OUT OF CONTROL

The Deadly Impact of Coal Pollution

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SIERRA CLUB

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EXECUTIVE SUMMARY

After decades of citizen advocacy and environmental policy gains, air quality in the United States has dramatically improved. However, many of the inequities in exposure to air pollution that spurred the creation of the Clean Air Act are still prevalent today.

This report explores the extent and impact of particulate pollution from the country's remaing coal-fired power plants to understand where that pollution is felt, which plants and parent companies are most responsible, and what authority and responsibility resides with EPA to fully implement the Clean Air Act's protections to ensure all communities have access to clean air. We estimate that the remaining fleet of coal-fired power plants is still responsible for 3,800 premature deaths per year due to particulate pollution. 10% of plants are super-polluters responsible for over 50% of these deaths.

We focus on premature mortality as a proxy for the relative burden attributable to particulate pollution from each coal-fired power plant. This burden is a function of the total emissions from a given plant as well as wind patterns and population density downwind. On average, we estimate that only 4% of premature deaths from remaining coal-fired power plants occur in the same county where the plant is located. Alleghany County in Pennsylvania and Cook County in Illinois roughly tie for the most premature deaths from coal. Yet Cook County is hundreds of miles away from any large coal-fired power plants — an example of how particulate pollution from coal blankets the country. In fact, we find that particulate pollution from the remaining coal fleet causes an estimated 234 premature deaths per year in New York, despite the state having retired all of its own coal plants.

We estimate that 15 utility parent companies own half of the remaining coal capacity and are responsible for over 60% of premature deaths from coal particulate pollution. The deadliest parent company is Tennessee Valley Authority (TVA) — which is not owned by the fossil fuel industry, but by the U.S. government. The majority of these utility parent companies have either non-existent or hollow decarbonization commitments, lacking measurable steps towards replacing their coal plants with clean energy. The utilities which are causing the most harm from air pollution aren't planning to do enough (or anything) to change.

The Clean Air Act requires the EPA to set National Ambient Air Quality Standards (NAAQS) to protect Americans from exposure to harmful levels of air pollution. In January 2023, the EPA released a long-awaited draft proposal to update the NAAQS for particulate matter. Under that draft, the agency would cut the current annual exposure limit from 12.0 μg/m³ to a range of 9–10 μg/m³. However, the draft standard does not address controlling emissions from power plants that contribute to particulate pollution. In addition, despite EPA's mandate to promulgate and enforce strong federal rules to address major sources of air pollution, over half of coal generating units online today still lack major air pollution controls.

The Beyond Coal Campaign advocates for all remaining coal plants to be retired and replaced with clean energy by 2030. On average, we find that retiring the remaining coal fleet would reduce particulate pollution enough to account for 34% of the difference between an 8 μg/m³ standard (as recommended by EPA's own independent scientific advisory committee) and the proposed 9 μg/m³ standard. Unfortunately, as written, even a stronger NAAQS would not necessitate that any coal plants retire or reduce their emissions. However, EPA has the authority to directly impact the highest polluting power plants through existing rules on cross-state air pollution, regional haze and others — ensuring that the most deadly plants have modern pollution controls or shut down for good.

BACKGROUND

The relationship between the quality of air that we breathe and effects on the human body has been studied for decades.

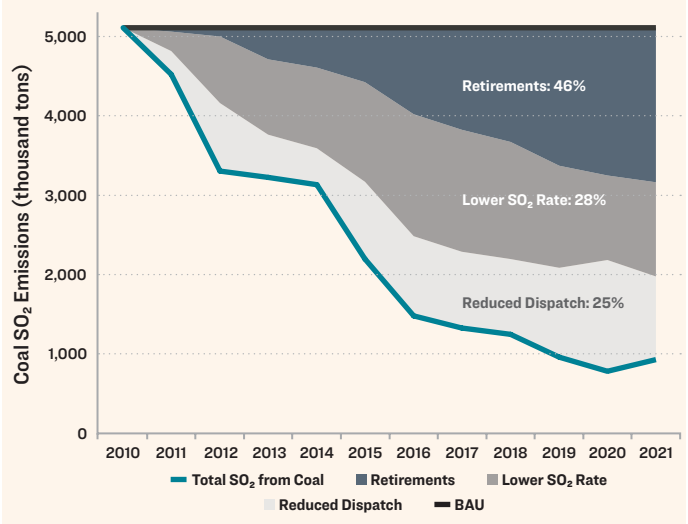
Polluted air has been linked to increased asthma rates, bronchitis, blood clots, heart attacks, chronic obstructive pulmonary disease (COPD), lung cancer, diabetes, and weakened immune systems among other adverse health impacts. These health impacts not only affect the quality of life for those who are exposed, but can also lead to premature mortality. In 2021, researchers at the University of Chicago estimated that air pollution reduces life expectancy by more than two years. The vast majority of this pollution is from the combustion of fossil fuels, which creates tiny particles in the air. The smallest of these particles (those with diameters 2.5 micrometers and smaller, known as $PM_{2.5}$) cause the greatest risk to public health. It's estimated that $PM_{2.5}$ pollution from burning fossil fuels is responsible for 1 in 5 premature deaths worldwide. Although regions of the world with the highest levels of fossil fuel pollution suffer the most, even short-term relief from moderate levels of $PM_{2.5}$ has been shown to have a measurable effect.

After decades of environmental policy and citizen advocacy, air quality in the United States has dramatically improved. However, it is well documented that people of color and lower income are historically at a higher risk of death from being exposed to $PM_{2.5}$ pollution. Although pollution levels have dropped overall, those areas that were most and least polluted in the 1980s remain so today. What's worse is that these inequities have been increasing over time. A recent study showed that in 2016, the average $PM_{2.5}$ exposure for Black Americans was 12% higher than white Americans. This inequity has doubled since 2010. Furthermore, neighborhoods that were redlined in the 1930s are directly correlated with higher pollution levels today. The fossil fuel industry continues to operate and expand in areas it treats like sacrifice zones which disproportionately burden people of color.

Human-caused $PM_{2.5}$ pollution kills an estimated 100,000–300,000 Americans each year. These types of estimates differ in how they use available data and computer models to assess the formation, spread and impact of $PM_{2.5}$. $PM_{2.5}$ pollution in the air is a combination of direct particulate matter emissions and other gasses, such as sulfur dioxides and nitrogen oxides (NO_x) which convert to $PM_{2.5}$ in the atmosphere. According to the U.S. Environmental Protection Agency (EPA), national ambient average $PM_{2.5}$ concentrations declined 37% between 2000 and 2021. Although the composition of $PM_{2.5}$ varies regionally, the largest driver of this decline was the reduction in sulfates (particularly in the eastern U.S.), which are formed by sulfur dioxide (SO_2) pollution. Just since 2010, national SO_2 emissions have decreased by three-quarters, with coal-fired power plants accounting for over 80% of that decrease.

Since 2010, the Sierra Club's Beyond Coal Campaign has been working alongside partner organizations and grassroots activists to advocate for meaningful changes in communities, including pushing electric utilities to retire coal-fired power plants and replace them with clean energy. Between 2010–2021, 36% of the country's coal generating capacity was retired (another 25% has retired since or has been committed to retire by the end of the decade). These retirements have been the primary driver of the reduction in coal SO_2 emissions, as shown in **Figure 1**. The second largest driver has been a reduction in the SO_2 emissions rate (SO_2 emissions per unit of energy generated) from coal-fired power plants that are still operating. This reduction in SO_2 rate is due in large part to increased prevalence of SO_2 emissions controls. The most effective of these controls is a system of technologies known as flue-gas desulfurization (FGD) which removes SO_2 from the exhaust gas of a coal-fired boiler. Sierra Club analysis of data from S&P Global shows that just 32% of coal generating units online in 2010 had an FGD installed vs 60% in 2021.

Figure 1: Primary factors contributing to the decline in coal SO_2 emissions from 2010–2021. *Source: Sierra Club analysis of generation and emissions data provided by S&P Global.*



Although national trends are helpful in understanding the scale of the problem, it's also important to note how drastically and quickly reducing coal air pollution can improve public health in an affected community. In 2020, a study led by Columbia University was published that linked SO_2 reductions from coal-fired power plants to a decline in hospital visits in the Louisville, Kentucky area. The study found that the retirement of generating units at the Cane Run plant and upgrade of SO_2 controls at the Mill Creek and Rockport plants resulted in 400 fewer hospital admissions or emergency room visits for asthma attacks the following year.

The statistics given above are meant to underscore the magnitude and inequity of $PM_{2.5}$ exposure, as well as the impact that retiring or controlling coal-fired power plants has had on reducing that exposure. As a public health agency, EPA has the authority and the obligation to address harmful air pollutants like $PM_{2.5}$. The Clean Air Act (CAA) requires the EPA to determine National Ambient Air Quality Standards (NAAQS) for outdoor air pollutants known to be harmful to public health and the environment. EPA is also required to complete regulatory impact analyses to assess the effects of the CAA and associated administrative rules — the primary co-benefit often being the reduction in $PM_{2.5}$-related premature mortality from those rules. Despite EPA's mandate to promulgate and enforce strong federal rules to address major sources of air pollution, **over half** of coal generating units online today still lack major pollution controls for SO_2 or NO_X.

In 2010, Clean Air Task Force (CATF) commissioned Abt Associates to do a comprehensive study of health impacts caused by fine particle air pollution from each of the nation's then roughly 500 coal-fired power plants. The Sierra Club's Beyond Coal Campaign has relied on this study as a valuable tool to assess which plants cause the most harm — ensuring that those are among the highest priority for retirement. In 2021, CATF released an update to this study, aptly titled *'The Toll From Coal'*. For this update, CATF utilized EPA's Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) to assess the level of $PM_{2.5}$ pollution caused by the coal fleet based on 2019 emissions data (detailed methodology provided here). The COBRA Tool outputs an estimate of the $PM_{2.5}$ contribution and premature mortality (in addition to other adverse health impacts) from each coal-fired power plant that occurs in each county in the contiguous U.S. CATF has generously shared these detailed output files with Sierra Club, which form the basis of this report.

The goal of this report is to explore the $PM_{2.5}$ burden from coal-fired power plants that remain today, to understand where that burden is felt, which plants and parent companies are most responsible, and what authority and responsibility resides with EPA to fully implement the Clean Air Act's protections to ensure all communities have access to clean air.

MOST DEADLY PLANTS

The latest *Toll From Coal* study finds that coal-fired power plants in the U.S. were responsible for 6,709 premature deaths in 2019.

According to Sierra Club's Beyond Coal Campaign, of the 261 gigawatts (GW) of coal-fired power plant capacity operating in 2019, 18% has since been retired with another 29% committed to retire by the end of the decade. We estimate that the remaining 53% of 2019 capacity (138 GW) is still responsible for **3,800 premature deaths per year** due to $PM_{2.5}$ pollution (see **Appendix** for methodology). What's worse is that these deaths are needless and avoidable. The same grid services these plants provide can be readily met by a mix of clean energy, storage and demand-side management. Moreover, local clean energy is now more cost effective than continuing to run existing coal-fired power plants. The newly passed Inflation Reduction Act has incentives to manufacture, purchase, cite and transmit clean energy as well as incentives to aid utilities in debt relief for their existing coal assets. Together, these incentives have solidified the path for transitioning from coal to clean energy — for utilities that are willing to take advantage of them.

