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YIELDING TO THE NECESSITIES OF A GREAT PUBLIC INDUSTRY: DENIAL AND CONCEALMENT OF THE HARMFUL HEALTH EFFECTS OF COAL MINING

CAITLYN GREENE* & PATRICK CHARLES MCGINLEY**

[M]ere private personal inconveniences . . . must yield to the necessities of a great public industry, which, although in the hands of a private corporation, subserves a great public interest.

—*Pa. Coal v. Sanderson*, 113 Pa. 126, 6 A. 453 (1886)

INTRODUCTION

In the mid-nineteenth century, coal mined in Central Appalachia began to flow into industrial markets.¹ Those mines and the coal they produced provided jobs, put food on family tables in coalfield households, and even provided housing for hundreds of thousands of coal miners and their families.² The bounty from America's expanding coalfields fueled the Industrial Revolution and powered the nation's steel mills, factories,

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¹ The coal-producing regions of Central Appalachia include southern West Virginia, Eastern Kentucky, the westernmost tip of Virginia, and East Tennessee. See Jedediah Purdy, *The Violent Remaking of Appalachia*, THE ATLANTIC (Mar. 21, 2016), <https://www.theatlantic.com/technology/archive/2016/03/the-violent-remaking-ofappalachia/474603/> [<https://perma.cc/GXB7-PN5R>] (“Central Appalachia’s history is the story of coal. At its peak in the mid-20th century, mining employed more than 150,000 people in West Virginia alone, mostly in the state’s otherwise poor and rugged counties.”). The broader Appalachia region includes thirteen states from southern New York to northern Mississippi. See *The Appalachian Region*, APPALACHIAN REG’L COMM’N, https://www.arc.gov/appalachian_region/theappalachianregion.asp [<https://perma.cc/WF9A-NPQ9>] (last visited Apr. 3, 2019).

² *The Coal Town System*, PUB. BROAD. SERV., <https://www.pbs.org/wgbh/americanexperience/features/minewars-coalcamps/> [<https://perma.cc/B7AG-E8ZB>] (last visited Apr. 3, 2019).

steamboats, and railroads.³ It powered America's defense through two World Wars and later military conflicts.⁴ Coal-fired power plants generated more than half of the electricity used in the United States in the latter quarter of the twentieth century.⁵

In her definitive book on the subject, *Coal: A Human History*, Barbara Freese observes that in many ways the mineral could be viewed as a gift from God that produced undeniable good—as well as evil health and environmental externalities.⁶ Coal's Jekyll-and-Hyde-like qualities have long been demonstrable and well-known where coal is mined.⁷ Outside of coal country, however, coal's dark side has largely escaped public attention.⁸

For well over one hundred years, American courts, politicians, and community leaders often gave an approving nod to the positive economic contributions of the coal industry while turning a blind eye to coal's many harmful externalities.⁹ In an 1886 opinion of the Supreme

³ Gregory Clark & David Jacks, *Coal and the Industrial Revolution, 1700–1869*, 11 EUR. REV. ECON. HIST. 39, 39–40, 43–44 (2007).

⁴ Raymond E. Murphy, *Wartime Changes in the Patterns of United States Coal Production*, 37 ANNALS ASS'N AM. GEOGRAPHERS 185, 185 (1947).

⁵ John Muyskens et al., *Mapping how the United States generates its electricity*, WASH. POST (Mar. 28, 2017), https://www.washingtonpost.com/graphics/national/power-plants/?utm_term=.735a929d2d6d [<https://perma.cc/UG22-LWWZ>].

⁶ Freese observes that

[t]o see coal purely as a gift from God overlooks the many dangerous strings attached to that gift. Similarly, to see it as just an environmental evil would be to overlook the undeniable good that accompanies that evil. Failing to recognize both sides of coal—the vast power and the exorbitant costs—misses the essential, heartbreaking drama of the story.

BARBARA FREESE, *COAL: A HUMAN HISTORY* 12–13 (2003).

⁷ See Patrick C. McGinley, *Climate Change and the War On Coal: Exploring the Dark Side*, 13 VT. J. ENVTL. L. 255, 257–58 (2012).

⁸ *Id.* The lack of public awareness extends to diverse negative coal mining externalities: The public is generally oblivious to coal's negative impacts on the environment, including soil erosion, landslides, sulfuric acid water pollution, stream sedimentation, and loss of potable water. They are also unaware of the workplace injuries, diseases, and fatalities associated with coal mining. Nor is the public aware of coal's socio-economic impacts, which include: family and community disruption; economic stagnation; and accompanying lack of educational, employment, and economic development opportunities.

Id. at 265.

⁹ See Robinson Meyer, *Coal's Devastation*, THE ATLANTIC (Aug. 12, 2015), <https://www.theatlantic.com/business/archive/2015/08/coal-externalities-medical-air-quality-financial-environmental/401075/> [<https://perma.cc/D2PU-S3SN>].

Court of Pennsylvania,¹⁰ *Pennsylvania Coal v. Sanderson*, the court cavalierly dismissed the pleas of a family whose property and livelihood had been despoiled by the polluting acid coal mine drainage pumped from a nearby mine into a stream that traversed their farm¹¹:

The plaintiff's grievance, is for a mere personal inconvenience, and we are of opinion that mere private personal inconveniences, arising in this way and under such circumstances, must yield to the necessities of a great public industry, which although in the hands of a private corporation, subserves a great public interest. To encourage the development of the great natural resources of a country, trifling inconveniences to particular persons must sometimes give way to the necessities of a great community.¹²

More than a century later, a broad expanse of coal-related “trifling inconveniences” have been fully documented. A New York Academy of Sciences analysis emphasized the economic costs of coal externalities:

Each stage in the life cycle of coal—extraction, transport, processing, and combustion—generates a waste stream and carries multiple hazards for health and the environment. These costs are external to the coal industry and are thus often considered “externalities.” We estimate that the life cycle effects of coal and the waste stream generated

¹⁰ Pa. Coal Co. v. Sanderson, 113 Pa. 126, 143 (1886). Mrs. Sanderson sued the coal company to recover damages caused by pollution of the stream. According to the court, the plaintiff was induced to purchase a tract of land on Meadow Creek in the Anthracite coal region because of “[t]he existence of the stream, the purity of its water, and its utility for domestic and other purposes . . .” Mr. and Mrs. Sanderson built a house on the land constructed dams across the stream to form a fish and ice pond and to supply a cistern that in turn provided potable water for domestic purposes and for a fountain. *Id.*

¹¹ The court characterized Mrs. Sanderson's injuries:

It is alleged that the large volume of mine water, which the defendants poured into the Meadow brook, has corrupted the water of that stream to such an extent as to render it totally unfit for domestic use; that the fish in the brook have been totally destroyed, the plaintiff's pipes corroded and her entire apparatus for the utilization of the water rendered wholly worthless; and that, in consequence, about the year 1875, the same was abandoned.

Id.

¹² *Id.* at 149.

are costing the U.S. public a third to over one-half of a trillion dollars annually. Many of these so-called externalities are, moreover, cumulative. Accounting for the damages conservatively doubles to triples the price of electricity from coal per kWh generated, making wind, solar, and other forms of nonfossil fuel power generation, along with investments in efficiency and electricity conservation methods, economically competitive.¹³

The coal industry and its supporters have consistently denied and minimized the impact of the adverse economic and health impacts of mining.¹⁴ The following discussion will examine two examples of coal's externalities that the industry has disputed or denied, despite evidence of serious public health concerns.

The first example relates to black lung disease.¹⁵ Since the earliest days of the last century, coal companies and their agents denied that inhaled coal dust caused black lung disease. Then, when the denial could no longer withstand the weight of science and logic, the industry fought at every turn to avoid government regulation of miner exposure to the lethal airborne coal dust in mine work places.¹⁶ Beyond opposing regulation, the

¹³ Paul R. Epstein et al., *Full Cost Accounting for the Life Cycle of Coal*, 119 ANNALS N.Y. ACAD. SCI. 73, 73 (2011).

¹⁴ Patrick McGinley, *Collateral Damage: Turning a Blind Eye to Environmental and Social Injustice in The Coalfields*, 19 J. ENVTL. & SUSTAINABILITY L. 304, 312 (2013) [hereinafter *Collateral Damage*] ("As it has for a century, the coal industry's response to the demonstrable negative externalized costs of coal is to deny and/or minimize, while ignoring demands that these costs be internalized.").

¹⁵ "Black lung disease" is the common colloquial name used in lieu of the medical term "coal workers' pneumoconiosis." Pathologists who observe lungs of diseased miners report they appear black, instead of the natural pink color of healthy lung tissue. *About Black Lung Disease*, LUNGS AT WORK, https://lungsatworkpa.org/?page_id=53 [<https://perma.cc/6NT7-2A5L>] (last visited Apr. 3, 2019).

¹⁶ ALAN DERICKSON, BLACK LUNG: ANATOMY OF A PUBLIC HEALTH DISASTER 54, 64, 70, 99, 108, 173 (1998). See James L. Weeks & Gregory R. Wagner, *Compensation for occupational disease with multiple causes: the case of coal miners' respiratory diseases*, 76 AM. J. PUB. HEALTH 58, 59 (1986). Weeks and Wagner explain:

"Black lung" is the common or popular term used to refer to occupational respiratory disease among miners. Imprecise and non-technical, it reflects what miners and their families have known and experienced for decades and what the emerging medical literature in this field supports, namely, that coal miners are at risk for a wide spectrum of lung diseases caused by their occupational exposures. Black lung is not referred to in medical text books except with disdain.

industry denied any responsibility or liability as thousands of its own employees were afflicted by the disabling and often fatal pulmonary disease.¹⁷ Today, despite concrete evidence that the incidence of black lung disease is increasing at an alarming rate, the coal industry's now-familiar response is to deny the need for additional regulatory efforts to protect miners' lives.¹⁸

The second example of health concerns arising from coal mining operations focuses on so-called "mountaintop removal" coal strip mining ("MTR").¹⁹ For two decades, people living in close proximity to large Appalachian MTR strip mines have expressed serious concerns about MTR's health impacts. Those concerns have intensified over the last decade as peer-reviewed epidemiology studies have identified correlations between MTR operations and negative public health outcomes.²⁰ Affected communities fear that exposure to mining-generated air and water pollution has caused a disproportionate range of serious illnesses and diseases in contrast to non-mining communities of the region that the studies show are not similarly situated.²¹

Id. For a remarkably jaundiced review of the struggle of miners and their medical care providers to force recognition of "black lung" as an occupational disease caused by inhalation of respirable coal dust in underground coal mines, see Daniel M. Fox & Judith F. Stone, *Black Lung: Miners' Militancy and Medical Uncertainty, 1968–1972*, 54 BULLETIN HIST. MED. 43, 43 (1980).

¹⁷ Ken Ward, Jr., *WV groups hope study leads to end of mountaintop removal mining*, CHARLESTON GAZETTE-MAIL (May 23, 2017), https://www.wvgazette.com/news/special_reports/wv-groups-hope-study-leads-to-end-of-mountaintop-removal/article_8cdfd973-99fe-5462-8338-a2aa7c8998ba.html [<https://perma.cc/N5HK-Q5P3>] ("[M]ore than two-dozen peer-reviewed papers . . . raised serious questions about increased risk of cancer, birth defects and premature death among coalfield residents living near large-scale surface coal-mining operations."). See also Press Release, Office of Surface Mining, Reclamation & Enforcement, OSMRE Funds National Academy of Sciences Study of Potential Health Risks Related to Surface Coal Mining in Central Appalachia (Aug. 3, 2016), <https://www.osmre.gov/resources/newsroom/news/2016/080316.pdf> [<https://perma.cc/4D2G-AG89>].

¹⁸ Sarah Jones, *Congress Is Giving the Coal Industry a Break, and Sick Miners May Pay the Price*, N.Y. MAG. (Dec. 16, 2018), <https://flipboard.com/@NYMag/congress-is-giving-the-coal-industry-a-break-and-sick-miners-may-pay-the-price/f-9dc9e68c9b%2Fnymag.com> [<https://perma.cc/F623-YLD9>].

¹⁹ *Community Impacts of Mountaintop Removal*, APPALACHIAN VOICES, <http://appvoices.org/end-mountaintop-removal/community/> [<https://perma.cc/483B-ZYDX>] (last visited Apr. 3, 2019).

²⁰ Richard Schiffman, *A Troubling Look at the Human Toll of Mountaintop Removal Mining*, YALE ENVIRONMENT 360 (Nov. 21, 2017), <https://e360.yale.edu/features/a-troubling-look-at-the-human-toll-of-mountaintop-removal-mining> [<https://perma.cc/M8M9-T526>]. Office of Surface Mining, Reclamation & Enforcement, *supra* note 17.

²¹ Office of Surface Mining, Reclamation & Enforcement, *supra* note 17.

Consistent with coal industry management's historic proclivity for denial and deflection of its negative externalities, coal interests not only reject epidemiologists' investigations and findings of correlations between coal mining and public health impacts, they also strongly opposed a \$1 million government-funded study of possible causal links between MTR operations and adverse health impacts experienced by those who live and work nearby.²² As discussed below, instead of supporting objective unbiased scientific analysis, to allay community concerns, the industry and its supporters have turned again to denial, attacking the science, the scientists, and black lung victims.

These two examples provide a useful lens to examine concerns about the impact of coal mining practices on the health of coal miners and the communities where they live and work. Ironically, the federal Mine Safety and Health Act declares that "[t]he first priority and concern of all in the coal mining industry must be the health and safety of its most precious resource—the miner."²³ Those words ring hollow today, as coal miners and their communities continue to bear the burden of disabling lung afflictions and a plethora of illnesses and diseases. Degraded health is not a natural consequence of working in or living near a coal mine. Disease and illnesses arising from exposure to environmental contaminants are preventable. In this Article we argue that, in Central Appalachia, objective science and strict enforcement of occupational and environmental laws must be the first priority of industry and government regulators.

I. COAL MINING HISTORY AND METHODS

A. *History*

Coal mining began in Central Appalachia as early as 1810, though it was known that coal was present in the region as early as the mid-1700s.²⁴ Professor Ronald Eller described the region prior to the Industrial Revolution:

²² See HUMAN RIGHTS WATCH, Letter from Hal Quinn, President and CEO of Nat'l Mining Assoc. to Human Rights Watch, in *THE COAL MINE NEXT DOOR: HOW THE US GOVERNMENT'S DEREGULATION OF MOUNTAINTOP REMOVAL THREATENS PUBLIC HEALTH* app. 3–4 (Dec. 18, 2018), https://www.hrw.org/sites/default/files/report_pdf/uscoal1218_web2.pdf [<https://perma.cc/FD4J-5TBV>]. The National Academy of Science study of possible health impacts of MTR mining was "a very expensive waste of taxpayer dollars." *Id.* at 66.

²³ 30 U.S.C. § 801(a) (2018).

²⁴ *History of West Virginia Mineral Industries—Coal*, W. VA. GEOLOGICAL & ECON. SURVEY (June 20, 2017), <http://www.wvgs.wvnet.edu/www/geology/geoldvco.htm> [<https://perma.cc/H9XC-D3ZY>].

Great forests of oak, ash, and poplar covered the hillsides with a rich blanket of deep hues, and clear, sparkling streams rushed along the valley floors. No railroad had yet penetrated the hollows. The mountain people lived in small settlements scattered here and there in the valleys and coves. Life on the whole was simple, quiet, and devoted chiefly to agricultural pursuits.²⁵

The coming of the industrial age awakened the coalfields of Appalachia.²⁶ By the beginning of the twentieth century, the quiet mountain life of the Central Appalachian coalfields vanished.²⁷ Agrarian subsistence farming declined precipitously as men, and even boys, trekked to coal mines seeking work underground.²⁸ Job-seekers from other regions of the country, including poor African American sharecroppers from the South and newly arrived immigrants from Europe, fueled the rapid change in Appalachian life and culture.²⁹

Thousands of miners toiled in oppressive, serf-like conditions in “coal camps” in the anthracite coalfields of northeastern Pennsylvania and the bituminous coalfields that spread across America.³⁰ Miners and their families found food and shelter in these company-built-and-owned towns situated in remote valleys and hollows of Central Appalachia—which had essentially been, hitherto, a remote wilderness unblemished by roads and rail lines.³¹

“In addition to owning and controlling all of the institutions in the town, coal company rule . . . included the company doctor who delivered the babies, the mines in which the children went to work, and the cemeteries where they eventually were buried.”³² From the houses in which

²⁵ RONALD D. ELLER, *MINERS, MILLHANDS, AND MOUNTAINEERS: INDUSTRIALIZATION OF THE APPALACHIAN SOUTH, 1880–1930* 161 (1st ed., 1982).

