The Long Shadow of Oil Refinery Waste

Petroleum Coke's Polluting Role in U.S. Industry

ENVIRONMENTAL INTEGRITY PROJECT

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In Port Arthur, on the Gulf Coast in southeast Texas, a nearly 90-year-old petroleum coke processing plant called Oxbow Calcining, owned by billionaire William Koch, lacks pollution control devices called 'scrubbers.' The plant releases health-damaging sulfur dioxide air pollution into a community that is majority people of color.

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EXECUTIVE SUMMARY

Modern life relies on countless materials that are used to create buildings, cars and airplanes, electronics, appliances, and so much more. While we benefit from these finished products, the impacts of making them on air, water, health, and the climate are not always obvious. This is certainly the case with metals, which start with rock, coal, and oil that have to be extracted from deep underground and then transformed into usable products through industrial processes that generate air and water pollution.

One example of an industrial material that has a big impact but is frequently in the shadows is a dirty oil-based substance that is a waste product from oil refineries: petroleum coke or "petcoke." The aluminum, steel, and other industries (e.g., brick and paint) rely on this carbon-dense, highly-polluting substance. As these industries continue to expand, petcoke causes more and more air and water pollution in the local communities where it is produced and used, contributes to climate change, and perpetuates incentives to keep drilling for oil.

Petcoke is the "bottom of the barrel" by-product that's left behind after refineries extract gasoline, diesel, and other higher-value products from crude oil. Rather than having to manage huge amounts of petcoke as waste, oil refineries sell it. Worldwide, an estimated 80 percent of petcoke is classified as "fuel grade," burned mostly to run power plants and cement factories.[1] Refineries keep some to fuel their own operations and the rest is used by a wide range of industries.

Lack of Pollution Controls on Petcoke Plants

73 percent (8 of 11) of petroleum coke processing plants* in the U.S. lack basic pollution control devices called "scrubbers" that have been used by other industries for decades to reduce deadly sulfur dioxide air pollution.

6 of the 8 plants lacking scrubbers are in disadvantaged communities.

*Stand-alone petcoke processing (or "calcining") plants, not including calcining plants that are part of oil refineries or other facilities.

Petcoke contains carbon, sulfur, and heavy metals like nickel and mercury—all of which make it a very dirty product with big pollution impacts when it is burned or further processed for industrial use. On top of this, oil refineries themselves release benzene, a carcinogen, and other dangerous substances into nearby communities.[2] Dust blowing off of huge piles of petcoke at refineries, transport depots, and processing plants can cause respiratory problems for nearby communities.[3]

For example, in Kremlin, Oklahoma, a 60-year-old petcoke processing plant owned by billionaire William "Bill" Koch's Oxbow Calcining releases enough sulfur dioxide (SO_2) to generate smog that impacts the health of residents and haze that reduces visibility in many other states—but the company has refused to install the modern pollution control devices called "scrubbers" that would slash pollution. Oxbow has also refused to install the equipment at its petcoke plant in Port Arthur, Texas, despite causing exceedances of federal air quality standards for SO_2 and poisoning the air for nearby communities.

In Gramercy, Louisiana, a plant owned by Rain CII Carbon transfers and stores huge piles of petcoke containing heavy metals like nickel, which is blown by wind into nearby communities and the Mississippi River. About three hours west, three petcoke processing plants in Calcasieu Parish, Louisiana, contribute to air and water pollution in a community already plagued by some of the highest cancer rates in the state.

The U.S. is one of the world's largest producers and importers of crude oil. It is therefore unsurprisingly also the single largest producer of petcoke, producing nearly 40 percent of the world's supply, about 51 million metric tons, in 2021.[4] That's equivalent to the weight of about 250 large cruise ships.[5] The U.S. exports most of its petcoke, nearly 70 percent in 2022, to other countries.[6] This contributes to degraded air quality and health impacts for communities across the globe.

About a third of the petcoke that is marketed in the U.S. is used by the domestic aluminum industry, which is the

The Baton Rouge Calcining Plant is one of seven high-polluting petroleum coke processing facilities clustered in Louisiana.

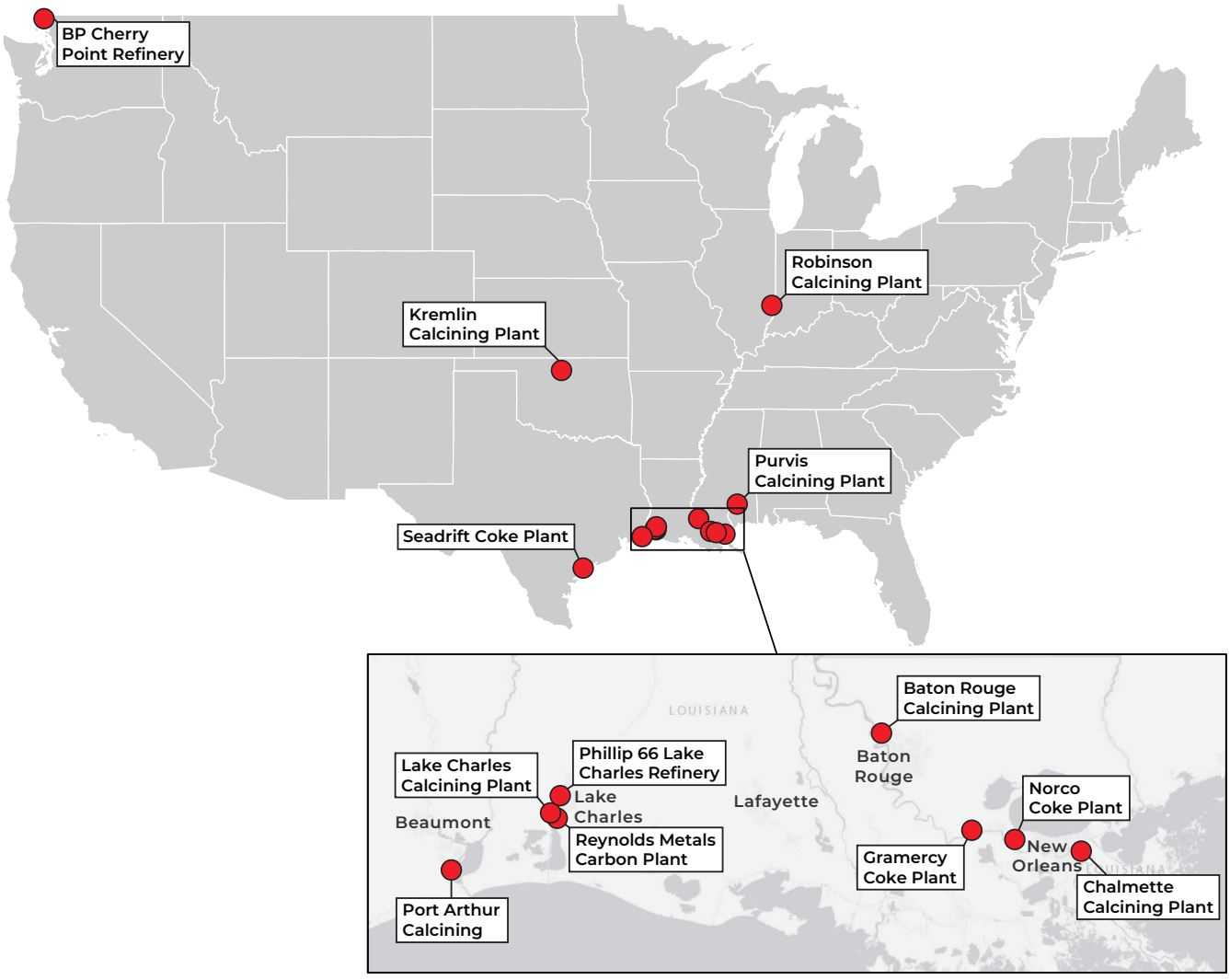
central focus of this report.[7] But the aluminum industry, as well as steel and other industries, do not use regular fuel-grade petcoke. Instead, they rely on a special type of processed petcoke, called "calcined" petcoke. Calcining involves taking "green" (or raw) petcoke from oil refineries and heating it in kilns and furnaces to very high temperatures—up to 2500°F, nearly 12 times the temperature of boiling water.[8]

This process burns off heavy hydrocarbons and sulfur, resulting in a dense, rock-like, nearly pure carbon product that is capable of conducting electricity in devices needed to make metals. These devices are called "anodes" for aluminum and "electrodes" for steel. Calcined petcoke is also used as an additive to increase the carbon content and hardness of steel and to make paint, chemicals, paper, and fertilizers.[9]

The accelerating demand for aluminum and steel are the major drivers of calcined petcoke markets, which are projected to see significant price and revenue growth in the coming years.[10] It takes about half a ton of calcined petcoke to create one ton of new aluminum.[11] Worldwide, the aluminum industry uses about three-quarters of the world's calcined petcoke.[12] In 2023, the U.S. produced about 13 million tons of it, equivalent to the weight of 65 large cruise ships.[13]

As shown in the map below, 11 stand-alone calcining plants are currently operating in the U.S. (six in Louisiana, two in Texas, and one each in Illinois, Mississippi, and Oklahoma). In addition, two oil refineries, in Washington State and

Map 1: Petroleum Coke Processing ("Calcining") Plants



Louisiana, operate calcining units.[14] Almost all of the plants are owned by two large companies: Oxbow Calcining, which is owned by politically active billionaire William "Bill" Koch; and a global firm called Rain CII Carbon. (See Appendix A for more details on the facilities.)

Most of the petcoke calcining plants in the U.S. are very old and were built between 1935 and 1983. Unfortunately, their advanced age means that they have generally escaped key provisions of the Clean Air Act that apply to the construction of new facilities. In addition, EPA has failed to establish pollution standards for the industry that require the use of modern technology. This means that these dirty plants often operate with weak pollution limits and minimal pollution controls that don't protect air and water quality.

Petcoke processing facilities in the U.S. released nearly **57,000 tons** of sulfur dioxide air pollution in 2022.

Calcining plants release large volumes of air pollution during the process of superheating petcoke to high temperatures in kilns. As a result, they are often the leading sources of pollution in the county or parish where they are located. Most of the stand-alone calciners rank as the number one source of SO_2 and account for large proportions of that pollutant reported by all industrial sources in that area. The calciners also rank high for fine particulate matter (PM2.5).

SO_2 reduces respiratory function, damages trees and vegetation, generates smog that harms health, impairs visibility in scenic areas, and contributes to the acid rain that harms vegetation, fish, and wildlife.[15] PM2.5 is a leading cause of asthma, heart attacks, and other respiratory and cardiovascular problems and carries toxic pollutants and metals through the air and into lungs.[16] Calcining plants also have the distinction of emitting substantial volumes of hydrochloric acid gas (also called hydrogen chloride), which can irritate and damage the eyes, skin, nose, and respiratory tract.[17]

Despite these hazards, only three of the 11 stand-alone calcining plants operate with air pollution control equipment (called "scrubbers") designed to reduce SO_2 and other gases (like hydrochloric acid) that have been widely used by power plants and other industries for decades.

Calcining plants also stand out for releasing thousands of pounds of two metals: nickel and vanadium, a hard, silvery element found in oil, coal, and other natural substances. These metals attach to particulate matter and, when inhaled, can damage the respiratory system. The calcining plants are among the top emitters of vanadium nationally, with eight ranking among the top 20 facilities out of 342 reporting releases of the metal to EPA's Toxic Release Inventory (TRI) in 2022. Yet in most cases, companies have inadequate systems for controlling vanadium and nickel from the calcining process.

At the same time, the main source of pollution at the plants—the kilns where petcoke is superheated—are not subject to national emission standards for hazardous air pollutants under the Clean Air Act. These standards, which apply to many other industries, require operators to use technologies that reduce air emissions of pollutants with serious health and environmental impacts.

Petcoke calcining is an integral part of a dangerous industrial production chain that accelerates climate change. Petcoke is a waste product created by petroleum refineries, which accounted for over six percent of all the greenhouse gases that a wide range of industries reported to EPA in 2022.[18] Oil refineries are big climate polluters, releasing more greenhouse gases per facility than any other sector.[19] At the same time, the U.S. keeps producing

more oil, with production nearly 20 percent higher today than just five years ago.[20]

In 2024, EPA established a specific category in its greenhouse gas reporting rules for petcoke calcining plants in order to improve accounting for the industry's climate impact, since the methods operators have long been using to assess and report their pollution are inconsistent and potentially inaccurate.[21]

When it comes to water pollution, calcining plants are also getting a free pass to pollute. These plants discharge wastewater and stormwater, which contains pollutants associated with petcoke handling and processing. However, unlike many other industries, petcoke calciners are not covered by EPA's national water pollution standards (called "effluent limitation guidelines"), which require operators to limit the pollutants discharged into U.S. waters.

At least eight of the calcining plants we examined reported to the EPA that they directly discharge certain toxic pollutants into waterways, including benzo(g,h,i)perylene, which can be toxic for aquatic life.[22] State regulators have not required these plants to sample wastewater for those same pollutants much less limit this pollution. A facility owned by the Rain CII company in Robinson, Illinois, has reported discharging lead, a neurotoxin, into a nearby creek and the Rain CII Carbon plant in Chalmette, Louisiana, has reported releasing nickel, which is toxic to aquatic life, into the Mississippi River. But the permits for both of these plants do not set any limits on those toxic pollutants.[23]

9 of 11

petroleum coke processing plants in the U.S. are located in disadvantaged communities.