Table 1 lists the most deadly coal-fired power plants which remain today. We estimate that the 17 plants shown here are responsible for 1,920 premature deaths per year — representing over half of deaths from the remaining fleet. In this report, we focus solely on premature mortality as a proxy for the relative burden that $PM_{2.5}$ air pollution from each coal-fired power plant causes. This burden is a function of the total emissions from a given plant as well as wind patterns and population density downwind. Coal-fired power plants have smokestacks which are often hundreds of feet high;

Table 1: The most deadly remaining coal-fired power plants — representing over 50% of premature deaths. *Source: Sierra Club analysis of data provided by Clean Air Task Force.*

Plant Name	Plant Location	Deaths	Deaths in Same County as Plant	Deaths in Same State as Plant	County Most Impacted	2019 SO_2 Emissions (thousand tons)
General James M Gavin	Gallia County, Ohio	244	3%	21%	Gallia County, Ohio	26
Labadie	Franklin County, Missouri	195	1%	7%	Cook County, Illinois	34
Keystone	Armstrong County, Pennsylvania	160	2%	32%	Allegheny County, Pennsylvania	20
Shawnee	McCracken County, Kentucky	154	1%	6%	Cook County, Illinois	16
Martin Lake	Rusk County, Texas	154	1%	22%	Harris County, Texas	47
Cardinal	Jefferson County, Ohio	132	8%	21%	Allegheny County, Pennsylvania	7
Harrison Power Station	Harrison County, West Virginia	122	<1%	5%	Allegheny County, Pennsylvania	11
W A Parish	Fort Bend County, Texas	109	3%	70%	Harris County, Texas	29
Ghent	Carroll County, Kentucky	95	<1%	9%	Hamilton County, Ohio	9
New Madrid	New Madrid County, Missouri	90	<1%	4%	Cook County, Illinois	13
Prairie State Generating Station	Washington County, Illinois	76	2%	25%	Cook County, Illinois	11
Antelope Valley	Mercer County, North Dakota	70	1%	3%	Cook County, Illinois	11
Coyote	Mercer County, North Dakota	68	1%	3%	Cook County, Illinois	10
Homer City Station	Indiana County, Pennsylvania	67	1%	31%	Westmoreland County, Pennsylvania	8
Mill Creek	Jefferson County, Kentucky	66	49%	57%	Jefferson County, Kentucky	2
Jim Bridger	Sweetwater County, Wyoming	60	<1%	2%	Los Angeles County, California	9
Bowen	Bartow County, Georgia	59	1%	19%	Fulton County, Georgia	9

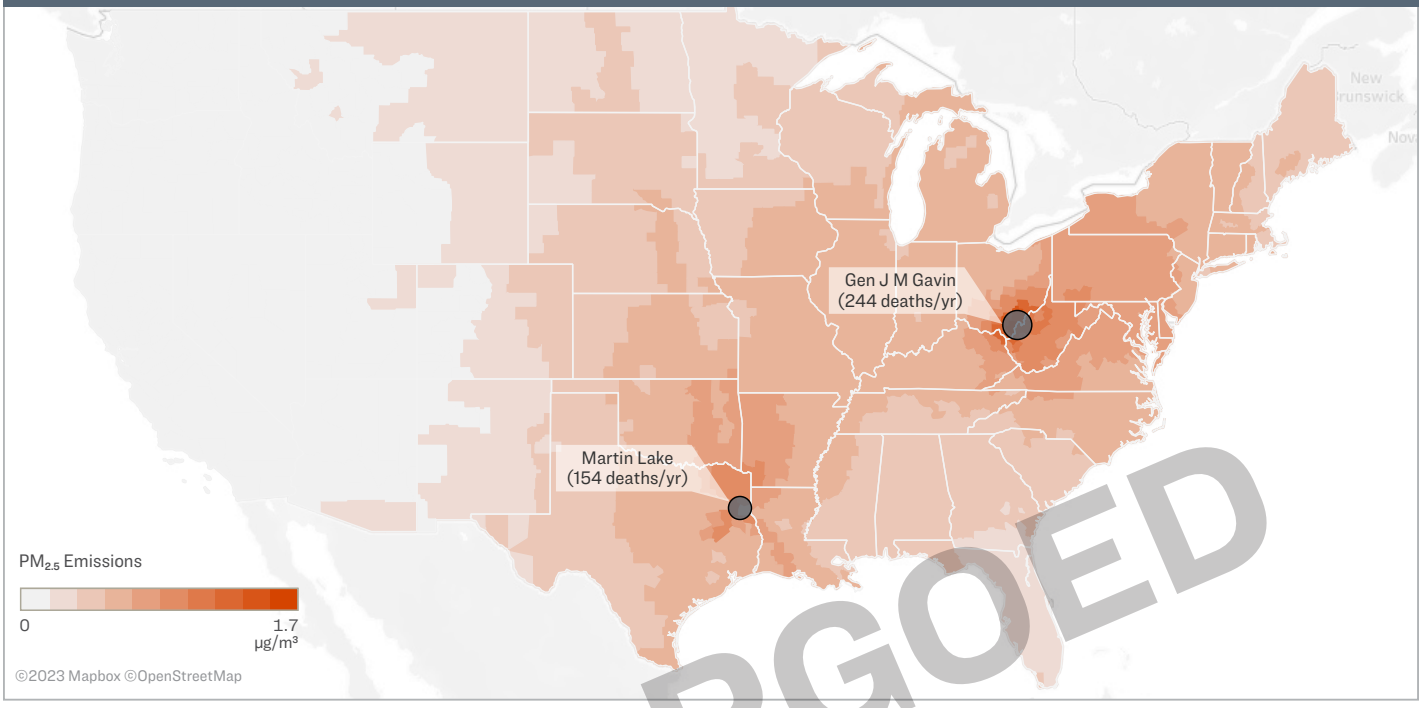
emitting SO_2 and NO_x into windier air high above the ground. It takes time for this SO_2 and NO_x to circulate and form $PM_{2.5}$, meaning that the resulting pollution burden can be felt hundreds of miles away.

For example, the Martin Lake plant in East Texas had the highest level of SO_2 emissions in 2019 at over 47 thousand tons. However, the most deadly plant is General James M Gavin on the Ohio River valley, which emitted roughly half as much SO_2 but was responsible for 50% more deaths.

The difference in the impact of these two plants can be explained, in part, by looking at where their pollution travels. **Figure 2** shows the estimated county-level $PM_{2.5}$ pollution from these two plants. Higher $PM_{2.5}$ pollution levels from Gavin generally spread east, to densely populated New England States, whereas pollution from Martin Lake primarily impacts the less populated Great Plains states.

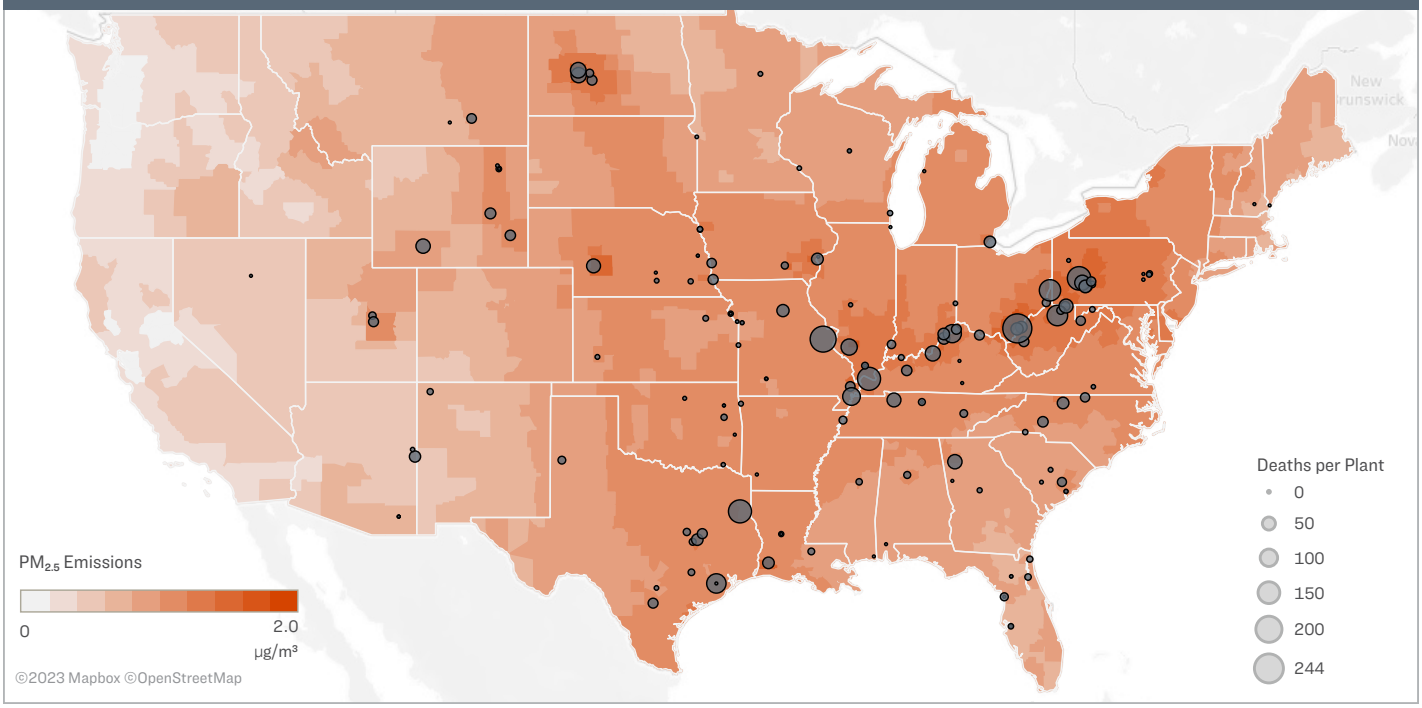
MARTIN LAKE (LEFT) AND GENERAL JAMES M GAVIN — TWO OF THE DEADLIEST REMAINING COAL-FIRED POWER PLANTS IN THE COUNTRY.
Martin Lake photo copyright Al Braden General James M Gavin photo copyright Kvaka9/Dreamstime.com

Figure 2: County-level $PM_{2.5}$ pollution (shown in shades of red corresponding to intensity) from the Martin Lake and General James M Gavin coal plants (which are shown as gray circles, sized by their total associated mortality impacts). *Source: Sierra Club analysis of data provided by Clean Air Task Force.*



Similarly, **Figure 3** shows the combined county-level $PM_{2.5}$ pollution from all remaining coal-fired power plants (i.e. those plants with at least one generating unit lacking a retirement commitment prior to 2031, according to Sierra Club). Although counties with the highest $PM_{2.5}$ levels are generally proximal to a coal plant, much of the eastern and central United States is affected. The relative impact of this $PM_{2.5}$ pollution on a given county also depends on how populous that county is. On average, we estimate that **only 4%** of premature deaths from remaining coal-fired power plants occur in the same county where the plant is located. The distribution of remaining plants and prevailing wind patterns result in a number of counties that experience an outsized burden

Figure 3: County-level $PM_{2.5}$ pollution (shown in shades of red corresponding to intensity) from remaining coal-fired power plants (which are shown as gray circles, sized by their total associated mortality impacts). *Source: Sierra Club analysis of data provided by Clean Air Task Force.*



(as evidenced by the repetition in the 'County Most Impacted' column of **Table 1**).