²⁶ McGinley, *supra* note 7, at 266.

²⁷ *Id.*

²⁸ *Id.*

²⁹ Heidi Taylor-Caudil & Whitney Hays, *Immigrants in the Coalfields*, UNIV. OF KY., <http://iia.uky.edu/immigrantsinthecoalfields> [https://perma.cc/53VD-AD77] (last visited Apr. 3, 2019).

³⁰ Patrick C. McGinley, *From Pick and Shovel to Mountaintop Removal: Environmental Injustice in the Appalachian Coalfields*, 34 ENVTL. L. 21, 26–27, 29 (2004).

³¹ Eileen Mountjoy, *Ernest: Life in a Mining Town*, IND. UNIV. PA., <https://www.iup.edu/archives/coal/people-lives-stories/ernest-life-in-a-mining-town/> [https://perma.cc/7ME3-N7AV] (last visited Apr. 3, 2019).

³² *THE WEST VIRGINIA MINE WARS: AN ANTHOLOGY 1* (David Alan Corbin ed., 1990).

miners and their families lived, to the store where they bought food, to the schools and the churches, the recreation facilities, and everything in between, the coal company controlled it all.³³

Workers were paid in “scrip,” a private form of currency issued by the company that was accepted only by company-owned-and-operated stores and businesses.³⁴ This form of compensation was problematic, placing miners further under the thumb of company bosses and making it nearly impossible to accumulate savings which could be used outside the camp limits.³⁵ Coal companies essentially had complete and total domination over the lives of the camps’ inhabitants, and they wielded this power with little government oversight.³⁶

Neither the health of miners nor the quality of life in the coal camps was of significant priority or concern for most coal company managers. Appalachian historian Ronald Eller drew a bleak picture of these benighted communities:

Coal-mining village after coal-mining village dotted the hollows along every creek and stream. The weathered houses of those who worked in the mines lined the creeks and steep slopes, and the black holes themselves gaped from the hillsides like great open wounds. Mine tipples, headhouses, and other buildings straddled the slopes of the mountains. Railroads sent their tracks in all directions, and long lines of coal cars sat on the sidings and disappeared around the curves of the hills.

The once majestic earth was scarred and ugly, and the streams ran brown with garbage and acid runoff from the mines. A black dust covered everything. Huge mounds of coal and “gob” piles of discarded mine waste lay about.

³³ *Southern West Virginia Coal Fields*, COAL CAMP USA, <http://coalcampusa.com/sowv/index.htm> [https://perma.cc/UY4H-8M2P] (last visited Apr. 3, 2019).

³⁴ DAVID ALAN CORBIN, *LIFE, WORK, AND REBELLION IN THE COALFIELDS: THE SOUTHERN WEST VIRGINIA MINERS, 1880–1922* 10 (1981) (“[T]he miner paid monopolistic prices for his goods To the miners, it meant, as they later sang, that they ‘owed their souls to the company store.’ For some miners, it meant being held in peonage.”). *Id.* See also *Keokee Consol. Coke Co. v. Taylor*, 234 U.S. 224, 226–27 (1914) (upholding law prohibiting mining companies from issuing scrip).

³⁵ CORBIN, *supra* note 34, at 10.

³⁶ McGinley, *supra* note 30, at 28.

The peaceful quiet of three decades before had been replaced by a cacophony of voices and industrial sounds.³⁷

While Appalachian coal powered the Industrial Revolution, it was also transforming the culture and landscape of the region.

B. *Central Appalachian Coalfield Population Growth*

From 1900 to 1950, the influx of workers, their families, and others employed in a variety of enterprises supporting the coal industry resulted in a huge expansion in the Central Appalachian population.³⁸ At its peak in 1923, the U.S. coal industry employed 862,536 miners; in 1948, the post-WWII mine work force numbered 507,333.³⁹ Twenty years later, 134,467 workers were employed in the mines.⁴⁰ From 1968 to 1978, a coal boom pushed coal mine employment to 255,588.⁴¹ Seven years later, in 1985, 197,049, or 75,000 fewer workers, toiled in U.S. mines.⁴² Although coal production continued to increase, only 132,111 miners were employed in 1995.⁴³ By December 2018, coal jobs had shrunk to approximately 54,000 workers.⁴⁴

³⁷ ELLER, *supra* note 25, at 161–62 (describing life in an early coal camp in Central Appalachia).

³⁸ Christopher Price, *The Impact of the Mechanization of the Coal Mining Industry on the Population and Economy of Twentieth Century West Virginia*, 22 W. VA. HIST. SOC'Y 1, 4 (2008). For example, the population of counties located in the Central Appalachian coalfields of southern West Virginia grew dramatically as mines proliferated and coal production exploded. From 1900 to 1950, the population of Logan County grew from 6,955 to 77,391—an increase of more than 1,000%; McDowell County's 1900 population of 18,747 increased by 1950 to 98,887, or more than 400%; Raleigh County's population of 12,346 grew to 96,273. *Id.* at 11. Exemplars of the Central Appalachian coal region, the same counties lost population with the onset of mechanization and loss of energy market share since 1950. Today, McDowell County's population is 18,456, Raleigh County 75,022, and Logan County 32,925. *Population of Counties in West Virginia (2019)*, WORLD POP. REV., <http://worldpopulationreview.com/us-counties/wv/> [<https://perma.cc/YM84-QZNK>] (last visited Apr. 3, 2019).

³⁹ *Coal Fatalities for 1900 Through 2018*, U.S. DEP'T OF LABOR, <https://arlweb.msha.gov/stats/centurystats/coalstats.asp> [<https://perma.cc/FCB8-DQR3>] (last visited Apr. 3, 2019).

⁴⁰ *Id.*

⁴¹ *Id.*

⁴² *Id.*

⁴³ *Id.*

⁴⁴ *All Employees: Mining and Logging: Coal Mining*, FED. RES. BANK OF ST. LOUIS, <https://fred.stlouisfed.org/series/CEU1021210001#0> [<https://perma.cc/8QK4-RUK9>] (last visited Apr. 3, 2019); U.S. DEP'T OF LABOR, *supra* note 39. *See also New data chart on mine employment and coal production 1978–2015*, U.S. DEPT. OF LABOR, MINE SAFETY HEALTH

With mechanization came higher levels of production using significantly less manpower—resulting in higher profits with less overhead.⁴⁵

C. *Mining Methodologies*

1. Mining Prior to Mechanization

The twentieth century saw coal mining evolve from labor-intensive, pick-and-shovel digging to modern, high-tech, mechanized mining.⁴⁶ Coal was mined from the late nineteenth century until the 1920s using primitive methods, employing men and boys wielding picks and hand-loading by shovels, blasting apart coal beds, and hauling coal to the surface in carts pulled on rails by horses or mules.⁴⁷ The mining was done using the “room and pillar technique,” which involves extracting coal while leaving pillars of coal to prevent the overlying strata from collapsing into the area (“room”) as coal was removed.⁴⁸

ADMIN., https://wvpolicy.org/wp-content/uploads/2018/5/SWWV2012_091912.pdf [https://perma.cc/L2R7-LR3E] (last visited Apr. 3, 2019). W. VA. CTR. ON BUDGET & POL'Y, THE STATE OF WORKING WEST VIRGINIA 2012 24 (Sept. 2012), https://wvpolicy.org/wp-content/uploads/2018/5/SWWV2012_091912.pdf [https://perma.cc/D9X8-Y2ES].

⁴⁵ See *infra* note 94.

⁴⁶ VACLAV SMIL, TRANSFORMING THE TWENTIETH CENTURY: TECHNICAL INNOVATIONS AND THEIR CONSEQUENCES 159–62 (2006).

⁴⁷ See, e.g., OHIO DEP'T NAT. RES., GEOFACTS NO. 14: HISTORY OF COAL MINING IN OHIO 1–2 (2008), <http://minerals.ohiodnr.gov/portals/minerals/pdf/coal/geof14.pdf> [https://perma.cc/VUS9-788Q] (However, “[b]y the 1930’s, many of Ohio’s underground coal mines had become fully mechanized with the introduction of coal-loading machinery”).

⁴⁸ Room and pillar mining involves:

extract[ing] the coal by cutting a series of rooms into the coalbed and leaving pillars . . . of coal, to help support the mine roof. As mining advances, a grid-like pattern is formed in the panel of coal, which is about 400 feet wide and more than half a mile long. Generally, the rooms are 20 to 30 feet wide and the pillars 20 to 90 feet wide; the height usually is the same as the coalbed thickness. When mining reaches the end of the panel, the direction of mining usually is reversed. During this “retreat” phase of mining the miners recover as much coal as possible from the pillars in a systematic manner until the roof caves in. When this phase of mining is completed, the area is abandoned. Generally, 50 to 60 percent of the minable coal [in a seam] is recovered with room-and-pillar mining.

U.S. ENERGY INFO. ADMIN., COAL DATA: A REFERENCE 10–11 (1995), http://webapp1.dlib.indiana.edu/virtual_disk_library/index.cgi/4265704/FID3754/pdf/Coal_nuc/006493.pdf [https://perma.cc/Q285-E3H9].

2. Continuous Mining

In the 1940s, mechanized “continuous mining” was introduced in American mines.⁴⁹ “Continuous mining uses a machine called the ‘continuous miner’ that combines cutting, drilling, and loading coal into one operation and requires no blasting.”⁵⁰ During the late 1940s, conventional techniques began to be replaced by these single machines, which broke off the coal from the seam and transferred it back to the haulage system.⁵¹ The new equipment was adapted for and used with the room-and-pillar method.⁵²

As mines were mechanized after the Second World War, coal production increased dramatically, while the number of miners dropped appreciably.⁵³ As discussed below, after reaching their post-WWII zenith

⁴⁹ KEITH DIX, WHAT’S A COAL MINER TO DO?: THE MECHANIZATION OF COAL MINING 77 (1988).

⁵⁰ U.S. ENERGY INFO. ADMIN., *supra* note 48, at 11. For an overview of changing mining methods, see generally JOEL DARMSTADTER, RES. FOR THE FUTURE, PRODUCTIVITY CHANGE IN U.S. COAL MINING (July 1997), <https://www.rff.org/documents/1097/RFF-DP-97-40.pdf> [<https://perma.cc/8F7R-GPYA>].

⁵¹ NAT’L ACAD. OF SCI., ENG’G & MED., MONITORING AND SAMPLING APPROACHES TO ASSESS UNDERGROUND COAL MINE DUST EXPOSURES, APP. F, UNDERGROUND COAL MINING METHODS AND ENGINEERING DUST CONTROLS 130 (2018) (“A continuous miner is used for cutting and loading and shuttle cars to transport coal from the miner to the intermediate haulage.”).

⁵² *Id.* at 130–32.

⁵³ INGRID H. RIMA, LABOR MARKETS IN A GLOBAL ECONOMY: AN INTRODUCTION 228 (1996). A 1947 publication reported how U.S. mines in the early twentieth century experienced an enormous increase in coal production. “[I]n the year 1923, 1,880,000 tons of bituminous coal were produced by mechanized mines; by 1931, the bituminous coal produced by mechanized mining had reached 47,562,000 tons, a growth of 25 fold in [eight] years.” TECHNOCRATIC STUDY COURSE, TECHNOCRACY INC. 116 (online ed. 2005), <https://www.technocracyinc.org/wp-content/uploads/2015/07/Study-Course.pdf> [<https://perma.cc/A97W-XDY4>]. The same publication also mentioned how the industry had witnessed a per worker-hour increase over the preceding century:

The best available data indicate that 100 years ago [1847], one man could not mine on the average more than a ton of coal in one day of 12 hours; in other words, it took 12 man-hours to mine one ton of coal. In the industrial growth that followed, the coal mining industry . . . produced 670 million tons of coal in one year. During all this period, . . . we improved our coal mining technique. First steam pumps and power hoists were introduced; then blowing engines for the ventilation of the mines; explosives were used for breaking the coal and rendering [easier] its extraction. Later, coal cutting machines and automatic loaders were introduced. More recently, large scale strip mining methods have been employed where giant steam shovels of 30 and 40 tons per bucket full strip off the overlying rock to depths of 50 or 60 feet Figured on the basis of coal mined, the average rate of production of all the coal

of 507,000 miners in 1948, the number of miners steadily declined.⁵⁴ In 2017, the total number of coal miners in the United States had fallen to a low of 53,051.⁵⁵ At the state level, for example, there were 13,222 miners working in West Virginia in 2017.⁵⁶ Today, slightly more than 12,000 people are employed in coal mining in West Virginia.⁵⁷

3. Contour Strip Mining

Two types of surface coal mining techniques were used from the late 1930s in Central Appalachia until the turn of the millennium to strip shallow-lying coal: contour mining and auger mining.⁵⁸ Professor Mark Squillace has summarized the aggregate environmental impact of strip mining prior to the time of enactment of the federal Surface Mining Control and Reclamation Act of 1977 (“SMCRA”):

[When] SMCRA was passed in 1977, more than 264,000 acres of cropland, 135,000 acres of pasture, and 127,800 acres of forest had been lost. More than 11,000 miles of streams had been polluted by sediment or acid from surface and underground mining combined. Some 29,000 acres

mined in the United States is approximately six tons per man per eight-hour day. Stated in terms of man-hours, this means that it now takes eight man-hours on the average to mine [six] tons of coal, whereas, 100 years ago it required twelve man-hours to mine one ton of coal. Thus, the man-hours required per ton of coal mined has declined since 1830 from 12 to 1.33 man-hours per ton of coal.

Id. at 115. In 2003, U.S. coal miners produced an average of nearly seven tons per worker hour. *Annual Energy Review*, U.S. ENERGY INFO. ADMIN. (Sept. 12, 2012), <https://www.eia.gov/totalenergy/data/annual/showtext.php?t=ptb0707> [<https://perma.cc/C4L6-HLRH>].

⁵⁴ G.E. Harding, *American Coal Production and Use*, 22 *ECON. GEOGRAPHY* 46, 47–48 (1946).

⁵⁵ U.S. ENERGY INFO. ADMIN., *ANNUAL COAL REPORT 2017 27* (2017), <https://www.eia.gov/coal/annual/pdf/acr.pdf> [<https://perma.cc/LB6J-J53F>].

⁵⁶ *Id.*

⁵⁷ Between 1948 and 1961, the number of miners employed in West Virginia fell from 117,000 to 42,000. Though mechanization and modern high-production mining methods resulted in record tonnage, employment plummeted, as did the Central Appalachian coalfield population. By 2017, only 12,606 miners were working in the state, and coal production plunged from a record 181,914,000 tons in 1997 to 105,000,000 in 2017.