The lack of protection from calcining plant pollution spells bad news for nearby communities. According to EPA, residents living within three miles of nine of the calcining plants are considered "disadvantaged," with 35 percent living in poverty and 45 percent people of color when all the plants are considered together.[24] Making matters worse, many of these communities are already severely impacted by a host of large industrial polluters, including oil refineries and chemical manufacturers.

Recommendations

Petcoke calcining plants are allowed to operate without modern pollution standards that reduce emissions and protect our climate, and air, and water quality. In the absence of national standards, states have failed to reign in these polluting plants and companies have little incentive to change the way they operate. Key ways to address these problems include:

1. **STRENGTHEN AIR POLLUTION RULES: EPA should develop New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) for the petcoke calcining sector.** Two industrial sectors that bookend the petcoke calcining process—petroleum refining and aluminum production—are required to comply with technology-based standards for certain air pollutants, leaving a gaping regulatory hole in the middle. As a result, calcining plants avoid compliance with the safeguards that the Clean Air Act is supposed to provide for communities living near large polluters.
2. **INSTALL SCRUBBERS: Petcoke calciners should be required to install and operate modern-day air pollution control equipment.** In particular, different types of scrubbers and other technologies are available to remove SO_2 and hydrochloric acid emissions from the gas stream so that far less is released straight into the air. Power plants and other industrial facilities are required to install scrubbers—petcoke

calcining companies should be too. Regulators should also require all plants to use and maintain effective particulate matter controls for kiln emissions and better manage piles of petcoke stored onsite. For example, properly covering petcoke piles could help reduce windborne particulate matter, as well as toxins like nickel and vanadium carried by blowing dust.

3. **TIGHTEN WATER POLLUTION RULES: EPA should develop effluent limitation guidelines for petcoke calcining and limit the amount of pollution these plants can discharge into our waterways.** It appears that EPA has never considered developing national pollution limits for the petcoke calcining sector. At a minimum, EPA should examine whether the EPA should establish national pollution standards for the calcining industry. In addition, state regulators must comply with the Clean Water Act and set limits in discharge permits that reduce the amount of pollution flowing into our waterways.

4. **ADVANCE CLEANER TECHNOLOGIES: Aluminum companies should expedite production of metal made with a different type of electricity-conducting device (called "inert anodes") that do not require petcoke as an ingredient.**[25] In addition, Rain Carbon has developed petcoke pellets that are denser than raw petcoke and can decrease the amount of petcoke needed for calcining; the company has said the technology will be commercially available in 2024.[26]

A pile of petroleum coke is watered down to prevent dust from blowing into the nearby community. It was located at a petcoke transfer facility along the Calumet River on Chicago's southeast side.

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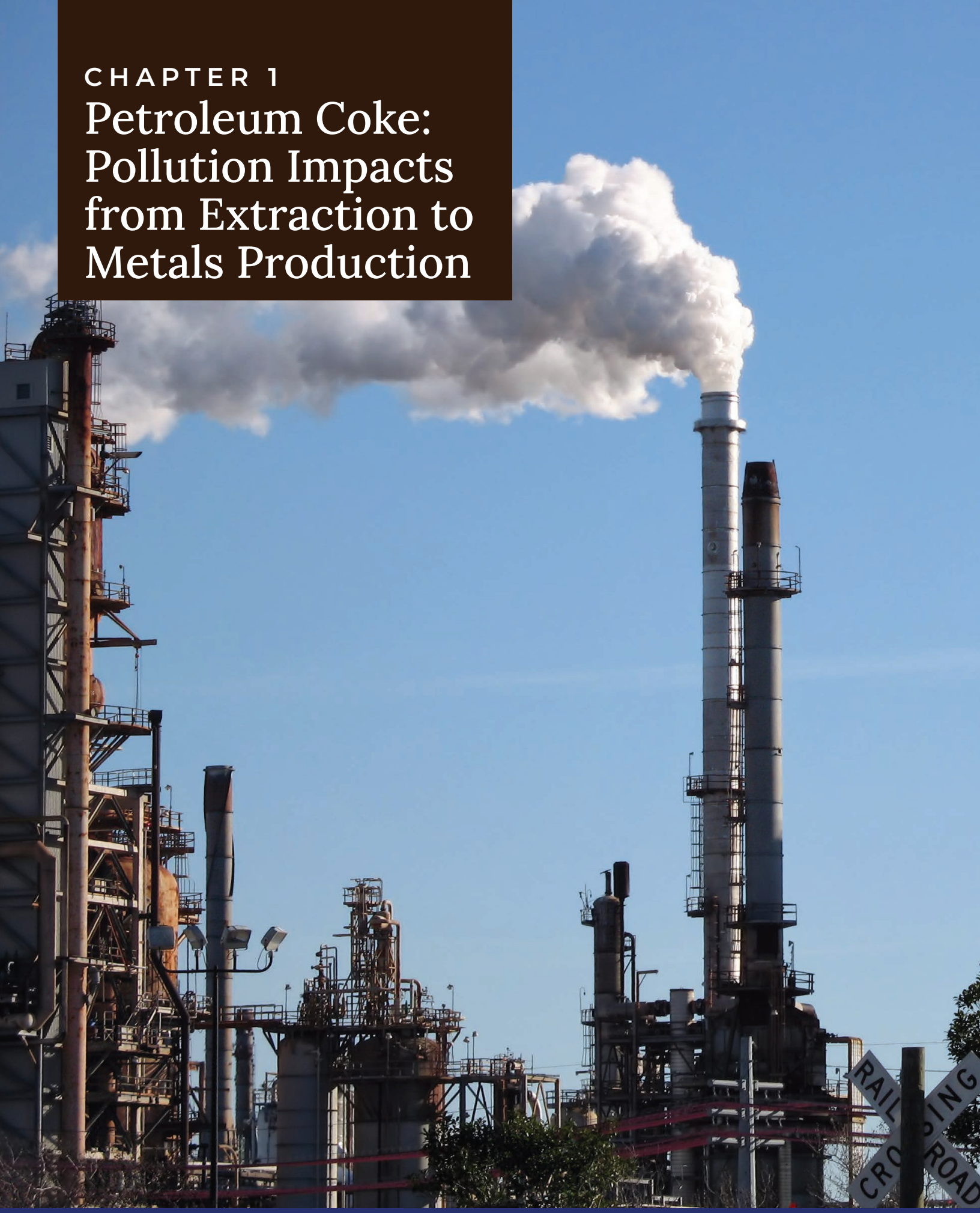
CHAPTER 1

Petroleum Coke: Pollution Impacts from Extraction to Metals Production



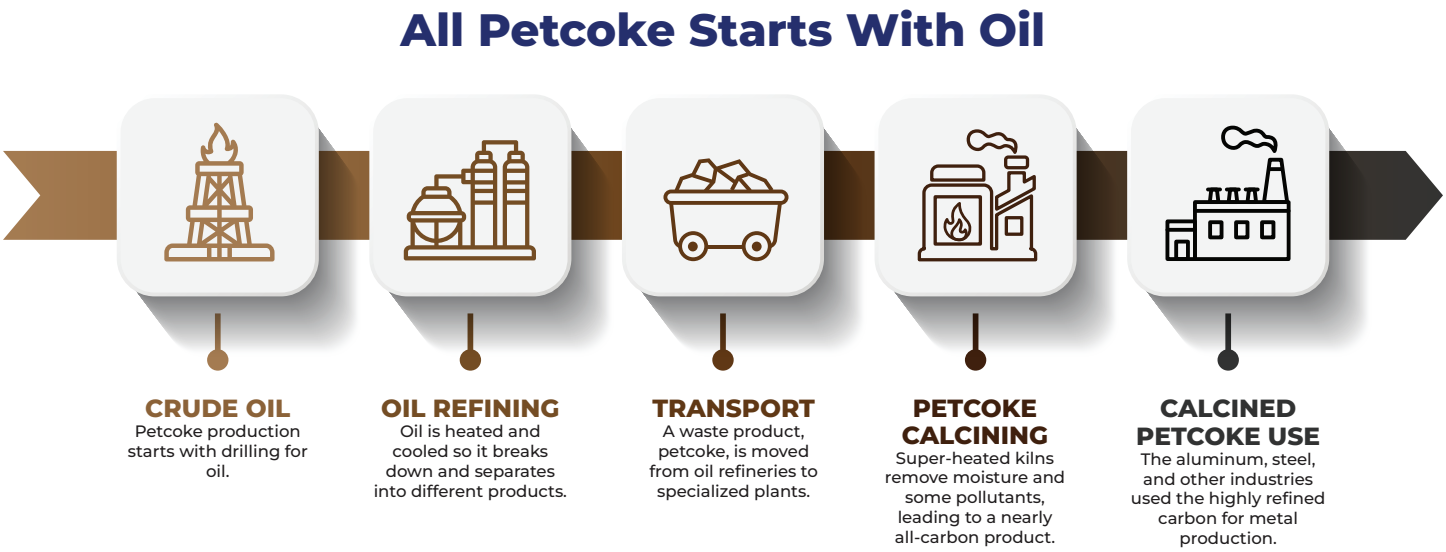
The Chalmette Calcining Plant in Louisiana processes petroleum coke for use by industry.

Petroleum Coke: Pollution Impacts from Extraction to Metals Production

From Oil Fields to Refineries

Drilling and extraction are just the starting point of oil's long journey and transformation into different products. One of these end uses is petroleum coke, or petcoke, which is a "bottom of the barrel" by-product that's left behind after refineries extract gasoline, diesel, jet fuel, and other higher-value products from crude oil.

Petcoke is a rock-like, highly concentrated form of carbon laced with metals and toxic substances. Rather than having to store, manage, and dispose of huge amounts of dirty petcoke as a waste product, oil refineries take advantage of its many potential uses. Given that the U.S. is one of the world's largest producers and importers of crude oil, it is also unsurprisingly the world's largest single producer of petcoke, accounting for nearly 40 percent of global production, or about 51 million metric tons, in 2021.[27] That's equivalent to the weight of about 250 large cruise ships.[28]



Most petcoke is marketed with a "priced to move" strategy: cheap enough to get rid of large quantities and compete with coal as a fuel source.[29] An estimated 80 percent of petcoke produced worldwide is classified as "fuel grade" and used mostly to run power plants and cement factories, which also rely on coal.[30]

This proportion is almost as high when it comes to U.S. petcoke, with about 75 percent considered fuel grade.[31] A key difference is that only 12 power plants and other facilities in the U.S. use petcoke to generate electricity, compared to over 500 that rely on coal.[32]

Instead of using the fuel-grade petcoke it produces, the U.S. exports most of it, about 70 percent in 2023, which is a higher proportion than a decade ago despite the country producing somewhat less petcoke over time.[33] Although dozens of countries purchase all types of U.S. petcoke, over 40 percent of it was exported to just three, China, India, and Brazil.[34]

Table 1. U.S. Power and Industrial Plants that Use Petcoke to Generate Electricity (2023)

State	Plant Name	Plant Type*	Petcoke Burned (tons)
MI	DTE Electric Monroe	Power Plant	529,886
FL	Northside Generating Station	Power Plant	383,267
LA	Brame Energy Center	Power Plant	308,619
LA	R S Nelson	Power Plant	93,117
IA	University of Northern Iowa	Power Plant	3,770
WI	Manitowoc	Power Plant	21,272
MI	Alpena Cement Plant	Cement Factory	279,947
MT	Yellowstone Energy LP	Oil Refinery/Power Plant	273,755
OH	Toledo Ref Power Recovery Train	Oil Refinery	177,516
TX	Valero Refinery Corpus Christi West	Oil Refinery	19,701
TX	Seadrift Coke LP	Petcoke Calciner	14,017
IA	Roquette America	Wet Corn Mill	22,371

Source: Energy Information Administration, "Form EIA-923 detailed data with previous form data," 2023, available at: https://www.eia.gov/electricity/data/eia923/ *Additional petcoke use is GA and OH has been reported to EIA, but represents cumulative use for electricity across a range of small facilities, the number of which is unknown.

Most raw petcoke is made at oil refineries, which are highly polluting and release large volumes of benzene and other dangerous substances.[35] Because petcoke is essentially carbon and contains metals, sulfur, and other potentially polluting substances, it also has a big impact on air quality, health, and the climate when burned as fuel. Just how much of these substances are in petcoke and in what proportions varies considerably, largely depending on where the oil that refineries process comes from.