Table 2 lists the 31 counties (top 1%) with the highest number of premature deaths from remaining coal plants. Alleghany County in Pennsylvania and Cook County in Illinois are roughly tied for the most premature deaths from coal. However, Cook County is hundreds of miles away from any large coal-fired power plants. In fact, Ameren's Labadie plant, which is the largest contributor to Cook County, is over 300 miles away near St. Louis. Some places, like Cook County, have moderate $PM_{2.5}$ pollution levels from coal, but dense populations — resulting in a relatively high estimate of premature mortality. Other places, like Jefferson County in Kentucky are less populous, but are subjected to high levels of $PM_{2.5}$ pollution. This effect can be seen by comparing the estimated premature deaths **per capita** in **Table 2**.

Table 2: Counties with the most premature deaths from remaining coal-fired power plants. *Source: Sierra Club analysis of data provided by Clean Air Task Force.*

County	State	Population	Deaths	Deaths per capita	Highest Contributing Plant (Plant Location)
Allegheny	Pennsylvania	1,221,744	63	51	Cardinal (Ohio)
Cook	Illinois	5,198,275	61	12	Labadie (Missouri)
Jefferson	Kentucky	767,419	43	56	Mill Creek (Kentucky)
Harris	Texas	4,646,630	42	9	W A Parish (Texas)
Wayne	Michigan	1,757,299	35	20	Labadie (Missouri)
Cuyahoga	Ohio	1,247,451	29	23	Shawnee (Kentucky)
Dallas	Texas	2,606,868	26	10	W A Parish (Texas)
Erie	New York	919,355	24	27	General James M Gavin (Ohio)
Philadelphia	Pennsylvania	1,579,075	22	14	Keystone (Pennsylvania)
Tarrant	Texas	2,049,770	21	10	W A Parish (Texas)
Westmoreland	Pennsylvania	352,590	20	56	Cardinal (Ohio)
Oakland	Michigan	1,253,185	19	15	Labadie (Missouri)
Baltimore	Maryland	828,018	18	22	General James M Gavin (Ohio)
Montgomery	Pennsylvania	823,823	18	22	Keystone (Pennsylvania)
Bexar	Texas	1,952,843	17	9	W A Parish (Texas)
Monroe	New York	743,341	17	22	Keystone (Pennsylvania)
Macomb	Michigan	870,325	17	19	Labadie (Missouri)
Marion	Indiana	951,869	16	17	Shawnee (Kentucky)
Hamilton	Ohio	813,589	15	19	Ghent (Kentucky)
St Louis	Missouri	996,919	15	15	Prairie State Generating Station (Illinois)
Franklin	Ohio	1,290,360	15	12	General James M Gavin (Ohio)
Ocean	New Jersey	596,415	15	24	Keystone (Pennsylvania)
Washington	Pennsylvania	207,212	14	69	Cardinal (Ohio)
Lancaster	Pennsylvania	540,999	14	26	Keystone (Pennsylvania)
Kings	New York	2,589,974	14	5	Keystone (Pennsylvania)
Montgomery	Maryland	1,043,530	14	13	General James M Gavin (Ohio)
Suffolk	New York	1,483,832	14	9	General James M Gavin (Ohio)
Bucks	Pennsylvania	626,806	13	21	Keystone (Pennsylvania)
Prince Georges	Maryland	908,670	13	14	General James M Gavin (Ohio)
Los Angeles	California	10,081,570	13	1	Jim Bridger (Wyoming)
Cambria	Pennsylvania	133,009	13	97	Colver Power Project (Pennsylvania)

THE LABADIE COAL-FIRED POWER PLANT CONTRIBUTES TO PREMATURE MORTALITY COOK COUNTY, ILLINOIS — OVER 300 MILES AWAY. Photo courtesy of Jenn DeRose

Of note in **Table 2** is Los Angeles County in California, which doesn't even border a state with any large coal-fired power plants, yet shows up in the top 30 counties for premature mortality due to its massive population. In fact, California experiences an estimated 48 premature deaths per year due to $PM_{2.5}$ pollution from remaining coal despite having no coal-fired power plants in the state. **Table 3** shows the premature deaths that A) occur in each state due to coal-fired power plants across the county as well as B) the premature deaths that occur across the country due to coal-fired power plants in each state. Some states experience more harm than they cause (New York being the highest " net importer" of premature deaths from coal-fired power plants in other states). Other states "export" a lot of $PM_{2.5}$ burden to other states (e.g. Kentucky and Missouri). Only a handful of states experience a high amount of premature deaths from coal-fired power plants within their own borders (e.g. Pennsylvania and Texas). On average, we estimate that **only 18%** of premature mortality from remaining coal-fired power plants occurs in the same state where the plant is located.

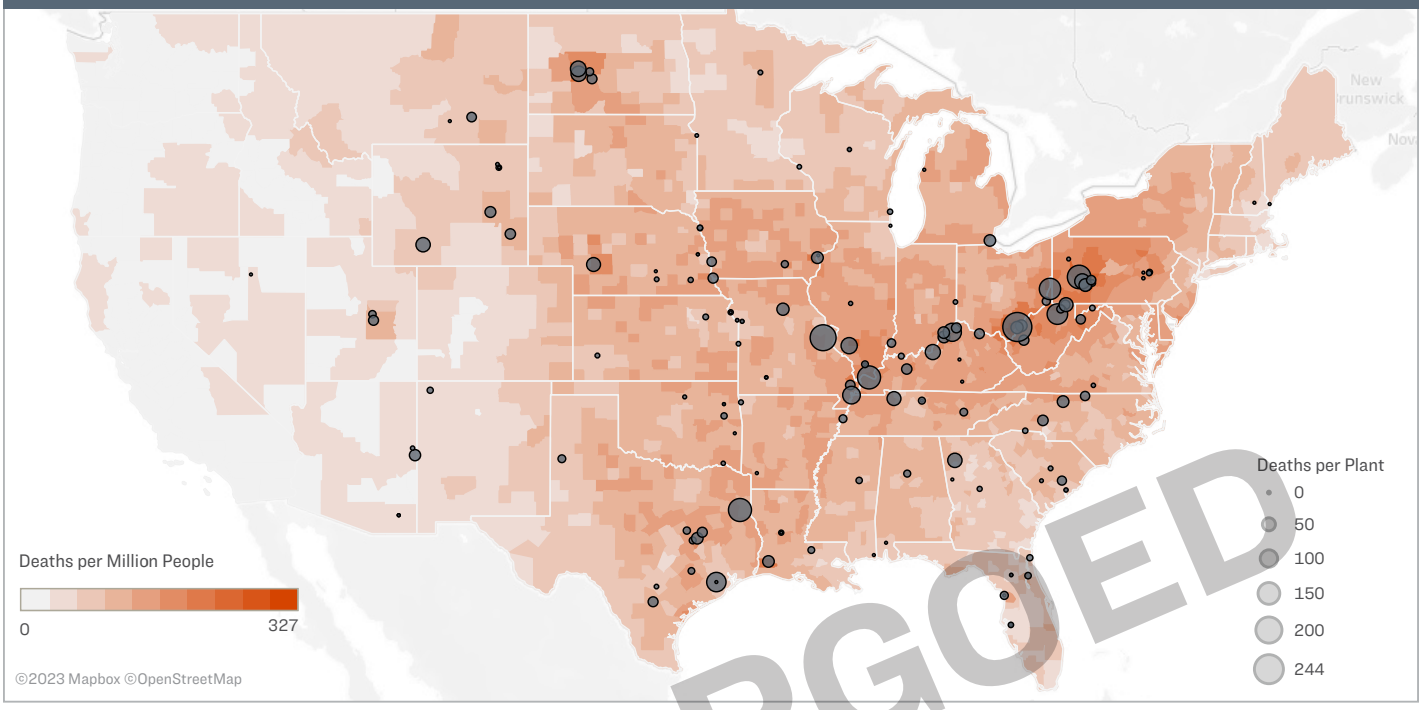
Figure 4 illustrates the estimated premature deaths per capita at a county level due $PM_{2.5}$ pollution from remaining coal-fired power plants (shown in shades of red corresponding to intensity) — as well as the plants that are the highest contributors to that burden (each dot sized by the total mortality associated with that plant). Whereas **Figure 3** shows where $PM_{2.5}$ pollution is concentrated, **Figure 4** shows where that pollution is causing the most harm.

It's also important to note **who** is experiencing this harm. **Figure 5** shows the population-weighted $PM_{2.5}$ exposure from all remaining coal-fired power plants for each race as categorized by the U.S. census (methodology provided in the **Appendix**). These findings are consistent

Table 3: State-level premature deaths from coal-fired power plants remaining today. *Source: Sierra Club analysis of data provided by Clean Air Task Force.*

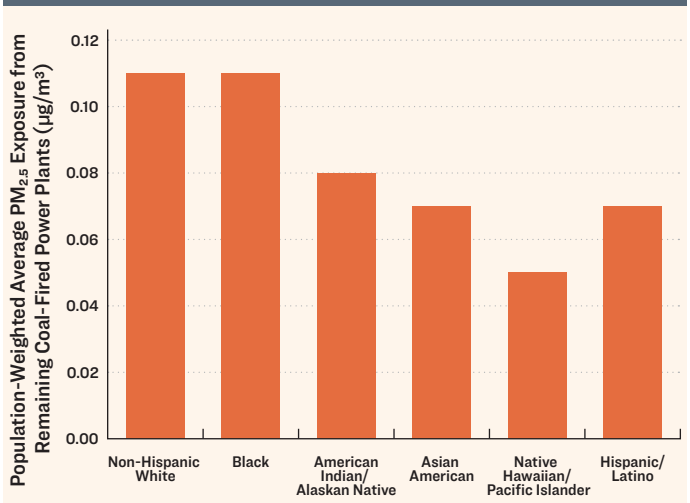
State	A) Total deaths in state due to all coal plants nationally	B) Total deaths nationally due to coal plants in state	C) Total deaths in state due to coal plants in state	D) Net imports (A-B)
Alabama	64	14	4	50
Arizona	23	43	5	-21
Arkansas	51	27	1	24
California	48	0	0	48
Colorado	30	0	0	30
Connecticut	45	0	0	45
Delaware	21	0	0	21
District of Columbia	9	0	0	9
Florida	131	53	35	78
Georgia	80	67	13	13
Idaho	4	0	0	4
Illinois	199	94	24	105
Indiana	136	75	8	61
Iowa	60	97	12	-37
Kansas	35	25	2	10
Kentucky	136	443	66	-307
Louisiana	66	59	18	6
Maine	12	0	0	12
Maryland	112	9	1	103
Massachusetts	49	0	0	49
Michigan	182	41	8	141
Minnesota	32	6	1	26
Mississippi	40	12	1	29
Missouri	94	372	27	-278
Montana	5	27	<1	-22
Nebraska	31	103	10	-73
Nevada	7	1	<1	6
New Hampshire	9	2	<1	7
New Jersey	130	0	0	130
New Mexico	9	11	1	-2
New York	234	0	0	234
North Carolina	129	104	20	25
North Dakota	9	184	6	-175
Ohio	288	419	87	-131
Oklahoma	59	24	2	35
Oregon	4	0	0	4
Pennsylvania	430	384	129	46
Rhode Island	11	0	0	11
South Carolina	56	40	8	16
South Dakota	9	4	<1	5
Tennessee	111	87	13	24
Texas	303	423	168	-120
Utah	10	44	4	-35
Vermont	9	0	0	9
Virginia	124	5	1	119
Washington	7	0	0	7
West Virginia	83	335	20	-252
Wisconsin	69	19	2	50
Wyoming	4	144	3	-139

Figure 4: County-level deaths per million people (shown in shades of red corresponding to intensity) from remaining coal-fired power plants (which are shown as gray circles, sized by their total associated mortality impacts). *Source: Sierra Club analysis of data provided by Clean Air Task Force.*



with recent research showing that particle pollution from coal-fired power plants is one of the only sources that substantially affects white Americans more than average. However, the population-weighted $PM_{2.5}$ exposure by-race varies substantially by plant, and, moreover by the utility that owns those plants. EPA's COBRA Tool and other models used to carry out analyses of $PM_{2.5}$ reductions estimate public health impacts based on concentration-response (CRF) studies, such as those published by the American Cancer Society or Harvard Six Cities (the latter is used in Clean Air Task Force's latest *Toll From Coal* study as well as this report). Although these studies are useful in their ubiquity of assessing $PM_{2.5}$ impacts, researchers have shown that they underestimate the impact that $PM_{2.5}$ exposure has on different races. In fact, a recent report published by the Environmental Defense Fund and others found that use of race/ethnicity-specific CRF factors greatly increased $PM_{2.5}$-related mortality estimates for minority populations (150% higher for Black Americans, 52% higher for Hispanic Americans, 34% higher for Native Americans, and 28% higher for Asian Americans). In other words, exposure to the **same amount** of $PM_{2.5}$ pollution has been shown to have different impacts on different populations — with minorities in the U.S. experiencing more harm.

