about the agency’s failure to hold TCEQ accountable, said Texas holds “authority to implement most environmental programs and regulations in the state,” while EPA retains “oversight authority.”

“EPA welcomes any specific input or correspondence regarding the execution of these roles,” Durant said.

Inside Climate News shared its findings with the TCEQ, but the agency declined to comment on any of the specific examples.

TCEQ spokesperson Richard Richter wrote in an email that the process of evaluating pollution permit applications “consists of a highly complex review,” including “in-depth analyses of many factors including, but not limited to, Best Available Control Technology, emission rate calculations, off-property impacts analysis, major new source review applicability, and review of applicable state and federal rules.”

The process typically involves requests for more information or design changes from the TCEQ and a lengthy back-and-forth with the applicant, Richter said. “After this detailed process is complete, TCEQ issues authorizations that are in compliance with all rules and regulations.”

Richter said specific questions from Inside Climate News “are either better suited for EPA or will require a Public Information Request.”

“TCEQ doesn’t have any additional comments regarding your report,” he said.

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By **Dylan Baddour**

Dylan Baddour is a reporter for Inside Climate News covering the energy sector and environmental justice in Texas.

Born in Houston, he's worked the business desk at the Houston Chronicle, covered the U.S.-Mexico border for international outlets and reported for several years from Colombia for media like The Washington Post, BBC News and The Atlantic. He also spent two years investigating armed groups in Latin America for the global security department at Facebook before returning to Texas journalism.

Baddour holds bachelor's degrees in journalism and Latin American studies from the University of Texas at Austin. He has lived in Argentina, Kazakhstan and Colombia and speaks fluent Spanish.

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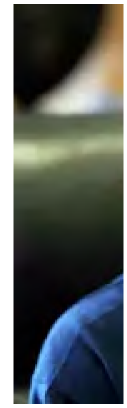

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