Heavier crudes, for example from the Canadian Tar Sands, yield more petcoke and have far higher sulfur content than lighter crudes, like from the Permian Basin of Texas. They also represent a greater climate impact, with an estimated 24 percent more carbon dioxide (CO_2) embedded in a barrel of tar sands bitumen (a thick, sticky form of oil) than in a barrel of light oil.[36]

Even while oil production in the U.S. surges, imports are still on the rise because of differences in the type of oil refineries need to produce different products.[37] The overall trend is for the U.S. to import heavier and export lighter crude oil.[38] In 2023, nearly 45 percent of U.S. oil imports were made up of heavy "sour" crude (i.e., with a high sulfur content), mostly from Canada and Mexico.[39]

Given the complexities of global oil production and markets, refineries face a conundrum when it comes to marketing petcoke. The heavier the oil, the less expensive it is, and the number of different petroleum products that can be extracted and marketed from it increases—but the higher an oil's sulfur and heavy metal content, the lower the resulting petcoke's quality and value for uses like metals manufacturing.[40]

Concerns around air quality and climate change have the potential to influence petcoke markets, just as they do the future of oil production broadly. In 2017, India banned the burning of petcoke for fuel because of pollution and health problems in several regions of the country, which led to restrictions on petcoke imports generally.[41] Notably, exceptions to the import restrictions were later instated for higher quality, lower-sulfur petcoke used to produce metals and electric vehicle batteries.[42] In 2024, China adopted an air pollution reduction plan that prohibited the use of fuel-grade petcoke with more than three percent sulfur.[43]

Such policies reflect petcoke's downside for health and the climate; when burned for fuel, petcoke releases higher levels of CO_2 and sulfur dioxide (SO_2) than coal.

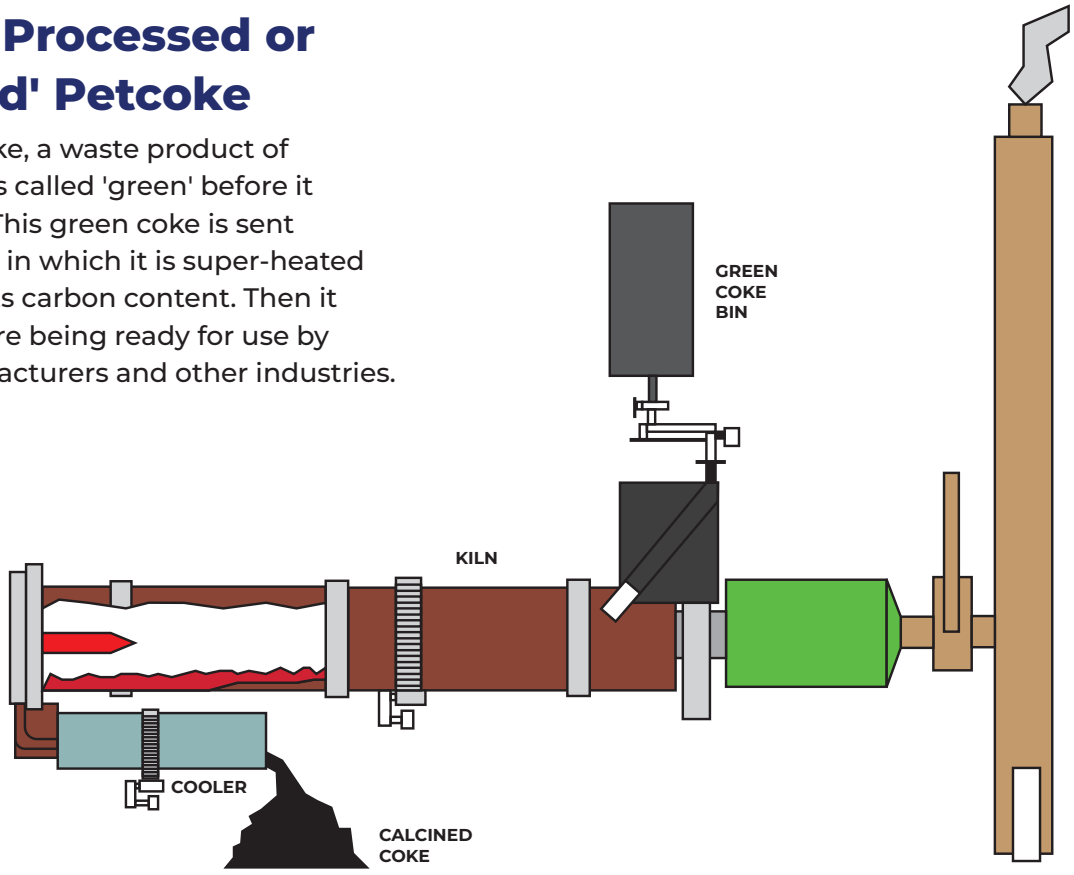
Table 2. Energy and Pollution Impacts, Petcoke vs. Coal

Fuel	Heat content (mmBtu per ton)	CO_2 (pounds per mmBtu)	SO_2 (pounds per ton) **
Petroleum coke	30	227	3.9-39
Bituminous coal*	25	205	3.8-38
Sub-bituminous coal*	17	214	3.5-35

Source: U.S. EPA, Emission Factors for Greenhouse Gas Inventories, Stationary Combustion; U.S. Energy Information Administration, Electric Power Annual Table, Sulfur Dioxide Uncontrolled Emission Factors. *Bituminous and sub-bituminous are the two most prevalent types of coal, accounting for 92% of production in the U.S. **Data based on EIA emission factors. The range represents emission rates from five types of boilers. Actual emission levels will vary depending on the sulfur content of the product.

Making Processed or 'Calcined' Petcoke

Petroleum coke, a waste product of oil refineries, is called 'green' before it is processed. This green coke is sent through a kiln in which it is super-heated to condense its carbon content. Then it is cooled before being ready for use by metals manufacturers and other industries.



Super-Heating Petcoke to Make New Products

Inventors have long known how to produce metals using dense carbon and other products. The core process and equipment used to refine, or calcine, petcoke was developed in the late 19th century and is still in use today.[44]

All of the calcined petcoke plants operating in the U.S. include a rotary kiln, a huge pipe-like structure that receives raw petcoke on one end and releases calcined petcoke on the other. These kilns are able to withstand the extreme temperatures needed to drive water, hydrocarbons, and metals out of petcoke: up to 2,500 degrees Fahrenheit,

nearly 12 times the temperature of boiling water.[45] They are generally fueled by both natural gas and some of the heat energy from the calcining process.

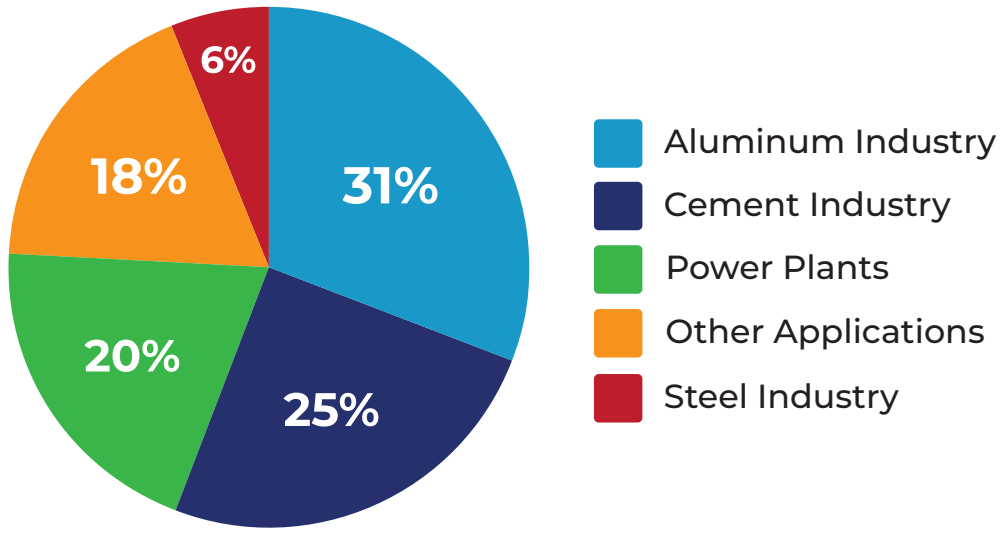
As their name implies, the kilns rotate and the gases generated (like SO_2) are released through a stack into the air. Then the superheated calcined petcoke flows into another chamber and is rapidly cooled down with water. An estimated ten percent of the raw petcoke that enters the kiln is ultimately burned away or lost.[46]

Aluminum and Steel Production Drive Demand for Processed Petcoke

The driving factor behind the production and use of calcined petcoke (as well as fluctuations in supply and price) is demand for the two metals that currently can't be made without it. As electric vehicles and solar energy are becoming more widespread, global production of new aluminum is on the rise, growing 50 percent between 2013 and 2023.[47] Production of new steel increased over 20 percent during the same period thanks to industries like construction, automaking, and shipping.[48] The electric vehicle industry also uses calcined petcoke to produce lithium-ion batteries.[49]

As Chart 1 shows, an estimated one-third of all raw petcoke produced in the U.S. in 2023 (about 16 million tons) was ultimately used by the aluminum industry, with steelmaking and other industries taking another quarter.[50] Although overall U.S. petcoke production is set to rise slightly in the coming years, the proportions of how it is used are expected to stay fairly constant.

Chart 1. Share of U.S. Petcoke Market by Application, 2023



Source: Global Market Insights, *Americas Petcoke Market Report*, 2023

Estimates of U.S. calcined petcoke production vary. Discrepancies may be due to a lack of detailed data on both production and sales and reliance by analysts on selected, self-reported data provided by companies, as well as a different number of facilities included in estimates.

In 2022, EPA stated that known petcoke calcining capacity in the U.S. is around five million tons per year.[51] But according to a leading market analysis, in 2023 the U.S. produced more than a third of the world's calcined petcoke—about 13 million tons, equivalent to the weight of 65 large cruise ships.[52] The number of producing facilities recently declined after two oil refineries in California shut down calcining operations, one of which shut

down petcoke production entirely because it's converting its facility to refine biofuels.[53]

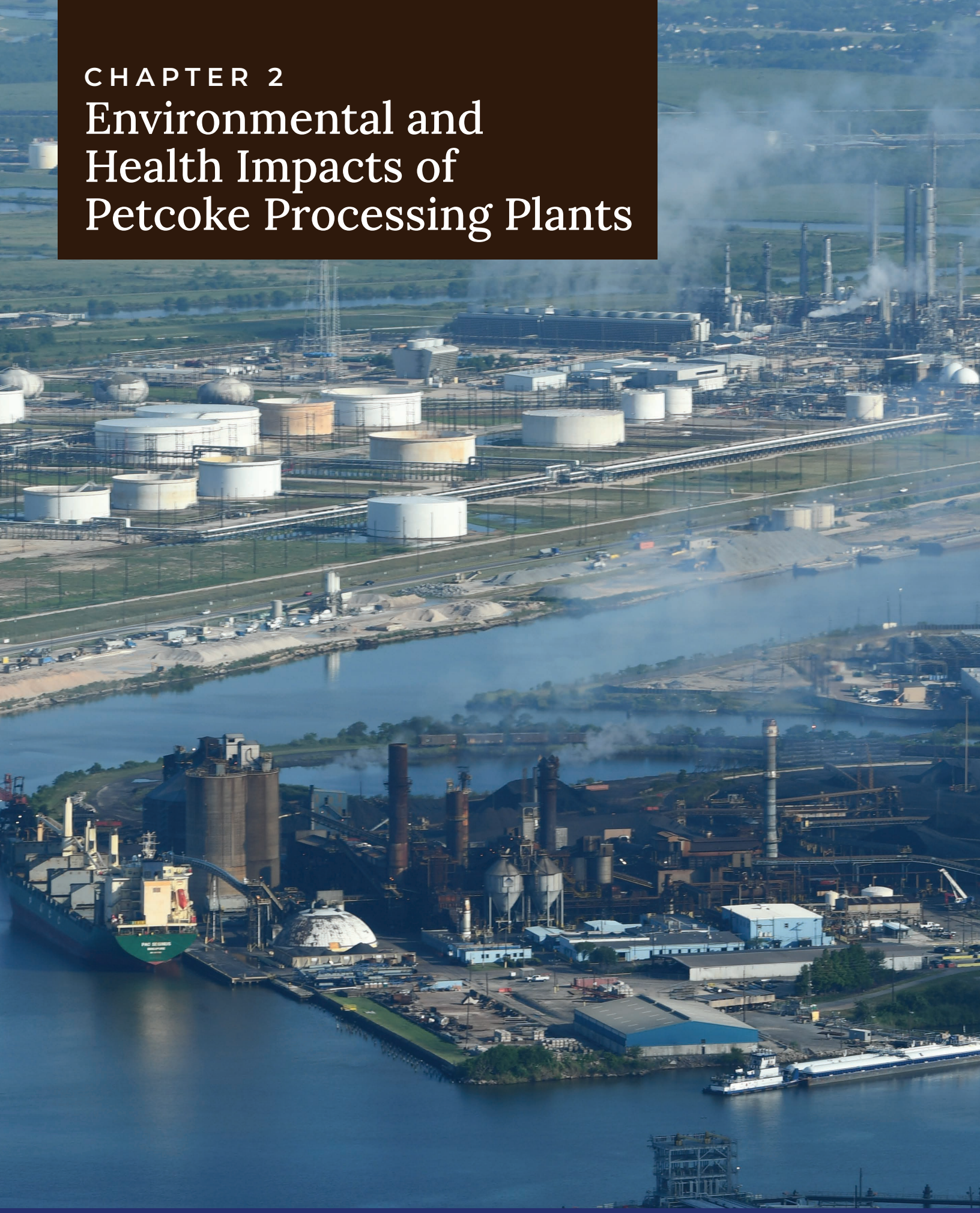
Regardless, as demand for aluminum and steel grows, demand for calcined petcoke will follow. Currently, the global aluminum industry uses three-quarters of calcined petcoke, which is produced and traded across the globe.[54] It takes about half a ton of calcined petcoke to create one ton of new aluminum.[55] That's because calcined petcoke makes up about 70 percent of the material of the device needed to produce aluminum called an anode. Aluminum smelters use hundreds of anodes each day.[56]

About 70 million tons of new aluminum was produced worldwide in 2023, implying that operators would have used about 35 million tons of calcined petcoke.[57] Following years of decline, in 2023 the U.S. aluminum industry produced only about one percent of the world's new aluminum (750,000 tons), which suggests that U.S. aluminum producers would have used about 375,000 tons of calcined petcoke.