Figure 5: Population-weighted $PM_{2.5}$ exposure from remaining coal-fired power plants on different races. *Source: Sierra Club analysis of data provided by Clean Air Task Force.*



MOST DEADLY PARENT COMPANIES

According to Sierra Club, 162 coal-fired power plants have at least one generating unit online which lacks a planned retirement date as of 1/1/2023.

Of those plants, 134 were included in Clean Air Task Force's *Toll From Coal* study. Those 134 plants, which total 133 GW of capacity, are owned by **over 200** utility companies. Investor-Owned Utilities own over half of that remaining coal capacity, and are responsible for the largest share (**40%**) of estimated premature deaths from $PM_{2.5}$ pollution (see **Table 4**). Of note, are Independent Power Producers — which own 17% of remaining coal capacity, but are responsible for a disproportionate **28%** of premature mortality.

Utilities also vary on their plans to retire their remaining coal capacity, as well as measurable steps they're making towards replacing that capacity with clean energy. Our latest *Dirty Truth About Utility Climate Pledges* report assigns each utility a letter grade based on its plans to 1) retire coal by 2030; 2) build or purchase an equivalent amount of clean generation; and 3) not build new gas. Utilities failing to plan to transition away from fossil fuels that earned an "F" or "D" grade in *the Dirty Truth* are also responsible for an estimated **58%** of premature mortality from $PM_{2.5}$ pollution. Thus, the utilities which are causing the most harm from air pollution aren't planning to do enough (or anything) to change.

Electric utilities are often owned by a larger parent or holding company. We estimate that the 15 most deadly parent companies (see **Table 5**) own **half** of remaining coal capacity and are responsible for **over 60%** of premature deaths from $PM_{2.5}$ pollution. Examples of some of the most deadly utility parent companies are explored below:

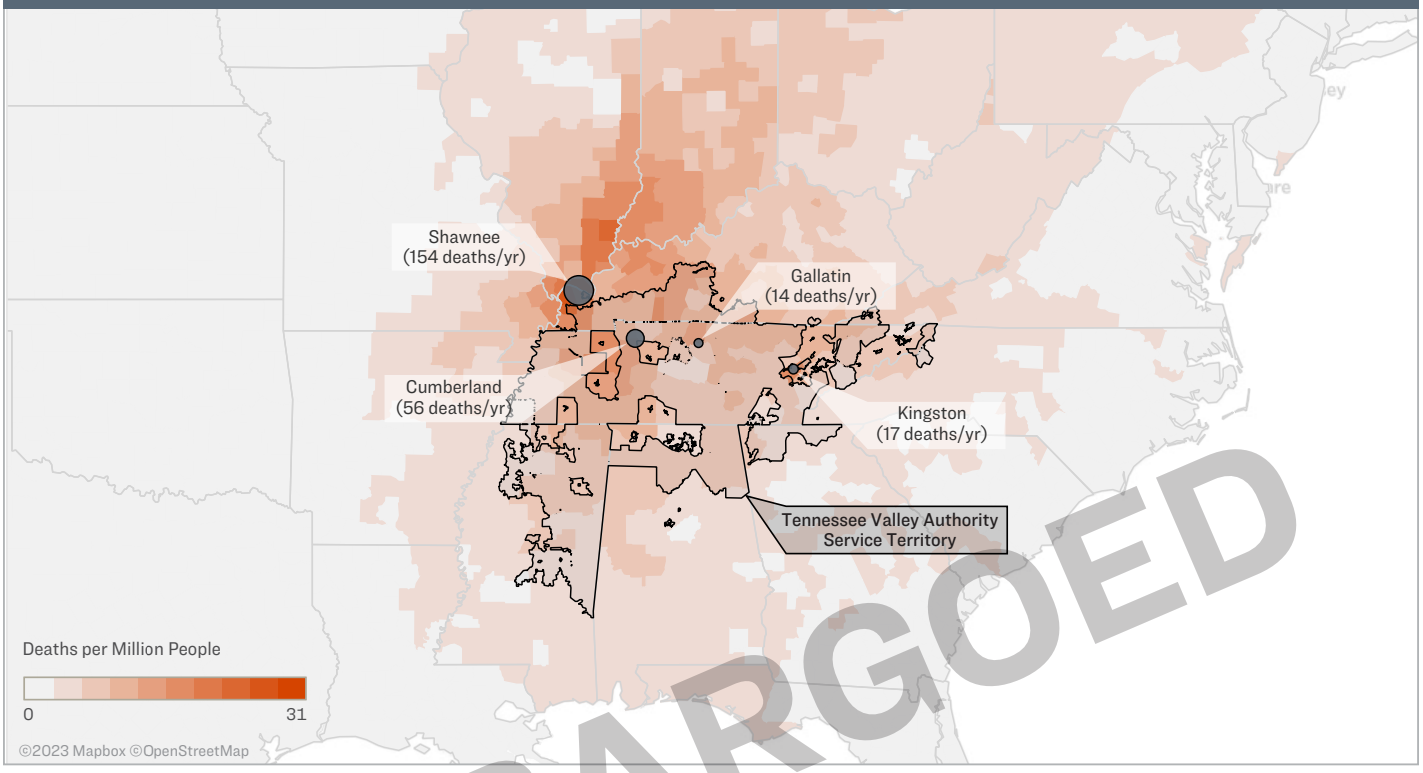
Table 4: Remaining coal capacity and $PM_{2.5}$-related premature deaths by ownership type. Source: Sierra Club analysis of data provided by Clean Air Task Force.

Utility Type	Remaining Coal Capacity		$PM_{2.5}$ Burden	
	GW	% of Total	Deaths	% of Total
Investor-Owned Utility	68	51%	1520	40%
Independent Power Producer	23	17%	1074	28%
Cooperative	17	13%	591	16%
Municipally-Owned Utility	9	7%	220	6%
Federally-Owned Utility	7	5%	241	6%
Public Power	4	3%	84	2%
State-Owned Utility	4	3%	54	1%
Industrial	1	<1%	15	<1%
TOTAL	**133**	**100%**	**3800**	**100%**

Table 5: The most deadly parent companies — representing over 60% of premature death from coal $PM_{2.5}$ pollution. *Source: Sierra Club analysis of data provided by Clean Air Task Force.*

Parent Company	Utility Type	Remaining Coal Capacity		Dirty Truth v2 Grade	Deaths
		GW	Rank		
Tennessee Valley Authority	Federally-Owned	7	4th	F	241
PPL	Investor-Owned	4	8th	F	198
Berkshire Hathaway	Investor-Owned	8	2nd	D	195
Ameren	Investor-Owned	2	14th	D	195
Vistra	Independent Power Producer	4	9th		192
FirstEnergy	Investor-Owned	3	11th	F	181
Duke	Investor-Owned	9	1st	D-F	176
ArcLight Capital Holdings	Independent Power Producer	2	16th		170
Buckeye Power	Cooperative	2	21st	F	147
NRG	Independent Power Producer	5	7th		138
AEP	Investor-Owned	8	3rd	B-F	129
Blackstone Inc.	Independent Power Producer	1	26th		122
Associated Electric Cooperative	Cooperative	2	18th	F	110
Basin Electric Power Cooperative	Cooperative	3	13th	F	105
The Southern Company	Investor-Owned	6	5th	B-F	74

Figure 6: County-level deaths per million people (shown in shades of red corresponding to intensity) from TVA's remaining coal-fired power plants (which are shown as gray circles, sized by their total associated mortality impacts). *Source: Sierra Club analysis of data provided by Clean Air Task Force.*



As of 1/1/2023, the most deadly parent company is **TENNESSEE VALLEY AUTHORITY** (TVA) — which is not owned by the fossil fuel industry, but by the **U.S. government**. As illustrated in **Figure 6**, $PM_{2.5}$ pollution from TVA's four remaining coal-fired power plants (Shawnee, Cumberland, Gallatin and Kingston) affects a large swath of counties in the midwest and Great Lakes. In fact, many of the counties most impacted are in Illinois, outside of TVA's service territory. In early January 2023, TVA announced that it will retire its largest coal plant — the 2.6 GW Cumberland plant — by the end of 2028. Moreover, TVA has plans to retire all of its coal-fired power plants by the end of 2033. However, every year until then, these plants will harm Americans with high amounts of $PM_{2.5}$ pollution. If just these four plants continued to emit pollution at 2019 levels, **they would cause another 2,176 premature deaths until they are all retired.**

Missouri's **AMEREN CORPORATION** is one of the most deadly Investor-Owned Utility companies in the country at 195 premature deaths per year, despite only owning one remaining coal plant. Ameren's 2.4 GW Labadie plant is the largest plant in the fleet lacking life-saving pollution controls for SO_2 and NO_x. **Figure 7** shows the extent to which $PM_{2.5}$ pollution from Labadie spreads across the country. In its latest IRP, Ameren committed to retiring generating units 1 & 2 by 2036 with the remainder of the plant to follow by 2042. If Labadie were allowed to continue to emit pollution at 2019 levels, **by the time it retires, it will cause another 3,387 premature deaths**. To date, calls from nearby community members to rein in Labadie's virtually unchecked air pollution have been ignored by state regulators who have chosen to issue free passes to pollute instead of protecting people and wildlife.

Houston-based **NRG ENERGY, INCORPORATED** (henceforth NRG), together with its subsidiaries, is one of the most deadly Independent Power Producers in the country. $PM_{2.5}$ pollution from NRG's Limestone and W A Parish power plants is responsible for 138 premature deaths per year, affecting much of Texas, Oklahoma, Louisiana, and Arkansas (see **Figure 8**), despite only providing power to the Texas grid. **Figure 9** is a snapshot from our Coal Mortality Tableau Dashboard, which summarizes the counties and people that are most impacted by coal $PM_{2.5}$ pollution from each utility parent company. Our analysis shows that **people of color are exposed to more $PM_{2.5}$ pollution from NRG than any other utility parent company in the country**. Moreover, **Figure 9** shows that Hispanic and Black Americans are exposed to 98% and 40% more $PM_{2.5}$ pollution, respectively from NRG's coal plants than white Americans. With no firm retirement plans, these plants will continue to cause undue harm to communities across the South.