⁵⁸ For a summary explanation of surface mining methodology, see *Basic Information about Surface Coal Mining in Appalachia*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/sc-mining/basic-information-about-surface-coal-mining-appalachia> [<https://perma.cc/2BEU-BRYF>] (last visited Apr. 3, 2019). For a more detailed description of surface mining methods used in Central Appalachia and other mining regions, see MARK SQUILLACE, *THE STRIP MINE HANDBOOK* 16–19 (2d. ed. 2009).

of reservoirs and impoundments had been seriously damaged by strip mining. Strip mining had created at least 3,000 miles of landslides and left some 34,000 miles of high-walls [of which, twenty thousand miles of abandoned high-walls exist in Appalachia alone]. Two-thirds of the land that had been mined for coal had been left unreclaimed, and the cost of reclamation in 1977 was estimated at between \$10 billion and \$35 billion. . . . The most serious adverse impacts from coal mining have occurred in the Appalachian region, especially the states of Kentucky, Pennsylvania, Tennessee, Virginia, and West Virginia⁵⁹

State laws, if they existed at all, were weak and largely unenforced.⁶⁰ The land, water, and general environment of the region suffered enormous damage for decades.⁶¹ Chad Montrie captured the cumulative impact of unregulated coal mining:

Surface coal mining has dramatically impacted communities in the Appalachian coalfields. As the industry expanded in the years after World War II, it exacerbated the poverty and chronic unemployment of the region, compounding the impoverishment that was a legacy of other extractive economic activities, including deep mining.⁶²

⁵⁹ SQUILLACE, *supra* note 58, at 7–8 (citing various sources including: S. REP. NO. 95-128, 95th Cong. 1st Sess. 50 (1977); H.R. REP. NO. 95-218, 95th Cong. 1st Sess. 135 (1977); H.R. REP. NO. 94-1445, 94th Cong. 2d Sess. 19, 135 (1976); FINAL ENVIRONMENTAL IMPACT STATEMENT, PERMANENT REGULATORY PROGRAM, OSM EIS-1.p. Bill-17 (1979); U.S. DEP'T. OF THE INTERIOR, SURFACE MINING AND OUR ENVIRONMENT 42, 54, 85 (USGPO. 1967-0-258-263)).

⁶⁰ See John D. Edgcomb, Comment, *Cooperative Federalism and Environmental Protection: The Surface Mining Control and Reclamation Act of 1977*, 58 TUL. L. REV. 299, 305–08 (1983) (describing state efforts in West Virginia, Virginia, Kentucky, and Ohio). See also McGinley, *supra* note 30, at 49.

⁶¹ RONALD D. ELLER, UNEVEN GROUND: APPALACHIA SINCE 1945 37 (2013) (“Surface mining . . . left the mountains disfigured and the environment altered in ways previously unimagined in the region. . . . The social cost of the new industry was as appalling as the cost to the land itself.”).

⁶² CHAD MONTRIE, TO SAVE THE LAND AND PEOPLE: A HISTORY OF OPPOSITION TO SURFACE COAL MINING IN APPALACHIA 2 (2003). Eventually, when Congress enacted comprehensive regulation to ameliorate the many harmful externalities of unregulated coal mining it identified the magnitude of the environmental and socio-economic harm that accrued as a result of coal mining up to 1977. H.R. REP. NO. 95-218, at 58–59 (1977), *reprinted in* 1977 U.S.C.C.A.N. 539, 596–97 (detailing the devastating consequences of surface mining that galvanized Congressional action on SMCRA).

Coalfield residents took notice and reacted—at first, locally, but soon the movement began to spread across the region.⁶³ People from Central Appalachian communities began to coordinate to form a loose grassroots movement, demanding cessation of the environmental degradation caused by both strip mining and underground mining.⁶⁴ Key to their plan of action was their call for Congress to intervene and establish uniform national coal mining and reclamation standards that could be enforceable in court by federal and state regulators, as well as through legislatively authorized “citizen suits.”⁶⁵

“The contour method is used almost exclusively in the steep Appalachian region of the United States where coal seams outcrop from the sides of hills or mountains.”⁶⁶ Contour mining makes cuts on the slope where the coal seam is located; trees, vegetation, and the soil and rock overburden are removed first, and then the coal itself.⁶⁷ Overburden from adjacent cuts is used to fill previous cuts; the operator continues making cuts until the ratio of overburden to coal becomes uneconomical.⁶⁸ The mining operation then continues along the contour of the mountain until the coal resources, or the operator’s resources, are exhausted.⁶⁹ Contour mining uses relatively small earth-moving equipment, including power shovels, backhoes, and bulldozers, similar to equipment used for many other kinds of construction activities.⁷⁰ Contour mining was the

⁶³ STEPHEN L. FISHER, *FIGHTING BACK IN APPALACHIA: TRADITIONS OF RESISTANCE AND CHANGE* 6–7 (1993) (“The grassroots anti-strip mining movement was at the heart of the initial outburst of community organizing in Appalachia in the latter half of the 1960s and early 1970s”). See generally MONTRIE, *supra* note 62 (describing the history of this citizens movement).

⁶⁴ See generally MONTRIE, *supra* note 62. This book provides a comprehensive chronicle of the history of coalfield citizens’ movement, the enactment of SMCRA, and the subsequent effect of the legislation on Appalachian communities and lands.

⁶⁵ Citizen suits are authorized by the Surface Mining Control and Reclamation Act of 1977, Pub. L. No. 95-87, 520, 91 Stat. 503 (1977) (codified as amended at 30 U.S.C. § 1270). See Edward M. Green et al., *The Surface Mining Control and Reclamation Act of 1977: New Era of Federal-State Cooperation or Prologue to Future Controversy?*, 16 E. MINERAL L. INST., 392, 392 (1996).

⁶⁶ SQUILLACE, *supra* note 58, at 18. ELLER, *supra* note 61, at 36–37 (“In the mountains . . . surface miners were forced to follow the contour of the coal seam as it wound around the mountainside. Contour mining removed the soil and rock from above the seam, gauging a shelf around the hillside to get at the coal below . . . The practice of contour mining cut into the hillsides [creating] ugly scars that ran for miles along the ridges.”).

⁶⁷ SQUILLACE, *supra* note 58, at 15.

⁶⁸ *Id.* at 18.

⁶⁹ *Id.*

⁷⁰ *Id.*

long-preferred strip-mining method in Central Appalachia.⁷¹ Contour mining usually produced too much spoil upon completion of mining, so the spoil was dumped in small tributary streams at the head of mountain hollows.⁷²

When contour mining is performed in accordance with later reclamation laws, the coal operator is required to reduce the attendant negative environmental externalities by using scrapers and loaders, or bulldozers, to remove and then stockpile the topsoil for later use in reclaiming the site.⁷³ The exposed strata (“overburden”) is then drilled and explosives are detonated to fragment it.⁷⁴

Bulldozers, excavators, shovels, or draglines are used to uncover the exposed coal seam.⁷⁵ The mine operator then scoops and deposits the coal into trucks or onto conveyor belts for transport, when necessary, to a cleaning facility on site where shale and other non-combustible materials are separated from marketable coal.⁷⁶ SMCRA requires the overburden or “spoil” removed during the mining process to be spread on a previously mined area, where it will be graded and compacted, rather than cavalierly dumped over steep hillsides.⁷⁷ SMCRA also required, for the first time, that overburden containing acid or alkaline materials be segregated and specially handled to prevent water from percolating through it and creating polluted runoff or groundwater contamination.⁷⁸

In Central Appalachia, before SMCRA was enacted, overburden or spoil that remained after backfilling the area of coal removal had to be placed somewhere on the mine site.⁷⁹ The easiest and cheapest way

⁷¹ *Id.*

⁷² *Id.*

This results from a phenomenon called the swell factor. When overburden is removed, it breaks up and loses some of the compaction that occurred over the thousands of years that it laid undisturbed. Even after replacement and mechanical compaction, the volume of the material increases by up to 25%. The pits left after extracting the relatively thin coal seams of the East are often not large enough to hold this added volume. As a result, most contour miners must dispose of their excess spoil in another fill or disposal area. The most common disposal areas are at the heads of valleys, called valley filles or heads of hollow fills.

Id. at 18.

⁷³ SQUILLACE, *supra* note 58, at 15.

⁷⁴ *Id.*

⁷⁵ *Id.*

⁷⁶ *Id.*

⁷⁷ *Id.* at 139–41.

⁷⁸ *Id.* at 70.

⁷⁹ ELLER, *supra* note 61, at 36 (“This process not only left a forty-to-ninety foot ‘highwall’ exposed on the inside of the cut but pushed most of the dirt, rock, and tree stumps from

was to push or shove it into a “fill” in narrow hollows at the top of valleys carved over geologic time by small headwater tributaries.⁸⁰ Under SMCRA, fills are regulated and supposed to be engineered and constructed to prevent environmental harm.⁸¹

Prior to SMCRA, coal operators seldom effectively revegetated the mined area.⁸² More often than not, they made no sincere effort to do what no law required, leaving the land ripe for soil erosion, landslides and stream sedimentation.⁸³ SMCRA established a regulated reclamation process that required the coal company to spread the stored topsoil on the surface and seed the area to ensure the establishment of a permanent vegetative cover throughout the mined area.⁸⁴

4. Auger Mining

Auger mining usually takes place in conjunction with contour mining operations.⁸⁵ The contour operator strips coal from the contour of a mountain until the stripping ratio—the “ratio between the thickness of the overburden and the coal seam”—makes it unprofitable to continue contour mining.⁸⁶ At that point, the operator may choose to maximize recovery of the coal by drilling (augering) holes into the exposed seam along

above the coal over the hillsides along the outer edges of the seam.”). *See generally* SQUILLACE, *supra* note 58 (describing the environmental impacts of strip mining before the passage of SMCRA).

⁸⁰ SQUILLACE, *supra* note 58, at 99–101.

⁸¹ 30 U.S.C. § 1265(b)(2–5), (22) (2018); *see* 30 C.F.R. §§ 816.71–816.74 (2018) (disposal of excess spoil in valley fills/head-of-hollow fills, durable rock fills and on preexisting benches). *See* SQUILLACE, *supra* note 58, at 99–101 (describing SMCRA’s requirements).

⁸² ELLER, *supra* note 61, at 37 (“Mining companies were required by law to replace the soil and to replant the ravaged hillsides, but . . . [e]ven when meager efforts at reclamation were undertaken, the absence of topsoil and the composition of the fill itself meant that little vegetation grew on the disturbed site.”). *See generally* SQUILLACE, *supra* note 58 (describing the environmental impacts of strip mining before the passage of SMCRA).

⁸³ Nathan Fetty, *Modern Battles*, in WRITTEN IN BLOOD: COURAGE AND CORRUPTION IN THE APPALACHIAN WAR OF EXTRACTION 217 (Wess Harris ed., 2017) (“The early ‘shoot and shove’ strip jobs of the mid-twentieth century sparked outrage in the communities where the practice led to floods, landslides and other tragedies”).

⁸⁴ SQUILLACE, *supra* note 58, at 134. The regulatory agency was required to document the permanency of the vegetative cover over a five-year period before the company’s reclamation bond would be released. *Id.* at 134–35. The actual effectiveness of this requirement, however, cannot be confirmed.

⁸⁵ Robert Leopold et al., *Surface Mining* 21 (presented at the Nat’l Conf. on Appl. Tech. for Analysis & Mgmt., Incline Village, Nevada, Apr. 23–25, 1979), https://www.fs.fed.us/psw/publications/documents/psw_gtr035/psw_gtr035_01_leopold.pdf [<https://perma.cc/Z3WE-U2SR>] (“Auger mining is often performed in conjunction with contour strip mining”).

⁸⁶ SQUILLACE, *supra* note 58, at 16.

the contour of the highwall using an “auger machine.”⁸⁷ “[I]t is an extremely wasteful technique . . . [A]ugering coal may recover only 40 per cent of the seam, leaving the remaining 60 per cent in a condition that makes it unrecoverable by existing mining techniques.”⁸⁸

These strip-mining methods have been eclipsed by the large-scale MTR mining method.⁸⁹ Today, contour and accompanying auger mining produce a relatively small percentage of coal in Central Appalachia, having been displaced by huge high-production mines, where coal is extracted using the modern longwall-mining method underground and mountaintop removal on the surface.⁹⁰

5. Mega-Production Longwall and Mountaintop Removal Mining

Mechanization and the concomitant massive job losses attendant to stripping operators’ embrace of mountaintop removal were paralleled by the underground operators’ adoption of new deep mining technology.⁹¹ The new equipment and mining methods contributed to a significant increase in worker productivity.⁹² Conversely, the increased efficiencies of mechanized mining caused a dramatic decrease in the number of coal mining jobs.⁹³ In 1979, 58,565 miners produced 112.3 million tons of coal

⁸⁷ *Id.* at 19. Tension cracks and other problems on the surface may result if auger holes are not filled. *See also* David J. Kessler, *Auger Mining*, E-WV: THE WEST VIRGINIA ENCYCLOPEDIA (Dec. 14, 2010), <https://www.wvencyclopedia.org/articles/312> [<https://perma.cc/FB2F-5W8Z>]. Kessler explains:

Auger mining uses large-diameter drills mounted on mobile equipment to bore into a coal seam. Holes are horizontally drilled at regular intervals to depths of as much as 1,000 feet. As the cutting head of the auger bites into the coalface, the cut coal is carried out by the screw portion of the bit. Once the hole is mined to its required depth, the auger machine is moved a few feet and another hole is drilled.

⁸⁸ Leopold et al., *supra* note 85, at 21.

⁸⁹ *See generally* SQUILLACE, *supra* note 58 (describing current mining practices). Jedediah Purdy, *The Violent Remaking of Appalachia*, THE ATLANTIC (Mar. 21, 2016), <https://www.theatlantic.com/technology/archive/2016/03/the-violent-remaking-of-appalachia/474603/> [<https://perma.cc/83T2-FPUV>] (“Today, contour mining seems almost artisanal. Since the 1990s, half the region’s coal has come from ‘mountaintop removal’”).

⁹⁰ Purdy, *supra* note 89. Jen Alyse Arena, *Coal production using mountaintop removal mining decreases by 62% since 2008*, U.S. ENERGY INFO. ADMIN. (July 7, 2015), <https://www.eia.gov/todayinenergy/detail.php?id=21952> [<https://perma.cc/KSX3-L26Y>] (“MTR is prevalent mostly in Central Appalachia, specifically West Virginia, Kentucky, Virginia, . . . West Virginia accounts for most domestic MTR production, and MTR production makes up most of the surface production in the state (61% in 2013)”).

⁹¹ SQUILLACE, *supra* note 58, at 21–22.

⁹² *See infra* note 94.

⁹³ Joel Darmstadter, *Innovation and Productivity in U.S. Coal Mining*, in PRODUCTIVITY

in West Virginia; two decades later, 15,000 miners produced more than 160 million tons.⁹⁴ As explained below, the new mining methods and equipment caused more extensive environmental damage than was possible by earlier mining methods.

6. Longwall Mining

In the decade and a half between 1975 and 1990, technological innovations shifted conventional underground coal mining away from the long-dominant continuous mining technology to “longwall” mining.⁹⁵ Only the largest companies could afford to invest in the new technology; capital costs for longwall mining are many times that required to operate a mine that utilizes only continuous mining units to extract coal.⁹⁶ Total initial capital costs for a longwall unit in 1995 dollars were \$13,738,000; one continuous miner unit costs \$1,835,000.⁹⁷ Productivity of mines using

IN NATURAL RESOURCE INDUSTRIES: IMPROVEMENT THROUGH INNOVATION 48 (Ralph David Simpson, ed., 1999). For example, coal production in West Virginia between 1975 and 2007 increased from 109,048,898 to 160,043,930 tons—or by more than 50%. *Id.* Many more miners were employed in conventional continuous operations in underground room and pillar mines employed as compared to longwall mines. *Id.* This can also be said with regard to MTR mines, as huge mining equipment came to replace cadres of miners. The last three decades has also witnessed a precipitous decline in non-union coal mine employment as coal companies have increasingly resisted unionization, even as corporate profits have risen. ERIC ARNESEN, ENCYCLOPEDIA OF U.S. LABOR AND WORKING-CLASS HISTORY 1432 (2007).

⁹⁴ U.S. ENERGY INFO. ADMIN., ANNUAL COAL REPORT 2010 (revised July 2012). It may be that it is inaccurate to attribute increased productivity to new mining methods and equipment because doing so fails to factor in externalized costs:

From a conceptual point of view, the questions arise as to whether, and to what extent, some of the health-safety-environmental impacts of coal mining fit the notion of “externalities”—at least for years preceding statutory requirements for dealing with such problems (see below). That is, were the costs of dealing with, or averting, these impacts borne by society at large or the affected individuals rather than being financially accounted for—“internalized”—in the operations of the mining firm? If the former, output and productivity of the firm and of the industry might, to some hard-to-quantify degree, be overstated because certain costly damages from coal mining failed to be reflected as an offset to the value of production.

Id. at 20.