Petcoke is often transported long distances in rail cars to aluminum and steel manufacturers and other industries across the U.S.

CHAPTER 2

Environmental and Health Impacts of Petcoke Processing Plants



The Oxbow Calcining Plant in Port Arthur, Texas, releases tons of sulfur dioxide air pollution, as well as particulate matter and other pollutants.

Environmental and Health Impacts of Petcoke Processing Plants

The sulfur and metal content of petcoke that calcining plants purchase depends largely on the original oil source and how it is refined. The aluminum industry in particular prizes calcined petcoke that has very little ash, sulfur, and heavy metals because these substances compromise the quality of produced metal. Calcined petcoke is generally defined as “anode grade” for use in aluminum production when it has a sulfur content of three percent or less and relatively low metal content.[58]

Aluminum companies often promise federal and state regulators that they will control SO_2 pollution and comply with air quality standards simply by using low-sulfur calcined petcoke, placing pressure to remove the contaminant higher up the production chain at calciners. For example, in 2022, Washington State issued a plan to bring the now-closed Alcoa Intalco aluminum smelter into compliance with federal SO_2 limits, in part through the use of calcined petcoke with a sulfur content of two percent or less.[59] Similarly, the SO_2 limits at the Alcoa Massena smelter are based in part on a petcoke sulfur content of 2.5 percent.[60]

Some industry analysts opine that supplies of calcined petcoke with low sulfur and metals could become constrained as demand for metals grows, making it harder for the aluminum, steel, and other industries to secure the petcoke they need.[61] Others suggest that global supplies will keep pace with growing demand for aluminum even if the price of anode-grade calcined petcoke keeps rising, as it did by 80 percent from 2018-2021.[62]

An additional view is that constraints in calcined petcoke markets could ultimately push aluminum producers to buy a more abundant, lower-cost product containing more sulfur and metals, and that this trend is already occurring.[63] If calcining plants (and aluminum smelters) are allowed to use lower-quality petcoke, the pollution burden they place on nearby communities and the environment would be even worse than it already is.

Plants are in Burdened Communities

Located in areas with other, often larger industrial facilities like petrochemical processing and oil refining, calcining plants may not be top of mind for frontline communities facing an onslaught of air and water pollution. Yet the plants pack their own pollution punch when it comes to risks to health and the environment.

Data from the federal Climate and Economic Justice Screening Tool (CEJST) and EPA’s Environmental Justice Screening Tool (EJScreen) show that 35 percent of residents living within three miles of all the calcining facilities live in poverty and 45 percent are people of color; nine of the facilities are located in areas considered "disadvantaged.[64] This means they experience persistent and significant health impacts, a high risk of climate disruption, and socioeconomic challenges.

45%

of the people living within three miles of the facilities are people of color.

The calcining plants are part of highly industrialized areas with multiple sources of toxic pollution and contribute to the overall burden in the communities where they’re located. As Table 3 shows, a higher proportion of residents living near seven of the plants are low-income than the national average of 31 percent, while near four of the plants a higher proportion than the national average of 39 percent are people of color.[65]

Table 3. Key Socioeconomic Indicators of Residents Within a 3-mile Radius Around Petcoke Processing Facilities

Plant Name	Within 3-mile Radius of Facility					
	Location	Population	% Low Income	% People of Color	# Disadvantaged Census Tracts	# Facilities Reporting Toxic Releases
Rain CII Carbon Chalmette	St. Bernard Parish, LA	64,601	40%	63%	26	12
Rain CII Carbon Gramercy	St. James Parish, LA	9,486	35%	56%	4	9
Rain CII Carbon Lake Charles	Calcasieu Parish, LA	4,578	9%	4%	1	9
Rain CII Carbon Norco	St. Charles Parish, LA	12,950	24%	24%	2	14
Reynolds Metal Co	Calcasieu Parish, LA	6,687	14%	11%	0	5
Conoco Phillips Lake Charles Refinery (calcining units only)	Calcasieu Parish, LA	10,486	30%	16%	3	26
Oxbow Baton Rouge	East Baton Rouge, LA	1,379	49%	87%	2	11
Oxbow Port Arthur	Jefferson County, TX	2,744	65%	96%	5	12
Seadrift Coke	Calhoun County, TX	92	18%	32%	2	4
Oxbow Kremlin	Garfield County, OK	745	6%	11%	0	1
Rain CII Carbon Purvis	Lamar County, MS	3,992	34%	14%	2	3
Rain CII Carbon Robinson	Crawford County, IL	8,260	29%	13%	1	8
BP Cherry Point Refinery (calcining units only)	Whatcom County, WA	4,357	33%	22%	0	5
Total		**128,314**	**35%**	**45%**	**48**	**119**

Source: Environmental Justice Screening and Mapping Tool, Council on Environmental Quality, Climate and Economic Justice Screening Tool, and EPA's Toxics Release Inventory. The total population figure is lower than all the separate figures summed due to overlap in the 3-mile radius around two of the facilities in Calcasieu Parish, LA.

High Emissions of Harmful Pollutants

The process of calcining is based on intense combustion, which just like other fossil-fuel based industries (from power generation to petrochemical processing) releases a host of pollutants into the air. Calcining plants stand out for five particular pollutants, which they release in high volumes and of which they are top emitters in communities.

Sulfur dioxide (SO_2). An estimated 9-13 percent of sulfur in petcoke is driven off during the calcining process.[66] This leads to the formation of SO_2, a federally regulated air pollutant that has significant impacts on respiratory function, damages trees and vegetation, and contributes to the smog that harms health, haze that reduces visibility inscenic areas, and the acid rain that harms vegetation, fish, and wildlife.[67]

Taken together, the stand-alone plants and refinery calcining units released nearly 57,000 tons of SO_2 in 2022—almost three times as much as all the fossil fuel power plants in Louisiana combined.[68] Most of them operate without

pollution "scrubbers," equipment designed to remove SO_2 before it can be released straight into the air. (See p. 30 for more on the need for this type of pollution control.) Instead, they are required to limit SO_2 emissions through the use of petcoke with a lower sulfur content. Yet this does not adequately reduce SO_2 emissions, especially in light of the potential challenges of securing supplies of low-sulfur petcoke—something that companies themselves recognize.[69]

In 2018, EPA designated St. Bernard Parish, Louisiana as being in nonattainment for (i.e., not in compliance with) the federal standards for SO_2.[70] A key reason was Rain CII Carbon's failure to reduce its emissions of the pollutant at its Chalmette calcining plant, despite legal requirements to do so.[71]

In 2021, EIP and its partners petitioned EPA under Title VI of the Civil Rights Act to investigate the refusal of the Texas state regulator to require Oxbow to install equipment needed to control SO_2 at its Port Arthur, Texas, calcining plant, which nearby air monitors showed was continually violating federal standards for the pollutant.[72] Oxbow has similarly balked at installing control equipment at its plant in Enid, Oklahoma—despite the plant emitting almost all of the SO_2 in the county where it's located.[73]

Table 4. Reported Air Emissions of Sulfur Dioxide From Petcoke Plants, Compared to Other SO_2 Sources in the County or Parish

SO_2 Emissions, 2022				
Plant Name	**County, State**	**Emissions, tons**	**County Ranking***	**% of County Emissions**
Kremlin Calcining Plant	Garfield County, OK	15,993	1 of 98	99.96%
Baton Rouge Calcining Plant	East Baton Rouge Parish, LA	11,184	1 of 33	90.21%
Port Arthur Calcining Plant	Jefferson County, TX	10,658	1 of 52	82.80%
Lake Charles Calcining Plant	Calcasieu Parish, LA	4,356	3 of 36	20.41%
Gramercy Coke Plant	St. James Parish, LA	4,313	1 of 18	75.44%
Reynolds Metal Co	Calcasieu Parish, LA	4,184	4 of 36	19.60%
Norco Coke Plant	St. Charles Parish, LA	2,091	1 of 26	67.23%
Chalmette Calcining Plant	St. Bernard Parish, LA	2,034	1 of 8	89.72%
Robinson Calcining Plant	Crawford County, IL	700	1 of 4	80.22%
Purvis Calcining Plant	Lamar County, MS	347	1 of 3	98.74%
Seadrift Coke Plant	Calhoun County, TX	324	1 of 6	90.64%
BP Cherry Point Refinery (calcining units only)	Whatcom County, WA	204	3 of 9	4.47%
Lake Charles Refinery (calcining units only)	Calcasieu Parish, LA	200	7 of 36	0.94%

Source: 2022 state emission inventories (2020 for Purvis Calcining Plant due to lack of more recent data.)
*For the purposes of county rankings, the refineries minus calcining units are counted as separate facilities.

Particulate matter. This federally regulated air pollutant is released directly through combustion and as a result of chemical reactions.[74] Metals and hazardous air pollutants can form into soot particles and be carried through the air.[75] Particulate matter, especially fine particulates (PM2.5, i.e., particles that are 2.5 or less microns in width), is a

leading cause of respiratory and cardiovascular problems, the formation of haze, and the depletion of nutrients in soil and water.[76]

Calcining plants generate PM2.5 directly during combustion, waste heat generation, and cooling. When not properly managed during transport, transfer, handling, and storage, dust blowing off piles of both raw petcoke and finished calcined petcoke can be significant sources of particulates. Studies have shown that dust from petcoke piles held at refineries and transport depots can cause respiratory problems for people nearby.[77]

In 2022, the Rain CII Carbon Gramercy plant was the top source of PM2.5 in St. James Parish, Louisiana, accounting for nearly 44 percent of the volume of the pollutant released by 17 industrial facilities. In St. Charles Parish, Louisiana, the Rain CII Carbon Norco plant released more PM2.5 than a nearby oil refinery.

Table 5. Reported Air Emissions of PM2.5 from Petcoke Plants, Compared to Other PM2.5 Sources in the County or Parish

PM2.5 Emissions, 2022				
Plant Name	**County, State**	**Emissions, tons**	**County Ranking***	**% of County Emissions**
Gramercy Coke Plant	St. James Parish, LA	251	1 of 18	43.88%
Baton Rouge Calcining Plant	East Baton Rouge Parish, LA	158	3 of 39	9.32%
Norco Coke Plant	St. Charles Parish, LA	157	4 of 27	10.36%
Chalmette Calcining Plant	St. Bernard Parish, LA	121	2 of 8	33.67%
Port Arthur Calcining Plant	Jefferson County, TX	101	6 of 53	4.67%
Lake Charles Calcining Plant	Calcasieu Parish, LA	68	10 of 38	2.87%
Kremlin Calcining Plant	Garfield County, OK	47	2 of 122	18.88%
BP Cherry Point Refinery (calcining units only)	Whatcom County, WA	39	5 of 11	2.86%
Robinson Calcining Plant	Crawford County, IL	33	2 of 7*	11.74%
Reynolds Metal Co	Calcasieu Parish, LA	26	14 of 38	1.09%
Lake Charles Refinery (calcining units only)	Calcasieu Parish, LA	21	18 of 38	0.84%
Purvis Calcining Plant	Lamar County, MS	20	1 of 3	61.37%
Seadrift Coke Plant	Calhoun County, TX	6	3 of 5	1.71%

Source: 2022 state emission inventories (2020 for Purvis Calcining Plant due to lack of more recent data).
*For the purposes of county rankings, the refineries minus calcining units are counted as separate facilities.

Hydrochloric acid (HCl). This federally regulated hazardous air pollutant forms during combustion as the result of chemical reactions involving chloride components in petcoke.[78] The result is a gas, hydrogen chloride, that converts to hydrochloric acid when it comes in contact with moisture in the air.[79] Hydrochloric acid contributes to the formation of acid rain that harms vegetation, fish, and wildlife.[80] Exposure to the gas can irritate and damage eyes, skin, the nose, respiratory tract, and digestive system.[81]

Nationally, key emitters of HCl gas include power plants, paper mills, the chemical industry, and petroleum product industries. In 2022, hydrochloric acid accounted for about seven percent of the total volume of toxic emissions that

Plumes of smoke from the Oxbow petcoke processing plant in Port Arthur can be seen staining the sky, day and night.

the petroleum products sector as a whole reported to the TRI. Yet among the seven calcining plants that reported releasing the gas, the proportion of it in their total toxic emissions ranged from 16-74 percent—a clear indication that calciners have a hydrochloric acid problem.