Figure 7: County-level deaths per million people (shown in shades of red corresponding to intensity) from Ameren's Labadie coal-fired power plant (which is shown as a gray circle). *Source: Sierra Club analysis of data provided by Clean Air Task Force.*

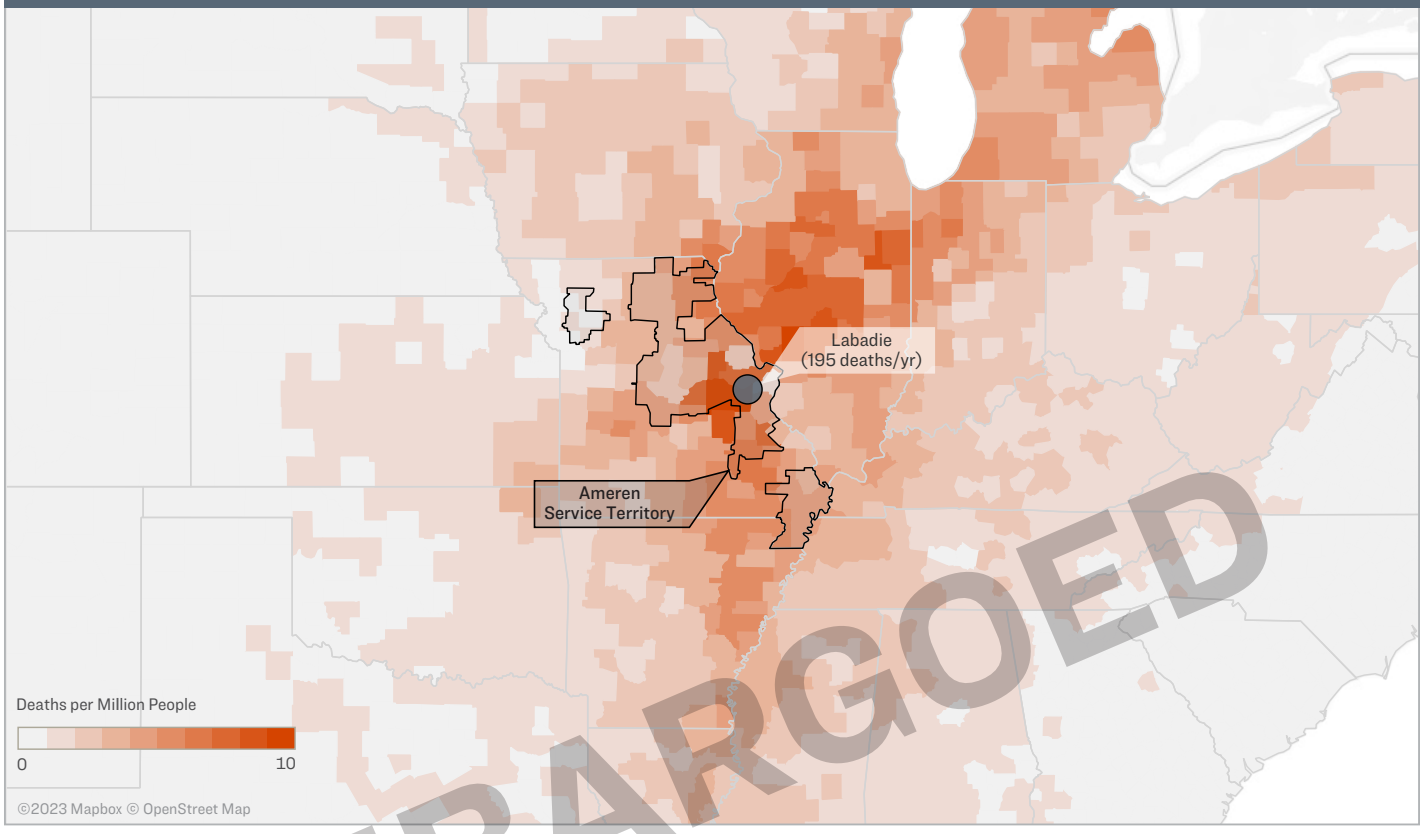


Figure 8: County-level deaths per million people (shown in shades of red corresponding to intensity) from NRG's Limestone and W A Parish coal-fired power plants (which are shown as gray circles, sized by their total associated mortality impacts). As an independent power producer, NRG doesn't have a 'service' territory map like Ameren. Instead, these plants dispatch into the ERCOT grid which serves the majority of Texas. *Source: Sierra Club analysis of data provided by Clean Air Task Force.*

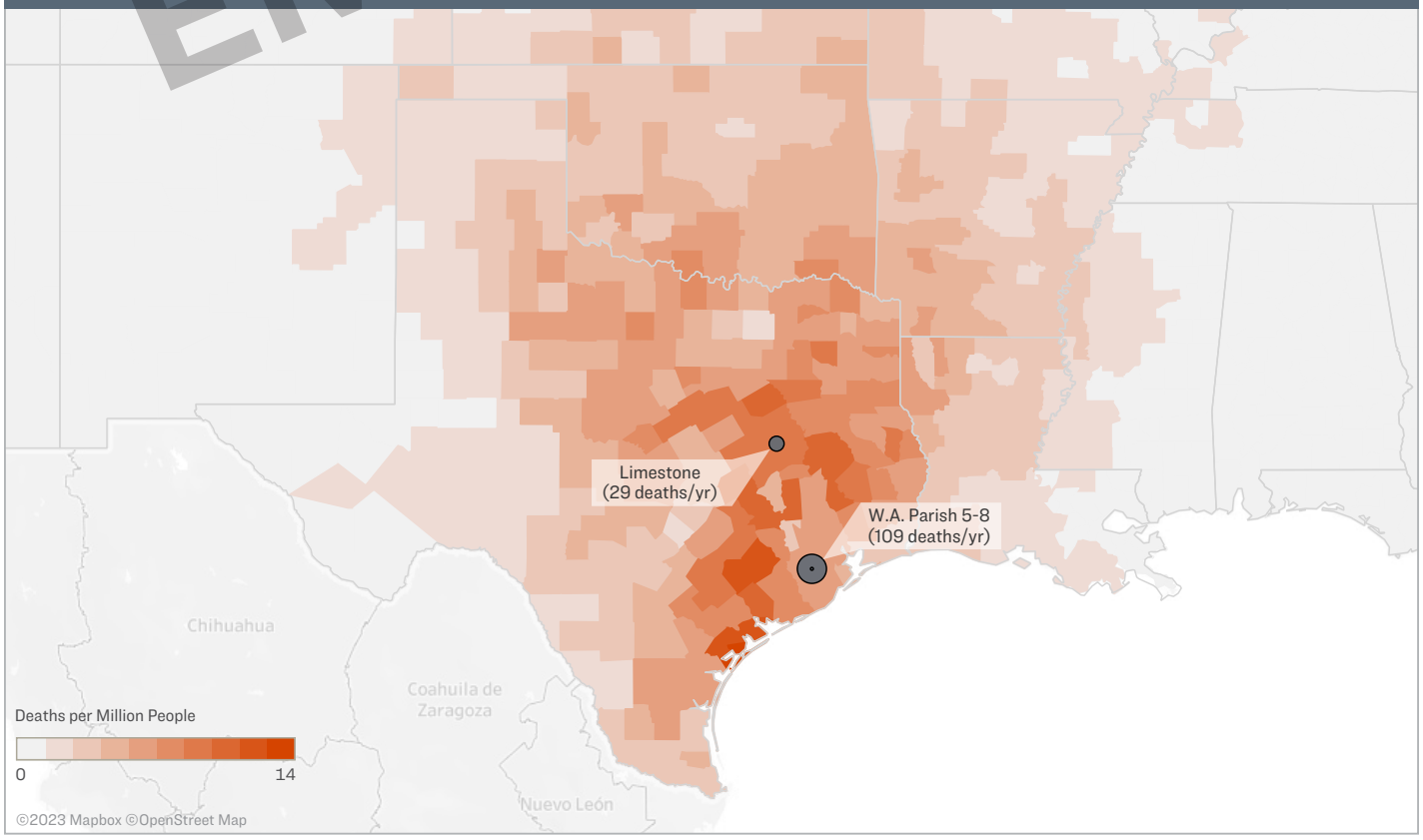
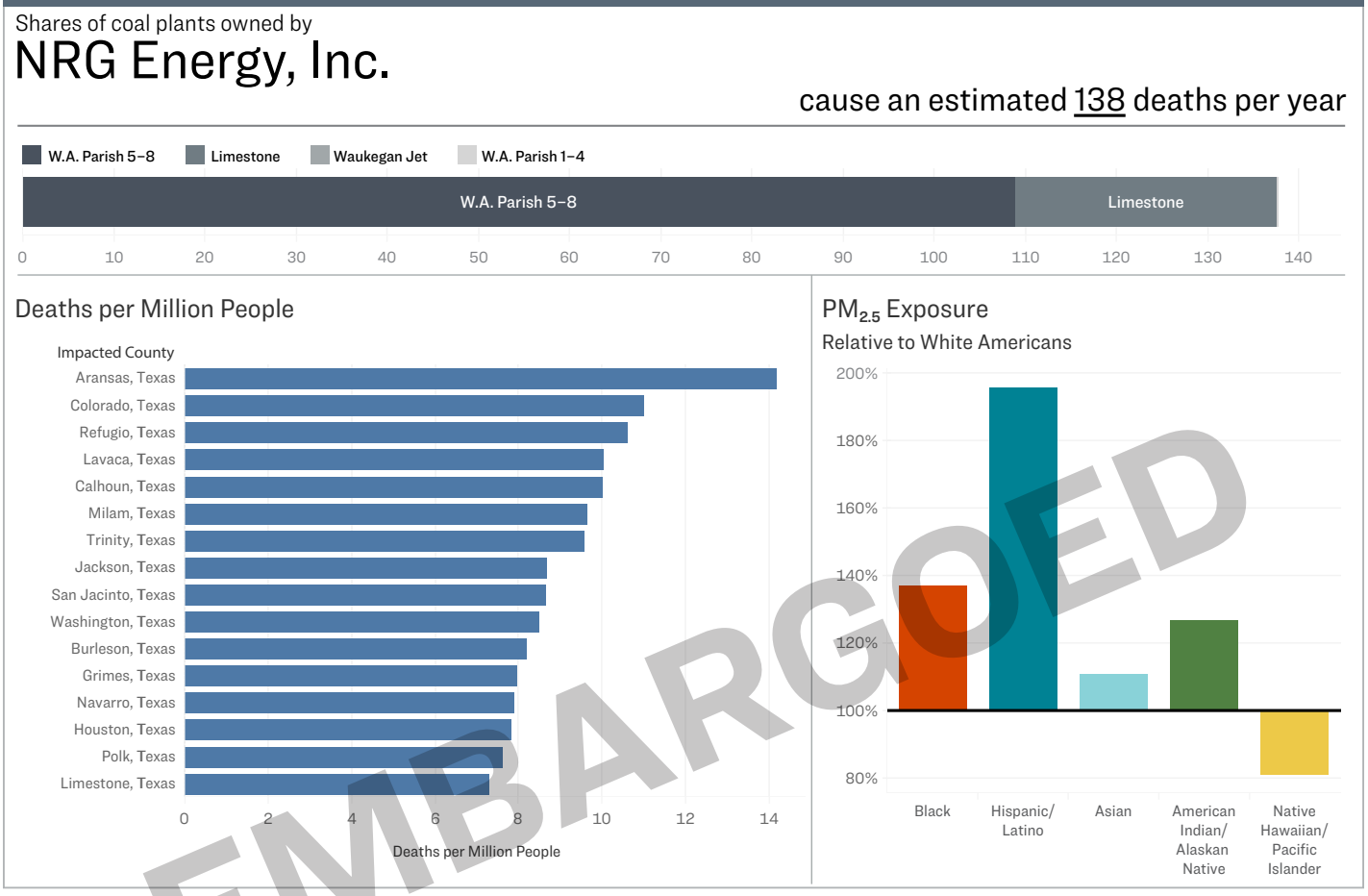


Figure 9: $PM_{2.5}$ pollution impacts from NRG's remaining coal-fired power plants. The $PM_{2.5}$ Exposure chart represents the level of exposure a person of given race experiences on average relative to white Americans. *Source: Sierra Club analysis of data provided by Clean Air Task Force.*



BASIN ELECTRIC POWER COOPERATIVE (henceforth Basin) is a generation & transmission (G&T) cooperative that provides electricity to member cooperatives in nine states across the Great Plains. Basin owns more remaining coal than any other G&T cooperative, with 2.6 GW of capacity across four plants. Basin's ownership share in these plants causes an estimated 105 premature deaths per year — primarily due to the Antelope Valley plant in North Dakota, which operates without an FGD. **Figure 10** shows that the **$PM_{2.5}$ pollution from Basin's coal plants spreads as far across the country as the member cooperatives it serves.** **Figure 11** shows that the counties most affected by Basin's coal plants are in the Dakotas. This area has a relatively dense population of Native American people, which means that Basin is also one of the largest contributors to $PM_{2.5}$ pollution exposure for this group. Like NRG, with no firm retirement plans, Basin's plants will continue to cause undue harm year after year.