⁹⁵ U.S. ENERGY INFO. ADMIN., EIA REPORT: LONGWALL MINING 3 (Mar. 1995), http://webapp1.dlib.indiana.edu/virtual_disk_library/index.cgi/4265704/FID1578/pdf/coal_nuc/ [<https://perma.cc/5M3B-9MP6>].

⁹⁶ *Id.* at 5 (“Because a large initial capital outlay is required with no immediate return from coal production . . . economics generally restricts longwall mining to large coal companies”).

⁹⁷ *Id.* at 45.

continuous miners is significantly lower than longwall mines.⁹⁸ Moreover, the method uses only one-tenth of the workers required by continuous mining.⁹⁹

Longwall mining uses very sophisticated technology to carve huge swaths, 1,500 feet wide and a mile or more long, through coal seams that lie horizontally, hundreds of feet beneath the earth's surface.¹⁰⁰ A huge circular drum with cutting bits (the "shear") cuts coal from the seam.¹⁰¹ The shear, related equipment, and the miners operating them are protected from roof cave-ins by overhead hydraulic shields ("roof supports").¹⁰² The roof supports move forward mechanically along the 1,000- to 1,500-foot-wide longwall "face" as the shears cut into the coal¹⁰³ that drops onto a conveyer belt that runs parallel to the coal seam face.¹⁰⁴ The conveyor carries the newly cut coal out of the mine to the surface for processing and transportation to market.¹⁰⁵

As the supports move forward, the mine roof caves in, causing overlying strata to subside into the mined-out area.¹⁰⁶ This subsidence radiates upward and affects overlying surface land, water bodies, roads, homes, and other structures.¹⁰⁷ Coal mine subsidence has been defined as "the lowering of strata overlying a coal mine, including the land surface, caused by the extraction of underground coal."¹⁰⁸ The United States Supreme Court described the harm that can accrue as a result of coal-mining-induced surface subsidence in *Keystone Bituminous Coal Ass'n v. DeBenedictis*:

This lowering of the strata can have devastating effects. It often causes substantial damage to foundations, walls, other structural members, and the integrity of houses and

⁹⁸ *Id.* ("productivity of the continuous miner units is also estimated to be much lower than that of the longwalls . . . 575 raw tons per continuous miner unit shift versus 3,575 tons per longwall unit shift . . .").

⁹⁹ *Collateral Damage*, *supra* note 14, at 360.

¹⁰⁰ McGinley, *supra* note 30, at 55–56, nn.179–80. *See also* BARLOW BURKE, JR. ET AL., *MINERAL LAW: CASES AND MATERIALS* 316 (1994). *See generally* S.S. PENG & H.S. CHIANG, *LONGWALL MINING* (1984) (describing this process).

¹⁰¹ McGinley, *supra* note 30, at 56–57.

¹⁰² *Id.*

¹⁰³ *Id.*

¹⁰⁴ *Id.* at 56 n.180.

¹⁰⁵ *Id.*

¹⁰⁶ *Id.*

¹⁰⁷ McGinley, *supra* note 30, at n.180.

¹⁰⁸ *Keystone Bituminous Coal Ass'n v. DeBenedictis*, 480 U.S. 470, 474 (1976). The Court upheld a Pennsylvania law prohibiting underground longwall and room and pillar mining where the extraction of coal might harm important public interests. *Id.*

buildings. Subsidence frequently causes sinkholes or troughs in land which make the land difficult or impossible to develop. Its effect on farming has been well documented—many subsided areas cannot be plowed or properly prepared. Subsidence can also cause the loss of groundwater and surface ponds.¹⁰⁹

Similarly, longwall subsidence has triggered pervasive loss and/or contamination of rural domestic well and spring water supplies.¹¹⁰ While some in the coal industry dispute the impact of longwall mining on water resources, evidence of such effect is pervasive.¹¹¹ Longwall mining, like MTR, produces prodigious amounts of coal waste after mined material is cleaned that, if not properly managed, can cause serious adverse impacts both above and below the ground, as well as contaminate wells and springs that often supply drinking water to the rural areas of Central Appalachia.¹¹²

7. Mountaintop Removal

In the mid-1990s, MTR emerged in Central Appalachia as the dominant method of surface mining, displacing contour mining, which now produces negligible coal tonnage by comparison.¹¹³ Conventional surface mine operations in Central Appalachia typically cut hundreds of feet into mountainsides but occurred “over relatively small spatial scales, [while MTR] mines have been constructed across thousands of square kilometers of

¹⁰⁹ *Id.* at 474–75.

¹¹⁰ For a discussion of the externalities of longwall coal mining, see SCHMID & CO., INC., CONSULTING ECOLOGISTS, THE INCREASING DAMAGE FROM UNDERGROUND COAL MINING IN PENNSYLVANIA 25–27 (2011), <http://www.schmidco.com/17April2011SchmidAct54Analysis.pdf> [<https://perma.cc/PAZ8-CXSL>]; Colin J. Booth, *Groundwater as an Environmental Constraint of Longwall Mining*, RMZ—MATERIALS & GEOENVIRONMENT 49, 49–52 (2003), http://www.rmz-mg.com/letniki/rmz50/rmz50_0049-0052.pdf [<https://perma.cc/QN34-TL8F>]. See generally U.S. ENERGY INFO. ADMIN., *supra* note 95.

¹¹¹ T. Ty Lindberg et al., *Cumulative impacts of mountaintop mining on an Appalachian watershed*, 108 PROC. NAT'L ACAD. SCI. 20,933 (Dec. 27, 2011), <https://www.pnas.org/content/pnas/108/52/20929.full.pdf> [<https://perma.cc/T3GG-D5NX>] (“The waste rock from these surface mines is disposed of in the adjacent river valleys, leading to a burial of headwater streams and dramatic increases in salinity and trace metal concentrations immediately downstream.”). See also U.S. ENVTL. PROT. AGENCY, THE EFFECTS OF MOUNTAIN-TOP MINES AND VALLEY FILLS ON AQUATIC ECOSYSTEMS OF THE CENTRAL APPALACHIAN COALFIELDS 7 (Mar. 2011), <https://cfpub.epa.gov/ncea/risk/recorddisplay.cfm?deid=215267> [<https://perma.cc/2YH8-4CTT>].

¹¹² McGinley, *supra* note 30, at 56, n.180.

¹¹³ *Id.* at 54–55.

land, making it the single largest source of land use change in the region.”¹¹⁴ It has been estimated that MTR mining has disturbed “400 square miles of southern West Virginia mountains and ridges . . . and 1,000 miles of streams [have been] buried beneath debris blasted, shoved, and dumped into narrow valleys.”¹¹⁵

MTR mining blasts through Appalachian ridges using explosives, often in areas where longwall operations are occurring simultaneously underground.¹¹⁶ “Explosives—equivalent to the power of one Hiroshima bomb each week—are then used with draglines [and other equipment] to blast and dig out the earth and expose the coal.”¹¹⁷ “Normally 600 to 800 feet of mountaintop [ridges] are removed.”¹¹⁸ After blasting overburden, surface soil, underlying strata, and coal are removed using twenty-story tall “draglines.”¹¹⁹

One of the first media articles about MTR mining underscored the difference between earlier, much smaller-scale strip mining technology and MTR:

A new generation of motorized shovels and huge dump trucks is being used to cut down entire mountaintops on a scale unknown 25 years ago. This \$100 million machine weighs 8 million pounds and contains enough steel to build 2,700 cars. An enormous extension cord feeds it up to \$50,000 worth of electricity a month. The dragline’s bucket could hold 26 Ford Escorts. It bites off 110 cubic yards of earth in a single scoop.¹²⁰

¹¹⁴ A. Pericak et al., *Mapping the yearly extent of surface coal mining in Central Appalachia using Landsat and Google Earth Engine 2*, PLOS ONE (July 25, 2018), <https://doi.org/10.1371/journal.pone.0197758> [<https://perma.cc/8DX5-LA9E>].

¹¹⁵ McGinley, *supra* note 30, at 55.

¹¹⁶ *Id.*

¹¹⁷ Rene Cho, *Mountaintop Removal: Laying Waste to Streams and Forests*, EARTH INST. (Aug. 11, 2011), <https://blogs.ei.columbia.edu/2011/08/11/mountaintop-removal-laying-waste-to-streams-and-forests/> [<https://perma.cc/WRW6-38HQ>].

¹¹⁸ *Id.*

¹¹⁹ McGinley, *supra* note 30, at 86.

¹²⁰ See Penny Loeb, *Shear Madness*, U.S. NEWS & WORLD REPORT (Aug. 3, 1997). See also Peter Galuszka, *Strip Mining On Steroids*, BLOOMBERG BUS. WEEK (Nov. 17, 1997), <https://www.bloomberg.com/news/articles/1997-11-16/strip-mining-on-steroids> [<https://perma.cc/95DU-8MEV>]. See also Ken Ward, Jr., *Industry, Critics Look for Mountaintop Removal Alternative: Is There Another Way?*, CHARLESTON GAZETTE-MAIL (June 6, 1999), <https://wal.lacehouse.umich.edu/wp-content/uploads/2000/06/MountaintopReduced.pdf> [<https://perma.cc/6G2Y-VP5V>] (“In the early 1980s, 85-ton trucks were the largest used in West Virginia mining. Back then, strip mines and valley fills were much smaller. Generally, fills

MTR became the strip mining method of choice when new restrictions on sulfur emissions were added by amendments to the Clean Air Act.¹²¹

The legislation resulted in heightened demand for the low-sulfur coal found in the Central Appalachian coalfields.¹²² “The market for low-sulfur coal, increased demand for electricity, and the development of heavy machinery” allowed coal companies using MTR “to mine coal . . . quicker, cheaper, and with fewer workers than underground mining.”¹²³ Unlike conventional, smaller-scale strip mining, MTR methodology and equipment allowed companies to extract multiple coal seams—some only a few feet thick—that otherwise could not be profitably mined by earlier mining methods.¹²⁴

The federal SMCRA of 1977 defines mountaintop removal as “surface mining activities, where the mining operation removes an entire coal

contained less than 250,000 cubic yards of rock and dirt. [By the end of the 1990s,] mountaintop removal mines use[d] 240-ton trucks. Valley fills sometimes measure 100 million cubic yards or more.”).

¹²¹ The Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (codified in scattered sections of 42 U.S.C.), reduced the competitiveness and demand for high-sulfur coal. JOHN ALEXANDER WILLIAMS, *APPALACHIA: A HISTORY* 345 (2002). The amendments provided electricity-generating utility companies a choice of means to reduce their emissions of polluting sulfur dioxide. They could choose to install expensive equipment to “scrub” their emissions, or replace high-sulfur with low-sulfur coal from central Appalachia or low-sulfur and low-btu coal from strip mines in Montana and Wyoming. *All. for Clean Coal v. Bayh*, 72 F.3d 556, 558 (7th Cir. 1995); *How Coal Works*, UNION OF CONCERNED SCIENTISTS, <https://www.ucsusa.org/clean-energy/all-about-coal/how-coal-works> [<https://perma.cc/T6NJ-D3LK>] (last visited Apr. 3, 2019).

¹²² See Peter T. Kilborn, *East's Coal Towns Wither in the Name of Cleaner Air*, N.Y. TIMES (Feb. 15, 1996), <https://www.nytimes.com/1996/02/15/us/east-s-coal-towns-wither-in-the-name-of-cleaner-air.html> [<https://perma.cc/7JHE-FDET>]:

[In] Eastern coal country . . . the coal here is too high in sulfur to easily meet the clean air requirements. Mines are thriving in the West and in eastern Kentucky and southern West Virginia, all producers of low-sulfur coal. But they are closing through most of Appalachia and in other coal-mining areas east of the Mississippi . . . The mines in the high-sulfur areas are shutting because when the coal they yield is burned, the sulfur produces sulfur dioxide, a cause of acid rain. Under the Clean Air Act, power plants were required to reduce sulfur dioxide emissions by half as of January 1995, and they must cut them further by 2000. [Utilities] can meet the air standards by blending high-sulfur coal with low-sulfur coal from Wyoming and Montana or from eastern Kentucky and southern West Virginia. Either way, the Clean Air Act has cut demand for high-sulfur coal . . .

¹²³ Cho, *supra* note 117.

¹²⁴ McGinley, *supra* note 30, at 57.

seam or seams running through the upper fraction of a mountain, ridge, or hill . . . by removing substantially all of the overburden off the bench and creating a level plateau or a gently rolling contour, with no highwalls remaining.”¹²⁵

This sterile statutory language belied the reality of the new mining methodology. A federal court summarized the MTR mining method:

The coalfields of southern West Virginia are mountainous, with steep wooded slopes. Coal in these mountains is found in seams of varying thickness sandwiched between layers of rock and dirt. In mountaintop removal mining, the rock and dirt overburden or “spoil” is removed, layer by layer, and the coal is mined at the exposed surface, as it appears. The ultimate effect is to remove the mountaintop to a depth where deep mining is the practical method of recovery.¹²⁶

After a helicopter overflight of all the then-existing MTR mines in southern West Virginia, the court observed:

the extent and permanence of environmental degradation this type of mining produces [T]he ground was covered with light snow, and mined sites were visible from miles away. The sites stood out among the natural wooded ridges as huge white plateaus, and the valley fills appeared as massive, artificially landscaped stair steps. Some mine sites were twenty years old, yet tree growth was stunted or non-existent. Compared to the thick hardwoods of surrounding undisturbed hills, the mine sites appeared stark and barren and enormously different from the original topography. . . . Destruction of the unique topography of southern West Virginia . . . cannot be regarded as anything but permanent and irreversible.¹²⁷

¹²⁵ 30 U.S.C. § 1265(c) (2000); 30 C.F.R. § 785.14(b) (2004). MTR mining is authorized by SMCRA as a variance from the general requirement that surface mines be returned to their approximate original contour. 30 U.S.C. § 1265 (c)(2) (2018).

¹²⁶ *Bragg v. Robertson*, 72 F. Supp. 2d 642, 646 (S.D.W. Va. 1999) (describing MTR and the creation of valley fills), *rev'd sub nom.* *Bragg v. W. Va. Coal Ass'n*, 248 F.3d 275 (4th Cir. 2001); *see also* *W. Va. Coal Ass'n v. Reilly*, 728 F. Supp. 1276, 1281 (S.D.W. Va. 1989) (discussing the construction of valley fills), *aff'd*, CA-87-834-2, 1991 WL 75217 (4th Cir. 1991).

¹²⁷ *Bragg v. Robertson*, 54 F. Supp. 2d 635, 646 (1999).

Moreover, MTR mining runoff and drainage has a significant adverse impact on downstream surface waters.¹²⁸

While the level of destruction varies with the size of the mine, “[a] large mine can deforest over 10 square miles and generate 750 million cubic yards of waste.”¹²⁹ The waste generated from this process is also called overburden.¹³⁰

D. *Environmental Concerns*

1. Valley Fills

Overburden from mountaintop removal is comprised of rocks, rubble, and coal debris from the mined area.¹³¹ It is dumped in nearby valleys using large earth-moving equipment and monster “rock trucks.”¹³² The area where the spoil is deposited is referred to as a “valley fill.”¹³³ Typically, these MTR fills bury thousands of lineal feet of headwater streams with waste hundreds of feet deep.¹³⁴ The areas that formerly were deep narrow valleys are filled to the adjacent ridge tops, whose surfaces are contoured and compressed by huge machines to create a rolling surface configuration.¹³⁵

¹²⁸ See, e.g., ES Bernhardt et al., *How Many Mountains Can We Mine? Assessing the Regional Degradation of Central Appalachian Rivers by Surface Coal Mining*, 46 ENVTL. SCI. & TECH. 8110, 8120 (2012), <https://pubs.acs.org/doi/abs/10.1021/es301144q> [<https://perma.cc/AXV9-FZAS>] (“[S]urface coal mines degrade water quality and substantially alter stream biota well downstream of their permit boundaries and that the extent and severity of these impacts within river systems are proportional to the areal extent of surface coal mining”).

¹²⁹ Cho, *supra* note 117.

¹³⁰ *Id.*

¹³¹ *Id.*

¹³² McGinley, *supra* note 30, at 86.

¹³³ *Id.* at 55 n.177, 57.