For example, only 12 industrial facilities across Oklahoma reported releasing hydrochloric acid to the TRI in 2022, but Oxbow Kremlin accounted for nearly 30 percent of the toxic gas and ranked second only to a large oil refinery. The Oxbow Baton Rouge calcining plant is the second largest emitter of the gas in heavily industrialized East Baton Rouge Parish, Louisiana, releasing nearly three times as much as a nearby plastics plant.

Table 6. Reported Air Emissions of Hydrocholoric Acid From Petcoke Plants, Compared to Other Hydrocholoric Acid Sources in the County or Parish

Hydrocholoric Acid Emissions, 2022				
Plant Name	**County, State**	**Emissions, lbs**	**County Ranking***	**% of County Emissions**
Kremlin Calcining Plant	Garfield County, OK	88,000	1 of 1	100%
Baton Rouge Calcining Plant	East Baton Rouge Parish, LA	50,000	2 of 5	18.93%
Norco Coke Plant	St. Charles Parish, LA	37,832	1 of 6	71.51%
Port Arthur Calcining Plant A & B	Jefferson County, TX	35,452	2 of 5	41.46%
Chalmette Calcining Plant	St. Bernard Parish, LA	15,788	1 of 1	100%
Lake Charles Calcining Plant	Calcasieu Parish, LA	1,988	7 of 8	0.44%
Gramercy Coke Plant	St. James Parish, LA	1,348	1 of 2	52.86%

Source: EPA's 2022 Toxic Release Inventory. Only stand-alone calcining plants are included, as emissions from the calcining units at the refineries cannot be separated from the rest of the facility.

Nickel. This natural element is classified as a federally regulated hazardous air pollutant because when inhaled, it can reduce lung function and cause asthma and bronchitis.[82] As a metal, it can attach to particulate matter and contribute to the risk of cardiovascular problems and cancer.[83]

Nationally, the metals manufacturing sector is the largest industrial source of nickel pollution. Aluminum producers want to receive calcined petcoke with as little metal content as possible, making calcining plants a key point for eliminating nickel.

Even though the petroleum products sector as a whole accounted for only three percent of the nickel air releases reported to TRI in 2022, some of the calcining plants are large sources in the areas where they're located. For example, the Rain CII Carbon Purvis plant in Mississippi released over 200 times more nickel than a nearby oil refinery. The Rain CII Chalmette plant accounted for nearly all of the nickel emissions reported in St. Bernard Parish, Louisiana.

Table 7. Reported Air Emissions of Nickel from Petcoke Plants, Compared to Other Nickel Sources in the County or Parish

Nickel Emissions, 2022				
Plant Name	**County, State**	**Emissions, lbs**	**County Ranking***	**% of County Emissions**
Chalmette Calcining Plant	St. Bernard Parish, LA	5,999	1 of 3	97.06%
Gramercy Coke Plant	St. James Parish, LA	2,105	1 of 2	99.97%
Norco Coke Plant	St. Charles Parish, LA	324	1 of 2	51.53%
Purvis Calcining Plant	Lamar County, MS	219	1 of 1	100%
Lake Charles Calcining Plant	Calcasieu Parish, LA	188	5 of 7	5.75%

Source: EPA's 2022 Toxic Release Inventory. Only stand-alone calcining plants are included, as emissions from the calcining units at the refineries cannot be separated from the rest of the facility.

Vanadium. While not currently on the federal list of hazardous air pollutants, vanadium can move through the air when released in industrial emissions and, as a metal, by attaching to particulate matter. Exposure can irritate the eyes, throat, and respiratory tract and has been classified as a possible carcinogen.[84] As the global production of heavy crude oil and petcoke has risen, so have levels of vanadium in the atmosphere—sparking growing concerns over its health and environmental impacts.[85]

The presence of vanadium in calcined petcoke has long been a concern for the aluminum industry because it contaminates finished metal, and standards exist for the level of vanadium content in purchased petcoke.[86] Calcining appears to be a key point for eliminating vanadium. Eight of the calcining plants are in the top 20 facilities nationwide for the amount of vanadium released into the air, out of 342 facilities reporting the pollutant to TRI in 2022. Nearly a quarter of all the vanadium emissions (about 88,000 pounds) reported to the TRI in 2022 were emitted by just nine calcining plants.

In particular, the Oxbow Port Arthur plant is the only facility in heavily industrialized Jefferson County, Texas, that releases vanadium. Vanadium made up nearly the entire volume of toxic air releases reported by the Rain CII Robinson plant in Illinois to TRI in 2022.

Table 8. Reported Air Emissions of Vanadium from Petcoke Plants, Compared to Other Vanadium Sources in the County or Parish

Vanadium Emissions, 2022				
Plant Name	**County, State**	**Emissions, lbs**	**County Ranking***	**% of County Emissions**
Kremlin Calcining Plant	Garfield County, OK	33,002	1 of 1	100%
Baton Rouge Calcining Plant	East Baton Rouge Parish, LA	23,039	1 of 3	99.34%
Port Arthur Calcining Plant A & B	Jefferson County, TX	12,325	1 of 2	99.99%
Robinson Calcining Plant	Crawford County, IL	5,923	1 of 1	100%
Gramercy Coke Plant	St. James Parish, LA	4,864	1 of 1	100%
Chalmette Calcining Plant	St. Bernard Parish, LA	4,129	1 of 3	98.59%
Lake Charles Calcining Plant	Calcasieu Parish, LA	2,951	1 of 3	90.33%
Norco Coke Plant	St. Charles Parish, LA	997	1 of 2	67.63%
Purvis Calcining Plant	Lamar County, MS	656	1 of 1	100%

Source: EPA's 2022 Toxic Release Inventory. Only stand-alone calcining plants are included, as emissions from the calcining units at the refineries cannot be separated from the rest of the facility.

Lax Water Permits Leave Pollution Unchecked

Calcining plants use water to cool down superheated petcoke, suppress dust blowing off petcoke piles, wash down equipment and petcoke transport and storage areas, and in some cases to operate wet "scrubbers" (a type of air pollution filter). Water is also drained from coolers and boilers. These and other processes result in large volumes of contaminated wastewater that is discharged directly into rivers and streams or stored onsite. In addition, contaminated stormwater runs off plant sites whenever it rains.

In all of these ways, contaminants found in raw or calcined petcoke can potentially make their way into wastewater.[87] Unfortunately, exactly which pollutants and in what volumes remain unclear because the permits that states issue to calcining plants do not limit or even require monitoring for many pollutants. These permits generally only limit conventional contaminants found in most water supplies, such as sediment, pH, coliform, and oil and grease.[88]

According to their water permits, nine of the calcining plants discharge wastewater and stormwater directly into canals, streams, and rivers. The exceptions are Oxbow Kremlin in Oklahoma, which stores wastewater in open pits, and Rain CII Carbon Norco in Louisiana, which sends its wastewater to the nearby Shell Refinery. Two of the plants, Rain CII Carbon in Chalmette and Gramercy, Louisiana, discharge wastewater into waterways that are sources of drinking water.

Seven of the calcining plants reported to EPA that during the 2019-2022 period, they discharged stormwater containing contaminants that weren't limited in their permits. All of these plants reported discharging polycyclic aromatic hydrocarbons (PAHs), six reported lead and vanadium, and four reported mercury and nickel.

Notably, none of the National Pollutant Discharge Elimination System (NPDES) permits for these plants required monitoring for these pollutants, much less established limits to reduce the amount of pollution allowed to flow into our waterways.

Table 9. Plants Reporting Toxic Pollutants to TRI but Absent from Discharge Permits

Plant Name	Lead	Mercury	Nickel	Vanadium	PAH
Rain CII Carbon Chalmette (LA)	X	X	X	X	X
Rain CII Carbon Gramercy (LA)	X	X	X	X	X
Rain CII Carbon Lake Charles (LA)		X	X	X	X
Rain CII Carbon Robinson (IL)	X			X	X
Oxbow Baton Rouge (LA)	X	X		X	X
Oxbow Pt. Arthur (TX)	X			X	X
Reynolds Metal Carbon (LA)	X				X

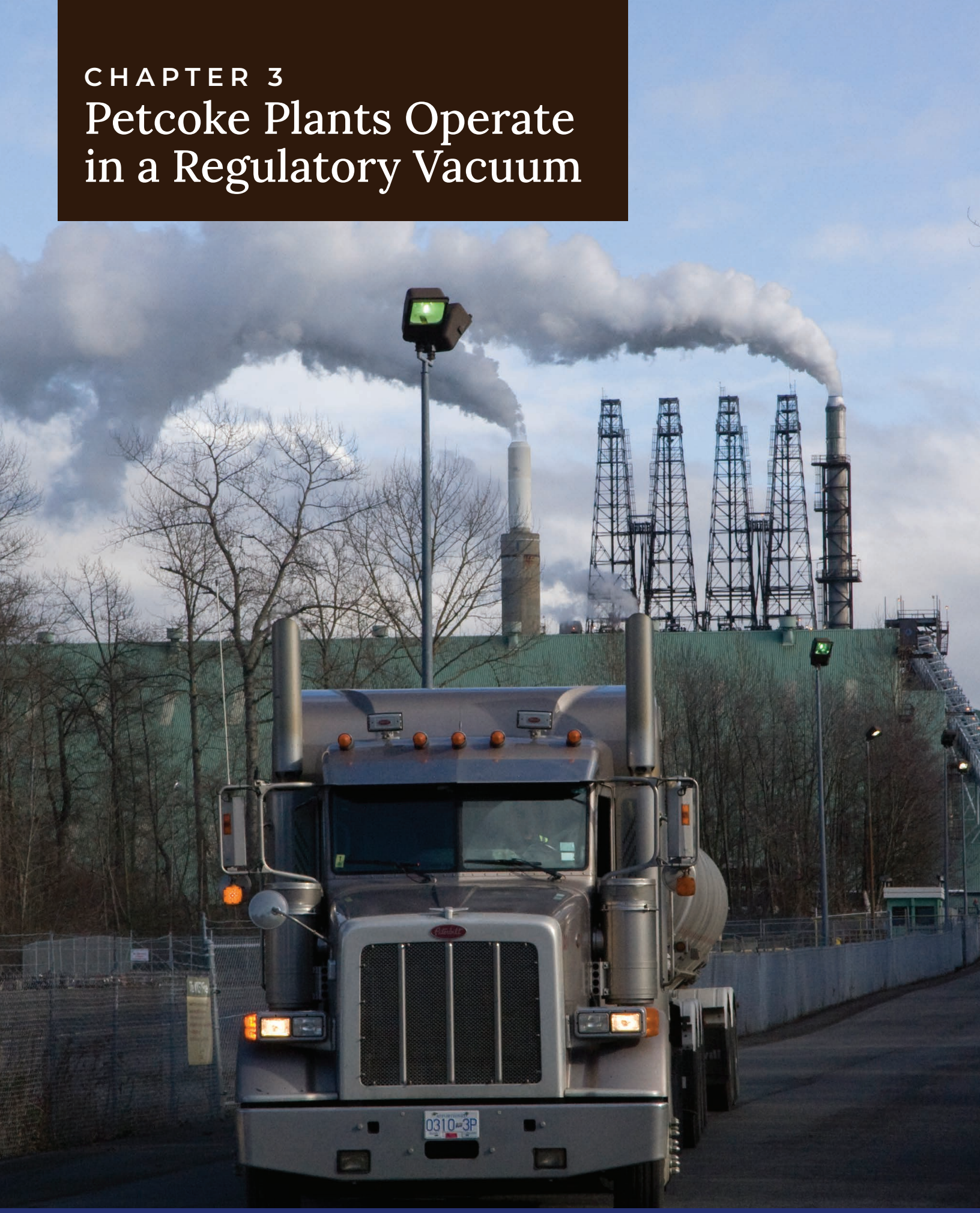
Table 10. Impacts of Key Pollutants Reported by Petcoke Processing Plants

Pollutant	Potential Health and Environmental Impacts
Lead	A metal that causes reproductive, cognitive, immune system, and kidney problems when consumed in drinking water. Toxic to aquatic life.
Mercury	A metal that damages soil, water systems, fish, and other aquatic life. When ingested by people, can cause loss of vision, sensory abilities, and muscle function.
Nickel	A metal that can cause digestive problems and kidney damage when ingested.
Vanadium	A metal that can be toxic for aquatic life and bioaccumulate through soil and plants to harm people and animals. EPA has considered regulating vanadium under the Safe Drinking Water Act.
Polycyclic Aromatic Hydrocarbons (PAH)	A broad class of contaminants that are toxic to fish and other aquatic life. Some are considered cancer-causing in humans. (Some plants have reported a specific PAH, benzo(g,h,i)perylene.)

Source: Pollution and hazard summaries from the U.S. Environmental Protection Agency and National Institutes of Health and academic studies.

CHAPTER 3

Petcoke Plants Operate in a Regulatory Vacuum



A truck rumbles out of the BP Cherry Point oil refinery in Washington State, which produces and processes petcoke for sale to metal and other industries.

Petcoke Plants Operate in a Regulatory Vacuum

Despite harming the air that communities breathe and the water they drink, petcoke calcining plants are allowed to operate without strong, enforceable standards for pollution control for all pollutants and with only limited monitoring and reporting of pollution.