Figure 10: County-level deaths per million people (shown in shades of red corresponding to intensity) from the Antelope Valley, Leland Olds, Dry Fork and Laramie River coal-fired power plants. These plants are shown as gray circles, sized by their total associated mortality impacts. Basin's ownership share in these plants causes an estimated 105 premature deaths per year *Source: Sierra Club analysis of data provided by Clean Air Task Force.*

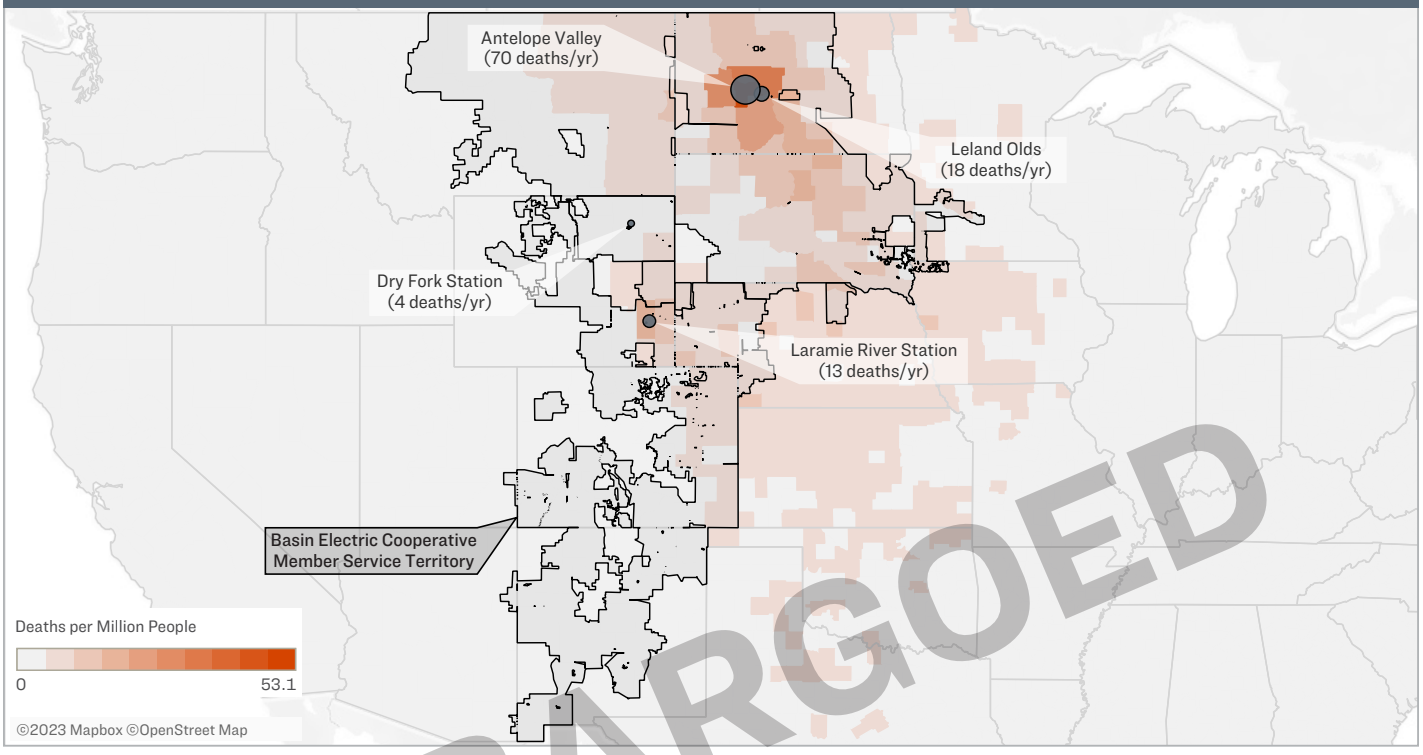
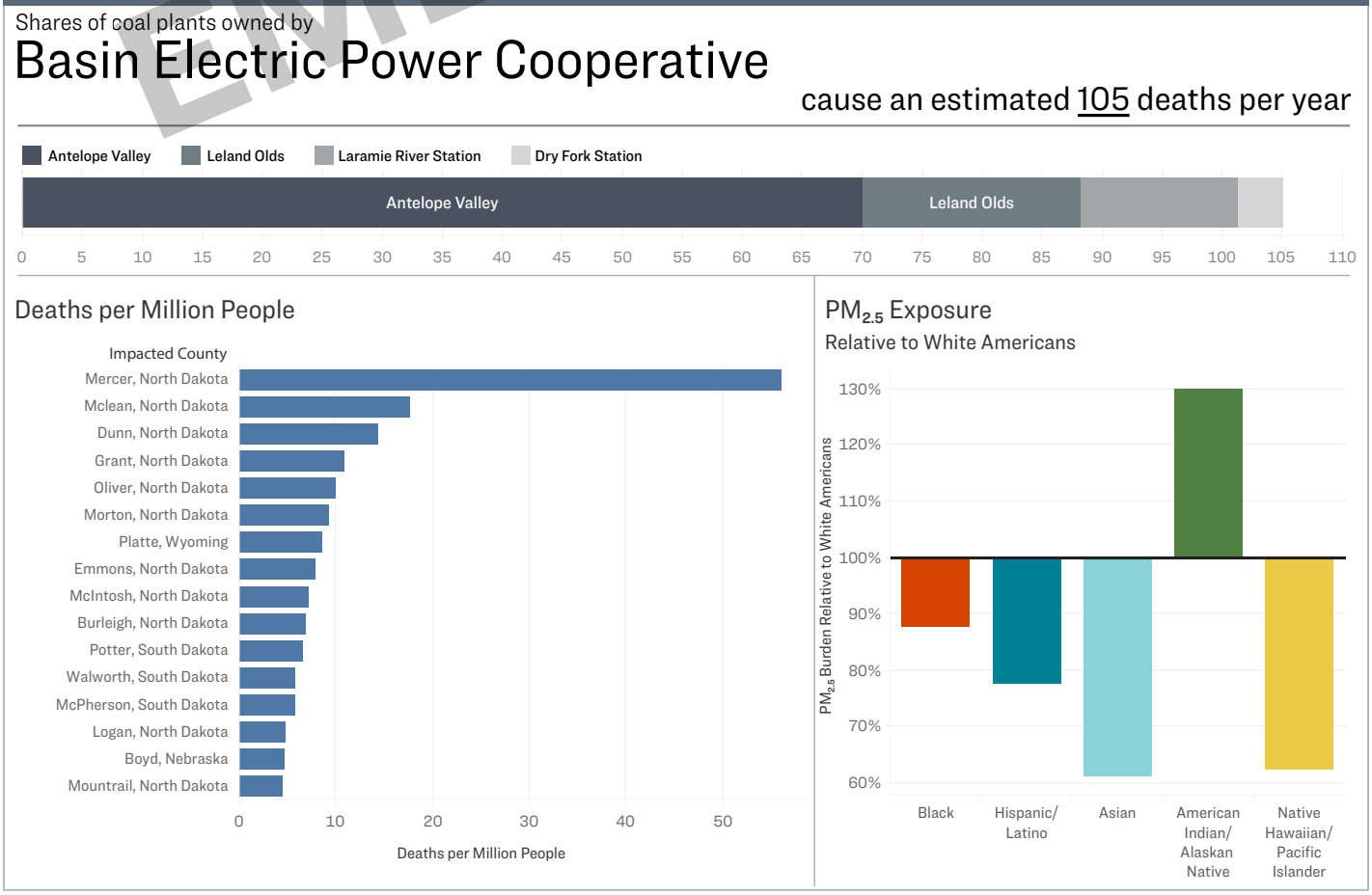


Figure 11: $PM_{2.5}$ pollution impacts from Basin's remaining coal-fired power plants. The $PM_{2.5}$ Exposure chart represents the level of exposure a person of given race experiences on average relative to white Americans. *Source: Sierra Club analysis of data provided by Clean Air Task Force*



REMAINING COAL AND THE DRAFT SOOT STANDARD

The Clean Air Act requires EPA to set and periodically revise National Ambient Air Quality Standards (NAAQS) for major pollutants, including $PM_{2.5}$.

These standards are based on the latest science and set at a level designed to protect Americans from exposure to harmful levels of air pollution. There are two current federal standards for $PM_{2.5}$ — an annual average standard of 12.0 µg/m³ and a 24-hour average standard of 35 µg/m³ — which were set in 2012 and 2006, respectively. In January 2023, the EPA released a long-awaited draft proposal to update the NAAQS for $PM_{2.5}$ (commonly referred to as the 'draft soot standard'). Under that draft, the agency would cut the current annual exposure limit for soot from 12.0 µg/m³ to a range of 9-10 µg/m³ (keeping the 24-hour standard in place); EPA has also invited public comment on a wider range of possible standards, including strengthening the 24-hour standard. This proposal comes after most members of EPA's independent scientific advisory committee recommended setting the standard as low as 8 µg/m³. A recent study on this range of possible standards led by the Environmental Defense Fund found that the potential mortality risk reductions under a lower 8 µg/m³ standard are roughly two to three times greater than a 10 µg/m³ standard. Moreover, their study found that 45% of white Americans and 56% of Black Americans live in areas with current average ambient $PM_{2.5}$ levels between 8-10 µg/m³ — thus a stronger standard would benefit a huge portion of the population.

EPA also released a Regulatory Impact Analysis (RIA) to show potential compliance options, costs and impacts at different alternative standards. However, the compliance options in this RIA are not prescriptive. For the current $PM_{2.5}$ NAAQS, states with counties in non-attainment need to create and submit a State Implementation Plan that details how they plan to lower emissions. EPA provides a menu of control measures for states to consider. However, none of these measures in EPA's menu or its RIA for the draft standard address controlling SO_2 or NO_x emissions from power plants. Moreover, the benefits of retiring these plants and replacing them with clean energy are not mentioned as a compliance strategy. As detailed throughout this report, the remaining coal fleet contributes $PM_{2.5}$ pollution to each county at a varying degree. The Beyond Coal Campaign is advocating for **all** of these remaining coal plants to be retired and replaced with clean energy by 2030. To that end, the analysis summarized below investigates the level to which retiring all the remaining coal plants could further reduce $PM_{2.5}$ levels from the proposed 9 µg/m³ standard to an even safer 8 µg/m³.