¹³⁴ Brian Lutz et al., *The Environmental Price Tag on a Ton of Mountaintop Removal Coal*, 8 PLOS ONE e73203, e73203 (Sept. 2013), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3770658/pdf/pone.0073203.pdf> [<https://perma.cc/C7ER-L48K>] (“The process of MTR uses explosives and heavy machinery to remove entire mountain ridges in order to access near surface coal deposits, producing vast quantities of mine spoil that fills valleys and buries streams. MTR has expanded dramatically in recent decades and is now the dominant driver of land-use change across the Central Appalachian region”).

¹³⁵ 30 C.F.R. § 785.14 (2018) (“Mountaintop removal mining means surface mining activities, where the mining operation removes an entire coal seam or seams running through the upper fraction of a mountain, ridge or hill . . . by removing substantially all of the overburden off the bench and creating a level plateau or gently rolling contour, with no highwalls remaining.”).

Valley fills are engineered and terraced in an effort to maintain their stability.¹³⁶ The fills are porous.¹³⁷ They act like sponges over time, slowly releasing water from the toe of the fill.¹³⁸ Although the valley fills are supposed to be reclaimed by establishing permanent native species through vegetative cover, as required by federal and state reclamation laws, in reality, revegetation leaves much to be desired.¹³⁹

Water discharged from valley fills has been found to be contaminated by toxic minerals like selenium.¹⁴⁰ A 2003 EPA report found that, “to date[,] functioning headwater streams have not been re-created on mined or filled areas as part of mine restoration or planned stream mitigation efforts.”¹⁴¹ Over 2,000 miles of headwaters have been buried by valley fills, and more than 500 mountaintop ridges in Appalachia, accounting for more than one million acres of land, have been leveled by MTR operations.¹⁴²

After overburden has been removed and the underlying coal excavated, it is loaded into trucks or placed on conveyor belts and “transported to processing sites, where it is washed, crushed, and separated from noncombustible” rock and shale.¹⁴³

The process produces enormous amounts of liquid waste, called sludge or slurry, which is held in impoundments often built onsite. These slurry ponds, usually hidden from public view, can store billions of gallons of waste contaminated with the carcinogenic chemicals used in coal processing and toxic heavy metals found in coal such as arsenic, mercury, chromium, cadmium, boron, selenium and nickel.¹⁴⁴

¹³⁶ McGinley, *supra* note 30, at 58 n.191.

¹³⁷ *See id.* at 56 n.177 (describing valley fills being made up of dirt and rocks).

¹³⁸ 30 C.F.R. § 817.72(b)(1) (2017).

¹³⁹ *See* Bragg, 54 F. Supp. at 635.

¹⁴⁰ David Holzman, *Mountaintop Removal Mining: Digging Into Community Health Concerns*, 119 ENVTL. HEALTH PERSPECTIVES A476, A478 (2011), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3226519/> [<https://perma.cc/SSR8-3VRM>] (investigating the many ways MTR has polluted and damaged the ecology of Appalachia, and its continuing negative impacts on public health).

¹⁴¹ U.S. ENVTL. PROT. AGENCY, DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT ON MOUNTAINTOP MINING/VALLEY FILLS IN APPALACHIA—2003, III.D-20 (2003), <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100G0BS.PDF?Dockey=P100G0BS.PDF> [<https://perma.cc/H2Q7-YM58>].

¹⁴² *Ecological Impacts of Mountaintop Removal*, APPALACHIAN VOICES, <http://appvoices.org/end-mountaintop-removal/ecology/> [<https://perma.cc/UA4Q-49JP>] (last visited Apr. 3, 2019).

¹⁴³ Loretta Cain & Michael Hendryx, *Learning Outcomes Among Students in Relation to West Virginia Coal Mining: An Environmental Riskscape Approach*, 3 ENVTL. JUST. 71, 72 (2010).

¹⁴⁴ Cho, *supra* note 117.

MTR sites, and associated processing facilities and slurry ponds, are concentrated in Central Appalachia.¹⁴⁵ An estimated 1.2 million acres of Central Appalachia had been impacted by MTR operations as of 2009, a number which has undoubtedly continued to rise in the past decade.¹⁴⁶

2. Air and Water Pollution, and Coal Waste

While Central Appalachian mining towns were once inhabited by tens of thousands of miners and their families, these numbers have dwindled as decades of coal mine mechanization decimated the workforce.¹⁴⁷ These coalfield communities are characterized by high rates of poverty, unemployment, sparse educational and occupational opportunities, and low educational attainments.¹⁴⁸ While mortality rates across the rest of the country are improving and life expectancies are on the rise, the opposite is true in Central Appalachian coalfield communities.¹⁴⁹ Not surprisingly, access to basic healthcare is problematic in the region where some of the most severe health disparities in the United States occur.¹⁵⁰

A comprehensive 2017 Appalachian Regional Commission (“ARC”) report confirmed that “Appalachian incomes, poverty rates, unemployment rates, and postsecondary education levels [are] still lagging behind

¹⁴⁵ *See id.*

¹⁴⁶ *Mountaintop Removal 101*, APPALACHIAN VOICES, <http://appvoices.org/end-mountaintop-removal/mtr101/> [<https://perma.cc/UPE7-EAHE>] (last visited Apr. 3, 2019).

¹⁴⁷ *Quick Facts*, U.S. CENSUS BUREAU, <https://www.census.gov/quickfacts/WV> [<https://perma.cc/QUU7-RVYW>] (last visited Apr. 3, 2019).

¹⁴⁸ *See generally* JULIE L. MARSHALL ET AL., APPALACHIA REG. COMM'N, HEALTH DISPARITIES IN APPALACHIA (Aug. 2017), https://www.arc.gov/research/researchreportdetails.asp?REPORT_ID=138 [<https://perma.cc/YCX4-K63W>] [hereinafter HEALTH DISPARITIES]. *See, e.g.*, W. VA. RURAL HEALTH ASSOC., HEALTH CARE IN WEST VIRGINIA 15–16 (Aug. 2017), <https://wvrha.org/wp-content/uploads/2017/06/2017-FINAL-WV-Workforce-8312017.pdf> [<https://perma.cc/LN5P-87PH>].

¹⁴⁹ *Id.* at 5–6. *See* Michael Hendryx, *Poverty and Mortality Disparities in Central Appalachia: Mountaintop Mining and Environmental Justice*, 4 J. HEALTH DISPARITIES RES. & PRAC. 44, 48–50 (Spring 2011); David Squires & David Blumental, *Mortality Trends Among Working-Age Whites: The Untold Stories*, COMMONWEALTH FUND, <https://www.commonwealthfund.org/publications/issue-briefs/2016/jan/mortality-trends-among-working-age-whites-untold-story> [<https://perma.cc/9XRM-H64J>] (last visited Apr. 3, 2019).

¹⁵⁰ HEALTH DISPARITIES, *supra* note 148, at 6. Leigh-Anne Krometis et al., *Environmental Health Disparities in the Central Appalachian Region of the United States*, 32 REV. ENVTL. HEALTH 253 (2017) (“the National Institute on Minority Health and Health Disparities has recognized Appalachia as an area exhibiting persistent disparities that require further research.”). *See also* W. VA. RURAL HEALTH ASSOC., *supra* note 148, at 98–105 (a 2015 report examining healthcare in West Virginia found that significant needs are unmet).

performance at the national level.”¹⁵¹ Moreover, the ARC study reported that the region “performs poorly when compared to the nation as a whole” with regard to many reviewed health drivers and outcomes.¹⁵² Importantly, the ARC report emphasized that “[p]rogress in the socioeconomic and health spheres are often interrelated, if not interdependent, and much work remains.”¹⁵³

Hopefully the forgoing summary discussion of the history of coal mining in Appalachia and the evolution of mining methods will inform the following discussion.

II. BLACK LUNG DISEASE

A. *Coal Workers’ Pneumoconiosis: Black Lung Disease*

As is the case with other major coal externalities, the public is almost completely unaware of an insidious health hazard known as “black lung.”¹⁵⁴ In earlier years the malady was called “miners’ asthma” and “anthracosis.”¹⁵⁵ Now, black lung is the commonly used term for a

¹⁵¹ HEALTH DISPARITIES, *supra* note 148, at 3. The report, however, observes that over the last fifty years, Appalachia has made significant progress. Its poverty rate dropped from 31% in 1960 to 17.2% from 2010–2014. Moreover, high-poverty counties in the region (those with poverty rates more than 1.5 times the national average) fell from 295 in 1960 to ninety-one over the same period). *Id.*

¹⁵² *Id.* The report explains that “health drivers” are often referred to as “health determinants.” They are “measures that impact health status and can be socioeconomic, behavioral, environmental, or associated with the quality of the health care system.” The ARC report correlates income and educational attainment with overall health status. “Some drivers,” like the availability of mental health providers, might impact outcomes regarding behavioral health. *Id.* at 21.

¹⁵³ *Id.*

¹⁵⁴ See Krometis et al., *supra* note 150, at 254.

¹⁵⁵ Pathologists who observed that lungs of diseased miners appeared black instead of the natural pink color of healthy lung tissue coined the non-scientific descriptive term “black lung.” See *Black Lung Disease*, WEBMD (May 4, 2010), <https://www.webmd.com/lung/black-lung-disease#1> [<https://perma.cc/T738-K6WY>]. Over time, inhalation of coal dust results in the accumulation of the foreign material in the lungs. See *id.* Miners’ risk of developing emphysema and chronic bronchitis increases as the dust accumulates in the organs. See *id.* Black lung presents in two forms: simple, which is known as coal workers’ pneumoconiosis (“CWP”), and complicated, referred to as progressive massive fibrosis (“PMF”). *Id.* Miners’ risk of incurring chronic obstructive pulmonary disease (“COPD”) also increases with inhalation of coal dust. *Id.*

lung disease whose medical name is “coal workers’ pneumoconiosis.”¹⁵⁶ Miners develop the disease as a result of their inhalation of coal dust while working in coal mines.¹⁵⁷ Symptoms of the disease include “progressive dyspnea, chest discomfort, and cough, sometimes dramatically accompanied by the expectoration of copious quantities of black, inky sputum.”¹⁵⁸ The malady can be debilitating and is often fatal.¹⁵⁹ West Virginia University doctor Edward Petsonk, a nationally recognized occupational health expert, described the horror of the disease:

Black lung leaves miners’ lungs scarred, shriveled and black. They struggle to do routine tasks and are eventually forced to choose between eating and breathing. “No human being should have to go through the misery that dying of [black lung] entails,” said Dr. Edward Petsonk, who treats patients with black lung and works with NIOSH. “It is like a screw being slowly tightened across your throat. It is really almost a diabolical torture.”¹⁶⁰

B. Nineteenth-Century Medicine Recognized Coal Dust As a Debilitating Cause of Lung Disease

Doctors treating miners in Great Britain first identified black lung disease in the mid-nineteenth century.¹⁶¹ By the latter half of the century, persuasive medical literature linked coal mine dust with workers’ lung disease.¹⁶² European science shaped the North American understanding of miners’ respiratory distress.¹⁶³ Tying unmistakable readily

¹⁵⁶ *Id.*

¹⁵⁷ *Id.*

¹⁵⁸ Greg Wagner, *Black Lung: Anatomy of a Public Health Disaster*, 340 NEW ENG. J. MED. 1770 (1999) (book review).

¹⁵⁹ *Id.*

¹⁶⁰ Chris Hamby, *Black Lung Surges Back in Coal Country*, CTR. FOR PUB. INTEGRITY (May 19, 2014), <https://publicintegrity.org/workers-rights/black-lung-surges-back-in-coal-country/> [<https://perma.cc/2Q9L-3R8X>]. See DERICKSON, *supra* note 16, at 6. See also BARBARA ELLEN SMITH, DIGGING OUR OWN GRAVES: COAL MINERS AND THE STRUGGLE OVER BLACK LUNG DISEASE 4 (1987).

¹⁶¹ See DERICKSON, *supra* note 16, at 6. However, it was not until 1937 that the disease was recognized in the United Kingdom as a compensable occupational medical condition. See SMITH, *supra* note 160.

¹⁶² See DERICKSON, *supra* note 16, at 6.

¹⁶³ *Id.* at 4.

perceived signs and symptoms to anatomical discoveries offered strong substantiation of the existence of miners' pneumoconiosis.¹⁶⁴

By 1900, there was compelling scientific evidence that many coal miners suffered from a debilitating occupational disease, commonly known in biomedical parlance as anthracosis and popularly referred to as "miners' asthma."¹⁶⁵ The United Mine Workers Union ("UMWA") took the lead in trying to educate the public about the causes and symptoms of black lung disease.¹⁶⁶ During a 1902 strike in the anthracite coalfields of Pennsylvania, the UMWA championed the cause of aging miners who, for very low wages, toiled in dangerous and dusty conditions—just to provide for the minimal basic needs of their families.¹⁶⁷

Even coal company managers grudgingly conceded the existence of miners' asthma.¹⁶⁸ Coal operators retrenched, insisting that "not very many men crawled to work."¹⁶⁹ Thus, at that time, it was well-established that coal dust caused miners' respiratory disease.¹⁷⁰ However, that conclusion was soon to be obscured by the coal industry and its doctors.¹⁷¹ It was even broadly denied by the medical profession.¹⁷²

C. *Refuting Science and Common Sense: Industry Denial of Causal Connection Between Coal Dust and Miner Respiratory Diseases: 1900–1935*

At the turn of the century, notwithstanding the fact that black lung was a reasonably well-understood major form of occupational disease, coal companies began to deny and discredit the obvious—that

¹⁶⁴ *Id.*

¹⁶⁵ *Id.* at 1–2 (In the U.S., "well before the turn of the 20th Century," clinical and pathological investigations supported the conclusion that inhaled coal dust caused miners' lung ailments).

¹⁶⁶ Richard Fry, *Making Amends: Coal Miner, the Black Lung Association, and Federal Compensation Reform, 1969–1972*, FED. HIST. 2013 35–37, [http://www.shfg.org/resources/Documents/FH%205%20\(2013\)%20Fry.pdf](http://www.shfg.org/resources/Documents/FH%205%20(2013)%20Fry.pdf) [<https://perma.cc/FGQ3-U86N>].

¹⁶⁷ DERICKSON, *supra* note 16, at 41. The small pay increase negotiated to end the strike, however, did not allow miners to keep their sons in school. The number of children employed in coal mines in the years following the work stoppage continued to grow. The National Child Labor Committee estimated that in 1906, approximately 10,000 boys under the age of fourteen worked in the anthracite coal region. *Id.* at 41–42.

¹⁶⁸ *Id.* at 14–15.

¹⁶⁹ *Id.* at 41.

¹⁷⁰ *See id.*

¹⁷¹ *Id.* at 16–17.

¹⁷² *Id.* at 20.

the blackened lungs of diseased coal miners were caused by inhalation of coal dust.¹⁷³ Creating an alternative reality fantasy, coal operators promoted the healthful nature of extractive work, with the intention of refuting the claims of the miners' union.¹⁷⁴ Coal companies trumpeted the alleged longevity of the coal workforce while dismissing black lung as an inconsequential discoloration of the lungs.¹⁷⁵ "There are no healthier men anywhere, than in the mining industry," they claimed.¹⁷⁶

Some coal industry officials, politicians, and many medical doctors claimed inhalation of coal dust posed no health threat.¹⁷⁷ Doctors influenced or employed by coal companies claimed that inhalation of fine coal particles "posed no hazard at all" to miners.¹⁷⁸ A Pennsylvania doctor working for the coal industry maintained that coal mine environments were inhospitable to infection.¹⁷⁹ Coal mines, some claimed, were much preferable to sweatshops and other disease-ridden workplaces.¹⁸⁰ Many in the medical profession embraced such opinions.¹⁸¹ "One doctor speculated that the mechanical action of inhaled coal particles in the lung conferred invulnerability to infection."¹⁸² Fallacious arguments supported the false narratives:

company physicians [asserted] that inhaling coal mine dust was harmless because the body was naturally equipped to expectorate "deposits of carbon" and thus purify itself. Another claim was that inhaling carbonaceous dusts was in fact *beneficial* to miners' health because it caused fibrotic formations which supposedly prevented tubercular bacilli "from getting a foothold" in the lungs. A third industry position was that the only real danger posed by either anthracite or bituminous mining was inhalation of "silicious dusts associated with sandstone, slate, and other minerals that occurred with coal deposits."¹⁸³

¹⁷³ DERICKSON, *supra* note 16, at 10.