This circumstance is partly the result of the sheer age of the plants—with many built before key protections even existed—compounded by ongoing neglect by federal regulators to develop technology-based pollution standards for the calcining sector. In addition, state agencies have failed to close these gaps in protections through operating permits.

EPA Has Failed to Require Compliance With Key Environmental Laws

Three important federal environmental laws are essential to limit air and water pollution from industrial facilities and provide standards through which operators can be held accountable. Unfortunately, none of these currently apply to the petcoke calcining sector.

New Source Performance Standards (NSPS). Section 111 of the Clean Air Act gives EPA authority to develop and periodically revise technology-based standards for different categories of air pollution sources in order to maintain and improve air quality over time.[89] These standards were designed to prevent large industries from releasing so much pollution that they risk endangering public health or welfare.[90]

EPA **never** developed new source performance standards for petcoke plants, although such rules reduce air pollution from other industries.

This goal is achieved by requiring operators that build new facilities or replace older industrial infrastructure to install the best air pollution control technologies that exist at the time. In establishing these requirements, called "performance standards," the EPA Administrator must first identify the "best system of emission reduction" that has been "adequately demonstrated" for the source category, taking into account various factors such as the degree of emissions reductions achieved, the cost of achieving such reduction, and any non-air quality health and environmental impact and energy requirements.[91]

In the event that the Administrator determines that it is isn't feasible to prescribe or enforce an emission standard, they may instead promulgate a "design, equipment, work practice, or operational standard, or combination thereof, which reflects the best technological system of continuous emission reduction" that has been adequately demonstrated.[92]

Once such standards have been established for new and modified sources, Section 111(d) of the Clean Air Act further directs EPA to establish guidelines for states to follow in applying those performance standards to existing sources within that source category. The requirements kick in and become applicable when pollution sources are constructed, modified, or reconstructed after an industry-specific NSPS has been adopted. For example, the standards for aluminum smelters include limits for pollutants like fluorides and apply to any part of a facility that is installed or constructed after a certain date.[93]

Unfortunately, EPA has never developed an NSPS for petcoke calcining. EIP reviewed all of the federal Clean Air Act operating permits for the calcining plants (called Title V permits) and none require compliance with any NSPS.[94]

In practice, this means that the petcoke calcining plants—all of which were built between 1935 and 1983—can

continue to operate with very old equipment. Even when operators replace equipment (such as dust filters or emission stacks), no standards exist to ensure that they are doing so with the most modern, effective pollution control technologies available.

If EPA listed petcoke calciners as a source category under Section 111 of the Clean Air Act, EPA would be required to establish standards for new and modified petcoke calciners that reflect emissions reductions achievable through application of the "best system of emission reduction" that has adequately been demonstrated for petcoke calciners, as well as guidelines for the states to apply these standards to existing calciners.

Though EPA generally cannot require sources to install and operate any particular pollution reduction technology to comply with a performance standard, the emissions levels achieved by facilities using specific technology is a relevant consideration in establishing appropriate NSPS levels. For example, several calcining facilities are already employing pollution control devices specifically designed to control SO_2, known as "scrubbers." Scrubbers are devices that absorb gasses and mix it with minerals, which causes a chemical reaction that results in waste for treatment and disposal or conversion into other products (such as gypsum in wallboard).[95] Were EPA to establish stringent standards reflecting the emission levels achieved by calciners already employing scrubbers, this could potentially push other calciners to install scrubbers in order to meet those standards.

National Emission Standards for Hazardous Air Pollutants (NESHAP). Under Section 112 of the Clean Air Act, EPA has the authority to establish limits on a variety of hazardous, or toxic, pollutants that cause serious health and environmental problems.[96] These standards were designed to prevent large industrial emitters from releasing air toxics above certain volumes.[97]

Under Section 112, EPA was required to identify an initial list of categories and subcategories of major sources of identified hazardous air pollutants, for which EPA would subsequently implement standards. EPA is required to update this list of source categories from time to time based upon any new information, and at least once every eight years.[98]

EPA has never developed hazardous air pollutant emission standards for the petcoke processing industry. Pictured here is the Seadrift Coke Plant in Calhoun County, Texas, southwest of Houston.

For each listed category, EPA must evaluate the technologies for controlling hazardous air pollutants from those specific sectors every eight years and adopt additional risk-based standards if they would provide greater protection of public health or prevent adverse environmental effects.[99] Depending on the result of these reviews, operators could be required to take additional measures to reduce the release of specific pollutants by using up-to-date technologies, called Maximum Achievable Control Technology (MACT) standards.

Unfortunately, EPA has never developed hazardous air pollutant emissions standards for the petcoke calcining sector. EIP reviewed all of the federal Clean Air Act operating permits for the calcining plants (called Title V permits) and none require the calcining units to comply with a NESHAP.[100]

If EPA were to develop standards specifically for petcoke calcining, the agency would have to review the risks of hazardous air pollutants released by these plants and technologies that would reduce harmful emissions. Both nickel and hydrochloric acid are toxic pollutants released by petcoke calcining plants and federally regulated hazardous air pollutants.[101] Some scrubbers are specifically designed to remove acid gases like hydrochloric acid and, along with other pollution controls, could potentially be required.[102]

Effluent Limitation Guidelines (ELGs). The Clean Water Act sets a national goal of eliminating all water pollution. To advance this important goal, the Act requires EPA to develop national water pollution limits for industries that release wastewater into waterways.[103] EPA is also required to regularly tighten these national limits over time to keep pace with new and more effective pollution control technologies.[104]

Petcoke processing facilities have not been required to reduce their discharges of toxic metals and organic chemicals for **40 years**—a clear contradiction of what the Clean Water Act intended.

Unfortunately, none of this has happened when it comes to petcoke calcining pollution. EPA overlooked the industry when it selected the initial industrial categories for national pollution limits in the 1970s and 1980s, and has never gone back to correct its mistake. Petcoke calcining facilities have effectively not been required to reduce their discharges of toxic metals and organic chemicals for 40 years—a clear contradiction of what the Clean Water Act intended.

As a result, despite significant evidence that there are toxic metals like lead, nickel, vanadium, and mercury and organic chemicals like benzo[g,h,i]perylene in wastewater from petcoke calcining plants, there are no national limits for these dangerous pollutants. In fact, none of the permits for the stand-alone petcoke calcining plants include limits for all of these five pollutants, and most plants do not have limits on any of them. For example, the Rain CII Carbon Chalmette plant in Louisiana has reported discharging lead, mercury, nickel, vanadium, and PAH, but its permit includes limits only for pH, oil and grease, and total organic carbon.

States Could Do More to Protect Air and Water

In the absence of federal environmental standards that apply to petcoke calcining plants, operators have effectively been allowed to continue to use outdated technologies and equipment. The Clean Air Act makes clear that the states have the authority to require additional control measures, or stricter emission limits and other requirements, even if they are more stringent than federal law.[105] State agencies that issue air and water permits could set stronger pollution limits and require the use of more effective pollution controls, but for the most part have chosen not to.

Louisiana exempts petcoke processing plants from regulations on toxic air pollutants. Pictured above is the Norco Coke Plant west of New Orleans.

In Louisiana (where six of the 11 stand-alone plants are located), petcoke calcining plant operators are getting a break from limits on toxic air pollutants and requirements to control them because of a state loophole. According to air permit applications, neither Rain CII Carbon nor Oxbow's plants are required to adhere to the state's regulations on toxic air pollutants because petcoke calcining plants are exempt.[106]

Rain CII Carbon operates SO_2 scrubbers at three of its plants in Louisiana (Lake Charles, Chalmette, and Norco), but the company has not been required to do so at its other plants in Louisiana, Mississippi, and Illinois.[107] Oxbow has refused to install scrubbers at its calcining plants in Texas, Louisiana, and Oklahoma despite the persistent release of high volumes of SO_2, and regulators have refused to make this a requirement for operating.[108] (See the issue profile on why scrubbers matter on page 30.)

When it comes to water pollution, the federal Clean Water Act makes clear that when national pollution limits don't exist for an industrial facility, the state agency issuing permits must step in to establish facility-specific pollution limits.[109] State agencies are supposed to consider specific technology and cost factors to establish increasingly more stringent limits based on the most effective water treatment technology available (called best available economically achievable treatment technologies, or "BAT").[110]

Yet states have not complied with these provisions of the Clean Water Act when it comes to calcining plants. They have systematically failed to establish or even consider establishing limits for pollutants present in water discharges, like lead, vanadium, benzo[g,h,i]perylene, PAHs, mercury, and nickel. Given the lack of federal limits and inaction by the states, the calcining plants are operating with permits that do not control all of these harmful pollutants.

CHAPTER 4

Community Impacts

OKLAHOMA: Refusal to Install a Scrubber Means Harmful Haze

The Oxbow Kremlin Calcining Plant in Oklahoma, owned by William Koch, emitted almost 16,000 tons of sulfur dioxide in 2022. That was almost half of this dangerous air pollutant released in the whole state.

Kremlin, Oklahoma, population 250, is small and rural.[111] But on the outskirts of town is an outsized Koch Brothers' Oxbow Corporation plant that packs a big pollution punch felt far and wide.

Oxbow, owned by politically-active industrialist William "Bill" Koch, built its giant plant in Kremlin about 60 years ago. It covers enough land for about 250 football fields and has the capacity to produce more calcined petcoke annually than any other U.S. plant.[112] In 2022, it released almost 16,000 tons of sulfur dioxide (SO_2)—about half of all the pollutant released in the entire state of Oklahoma.[113]

This is also more SO_2 than any other source in Garfield County, home to more than 330 highly-polluting industrial facilities.[114] At the same time, Oxbow Kremlin is the only source of hydrochloric acid and the second-highest source of particulate matter emissions in the County.

It's no wonder that Oxbow Kremlin holds a prominent spot in Oklahoma's plan to address the haze that impairs visibility in national parks and wilderness areas.[115] According to the National Parks Conservation Association (NPCA), Oxbow Kremlin's emissions contribute to visibility problems in 30 parks and wilderness areas.[116] Notably, the same pollutants that cause haze—SO_2 , nitrogen oxides, and particulate matter—also cause respiratory, cardiovascular, and other health problems.

Yet Oxbow has resisted the idea of installing modern-day pollution control equipment called scrubbers, which can significantly reduce pollution.[117]

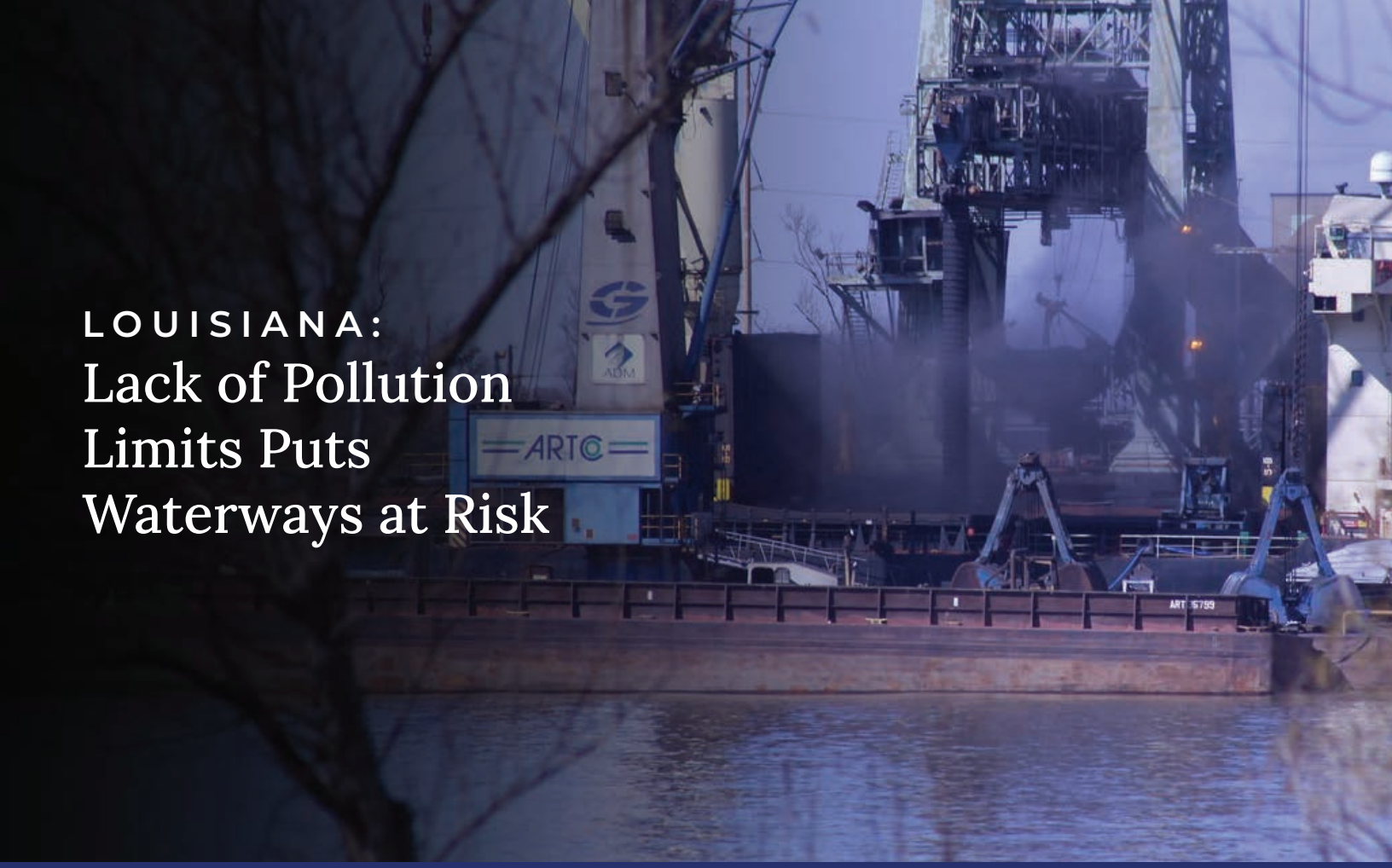
According to EPA, scrubbers can reduce the amount of SO_2 that's released into the air by 50-98 percent, depending on the kind of system used.[118] For example, after Rain CII Carbon installed a scrubber at its Chalmette, Louisiana, plant in 2015, SO_2 emissions dropped nearly 60 percent even while production remained the same.[119] Some newer systems, available to Oxbow today, could be even more effective at cutting pollution.