In its RIA, EPA calculated a "baseline" projection of the annual average $PM_{2.5}$ level for each county in 2032 under the current 12.0 µg/m³ standard. This projection takes into account current federal regulations, enforcement actions, state regulations, population and economic growth. This baseline projection shows 142 counties in the contiguous U.S. with annual average $PM_{2.5}$ levels above 8 µg/m³. **Figure 12** shows these counties shaded to represent how far retiring the remaining coal fleet[1] would move them from a 9 µg/m³ standard to 8 µg/m³ (see **Appendix** for methodology). Many counties projected to be above 8 µg/m³ are along the West Coast and have relatively low impacts from coal. Conversely, counties projected to be above 8 µg/m³ in other parts of the country could reduce ambient $PM_{2.5}$ by as much as 0.98 µg/m³ if the remaining coal fleet were to retire. **On average, we found that retiring the remaining coal fleet would account for 34% of the difference between an 8 µg/m³ standard and 9 µg/m³ standard**[2]. Moreover, a small number of plants account for the majority of $PM_{2.5}$ pollution from coal affecting these counties. Just 25 plants (listed in **Table 6** and shown in **Figure 12**) account for two-thirds of the average coal $PM_{2.5}$ pollution in these counties.

For many counties with high soot levels, retiring coal could make the difference between having safe air to breathe or not. However, it's also important to note that **even a stronger NAAQS would not necessitate that any of these plants retire**. Instead, EPA is able to directly impact the highest polluting power plants through existing rules on cross-state air pollution, regional haze and others, including setting Reasonably Available Control Technology requirements for coal plants in states failing to attain ozone standards. Strengthening or enforcing these rules within Biden's first term presents an opportunity to have fewer areas in nonattainment for $PM_{2.5}$ and rapidly improve the health of millions of Americans. The Beyond Coal Campaign is currently evaluating which of these rules would affect each of the remaining coal plants, prioritizing those rules that affect the most deadly plants as discussed in this report.

1. EPA cautions against using the results from its COBRA Tool for analyses regarding attainment of NAAQS. We've used the $PM_{2.5}$ totals from COBRA here to illustrate the general magnitude of the contribution from coal and potential that retiring those plants would create for a safer NAAQS.

2. These percentages, by county, are listed in **Table A2** of the **Appendix**.

Figure 12: The EPA has found 142 counties in the contiguous US with projected ambient $PM_{2.5}$ levels above 8 µg/m³ in 2032. Pollution from coal plants contributes to these counties in varying degrees. The map is shaded to show how far (from 0 to 100%) retiring the remaining coal fleet would move these counties from a proposed 9 µg/m³ annual standard to a safer 8 µg/m³. The 25 plants which contribute the majority of coal $PM_{2.5}$ pollution to these counties are shown as gray circles, sized by their relative $PM_{2.5}$ contribution. *Source: Sierra Club analysis of data provided by Clean Air Task Force and EPA.*

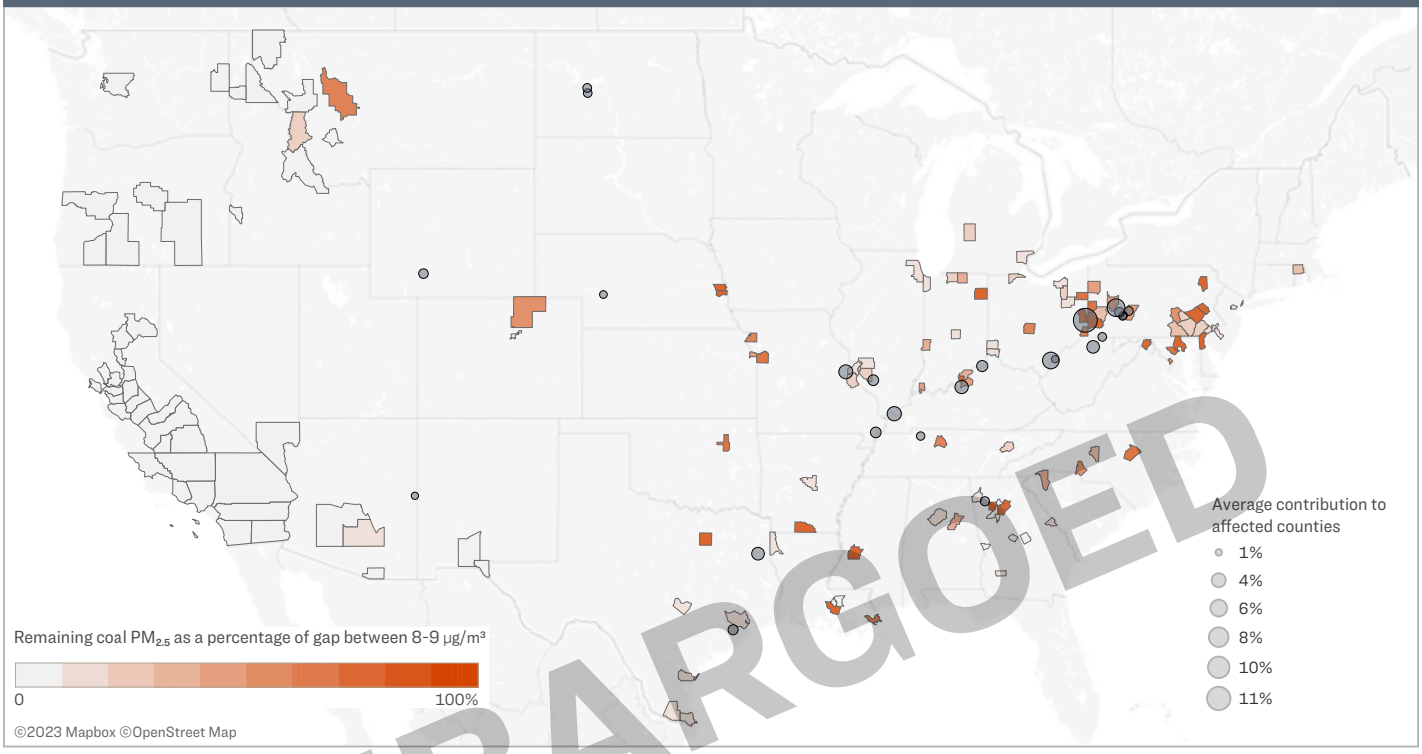


Table 6: The EPA has found 142 counties in the contiguous US with projected ambient $PM_{2.5}$ levels above 8 µg/m³ in 2032. The 25 plants listed here are the largest contributors to coal $PM_{2.5}$ pollution for those counties. *Source: Sierra Club analysis of data provided by Clean Air Task Force and EPA.*

Plant Name	Average contribution to affected counties
Cardinal	11%
Keystone	6%
General James M Gavin	5%
Shawnee	4%
Labadie	4%
Mill Creek	3%
Martin Lake	3%
Harrison Power Station	3%
Ghent	2%
Prairie State Generating Station	2%
New Madrid	2%
W A Parish	2%
Jim Bridger	2%

Plant Name	Average contribution to affected counties
Homer City Station	2%
Bowen	2%
Colver Power Project	1%
Antelope Valley	1%
Fort Martin Power Station	1%
Coyote	1%
Cumberland	1%
Seward	1%
Conemaugh	1%
Gerald Gentleman	1%
Mountaineer	1%
Springerville	1%

APPENDIX

DATASETS USED

1. *Toll From Coal*: EPA's COBRA Tool provides an estimate of $PM_{2.5}$ impacts for each of the 3,108 counties (or county equivalents, including the District of Columbia) in the United States excluding Hawaii and Alaska. Clean Air Task Force used the COBRA Tool to analyze the $PM_{2.5}$ impact from each coal-fired power plant (as detailed here) using 2019 emissions of SO_2, NO_x and PM as provided in EPA's Air Markets Program Database.

   According to Sierra Club's Beyond Coal Campaign, there are 27 coal-fired power plants (totaling 3.7 GW) which remain online as of 1/1/2023 that were excluded from Clean Air Task Force's analysis. Those plants are listed in **Table A1**.

   In addition, Sierra Club's analysis excludes the Coal Creek plant in North Dakota. This plant was previously slated for retirement, but owner Great River Energy changed course and decided to sell the plant.

2. *County-level demographics:* County-level demographics were obtained from the 5 year census (ACS 2015-2019).
3. *S&P Global:* Data on individual generating unit annual operations, installed pollution controls and ownership structure were obtained through a paid subscription to S&P Global.
4. *Coal retirements and announced retirements:* Any assessment of coal-fired power plant retirements or announced retirements, as well as accompanying dates and stringency are evaluated by Sierra Club's Beyond Coal Campaign. These dates may or may not comport with other published data.

Table A1: Remaining coal-fired power plants as of 1/1/2023 (according to Sierra Club's Beyond Coal Campaign) not included in Clean Air Task Force's Toll From Coal study.

Plant Name	2019 SO_2 Emissions (tons)	Reason Excluded
Aurora Energy LLC Chena	N/A	Not in EPA CAMPD dataset
Colstrip Energy LP	N/A	Not in EPA CAMPD dataset
Dover	N/A	Not in EPA CAMPD dataset
Eielson AFB Central Heat & Power Plant	N/A	Not in EPA CAMPD dataset
Ft. Wainwright Utility Plants Section	N/A	Not in EPA CAMPD dataset
Iowa State University	N/A	Not in EPA CAMPD dataset
Orrville	N/A	Not in EPA CAMPD dataset
Painesville	N/A	Not in EPA CAMPD dataset
University of Alaska Fairbanks	N/A	Not in EPA CAMPD dataset
University of Illinois Abbott Power Plt	N/A	Not in EPA CAMPD dataset
University of Missouri Columbia	N/A	Not in EPA CAMPD dataset
University of Northern Iowa	N/A	Not in EPA CAMPD dataset
Virginia	N/A	Not in EPA CAMPD dataset
Virginia Tech Power Plant	N/A	Not in EPA CAMPD dataset
Healy	N/A	Not in EPA CAMPD dataset
Warrick	648	Industrial plant
Manitowoc	246	Primarily burns pet coke
Northampton Generating Company LP	87	Under 100 ton SO_2 threshold
Panther Creek Energy Facility	79	Under 100 ton SO_2 threshold
Virginia City Hybrid Energy Center	69	Under 100 ton SO_2 threshold
Edwardsport (IGCC)	55	Under 100 ton SO_2 threshold
Polk	14	Under 100 ton SO_2 threshold
Streeter Station	<1	Under 100 ton SO_2 threshold
Cogen South	<1	Under 100 ton SO_2 threshold
Purdue University	<1	Under 100 ton SO_2 threshold
Sunnyside Cogen Associates	<1	Under 100 ton SO_2 threshold
UNC Chapel Hill Cogen Facility	<1	Under 100 ton SO_2 threshold

METHODOLOGY NOTES:

- **Estimated $PM_{2.5}$ / premature mortality from remaining units**

  According to Sierra Club's Beyond Coal Campaign, 162 coal-fired power plants had at least one generating unit remaining on 1/1/2023 without plans to retire prior to 2031. These "remaining" units total 138 GW in capacity. As detailed above, 28 of those plants were not included in this analysis.