¹⁷⁴ *Id.* at 58.

¹⁷⁵ *Id.* at 44.

¹⁷⁶ *Id.* at 53.

¹⁷⁷ *Id.* at 49.

¹⁷⁸ *Id.* at 43.

¹⁷⁹ DERICKSON, *supra* note 16, at 46.

¹⁸⁰ *Id.*

¹⁸¹ *Id.*

¹⁸² *Id.*

¹⁸³ Brian C. Murchison, *Due Process, Black Lung, and the Shaping of Administrative Justice*, 54 ADMIN. L. REV. 1025, 1040–41 (2002) [hereinafter *Shaping Administrative Justice*] (emphasis in original).

Remarkably, the companies' efforts to link all mining-related dust disease with silicosis evolved into conventional wisdom—"the only conceded effect of inhaling coal particles without significant silica was anthracosis, which coal interests insisted was not a disease but a discoloration of the lung."¹⁸⁴ Disturbingly, coal industry officials deflected attention by claiming silica inhalation, not coal dust, was the cause of miners' lung disorders.¹⁸⁵ Moreover, government scientists with expertise did nothing to resist the absolution of coal mine dust during the first three decades of the century; instead, public health officials "helped white-wash black lung."¹⁸⁶ Over the period from 1900–1930, black lung "virtually disappeared from the view of those outside the working class."¹⁸⁷

Of course, coal miners and many doctors and mining engineers were not deceived.¹⁸⁸ For those who had worked underground, treated miners gasping for breath, or participated in a post-mortem, the disavowal of a causal connection between miners' inhalation of coal dust and lung disease perpetrated a cynical sham.¹⁸⁹ Daniel Harrington, an experienced engineer employed by the U.S. Bureau of Mines in the 1920s, provided one of the few voices calling public attention to the malevolent ruse.¹⁹⁰ Harrington condemned the "sheep-like acceptance of half-baked statements and misinterpreted statistics . . . [t]hat . . . [had fostered] a positive belief the coal mining is one of the most healthful occupations."¹⁹¹

D. The Coal Industry's Black Lung Reductionist Paradigm Survives: 1935–1969

Professor Alan Derickson, the author of the definitive history of black lung disease, has observed that "biomedical rethinking and industrial public relations effectively combined to marginalize miners' grievances regarding their lung ailments."¹⁹² However, in 1935, the New Deal

¹⁸⁴ *Id.*

¹⁸⁵ *Id.* at 1040–41.

¹⁸⁶ DERICKSON, *supra* note 16, at 60 (citing Emery R. Hayhurst, *Health Hazards of Nonpoisonous Costs: A Resume of Some Recent Investigations*, 10 AM. J. PUB. HEALTH 60, 62 (1920)).

¹⁸⁷ DERICKSON, *supra* note 16, at 58.

¹⁸⁸ *Id.*

¹⁸⁹ *Id.* at 4, 36.

¹⁹⁰ *Id.* at 77.

¹⁹¹ *Id.* at 78.

¹⁹² *Id.* at 59.

Congress enacted the National Labor Relations Act (“NLRA”).¹⁹³ The NLRA established federally protected rights of employees and employers, encouraged collective bargaining, and sought to curb harmful private-sector labor and management practices that disadvantaged workers, and adversely impacted businesses and the U.S. economy.¹⁹⁴

The NLRA, and other laws passed during the New Deal administration of President Franklin Roosevelt in response to the Great Depression and worldwide economic crisis, radically altered the balance of political and economic power in the nation.¹⁹⁵ A new era of government regulation of business and industry saw the UMWA acquire new influence in public policymaking; by the late 1930s, after almost four decades of coal industry denial, black lung disease reemerged as an important public issue.¹⁹⁶ In addition to pressing for legislation imposing a federal system of mine safety regulation, the UMWA renewed its campaign advocating for a federal program to provide financial support for disabled mine workers and a pension for widows of miners succumbing to black lung disease.¹⁹⁷

Not surprisingly, coal companies and their insurers sought to avoid underwriting the risk to which coal miners would be exposed on the job, and consequently afflicted with black lung disease.¹⁹⁸ “In this perverse view, victims of the disabling disorder deserve no compensation not because their disease was so rare as to fall below the threshold of public concern but rather because it was so commonplace.”¹⁹⁹

In spite of industry and insurer resistance, legislation was eventually enacted in 1937 by the Pennsylvania legislature that, on its face, seemed to require compensation for anthracite coal miners suffering from lung disease.²⁰⁰ However, coal companies dodged the bullet of financial

¹⁹³ 29 U.S.C. §§ 151–169 (2018).

¹⁹⁴ *Introduction to the NLRB*, NLRB, <https://www.nlr.gov/nlr-introduction> [<https://perma.cc/QS63-JUHD>] (last visited Apr. 3, 2019).

¹⁹⁵ See generally ARTHUR M. SCHLESINGER JR., *THE POLITICS OF UPHEAVAL: 1935–1936, THE AGE OF ROOSEVELT*, VOLUME III (2003).

¹⁹⁶ *Id.*

¹⁹⁷ DERICKSON, *supra* note 16, at 87. A coal miner, commenting on the dilemma in the UMWA union’s journal, observed that “sick men clung to their jobs because ‘their options were to dig coal or the poorhouse.’” *Id.* He asserted that they worked as long as they could in the mines, though suffering from lung disease, because their low wages did not permit them to save for retirement. *Id.* Responding to the industry claim that coal mining was a healthy occupation, Joseph Pico remarked that if someone took a mining job to cure his lung disease he would “soon be where he doesn’t need any cure.” *Id.* at 57.

¹⁹⁸ *Id.* at 91.

¹⁹⁹ *Id.*

²⁰⁰ *Id.* at 67.

responsibility by persuading legislators to pin the cost on state taxpayers.²⁰¹ Pennsylvania's mine owners were not satisfied.²⁰² Almost all coal companies refused to participate in the compensation program.²⁰³ In 1941, a state union leader observed, "we now have on the statute books of Pennsylvania an occupational disease law that means actually nothing to the anthracite miner."²⁰⁴

Professor Derickson has observed that "[t]he [black lung] reductionist paradigm emerged from the turmoil of the depression very much intact."²⁰⁵ The paradigm lasted for two more decades before it was jettisoned when "confrontational collective action accomplished what careful scientific investigation and subtle private negotiation could not."²⁰⁶

E. Federal Regulation of Respirable Coal Dust

Ultimately, government-based respirable dust regulation and compensation was not triggered by the overwhelming medical and scientific evidence of the devastating effect of coal dust.²⁰⁷ Instead, a grassroots movement that gathered steam over a decade was propelled forward by a tragic mine disaster that killed seventy-eight men in November of 1968 at Farmington, West Virginia.²⁰⁸ In the winter of 1969, thousands of miners and black lung widows marched on the West Virginia Capitol, successfully demanding state legislation to compensate miners afflicted with black lung.²⁰⁹ Later that year, and under growing pressure by the

²⁰¹ *Id.* at 101.

²⁰² *Id.*

²⁰³ DERICKSON, *supra* note 16, at 103.

²⁰⁴ *Id.*

²⁰⁵ *Id.* at 110–11 ("If anything, it became more secure by adapting in response to political challenges [. . .] Just as they enjoyed no Progressive Era with regard to occupational disease reform, breathless coal miners had no New Deal [. . .] [weak federal policy] also reflected the historical accumulation and dissemination of a body of official misinformation.").

²⁰⁶ *Id.* at xii ("mystifying scientific jargon lifted to reveal masses of breathless, displaced old men, destroyed by their work.").

²⁰⁷ *Id.* at 20.

²⁰⁸ In November 1968, the Farmington Mine exploded in West Virginia, killing seventy-eight miners. The Farmington disaster "intensified national concern about occupational hazards and provided the black lung protesters with a direct opportunity to influence policy debates within the West Virginia Legislature and the U.S. Congress." ROBERT GOTTLIEB, *FORCING THE SPRING: THE TRANSFORMATION OF THE AMERICAN ENVIRONMENTAL MOVEMENT* 358–59 [hereinafter *FORCING THE SPRING*].

²⁰⁹ *See id.* *See also* *Shaping Administrative Justice*, *supra* note 183, at 1026–27 ("it is the

grassroots movement and media attention, Congress enacted the federal Coal Mine Health and Safety Act of 1969 (“1969 Act”).²¹⁰ That law required coal operators to reduce miner exposure to respirable coal dust, and mandated compensation for disabled black lung victims, miners’ widows, and their families.²¹¹

Finally, after decades of dispute and denial, Congress recognized that miners’ respiration of coal dust is the cause of black lung disease.²¹² The 1969 Act created a regulatory agency to administer and enforce the law’s protective safety and health requirements.²¹³ It required coal companies to limit miners’ exposure to coal dust in their underground workplace.²¹⁴ The goal of the statute was to:

provide, to the greatest extent possible, that working conditions in each underground coal mine are sufficiently free of respirable dust to permit each miner the opportunity to work underground during the period of his entire life without incurring any disability from pneumoconiosis or any other occupation-related disease during or at the end of such period.²¹⁵

This Congressional goal reflects a deeply disturbing truth—black lung disease is, and has been, entirely preventable over the course of many decades with application of basic protective measures.²¹⁶ Since 1969, the federal government has administered a compensation program for victims of black lung, paid in part by coal company fees.²¹⁷ From 1969

story of workers who moved from passive frustration about occupational disease to militancy about legislative solutions . . . miners in the late 1960s used the pressure of strikes to force state and federal officials to recognize what miners had long known: that [coal dust] can grievously impair breathing function and even cause premature death”).

²¹⁰ See *Shaping Administrative Justice*, *supra* note 183, at 1043–47 (detailed review of events leading up to the enactment of the 1969 Act).

²¹¹ FORCING THE SPRING, *supra* note 208, at 359. See 30 U.S.C. § 842 (2018) (“Dust concentration and respiratory equipment”); 30 U.S.C. §§ 901–945 (2018) (Black Lung Benefits Act).

²¹² DERICKSON, *supra* note 16, at 169–75.

²¹³ Federal Coal Mine Health and Safety Act of 1969, Pub. L. 91-173, title II, § 202, Dec. 30, 1969; amended by the Federal Mine Safety and Health Act of 1977, Pub. L. 95-164 (1977).

²¹⁴ See Federal Mine Safety and Health Act of 1977, 30 U.S.C. § 842(b)(2) (2018); Black Lung Benefits Act, 83 Stat. 792 (2018).

²¹⁵ 30 U.S.C. § 841(b) (2018).

²¹⁶ D.J. Blackley et al., *Continued Increase in Prevalence of Coal Workers’ Pneumoconiosis in the United States, 1970–2017*, 108 AM. J. PUB. HEALTH e1–e3 (Sept. 2018).

²¹⁷ See *Usery v. Turner Elkhorn Mining Co.*, 428 U.S. 1, 8–12 (1976) (highlighting the origins

through 2004, black lung benefits paid to almost one million miners totaled more than \$41 billion.²¹⁸ As discussed below, over time, the dust mitigation measures required by the 1969 Act significantly reduced, but did not eliminate, the scourge of black lung among the nation's coal miners.²¹⁹

F. Resurgence of Black Lung & Related Lung Diseases & Industry Resistance

By 2004, thirty-five years after the 1969 Act was passed, another 123,000 miners were estimated to have died as a result of inhalation of coal dust.²²⁰ While the incidence of black lung disease declined substantially for a time, the prevalence of the disease has been increasing for more than a decade and a half.²²¹ Although the law was intended to minimize miner exposure to coal dust in the workplace, and consequently black lung disease, modern coal mining technologies have increased exposure

of the black lung program and the system it creates). *See generally* Donald T. DeCarlo, *The Federal Black Lung Experience*, 26 HOW. L.J. 1335 (1983).

²¹⁸ U.S. GOV'T ACCOUNTABILITY OFF., GAO 08-628T, FEDERAL COMPENSATION PROGRAMS: PERSPECTIVE ON FOUR PROGRAMS FOR INDIVIDUALS INJURED BY EXPOSURE TO HARMFUL SUBSTANCES, BEFORE SUBCOMMITTEES OF THE HOUSE COMMITTEE ON THE JUDICIARY, 111th Cong. (2008), at 2 (Statement of Anne-Marie Lofaso, Acting Director Education, Workforce, and Income Security Issues), <https://www.gao.gov/assets/120/119462.pdf> [<https://perma.cc/F9V7-JFBR>]. One black lung program expert noted that mine “owners have managed to cap and partially off-load their liability for black lung disease on both the companies that buy coal and the American people.” DERICKSON, *supra* note 16, at 6.

²¹⁹ M.D. Attfield et al., *Changing Patterns of Pneumoconiosis Mortality—United States, 1968–2000*, CTR. FOR DISEASE CONTROL (July 23, 2004), <https://www.cdc.gov/MMWR/preview/mmwrhtml/mm5328a1.htm> [<https://perma.cc/EU4B-42DS>].

²²⁰ *See* CHRISTOPHER W. SHAW, UNDERMINING SAFETY: A REPORT ON COAL MINE SAFETY 7–8 (2008), <https://www.csrl.org/UnderminingSafety/UnderminingSafety.pdf> [<https://perma.cc/2K2K-AX36>]; *see also* Brenda Wilson, *The Quiet Deaths Outside the Coal Mines*, NPR (Apr. 16, 2010), <http://www.npr.org/templates/story/story.php?storyId=126021059> [<https://perma.cc/K8FQ-KEYD>].

²²¹ Gardiner Harris & Ralph Dunlop, *Dust, Deception and Death: Why Black Lung Has Not Been Wiped Out*, LOUISVILLE COURIER-JOURNAL, Apr. 19, 1998, at A1, https://www democracynow.org/1999/4/14/dust_deception_and_death [<https://perma.cc/3ZUA-EXXS>] (“Every year, black lung disease kills almost 1,500 people who have worked in the nation’s coal mines. It’s as if the Titanic sank every year, and no ships came to the rescue. While that long-ago disaster continues to fascinate the nation, the miners slip into cold, early graves almost unnoticed.”). NAT’L ACAD. OF SCI., ENG’G, & MED., MONITORING AND SAMPLING APPROACHES TO ASSESS UNDERGROUND COAL MINE DUST EXPOSURES 15–16 (2018).

of miners to black lung disease.²²² Both young and experienced miners are being diagnosed with the disease.²²³

The National Institute for Occupational Safety and Health (“NIOSH”) first confirmed this trend in 1995 and emphasized that respirable dust standards had to be strengthened.²²⁴ Notwithstanding NIOSH’s findings, and the urgency they suggested, the Mine Safety and Health Administration (“MSHA”) did not move to tighten respirable coal dust standards until 2010.²²⁵ In that year, the agency finally proposed a rule aimed at lowering miners’ exposure to coal dust.²²⁶

²²² See Howard Berkes, *Republican Lawmakers Seek To Block Funding On Black Lung Regulation*, NPR (July 17, 2012), <https://www.npr.org/sections/thetwo-way/2012/07/17/156908140/republican-lawmakers-seek-to-block-funding-on-black-lung-regulation> [<https://perma.cc/498K-2K7Y>] (“[D]ata from the National Institute for Occupational Safety and Health (NIOSH) also shows that diagnoses of the worst stages of the disease have quadrupled since the 1980’s in eastern Kentucky, southwestern Virginia and southern West Virginia.”).

²²³ One indication that coal companies were ignoring the danger of exposing their workers to dangerous levels of coal dust surfaced with MSHA’s 2006 report that, over a five-year period, U.S. coal mines had been cited for more than 6,000 violations of airborne coal dust rules each year. Ken Ward Jr., *Beyond Sago; Coal Mine Safety in America: Coal Dust Most Common Violation; Mines Averaging 6,000 Citations for it Each Year*, CHARLESTON GAZETTE-MAIL, Dec. 17, 2006, at 1B.