Installing scrubbers can reduce a plant's sulfur dioxide air pollution by as much as **98%.**

Yet Oxbow asserts that any type of scrubber would be "economically infeasible" because of the cost of the water needed to make the pollution control device work.[120] Unfortunately, the Oklahoma Department of Environmental Quality accepted Oxbow's assertions without explaining how required haze reductions will be achieved without cutting pollution from the largest single source of SO_2 in the state.[121]

EPA is currently reviewing Oklahoma's plan to address regional haze—including the state's acceptance of Oxbow's refusal to install a scrubber. According to a comprehensive technical analysis by NPCA, Oxbow has inflated potential costs and ignored a variety of commercially available scrubbers that would be affordable and effective to install and operate.[122] NPCA argues that a scrubber is necessary to control the plant's air pollution and reduce its impact on many people and places.

"The purpose of the regional haze rule is to cut pollution from facilities like Oxbow Kremlin that are contributing to visibility impairment and other air pollution problems in national parks and wilderness areas. A scrubber is really the low-hanging fruit for Oklahoma to address its haze obligations. Our analysis presents options for pollution control equipment that would nearly eliminate sulfur dioxide pollution from Oxbow Kremlin at a relatively low cost," said Daniel Orozco, Senior Clean Air and Climate Manager at NPCA.[123]



LOUISIANA: Lack of Pollution Limits Puts Waterways at Risk

The Rain CII Carbon petcoke processing plant in Gramercy, Louisiana, dumps an average of 500,000 gallons of wastewater a day into the Blind River.

Located between Baton Rouge and New Orleans along the mighty Mississippi River, the Rain CII Carbon petcoke calcining plant in Gramercy releases an average of 500,000 gallons of polluted water—enough to fill 50 swimming pools—every day.[124] These discharges inflict additional harm on waterways impacted by many industrial activities in the region, from oil refining to chemical manufacturing.

Barges transport raw petcoke to a dock at the Gramercy plant. The barges and petcoke storage areas are open-air with no covers, which means petcoke dust blows through the air and into water.[125] In addition, Rain CII Carbon re-uses the contaminated wastewater it generates to both suppress dust and wash down storage areas, which then runs off into the water.[126] This practice also raises the possibility that every time the wastewater is reused, the concentration of pollution increases and poses greater hazards.

Much of Gramercy's wastewater ends up in the Blind River, which feeds into the Mississippi River. The Louisiana Department of Environmental Quality (LDEQ) has classified the Blind River as a scenic waterbody and "outstanding natural resource"—yet one that is currently too polluted for safe swimming or other recreation and for fish and wildlife to breed successfully.[127]

Rain CII Carbon also routes completely untreated stormwater through a pipe that dumps straight into the Mississippi River. Unfortunately for Gramercy's residents, the place where that happens is just upstream of one of the city's intakes for drinking water from the Mississippi.[128]

"My family and neighbors have known for years that the public water supply is unsafe because of all the industries that pollute the Mississippi River, and we spend a lot of money to buy drinking water," said Jo Banner, local resident

and co-founder of the Descendants Project, which works to protect Black communities in Louisiana's river parishes.[129] "Both the Gramercy calcining plant and the alumina refinery next to it send their toxics straight into the river without any accountability, while we are forced to live with the impacts."

The Rain CII Carbon Gramercy plant exemplifies just how weak water permits are for the petcoke calcining industry. The plant reports very little about the contaminated water it generates to LDEQ, which issues its discharge permits. Making matters worse, there are no national pollutant limits for the industry.

What we know about water pollution from Gramercy and other calcining plants stems from a federal law that requires all industrial polluters to report their releases of toxic chemicals to EPA.[130] The resulting database, the Toxic Release Inventory, reveals that Rain CII Carbon Gramercy is releasing lead, mercury, nickel, vanadium, and polycyclic aromatic hydrocarbons—even though its permit does not limit or even require monitoring of these pollutants.

The disconnect between what is discharged into the river versus what is limited in Clean Water Act permits is not a minor omission or a matter of recordkeeping. Unless a pollutant is included in a permit, there won't be limits on how much can be discharged and operators are also less likely to sample and monitor wastewater for their presence.

"Petcoke facilities often seem hidden among all of the industries along the Mississippi River, but they're serious polluters," said Scott Eustis, Community Science Director for Healthy Gulf, an environmental nonprofit organization. "We've sued before over Clean Water Act violations related to petcoke. DEQ really needs to get more stringent with permits and water monitoring for the plants."[131]

The Rain CII Carbon calcining plant in Gramercy, Louisiana, releases lead, mercury, vanadium and other pollutants into a tributary to the Mississippi River.

LOUISIANA:
Pollution Damages Distressed Region

Water pollution from a petcoke and coal transfer facility, the United Bulk Terminal, in Davant, Louisiana. Healthy Gulf sued the company over the water pollution, resulting in new requirements to limit spills in the Mississippi River.

Calcasieu Parish, Louisiana, is a land of lakes and rivers snaking south to the Gulf of Mexico. This large parish, which is 15 times the size of Washington, DC, is also where many large industries have long operated.[132] The heart of Calcasieu Parish is crisscrossed with roads and dotted with dozens of oil refineries, power stations, chemical and plastic manufacturers, and more.

Petcoke calcining is an integral part of this massive industrial complex, particularly given its close ties to the oil industry. Three of the thirteen U.S. calcining operations are in Calcasieu Parish: the Reynolds Lake Charles Carbon Company, Rain CII Carbon Lake Charles, and the Phillips Lake Charles oil refinery's calcining unit. All of them rank among the top emitters of health-harming SO2 and particulate matter emissions in the Parish. The Rain CII Carbon plant also has the distinction of being in the Top 20 air emitters of toxic vanadium in the entire U.S.

Industries across Calcasieu Parish have spilled oil and toxic chemicals and dumped hazardous waste, severely damaging water, air, and the health of communities for decades.[133] About 500 new cancer cases occur every year in Calcasieu. That's even more than some of the parishes located in nearby "Cancer Alley," an area so named because of the harm caused by a large number of petrochemical and chemical plants.[134]

"I grew up in Lake Charles," said Michael Tritico, founder of the community organization Restore Explicit Symmetry

to Our Ravaged Earth or RESTORE.[135] "I have watched the sustainable natural systems here be mortally wounded for the sake of the unsustainable fossil fuel and petrochemical industry. Terrible water contamination, fish kills, and a lot of sickness, including cancer, replaced a providential natural equilibrium. We have sacrificed the old way of life for new ways of death. The calciners are not small when it comes to the pollution they cause, and they have been part of the bigger problem for a very long time."

"I have watched the sustainable natural systems here be **mortally wounded** for the sake of the...petrochemical industry."

- Michael Tritico, founder of the community organization Restore Explicit Symmetry to Our Ravaged Earth

Like other large industries in the area, the three petcoke calcining plants release their wastewater into the Calcasieu River and its surrounding bayous and swamps. The Louisiana Department of Environmental Quality classifies the 200-mile-long Calcasieu as an "outstanding natural resource," but large sections are also defined as "impaired" because the water is unsafe for some recreational activities and fish and wildlife.[136]

A variety of industrial pollutants plague the Calcasieu River, including lead and mercury, which the calcining plants have reported as being in their wastewater. A transport terminal that handles petcoke for the area's calcining plants and oil refineries has also been linked to pollution of the Calcasieu and nearby lakes because of poor management of petcoke piles.[137]

"At first look, calciners may not seem like a big deal because residents have to contend with so many refineries and petrochemical plants," said Wilma Subra, a chemist and technical advisor with the Louisiana Environmental Action Network. "But if you dig into the records of each facility, many pollution incidents occur and communities log odor complaints that signal health impacts. The sulfur and carbon issues are concerning, and Louisiana's strong winds means a lot of petcoke dust in the air."[138]

CHAPTER 5
Recommendations

Petcoke calcining plant operators often portray the process of petcoke calcining as straightforward and even beneficial because it turns petroleum waste into a product that can be sold. Yet petcoke calcining is inextricably tied to the climate- and health-harming oil industry, a highly polluting process in its own right, and a dirty component of metals manufacturing. As demand for aluminum, steel, and other products continue to grow—including to support the transition to clean energy and transportation—so too will the demand for calcined petcoke.

Unfortunately, the petcoke calcining industry has long been "flying under the radar" when it comes to protections for public health, air and water quality, and the climate. This needs to change. U.S. petcoke producers have considerable room for improvement in how they operate, and federal and state regulators have the authority and responsibility to require the adoption of new technologies and practices to reduce pollution.

Key steps going forward include:

1. **STRENGTHEN AIR POLLUTION RULES: EPA should develop New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) for the petcoke calcining sector.** The lack of coverage of petcoke calcining under these two bedrock environmental standards means that plant operators are able to avoid compliance with more stringent pollution control standards that apply to other large polluters. Instead, they continue to operate using old equipment and

limited pollution control measures and are able to avoid upgrading to modern-day, more effective pollution reduction practices.

The two sectors that bookend and drive the petcoke calcining process, petroleum refining and aluminum production, are covered by New Source Performance Standards and National Emissions Standards for Hazardous Air Pollutants—leaving a gaping regulatory hole in the middle. Under the Clean Air Act, EPA may add new industrial sectors for coverage under these standards, and should do so for petcoke calcining.[139]

2. **INSTALL SCRUBBERS: EPA should require the installation and operation of more effective pollution controls.** In particular, pollution scrubbers can remove large volumes of SO_2 and hydrochloric acid emissions from the gas stream so that far less is released straight into the air.[140] Power plants and other industrial facilities are required to use scrubbers, the installation of which is a key reason why SO_2 emissions have fallen over time at coal-fired power plants nationwide.[141] Calcining plants should also be required to use this modern technology to clean up their striking and harmful SO_2 problem.

   In addition, regulators should require all plants to use and maintain effective particulate matter controls and properly manage piles of petcoke stored onsite. For example, petcoke piles could be covered to reduce windborne particulate matter and toxins like nickel and vanadium carried by blowing dust. Operators could use systems to collect and treat contaminated stormwater, rather than letting it stream off sites into waterways.

3. **TIGHTEN WATER POLLUTION RULES: EPA should develop effluent limitation guidelines for petcoke calcining and include more pollution limits in water permits.** It does not appear that EPA has ever considered developing national pollution limits for the sector or adding it to those that exist for petroleum refining or other related sectors. EPA should do so in order to strengthen water pollution discharge sampling, monitoring, and reporting at calcining plants.

   At a minimum, EPA should examine whether national water pollution limits should be required for lead, nickel, mercury, vanadium, and benzo(g,h,i)perylene, since they have already been reported coming off these sites and are present in most petcoke. State regulators should also exercise their legal authority and responsibility under the Clean Water Act to set limits in permits for the full range of pollutants that calciners clearly discharge.

4. **ADVANCE CLEANER TECHNOLOGIES: Industry should advance new aluminum production and calcining technologies.** Companies need to move past the research, pilot project, and marketing phase and expedite the widespread application of advanced production technologies, particularly if they want to continue to tout them as part of corporate sustainability efforts.