  Sierra Club analyzed data obtained from Clean Air Task Force on the remaining 134 plants. This data represents the impact of these plants based on 2019 emissions (as detailed above). County-level $PM_{2.5}$ and premature mortality estimates were scaled by the portion of 2019 SO_2 emissions from "remaining" coal units. For example, the "remaining" $PM_{2.5}$ burden in county *i* from plant *j* was calculated as:

$$Remaining\ \Delta PM2.5_{i,j} = \Delta PM2.5_{i,j} \times \frac{\sum_k SO2_{j,k}}{SO2_j}$$

  where $\sum_k SO2_{j,k}$ is the total SO_2 at plant *j* from all units, *k* that are still "remaining" (i.e. no planned retirement date as of 1/1/2023).

  Some plants included in Clean Air Task Force's analysis have generating units which burn gas or other non-coal fossil fuels. The SO_2 emissions (and assumed portion of $PM_{2.5}$ and premature mortality) from these units were negligible.

- **Attribution of plant-level impacts to owners and parent companies**

  Each generating unit at a power plant can have multiple owners. Each owner, parent company and their percentage ownership in a generating unit were obtained from S&P Global on 11/2022 (thus the analysis reflects "current" ownership).

  - Unit-level 2019 SO_2 emissions were apportioned to each owner based on their percentage ownership of that generating unit. For owner *i* of unit *j* at plant *k*:

$$Owned\ SO2_{i,j,k} = Ownership\ \%_{i,j,k}\ x\ SO2_{j,k}$$

  - Each owner was then apportioned a percentage of total plant SO_2:

$$Owned\ SO2\ \%_{i,k} = \frac{Owned\ SO2_{i,j,k}}{\sum_j SO2_{j,k}}$$

  - Plant-level $\Delta PM_{2.5}$ / Mortality was then scaled by $Owned\ SO2\ \%_{i,k}$:

$$Owned\ Mortality_{i,k} = Owned\ SO2\ \%_{i,k}\ x\ Mortality_k$$

  - Parent-level owned $PM_{2.5}$ / Mortality across the coal fleet was then calculated as:

$$Owned\ Mortality_i = \sum_k Owned\ Mortality_{i,k}$$

- **Population-weighted $PM_{2.5}$ exposure**

  As detailed in the report, different races are exposed to $PM_{2.5}$ from a given coal plant (or set of plants) at different levels based on where their populations are concentrated. This report uses data on both demographics and $PM_{2.5}$ burden at a county level. Thus, the population-weighted $PM_{2.5}$ exposure for white americans (for example) across every county from plant, *i* is calculated as:

$$PM2.5_{i,white} = \frac{\sum_{counties} (PM2.5_{i,county}\ X\ POP_{county}\ X\ pct\ white_{county})}{\sum_{counties} (POP_{county}\ X\ pct\ white_{county})}$$

- **Figure 1 was created using unit-level SO_2 and net generation data from S&P Global.**
  - The 'Retirements' wedge represents annual reductions in SO_2 from coal-fired generating units that have retired (according to Sierra Club's Beyond Coal Campaign).
  - The 'Lower SO_2 Rate' wedge represents the difference between actual year X emissions from remaining units and what the emissions would have been if those units maintained the same emissions rate (SO_2/MWh) they had in 2010
  - Any emissions reductions in excess of 'Retirements' and 'Lower SO_2 Rate' are designated as 'Reduced Dispatch'
- **Remaining Coal and the Draft Soot Standard**
  - Projections of 2032 baseline design values under the current 12 μg/m³ standard were taken from Table 2A-13 of EPA's draft NAAQS RIA
  - To assess a potential 9 μg/m³ NAAQS, counties with baseline design values above that level were lowered to 9 μg/m³
  - For counties above 8 μg/m³, we then calculated the difference between their projected design value under a 9 μg/m³ NAAQS and 8 μg/m³
  - For each county, we summed the $PM_{2.5}$ contribution from all coal units which lack a retirement date.

Table A2: EPA's baseline 2032 projection (under a 12 µg/m³ standard) for counties above 8 µg/m³ — as well as $PM_{2.5}$ pollution from remaining coal plants in those counties as a percentage of the difference between a 9 or 10 µg/m³ standard and a 8 µg/m³ standard.

State	County	EPA's Baseline 2032 Projection (12 µg/m³ Standard)	Coal $PM_{2.5}$ Pollution as a % of Difference Between a 9 µg/m³ Standard and 8 µg/m³	Coal $PM_{2.5}$ Pollution as a % of Difference Between a 10 µg/m³ Standard and 8 µg/m³
AL	Jefferson	9.86	11%	6%
AL	Talladega	8.2	43%	43%
AZ	Maricopa	9.47	3%	2%
AZ	Pinal	8.16	19%	19%
AZ	Santa Cruz	8.99	3%	3%
AR	Pulaski	8.99	12%	12%
AR	Union	8.12	100%	100%
CA	Alameda	10.14	1%	0%
CA	Butte	8.28	5%	5%
CA	Contra Costa	9.16	1%	1%
CA	Fresno	11.43	2%	1%
CA	Imperial	12.04	2%	1%
CA	Kern	12.04	2%	1%
CA	Kings	12.04	2%	1%
CA	Los Angeles	12.04	2%	1%
CA	Madera	10.6	1%	1%
CA	Marin	8.18	9%	9%
CA	Merced	10.79	2%	1%
CA	Napa	10.09	1%	0%
CA	Plumas	10.6	2%	1%
CA	Riverside	12.04	2%	1%
CA	Sacramento	9.29	1%	1%
CA	San Bernardino	12.04	2%	1%
CA	San Diego	9.16	2%	1%
CA	San Joaquin	10.08	1%	1%
CA	San Luis Obispo	9.63	2%	1%
CA	Santa Clara	9.56	1%	1%
CA	Solano	9.04	1%	1%
CA	Stanislaus	11.08	1%	1%
CA	Sutter	8.82	1%	1%
CA	Tulare	12.04	2%	1%
CA	Ventura	9.23	2%	1%
CO	Denver	9.04	5%	5%
CO	Weld	8.14	67%	67%
DE	New Castle	8.14	100%	100%
DC	District of Columbia	8.21	69%	69%
GA	Bibb	8.8	8%	8%
GA	Clayton	8.57	13%	13%
GA	Cobb	8.09	100%	100%
GA	De Kalb	8.08	100%	100%
GA	Dougherty	8.38	18%	18%
GA	Floyd	8.72	15%	15%
GA	Fulton	9.46	9%	6%
GA	Gwinnett	8.06	100%	100%
GA	Muscogee	8.68	11%	11%
GA	Richmond	8.54	13%	13%
GA	Wilkinson	8.97	7%	7%
ID	Benewah	9.61	2%	1%
ID	Canyon	8.86	2%	2%
ID	Lemhi	10.05	6%	3%
ID	Shoshone	10.75	2%	1%
IL	Cook	9.43	12%	8%
IL	Madison	9.03	16%	16%
IL	St Clair	8.99	22%	22%
IN	Allen	8.1	100%	100%
IN	Clark	8.58	42%	42%
IN	Elkhart	8.37	43%	43%
IN	Floyd	8.08	100%	100%
IN	Lake	8.92	13%	13%
IN	Marion	9.61	16%	10%
IN	St Joseph	8.72	22%	22%
IN	Vanderburgh	8.4	53%	53%
IN	Vigo	8.47	41%	41%
KS	Wyandotte	8.15	58%	58%
KY	Jefferson	8.85	52%	52%
LA	Caddo	9.44	13%	9%
LA	East Baton Rouge	8.69	9%	9%
LA	Iberville	8.06	100%	100%
LA	St Bernard	8.11	71%	71%
LA	West Baton Rouge	8.67	10%	10%

State	County	EPA's Baseline 2032 Projection (12 µg/m³ Standard)	Coal $PM_{2.5}$ Pollution as a % of Difference Between a 9 µg/m³ Standard and 8 µg/m³	Coal $PM_{2.5}$ Pollution as a % of Difference Between a 10 µg/m³ Standard and 8 µg/m³
MD	Howard	8.21	82%	82%
MD	Baltimore	8.17	100%	100%
MI	Kent	8.49	28%	28%
MI	Wayne	10.06	15%	8%
MS	Hinds	8.08	100%	100%
MO	Buchanan	8.15	73%	73%
MO	Jackson	8.09	85%	85%
MO	Jefferson	8.51	24%	24%
MO	St Louis	8.82	15%	15%
MO	St Louis City	8.36	32%	32%
MT	Lewis and Clark	8.03	76%	76%
MT	Lincoln	11.08	3%	1%
MT	Missoula	9.53	5%	3%
MT	Ravalli	8.11	30%	30%
MT	Silver Bow	8.64	8%	8%
NE	Douglas	8.08	100%	100%
NE	Sarpy	8.1	100%	100%
NV	Clark	9.24	3%	2%
NJ	Camden	9.21	14%	12%
NJ	Union	8.62	18%	18%
NM	Dona Ana	8.57	6%	6%
NY	New York	8.95	8%	8%
NC	Davidson	8.29	37%	37%
NC	Mecklenburg	8.15	61%	61%
NC	Wake	8.12	85%	85%
OH	Butler	9.82	16%	9%
OH	Cuyahoga	10.23	16%	8%
OH	Franklin	8.17	75%	75%
OH	Hamilton	8.91	17%	17%
OH	Jefferson	9.26	98%	78%
OH	Lucas	8.7	23%	23%
OH	Mahoning	8.2	90%	90%
OH	Stark	8.92	19%	19%
OH	Summit	8.72	22%	22%
OK	Tulsa	8.13	88%	88%
OR	Crook	8.27	9%	9%
OR	Harney	8.61	7%	7%
OR	Jackson	9.18	1%	1%
OR	Klamath	8.64	2%	2%
OR	Lane	8.12	9%	9%

State	County	EPA's Baseline 2032 Projection (12 µg/m³ Standard)	Coal $PM_{2.5}$ Pollution as a % of Difference Between a 9 µg/m³ Standard and 8 µg/m³	Coal $PM_{2.5}$ Pollution as a % of Difference Between a 10 µg/m³ Standard and 8 µg/m³
PA	Allegheny	11.19	35%	18%
PA	Armstrong	9.28	56%	44%
PA	Beaver	8.44	83%	83%
PA	Berks	8.18	100%	100%
PA	Cambria	9.08	55%	51%
PA	Chester	8.97	22%	22%
PA	Dauphin	8.37	68%	68%
PA	Delaware	9.96	17%	9%
PA	Lackawanna	8.07	100%	100%
PA	Lancaster	10.14	21%	11%
PA	Lebanon	9.1	25%	22%
PA	Lehigh	8.17	100%	100%
PA	Mercer	8.42	53%	53%
PA	Philadelphia	9.75	12%	7%
PA	Washington	8.37	100%	100%
PA	York	8.56	40%	40%
RI	Providence	8.27	33%	33%
SC	Greenville	8.16	49%	49%
TN	Davidson	8.17	74%	74%
TN	Knox	8.6	25%	25%
TX	Cameron	9.75	14%	8%
TX	Dallas	8.08	100%	100%
TX	El Paso	9.08	4%	4%
TX	Harris	10.37	13%	6%
TX	Hidalgo	10.29	12%	6%
TX	Nueces	9.03	13%	12%
TX	Travis	9.07	11%	10%
WA	King	8.31	2%	2%
WA	Spokane	8.18	10%	10%
WV	Berkeley	8.21	100%	100%
WV	Brooke	8.41	99%	99%
WV	Marshall	8.46	72%	72%

EMBARGOED

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