²²⁴ NAT’L INST. OCCUP. SAFETY & HEALTH, U.S. DEP’T OF HEALTH & HUMAN SERV., NIOSH PUB. NO. 95-106, CRITERIA FOR A RECOMMENDED STANDARD: OCCUPATIONAL EXPOSURE TO RESPIRABLE COAL MINE DUST iii (1995), <https://www.cdc.gov/niosh/docs/95-106/default.html> [<https://perma.cc/JP22-ACPJ>]. The NIOSH report warned that the “recommended exposure limit . . . does not insure that miners exposed at this concentration over a lifetime will have a zero risk of developing occupational respiratory diseases.” NIOSH recommended additional protective measures including limiting worker exposure through “engineering controls and work practices” and “frequent monitoring of worker exposures, and . . . participation of miners in . . . medical screening and surveillance program.” *Id.*

²²⁵ See Kevin Ward, Jr., *Obama MSHA Proposes Phase-in of Tighter Standards on Coal Dust That Causes Deadly Black Lung Disease*, CHARLESTON GAZETTE-MAIL: COAL TATTOO (Oct. 14, 2010), <http://blogs.wvgazette.com/coaltattoo/2010/10/14/obama-msha-proposes-phase-in-of-tighter-standard-on-coal-dust-that-causes-deadly-black-lung-disease/> [<https://perma.cc/56MP-NNXW>] (The rule addressed many previously identified problems with existing federal mining regulations, such as updating methods to measure coal dust to have information collected better reflect working conditions. If implemented, the proposed rule would have required miners working in high dust-concentration areas to wear personal dust monitors).

²²⁶ Lowering Miners’ Exposure to Respirable Coal Mine Dust, Including Continuous Personal Dust Monitors, 75 Fed. Reg. 64,412 (proposed Oct. 19, 2010) (to be codified at 30 C.F.R. pts. 70, 71, 72, 75, 90). Referring to the 1969 Act, one commentator put MSHA’s inability to act on NIOSH’s 1995 recommendations in a larger context:

For 15 years, the scientific evidence has been telling us that US coal miners are exposed to levels of respirable dust that cause disease, but under the current federal mine safety regulations, these exposure levels

The coal industry, however, almost uniformly objected to the proposed rule on a number of grounds, which included the assertion that the rule would not reduce the incidence of black lung.²²⁷ A coal company executive attacked the proposal using familiar industry hyperbole:

It's absolutely a job killer, and it's killing jobs across Ohio and Appalachia . . . MSHA has proposed a Respirable Dust Standard that is unachievable in underground mine settings, and continues to be unable to produce the relevant data that they claim creates the causation basis for their rule. Day to day, our company sees the impacts of how MSHA is being used as a tool to stop coal mining.²²⁸

As coal industry executives and lobbyists were gearing up to resist the proposed rule, investigators reported that autopsies of the miners killed by the 2010 explosion at the Upper Big Branch (“UBB”) mine found

are legal. That needs to change. Not only is it ethically the right thing to do, but it is also the law of the land.

Celeste Montforton, *No Matter What Mining Industry Reps Say, MSHA's Proposed Rule to Address Black Lung is Easily Achievable*, THE PUMP HANDLE (July 19, 2011), <http://www.thepumphandle.org/2011/07/19/no-matter-what-mining-industry/> [<https://perma.cc/DC9Q-K4U4>].

²²⁷ See Industry submission to docket MSHA-2010-0007, *Lowering Miners' Exposure to Respirable Coal Mine Dust, Including Continuous Personal Dust Monitors*, OFFICE OF THE FED. REG., <https://www.federalregister.gov/documents/2010/10/19/2010-25249/lowering-miners-exposure-to-respirable-coal-mine-dust-including-continuous-personal-dust-monitors> [<https://perma.cc/7AFY-R6P6>] (last visited Apr. 3, 2019) (public comments involved in the proposed rule *Lowering Miners' Exposure to Respirable Coal Mine Dust Including Continuous Personal Dust Monitors* (Fed. Reg. Doc. 2010-25249)). See also, e.g., *Testimony of George Ellis, President, Pennsylvania Coal Association*, MINE SAFETY & HEALTH ADMIN. 9 (Feb. 8, 2011), http://files.dep.state.pa.us/publicparticipation/citizens%20advisory%20council/cacportalfiles/meetings/2011_04/testimonyact54april19,2011compatibleversion.pdf [<https://perma.cc/2JTE-6JCN>] (“What evidence does MSHA have to show that the . . . standard that has been used to protect Part 90 miners for the past 40 years is no longer adequate? This appears to be a case of arbitrarily cutting the standard in half, since the proposed standard will be reduced by that amount? The rule also appears to include a variety of 30 C.F.R. Part 75 changes that bear no rational relationship whatsoever to preventing CWP.”).

²²⁸ *EPA's Appalachian Energy Prematorium: Job Killer or Creator? Hearing before the Subcomm. on Reg. Affairs, Stimulus Oversight & Gov't Spending of the H. Comm. on Oversight & Gov't Reform*, 112th Cong. (July 14, 2011) (statement of Tom Mackall, President, Sterling Mining Corp.), <https://www.govinfo.gov/content/pkg/CHRG-112hrg73445/html/CHRG-112hrg73445.htm> [<https://perma.cc/597H-PNEX>]. But see Montforton, *supra* note 226 (“Respirable dust concentrations at Mr. Mackall’s underground coal mines are comparable to the situation nationwide. MSHA’s enforcement data indicates that the vast majority of coal mine operators are already complying with the 1.0 milligram standard.”).

almost three-quarters of them had black lung disease.²²⁹ This percentage was more than twenty times higher than what MSHA and the industry had claimed to be the average for all underground coal miners.²³⁰ The autopsies revealed that both old and young UBB miners had acquired the disease—a few were as young as twenty-five.²³¹ Five had been working in coal mines for fewer than ten years.²³² The West Virginia Governor's Independent Investigation Panel on the UBB explosion asserted that “the victims at UBB constitute a random sample of miners . . . the fact that 71 percent of them show evidence of CWP is an alarming finding given the ages and work history of these men.”²³³

Over the objections of coal companies and their lobbyists, MSHA promulgated a final rule six years into the Obama administration.²³⁴ Notwithstanding the coal industry's complaints of over-regulation, convincing, robust evidence shows that coal miners, in increasing numbers, continue to be exposed to crippling levels of respirable dust in American mines.²³⁵

²²⁹ GOVERNOR'S INDEPENDENT INVESTIGATION PANEL, UPPER BIG BRANCH: REPORT TO THE GOVERNOR 32 (May 2011), <https://media.npr.org/documents/2011/may/giip-massey-report.pdf> [<https://perma.cc/SJ2S-X9ZE>]. See also Hamby, *supra* note 160.

²³⁰ See *id.*

²³¹ GOVERNOR'S INDEPENDENT INVESTIGATION PANEL, *supra* note 229, at 32.

²³² *Id.* at n.260.

²³³ *Id.* at 32. Dr. Edward Petsonk, a nationally recognized black lung expert, indicates that in 2003, researchers identified an increase in the incidence of the disease and since then documented the doubling of cases. See *Most Upper Big Branch Mine Disaster Victims Had Black Lung Disease*, HAZARDEX (July 9, 2012), <http://www.hazardexonthenet.net/article/51666/Most-Upper-Big-Branch-mine-disastervictims-had-black-lung-disease.aspx?AreaID=2> [<https://perma.cc/MA6N-4SND>]. Of great concern is the frequency of the most severe type—progressive massive fibrosis, which is incapacitating and fatal. *Id.* “Researchers have identified hot spots of new cases, many in a triangular region of Appalachia stretching from eastern Kentucky through southern West Virginia and into southwestern Virginia.” *Id.*

²³⁴ Lowering Miners' Exposure to Respirable Coal Mine Dust, Including Continuous Personal Dust Monitors, 79 Fed. Reg. 24,813 (May 1, 2014). See *Nat'l Min. Ass'n v. Sec., U.S. Dep't of Labor*, 812 F.3d 843 (11th Cir. 2016) (upholding regulation over coal industry objections).

²³⁵ A very recent report of the National Academies of Sciences emphasized that:

. . . since around the year 2000, an increase in prevalence and severity of CWP has been observed in various hot-spot geographic regions. The reasons for this increase are not obvious but could be related to changes in mining practices and conditions (for instance, increase in equipment size and horsepower and mining increasingly thinner coal seams) leading to increased extraction of rock containing crystal silica and other [respirable coal mining dust] components.

NAT'L ACAD. OF SCI., ENG'G & MED., *supra* note 221. See, e.g., Howard Berkes, *As Mine*

A recent in-depth report by National Public Radio and the Center for Public Integrity explored the failure of government regulators to enforce the 1969 Act, as well as the coal industry's resistance to, and worse, its intentional cheating to avoid, compliance with mine dust regulatory standards:

A multiyear investigation by NPR and the PBS program Frontline found that Smith and Kelly are part of a tragic and recently discovered outbreak of the advanced stage of black lung disease A federal monitoring program reported just 99 cases of advanced black lung disease nationwide from 2011–2016. But NPR identified more than 2,000 coal miners suffering from the disease in the same time frame, and in just five Appalachian states . . . analysis of federal regulatory data—decades of information recorded by dust-collection monitors placed where coal miners work—has revealed a tragic failure to recognize and respond to clear signs of danger. For decades, government regulators had evidence of excessive and toxic mine dust exposures, the kind that can cause PMF, as they were happening. They knew that miners like Kelly and Smith were likely to become sick and die. They were urged to take specific and direct action to stop it. But they didn't.²³⁶

Protections Fail, Black Lung Cases Surge, NPR (July 9, 2012), <http://www.npr.org/2012/07/09/155978300/as-mine-protections-fail-black-lung-cases-surge> [<https://perma.cc/W3L6-237W>] (“Incidence of the disease has doubled in the last decade, according to data analyzed by [an] epidemiologist . . . at the National Institute for Occupational Safety and Health.”).²³⁶ Howard Berkes, Huo Jingnan, & Robert Benincasa, *An Epidemic Is Killing Thousands Of Coal Miners. Regulators Could Have Stopped It*, NPR (Dec. 18, 2018), <https://www.npr.org/2018/12/18/675253856/an-epidemic-is-killing-thousands-of-coal-miners-regulators-could-have-stopped-it/> [<https://perma.cc/4YPQ-6Q8T>]. The NPR assertion that coal company managers engaged in “intentional cheating to avoid compliance with mine dust regulatory standards” is underscored by the fact that in the winter of 2019 the Department of Justice charged “the manager of all of Armstrong Coal’s western Kentucky mines, a superintendent, safety director and section foreman at Armstrong’s Parkway Mine and a safety director at the company’s Kronos mine” with “fabricating dust tests, placing dust monitors in clean rooms instead of actual workplaces, and submitting results from days when the mine was not operating.” Becca Schimmel, *Federal Prosecutor Adds Charges In Kentucky Coal Dust Fraud Case*, OHIO VALLEY RESOURCE (Feb. 27, 2019), <https://ohiovalleyresource.org/2019/02/27/federal-prosecutor-adds-charges-in-kentucky-coal-dust-fraud-case/> [<https://perma.cc/JY34-HBEE>] (The United States Attorney overseeing the prosecutions stated “Our goal is to go up the chain to those that made decisions, very clear business decisions that exposed miners to a grave degree of risk.”).

Scott Laney, an epidemiologist at the National Institute for Occupational Safety and Health said that black lung is an “epidemic” and “clearly one of the worst industrial medicine disasters that’s ever been described [. . .] [w]e’re counting thousands of cases,” he said.²³⁷ “Thousands and thousands and thousands of black lung cases. Thousands of cases of the most severe form of black lung. And we’re not done counting yet.”²³⁸

NPR and Frontline asked Bruce Watzman, the National Mining Association’s top lobbyist for the last thirty years, why mining companies did not act on their own to protect their workers:

Sure they could have done that But . . . I’m not going to speculate on why they did or didn’t do what they chose Our focus here is forward looking How do we prevent this in the future? I can’t answer for . . . what happened in the past [The industry] is doing far better today than we did in the past, far better.²³⁹

Notwithstanding the sordid history reviewed above at a time when hidden truths are beginning to emerge about the resurgence of black lung disease in Central Appalachia and its horrendous impacts on coal miners, their families, and coalfield communities, the Trump administration has announced that it is reconsidering the 2014 black lung rule issued by former President Obama’s regulators.²⁴⁰

True to its history of resistance to black lung regulation, the coal industry supports this action.²⁴¹ In a press release, the National Mining Association spokesman, Luke Popovich, stated that the Association’s members “believe a review of the dust-exposure rule ‘might shed valuable information on . . . ways it might be improved to provide further protection for miners while eliminating unnecessary implementation requirements for operators.’”²⁴²

As discussed below, at the same time miners are suffering and dying while black lung disease surges in Central Appalachia, the coal industry

²³⁷ *Id.*

²³⁸ *Id.*

²³⁹ Berkes, Jingnan, & Benincasa, *supra* note 236 (internal quotation marks omitted).

²⁴⁰ *Trump Reconsiders Rules Protecting Miners from Black Lung*, ASSOC. PRESS (Dec. 15, 2017), <https://www.apnews.com/7c330c7303f546cbb0d782d1dfe59c8c> [<https://perma.cc/SH9R-KPG2>].

²⁴¹ *Id.*

²⁴² *Id.*

and the Trump administration dispute and belittle a decade of epidemiological research that has found significant correlations between the environmental externalities of coal mining in the region and poor public health outcomes.²⁴³ The history of the struggle to protect coal miners from black lung disease provides a context to keep in mind as the Trump administration and the coal industry halt objective, nascent epidemiological research by the National Academies of Science into the possible negative effects of coal mining pollution on community health in Central Appalachia.²⁴⁴

The following Part III identifies major sources of coal mining-related environmental pollution and the pathways through which individuals living near coal mining-related activities may be exposed. An understanding of the sources of coal pollution and the pathways to human exposure provides context for the subsequent discussion of the state of epidemiological research that has identified correlations between coal mining and negative community health outcomes.

III. SOURCES OF POLLUTION AND PATHWAYS OF EXPOSURE

Underground and MTR mining, reclamation, coal cleaning, transportation, and waste disposal create pathways delivering air and water borne mining-generated pollution into communities near MTR and other coal mining operations.²⁴⁵ A 2010 epidemiological study of the environmental and health effects of coal waste disposal observed that:

Coal contaminants from numerous stages of coal mining, cleaning, transport, and waste can enter waste streams. . . . [E]ach step of coal processing, from mining to waste disposal, including coal washing can potentially impact human health. . . . [C]oal washing generating coal slurry can release arsenic, barium, lead, and manganese, and contaminate nearby wells and local water supplies.²⁴⁶

According to the U.S. Geological Survey (“USGS”), “in the Appalachian Plateaus, iron and manganese concentrations exceeded USEPA drinking-water

²⁴³ *See id.*

²⁴⁴ *Id.*

²⁴⁵ *See* ALAN DUCATMAN ET AL., W.VA. DEP’T HEALTH & HUM. RES., COAL SLURRY WASTE UNDERGROUND INJECTION ASSESSMENT FINAL REPORT: PHASE II 24 (July 30, 2010), <http://www.wri.org/wp-content/uploads/2012/06/Coal-Slurry-Injection-Phase-II-Final-Report.pdf> [<https://perma.cc/Y3WX-74AK>] [hereinafter INJECTION REPORT].

²⁴⁶ *Id.*

guidelines in at least 40 percent of the wells and in about 70 percent of wells near reclaimed surface coal mines.”²⁴⁷ USGS reported that elevated sulfate concentration and slightly acidic water were more common in wells located within 1,000 feet of reclaimed mines.²⁴⁸

A. *Air Pollution Exposure Pathways*

MTR mining and other surface mining methods require blasting to fragment the strata overlying coal seams, or overburden, so the mineral may be extracted. In stark contrast to conventional strip mining methods, MTR-related blasting requires tens of thousands of pounds of an explosive mixture of ammonium nitrate and diesel fuel called ANFO.²⁴⁹ The E.P.A. has called these blasting activities “a particular concern, in that they can produce particulate matter (dust), fumes, and potentially damaging low-frequency noise and pressure waves.”²⁵⁰ Blasting produces airborne coal and rock dust containing sulfur compounds, fine particulates with metals, and nitrogen dioxide.²⁵¹

Additional air pollution is caused by dust blown from disturbed mined lands, uncovered piles of crushed coal at processing sites, coal storage areas, loaded coal trains and trucks, and shipping facilities.²⁵² Air pollution is also generated by dust emissions from coal trucks that transport coal from mine sites to preparation plants, coal loading and

²⁴⁷ *Summary of Major Findings: Stream and River Highlights*, U.S. GEOLOGICAL SURVEY, <https://pubs.usgs.gov/circ/circ1204/summary.htm> [<https://perma.cc/7NMU-MN5X>] (last visited Apr. 3, 2019).