   The aluminum industry has promised for years that they will develop a lower-carbon, less polluting method for producing aluminum that relies on different type of electricity-conducting device (called “inert anodes”) that do not require calcined petcoke as an ingredient.[142] Alcoa and other companies have announced that production using the technology is now possible and that inert anodes could soon be commercially available.[143] In addition, Rain Carbon has developed petcoke pellets that are denser than raw petcoke and can decrease the amount of petcoke needed for calcining; the company has said the technology will be commercially available in 2024.[144]

Appendix A

List of U.S. Petcoke Processing ('Calcining') Facilities

Operator	Plant and Location	Year Built*	Stated capacity (tons/year)
Calcining Plants			
Rain CII Carbon	Chalmette Coke Plant, St. Bernard Parish, LA	1960s	400,000
Rain CII Carbon	Gramercy Coke Plant, St. James Parish, LA	1978	400,000
Rain CII Carbon	Lake Charles Calcining Plant, Calcasieu Parish, LA	1979	350,000
Rain CII Carbon	Norco Coke Plant, St. Charles Parish, LA	1965	400,000
Rain CII Carbon	Robinson Calcining Plant, Crawford County, IL	Pre-1972	315,000
Rain CII Carbon	Purvis Calcining Plant, Lamar County, MS	1959	Not available
Oxbow Calcining LLC	Baton Rouge Calcining Plant, East Baton Rouge Parish, LA	1962	700,000
Oxbow Calcining LLC	Port Arthur Calcining Plant A & B, Jefferson County, TX	1935	700,000
Oxbow Calcining LLC	Kremlin Calcining Plant, Garfield County, OK	1963-1971	500,000
Seadrift Coke L.P.	Seadrift, Calhoun County, Port Lavaca, TX	1983	154,000
Alcoa	Reynolds Metals Carbon Plant, Lake Charles, Calcasieu Parish, LA	1969-1970	Not available
Calcining Units at Oil Refineries			
BP	Cherry Point #1, 2, 3, Whatcom County, WA	Not available	Not available
ConocoPhillips	Calcasieu Parish (Lake Charles), LA. AI #2538	Not available	303,000

Notes: * Dates represented as stated in permits or company communications. ** Capacities from permit and company documents and EPA's Office of Air and Radiation, *Technical Support Document for Coke Calcining: Proposed Rule for the Greenhouse Gas Reporting Program*, January 2022.

Appendix B: Research Methodology

This report is based on an extensive review of research on the petroleum coke calcining industry, including scientific studies; industry association data and publications; media articles; and air and water pollution data and regulatory and technological analyses from public agencies.

Facility-specific operational and regulatory information was gleaned primarily from air and water permits, permit applications, and permit support documentation obtained from state permitting agencies (through both online sources and public records requests). Additional information was obtained from databases of federal and state pollution data, including state-by-state annual emissions inventories and EPA's Enforcement and Compliance History Online, National Emissions Inventory, and Toxics Release Inventory.

Production Volumes

Petcoke calcining plants do not make production data publicly available. Because Oxbow Carbon LLC and Rain CII Carbon—which own nine of the eleven stand-alone calcining plants—are not publicly traded companies, information on their production and operations was not obtainable through public sources (e.g., filings with the Securities and Exchange Commission).

Overall production capacity volumes for most facilities were obtained from statements found in permit documents and in EPA's Office of Air and Radiation, *Technical Support Document for Coke Calcining: Proposed Rule for the Greenhouse Gas Reporting Program*, January 2022.

EIP purchased industry analyses of the petcoke calcining industry from Global Market Insights (GMI), a global market research and management consulting firm that supports corporations, agencies, and researchers with data on numerous industries. The data provided covered global and U.S. market trends, types of calcined petcoke produced (i.e., fuel-grade and calcined) and end-use application (i.e., aluminum, steel, and other industries). However, neither GMI nor other industry data firms could provide actual production data at the company or facility level.

Regulatory Applicability

EIP conducted a thorough review of federal standards discussed in this report (i.e., New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants, and Effluent Limitation Guidelines) to determine whether they have any applicability to the petcoke calcining sector. In the case of Louisiana, we also reviewed the regulations pertaining to toxic air pollutants from which plants in that state claim exemption.

In addition, EIP reviewed the regulatory applicability sections of federal air and water permits to determine which parts of facilities would be covered and how. We also conducted a thorough search of terms pertaining to the federal standards in all of the permits. Finally, we reviewed permits with regard to the types and applicability of state regulations.

Demographic Information

The assessment of communities near petcoke calcining facilities is based on EPA's Environmental Justice Screening and Mapping Tool (EJScreen) and the Climate and Economic Justice Screening Tool (CEJST) developed by the U.S. Council on Environmental Quality, which provides an assessment of several environmental and socioeconomic conditions at the census tract level.

Because census tract boundaries do not define communities, and these production facilities can impact residents who are nearby but not necessarily located within the same census tract, EIP expanded identification of the population and "disadvantaged" status of nearby communities to include census tracts that are entirely or partially within a three-mile radius around the facilities, based on the center point of the facility.

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[65] Based on the U.S. Census Bureau's American Community Survey 2017-2021 5-Year Estimates. EJScreen defines "low-income" as a household in which income is less than or equal to twice the federal poverty level.

[66] Stephan Broek, "Update on SO_2, Scrubbing Applied in Primary Aluminum Smelters," *Light Metals*, 2020, https://link.springer.com/chapter/10.1007/978-3-030-36408-3_103.

[67] EPA, "Sulfur Dioxide (SO_2) pollution," https://www.epa.gov/so2-pollution

[68] Based on state emission inventories for reporting year 2022 for all facilities except 2020 data for Rain CII Carbon Purvis in Mississippi, the latest year for which emission inventory data are available.

[69] This is called a "mass balance" approach. Letter from Scott E. Stewart, Oxbow Calcining LLC, to Kendal Stegmann, Oklahoma DEQ Air Quality Division, regarding four-factor analysis under the Clean Air Act Regional Haze Program, March 7, 2022.

[70] The 2010 SO_2 standard is for 1-hour at a level of 75 parts per billion (ppb), based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations; see EPA, "Primary National Ambient Air Quality Standard (NAAQS) for Sulfur Dioxide," https://www.epa.gov/so2-pollution/primary-national-ambient-air-quality-standard-naaqs-sulfur-dioxide

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[72] Lone Star Legal Aid, Complaint under Title VI of the Civil Rights Act of 1964 42 U.S.C. 2000d, by Port Arthur Community Action Network regarding the Texas Commission on Environmental Quality's Issuance of Federal Operating Permit No. O1493 to Oxbow Calcining LLC, submitted to EPA Office of General Counsel, Aug. 18, 2021.

[73] Trinity Consultants, *Regional Haze Reasonable Progress Analysis*, Oxbow Calcining LLC Kremlin Calcined Coke Plant, report prepared for the Oklahoma Department of Environmental Quality, September 29, 2020, https://www.deq.ok.gov/wp-content/uploads/air-division/RH_2021_Response_Oxbow.pdf

[74] EPA, Particulate Matter basics, https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#effects

[75] American Lung Association, "What is Particle Pollution," https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/particle-pollution.

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[77] Congressional Research Service, *Petroleum Coke: Industry and Environmental Issues*, October 29, 2013, https://crsreports.congress.gov/product/pdf/R/R43263#.

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[79] Quade R. Stahl, *Air pollution aspects of hydrochloric acid*, paper prepared for the National Air Pollution Control Administration, 1969, https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=91008039.TXT.

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[81] EPA, "Proposed rule to reduce toxic air pollution from hydrochloric acid production," fact sheet, 2001. https://www.epa.gov/sites/default/files/2015-06/documents/hcl_fs.pdf

[82] EPA, Nickel Compounds Hazard Summary, https://www.epa.gov/sites/default/files/2016-09/documents/nickle-compounds.pdf

[83] Harvard T.H. Chan School of Public Health, "Nickel may contribute to air pollution's cardiovascular effects," 2015, https://www.hsph.harvard.edu/news/hsph-in-the-news/nickel-may-contribute-to-air-pollutions-cardiovascular-effects/ ; National Cancer Institute, "Nickel Compounds," https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/nickel#.

[84] Agency for Toxic Substances and Disease Registry, ToxFAQs for Vanadium, https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=275&toxid=50#.

[85] Schlesinger, William H., Klein, Emily M., and Vengosh, Avner. "Global Biogeochemical Cycle of Vanadium," *Proceedings of the National Academy of Sciences*, Dec. 11, 2017, https://www.pnas.org/doi/full/10.1073/pnas.1715500114

[86] Les Edwards, "The History and Future Challenges of Calcined Petroleum Coke Production and Use in Aluminum Smelting," *Journal of the Minerals, Metals & Materials Society*, December 2014, https://link.springer.com/article/10.1007/s11837-014-1248-9

[87] Caruso J.A., Zhang K., Schroeck, N.J., McCoy B., McElmurry S.P., "Petroleum coke in the urban environment: a review of potential health effects," *International Journal of Environmental Research and Public Health*, May 2015.

[88] The exception to this rule is Seadrift Coke Plant in Texas. Its water discharge permit includes limits on all basic contaminants as well as several toxic substances such as copper, benzene, and toluene. Seadrift operates differently than the other plants because it refines different products directly from oil, of which calcined petcoke is one.

[89] Code of Federal Regulations, Title 40, Part 60.

[90] Definition of New Source Performance Standards under the Clean Air Act, EPA, https://www.epa.gov/stationary-sources-air-pollution/calciners-and-dryers-mineral-industries-new-source-performance

[91] 42 United States Code. § 7411(a)(1).

[92] 42 United States Code. § 7411(h).

[93] *Background Information for Standards of Performance: Primary Aluminum Industry Volume 1: Proposed Standards*, EPA-450/2-74-020a, October 1974. EPA has not revised the NSPS for the primary aluminum sector in more than 25 years nor determined that a review and revision is not necessary—despite having a legal obligation to do so at least every eight years.

[94] The only exceptions were a few references to the NSPS in the permits for the two petroleum refineries (BP Cherry Point in Washington and Conoco-Phillips in Louisiana) related to fuel gas use, specifically Title 40 of the Code of Federal Regulations, Subpart J, Standards of Performance for Petroleum Refineries, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-60/subpart-J.

[95] John L. Sorrels et al., "Wet and Dry Scrubbers for Acid Gas Removal," Section 5 in *Control Cost Manual*, EPA, 2021, https://www.epa.gov/sites/default/files/2021-05/documents/wet_and_dry_scrubbers_section_5_chapter_1_control_cost_manual_7th_edition.pdf

[96] EPA, National Emission Standards for Hazardous Air Pollutants (regulatory overview and list of covered sectors), https://www.epa.gov/stationary-sources-air-pollution/national-emission-standards-hazardous-air-pollutants-neshap-8. There are currently 188 pollutants on the list.

[97] Under Section 112 of the Clean Air Act, a "Major Source" of air pollution is in part defined as one that releases ten or more tons per year of any regulated hazardous air pollutant or 25 or more tons per year of a combination of hazardous air pollutants; Title 42, U.S. Code § 7412(a)(1).

[98] 42 United States Code, § 7412(c)(1).

[99] EPA, "Setting Emissions Standards for Major Sources of Toxic Air Pollutants," https://www.epa.gov/clean-air-act-overview/setting-emissions-standards-major-sources-toxic-air-pollutants

[100] The only exceptions were a few references to the NSPS in the permits for the two petroleum refineries (BP Cherry Point in Washington and Conoco-Phillips in Louisiana) related to benzene waste, specifically Title 40 of the Code of Federal Regulations, Subpart FF, Standards of Performance for Benzene Waste Operations, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-61/subpart-FF. However, the applicability of this requirement to the calcining units at the refineries is unclear.

[101] Although not currently classified as a hazardous air pollutant, vanadium is emitted during the petcoke calcining process and there is growing concern about its impact on health and the environment. Schlesinger, William H., Klein, Emily M., and Vengosh, Avner. "Global Biogeochemical Cycle of Vanadium," *Proceedings of the National Academy of Sciences*, Dec. 11, 2017, https://www.pnas.org/doi/full/10.1073/pnas.1715500114.

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[103] EPA, "Learn about Effluent Guidelines," https://www.epa.gov/eg/learn-about-effluent-guidelines

[104] Southwest Electric Power Company v. EPA, 920 F.3d 999, 1005 (5th Circuit, 2019).

[105] Title 42, U.S. Code § 7416 (stating generally that "nothing in this chapter shall preclude or deny the right of any State or political subdivision thereof to adopt or enforce (1) any standard or limitation respecting emissions of air pollutants or (2) any requirement respecting control or abatement of air pollution," except that such limits may not be less stringent than any federal limits established under Section 7411 or Section 7412).

[106] Louisiana Administrative Code, Chapter 51, Title 33, §5105, Special Provisions.

[107] Rain CII Carbon, "Resourceful, Reliable, Responsible," 2022 Corporate Sustainability Report, https://raincarbon.com/Upload/Content_Files/rain-carbon-inc-sustainability-report-cy2022.pdf

[108] Naveena Sadasivam and Clayton Aldern, "Any Way the Wind Blows," *Grist*, Feb. 16, 2023, https://grist.org/project/accountability/koch-oxbow-port-arthur-texas-clean-air-act-pollution/; Oklahoma Department of Environmental Quality, Regional Haze State Implementation Plan, June 1, 2022, https://www.deq.ok.gov/wp-content/uploads/air-division/RH_PP2_Plan_Draft.pdf

[109] Title 40, Code of Federal Regulations, §125.3(c)(2) and §125.3(d)(3).
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[111] U.S. Census Bureau, 2020 Census, https://data.census.gov/all?q=kremlin%20ok
[112] Oxbow Calcining LLC, Title V air permit application review for permit number 2019-0973-TVRJ (M-1), OK Department of Environmental Quality, Feb. 22, 2023. Oxbow states acreage of the Kremlin plant as 320 acres and production capacity as 805,920 tons.
[113] Oklahoma State Emissions Inventory, Point Sources, Reporting Year 2022.
[114] Based on the Oklahoma Department of Environmental Quality, state emissions inventory, reporting year 2022, https://www.deq.ok.gov/air-quality-division/emissions-inventory/
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