²⁴⁸ *Id.*

²⁴⁹ U.S. ARMY CORPS OF ENG'RS, DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT ON MOUNTAINTOP MINING/VALLEY FILLS IN APPALACHIA III.V-6 (2003) (“Ammonia is released during this combustion process. Exposure to ammonia causes eye and respiratory irritation”). See, e.g., Sophia Yan, *In West Virginia, a Battle Over Mountaintop Mining*, TIME MAG. (Mar. 12, 2010), <https://minerals.usgs.gov/minerals/pubs/commodity/explosives/explomyb05.pdf> [<https://perma.cc/N7UE-7JUE>] (three million pounds of explosives are detonated each day in West Virginia for coal mining) (referencing Deborah A. Kramer, U.S. GEOLOGICAL SURVEY, 2005 MINERALS YEARBOOK: EXPLOSIVES 24.5 (Sept. 2006), <https://minerals.usgs.gov/minerals/pubs/commodity/explosives/explomyb05.pdf> [<https://perma.cc/B6M7-4PA5>]).

²⁵⁰ U.S. ARMY CORPS OF ENG'RS, *supra* note 249, at II.C-83.

²⁵¹ *Id.* at W-1. See also Melissa Ahern & Michael Hendryx, *Cancer Mortality Rates in Appalachian Mountaintop Coal Mining Areas*, 1(2) J. ENVTL. & OCCUPATIONAL SCI. 63, 63 (2012).

²⁵² Dan Ferber, *Research Finds Additional Harm From Coal Dust Exposure*, MIDWEST ENERGY NEWS (Feb. 20, 2013), <https://energynews.us/2013/02/20/midwest/research-finds-additional-harm-from-coal-dust-exposure/> [<https://perma.cc/3WBY-PN6C>] [hereinafter *Coal Dust Exposure*].

shipping facilities, and coal “unit trains” of 120 uncovered cars loaded with coal.²⁵³ Coal trucks also emit soot from diesel exhaust, further degrading the air quality in mining communities and compounding environmental stressors.²⁵⁴

In an early epidemiological study, researchers found “[e]vidence indicat[ing] elevated levels of respirable ambient particulate matter, sulfur dioxide, nitrous oxide, benzene, carbon monoxide, and polycyclic aromatic hydrocarbons in areas proximate to coal extraction, processing and transportation.”²⁵⁵ Atmospheric contaminants in coal dust also include arsenic, mercury, and other heavy metals.²⁵⁶ Another study observed that atmospheric “[p]article number concentrations and deposited lung dose were significantly greater around mining areas compared with non-mining areas, demonstrating elevated risks to humans.”²⁵⁷ Researchers reported higher dosage rates correlated with elevated disease rates in communities located near mining-related activities.²⁵⁸ Additional research has also raised concerns of negative health impacts linking exposure to coal dust to cardiovascular diseases, lung diseases, and potentially cancer, as evidenced by observed patterns within the general populations living in affected areas.²⁵⁹

B. Surface and Groundwater Water Exposure Pathways

MTR valley fills and runoff, as well as discharges of contaminated underground mine drainage, impact water quality, clogging streams and leaching heavy metals and other toxins into waterways.²⁶⁰ A 2011 study found that “more than 90% of 27 Appalachian streams below valley fill sites were impaired as per Clean Water Act standards, while none of 10

²⁵³ *Id.*

²⁵⁴ *Id.*

²⁵⁵ Ahern & Hendryx, *supra* note 251, at 64 (“examin[ing] the association between age-adjusted cancer mortality rates and mountaintop coal mining (MTM) in Central Appalachia” and finding strong correlations between living in mountaintop mining areas and increased rates of “lung, colon, bladder, and kidney cancer and leukemia,” as compared to non-mountaintop mining areas).

²⁵⁶ *Coal Dust Exposure*, *supra* note 252.

²⁵⁷ Laura Kurth et al., *Atmospheric Particulate Matter Size Distribution and Concentration in West Virginia Coal Mining and Non-Mining Areas*, 24 J. EXPOSURE SCI. & ENVTL. EPIDEMIOLOGY 405, 405 (2014).

²⁵⁸ *Id.*

²⁵⁹ Holzman, *supra* note 140, at A480.

²⁶⁰ *See infra* notes 261–62.

streams sampled in nonmined valleys were impaired.”²⁶¹ Contaminants in soil and exposed rock include sulfate, carbon, and strontium that make their way into the ground and nearby waterways when storms cause runoff to spread from mining sites.²⁶²

C. *Coal-Waste Disposal Pathways: Surface Impoundments and Underground Injection*

1. Coal-Waste Surface Impoundments

New mining technology and methods have significantly increased the scale of wastes generated during coal mining.²⁶³ MTR, underground continuous mining, and longwall operations generally require the separation of coal from waste material in coal-cleaning facilities before the marketable mineral portion is transported to market.²⁶⁴ Coal operators in the U.S. annually dispose of an estimated two billion tons of coal slurry, produced as by-product in the preparation of raw coal for market.²⁶⁵ Approximately 30–40% of the underground mined material transported to the surface is unmarketable coarse and fine waste.²⁶⁶ Large MTR mines also produce significant non-combustible wastes.²⁶⁷

Coal slurry waste intermixed with chemicals used in the cleaning process is disposed of either in surface impoundments or is injected into abandoned underground mines in one of two ways: (1) it is piped into permanent surface impoundments that eventually are supposed to be

²⁶¹ Holzman, *supra* note 140, at A482. A primary goal of the Clean Water Act is to protect the quality of surface waters to insure their suitability for “designated uses” including recreation, human consumption of fish, and adequate protection of aquatic life. *See* U.S. ENVTL. PROT. AGENCY, *What are Water Quality Standards?* (Jul. 23, 2018), <https://www.epa.gov/standards-water-body-health/what-are-water-quality-standards> [<https://perma.cc/7DK6-FZHU>]. The statute prohibits discharges of pollutants into waters of the United States in violation of water quality standards impairing stream water quality and designated uses. *Id.*

²⁶² *Mountaintop mining pollution has distinct chemical signatures*, PHYS (Aug. 15, 2013), <https://phys.org/news/2013-08-mountaintop-pollution-distinct-chemical-signatures.html> [<https://perma.cc/3YZ7-DR5B>].

²⁶³ *See generally* Yoginder P. Chugh & Paul T. Behum, *Coal waste management practices in the USA: an overview*, 1 INT. J. COAL SCI. TECH. 163 (2014) [hereinafter *Coal Waste Practices*] (providing an overview of coal waste management practices).

²⁶⁴ *Id.*

²⁶⁵ Stanton D. Ernest & William C. Illingworth, *Underground Disposal of Slurry and Coal Refuse in Mine Voids: Does the Coal Owner/Lessee Have the Legal Right to Dispose of Slurry and Coal Refuse in the Mine Voids?*, 28 ENERGY & MINERAL L. INST. 318 (2008).

²⁶⁶ *Coal Waste Practices*, *supra* note 263, at 164.

²⁶⁷ *Id.*

dewatered, covered with impermeable layers of material and revegetated, or (2) it is injected into underground strata and previously mined voids.²⁶⁸

A joint coal industry/state government analysis of coal waste management practices emphasized that:

[C]oal waste management is a very important part of the cost of the mining operation[,] particularly when you consider the environmental impacts of coal waste. Furthermore, [these wastes] may contain a large percentage of pyrite that can oxidize to generate acid-drainage, elevated levels of sulfate in water discharges, and trace metals.²⁶⁹

The chemicals used in coal cleaning and processing vary by site.²⁷⁰ Among the chemical mixtures are those containing flocculants, surfactants, and other substances used to wash the coal and prepare it for additional processing before it is ready to transport to markets.²⁷¹

It is not sufficient to understand the method and technology involved in coal waste disposal. To fully appreciate the impact of coal waste disposal and its importance to an analysis of current coalfield community concerns, a glance backward in time is appropriate. Few Americans are aware of the 1972 collapse of a large coal waste impoundment at Buffalo Creek, West Virginia.²⁷² A towering flood wall created by a succession of

²⁶⁸ See *id.* at 163–76. Possible environmental impacts of coal waste containing materials cut from just above and below the mined coal seam include:

(1) Potential degradation of surface and ground water quality due to pyrite oxidation, dissolution of soluble salts, cation exchange reactions, mobilization of trace elements; erosion and sedimentation of freshly reclaimed soils due to freshly reclaimed soils and slopes, (2) possible increased air quality impacts due to a higher percentage of sulfur in roof and floor rocks, along with higher volatile trace elements such as mercury, arsenic, and hazardous air pollutants; (3) spontaneous combustion of carbonaceous materials in waste and high air permeability of coal waste piles, (4) low fertility of reclaimed lands composed of acid—or toxic-forming materials, (5) highly compacted waste piles that negatively impact root penetration and growth.

Id. at 165.

²⁶⁹ *Id.* at 164.

²⁷⁰ *Id.*

²⁷¹ Ahern & Hendryx, *supra* note 251, at 64.

²⁷² *Slurry Spill Suffering: The Buffalo Creek Flood*, U.S. MINE SAFETY & HEALTH ADMIN. (Feb. 26, 2016), <https://www.msha.gov/news-media/events/2016/02/25/slurry-spill-suffering-buffalo-creek-flood> [<https://perma.cc/P52E-3ZC5>]. See GERALD M. STERN, *THE BUFFALO CREEK DISASTER: HOW THE SURVIVORS OF ONE OF THE WORST DISASTERS IN COAL-MINING HISTORY BROUGHT SUIT AGAINST THE COAL COMPANY—AND WON* 41–42 (1977).

huge, collapsing waste impoundments upstream hurtled 132 million gallons of slurry down a narrow valley, killing 125 people and injuring thousands more.²⁷³ The flood completely destroyed seventeen coal camp communities, leaving 4,000 people homeless.²⁷⁴

Most Americans are similarly unaware of the more than ninety million gallons of “black water” that polluted Appalachian streams caused by defective coal waste structures.²⁷⁵ In Eastern Kentucky in 2000, liquid coal slurry drained from a coal waste lagoon, spilling 300 hundred million gallons of the black water into a nearby adjacent stream.²⁷⁶ The waste coming downstream from Kentucky into West Virginia suffocated more than one hundred miles of stream life.²⁷⁷ Concerns persist about the stability of these impoundments and the dangers they pose to surface water, groundwater, and downstream communities.²⁷⁸

Ten years ago, more than one billion tons of coal were being mined annually.²⁷⁹ More than 600 million tons were washed (processed).²⁸⁰ Today, in excess of 700 federally regulated coal waste impoundments are located in the United States, mostly in Appalachia.²⁸¹ Every year, seventy

²⁷³ SHANNON ELIZABETH BELL, *FIGHTING KING COAL* 29 (2016).

²⁷⁴ ROBIN MORRIS COLLIN & ROBERT WILLIAM COLLIN, *ENERGY CHOICES* 44 (2014).

²⁷⁵ See NAT'L ACAD. OF SCI., ENG'G & MED., *COAL WASTE IMPOUNDMENTS: RISKS, RESPONSES, ALTERNATIVES* 27–31 (2002) [hereinafter *WASTE IMPOUNDMENTS*] (“Black water” refers to the liquid waste contained in or released untreated from surface coal waste impoundments).

²⁷⁶ MINE SAFETY & HEALTH ADMIN., *INTERNAL REVIEW OF MSHA'S ACTIONS AT THE BIG BRANCH REFUSE IMPOUNDMENT, MARTIN COUNTY COAL CORPORATION, INEZ, MARTIN COUNTY, KENTUCKY* 1, 3 (2003) [hereinafter *INTERNAL REVIEW*]; MINE SAFETY & HEALTH ADMIN., *REPORT OF INVESTIGATION* (2000).

²⁷⁷ See *INTERNAL REVIEW*, *supra* note 276, at 1, 3. See also Dylan Lovan, *Toxic coal sludge pollute Ky. town 10 years later*, SAN DIEGO UNION-TRIBUNE, Oct. 10, 2010, <https://www.sandiegouniontribune.com/sdut-toxic-coal-sludge-pollutes-ky-town-10-years-later-2010oct10-story.html> [<https://perma.cc/9KAV-JHL6>]. Eight feet of sludge impacted twenty miles of streams and floodplains. This slurry contained substantial amounts of heavy metals such as arsenic, mercury, lead, cadmium, copper, copper, and chromium. Riverside communities in Kentucky and West Virginia had their water supplies contaminated. Cleanup costs reached an estimated \$58 million. *Collateral Damage*, *supra* note 14, at n.239.

²⁷⁸ Juliet Eilperin & Steven Mufson, *Many Coal Sludge Impoundments Have Weak Walls, Federal Study Says*, WASH. POST (Apr. 24, 2013), https://www.washingtonpost.com/national/health-science/many-coal-sludge-impoundments-have-weak-walls-federal-study-says/2013/04/24/76c5be2a-acf9-11e2-a8b9-2a63d75b5459_story.html?utm_term=.4cb3cff41560 [<https://perma.cc/6DW2-3ZUR>].

²⁷⁹ *WASTE IMPOUNDMENTS*, *supra* note 275, at 24.

²⁸⁰ *Id.*

²⁸¹ *Id.* at 23–24; see generally Stanley J. Michalek et al., *Accidental Releases of Slurry and Water From Coal Impoundments Through Abandoned Underground Coal Mines*, MINE

to ninety million tons of slurry waste are disposed of in surface impoundments or injected underground as a water-coal slurry.²⁸² Generally, these wastes and how they are “managed” is beyond the ken of the public.

A 2013 study by the U.S. Department of the Interior found that impoundment structures have dangerously weak walls because of poor construction methods—“[f]ailing field density tests occurred at all seven of the sites investigated[,] . . . [and] of 73 field density tests performed at the seven sites only 16 yielded passing results.”²⁸³ Coal waste discarded in these structures is generated by underground longwall, continuous, and MTR mines. Coal waste impoundments are ubiquitous in Central Appalachia—as of 2006, there were 126 slurry impoundments permitted to hold over 110 billion gallons of slurry in West Virginia alone.²⁸⁴

A recent analysis of U.S. coal waste practices noted that some slurry impoundments have experienced catastrophic breaches that cause major contamination of surface and underground waters.²⁸⁵ The authors caution, however, that “[p]otential environmental impacts of current waste disposal practices are not limited to a relatively few catastrophic events involving impoundment structure collapse.”²⁸⁶ Implementation of proper management practices is necessary for prevention of groundwater contamination and mitigation of surface water impact to the receiving water body.²⁸⁷

SAFETY & HEALTH ADMIN. (1996), <https://miningquiz.com/pdf/Impoundments/ASDSO2.pdf> [<https://perma.cc/U4Z9-54GG>] (background information on impoundments). Most coal from Western coalfields does not require cleaning. WASTE IMPOUNDMENTS, *supra* note 275, at 23–24.

²⁸² WASTE IMPOUNDMENTS, *supra* note 275, at 23–24.

²⁸³ U.S. DEP’T OF THE INTERIOR OFF. OF SURFACE MINING, OVERSIGHT REPORT OF COMPACTION OF COAL MINE WASTE SLURRY IMPOUNDMENT EMBANKMENTS EVALUATION YEAR 2011 (2011), <http://www.washingtonpost.com/wp-srv/politics/documents/Coal-Refuse-Dams-OSM-Compaction-Study.pdf> [<https://perma.cc/JVP5-EQ9X>].

²⁸⁴ Eilperin & Mufson, *supra* note 278 (“There are 596 coal slurry impoundments in 21 states, according to the Mine Safety and Health Administration, of which the largest number, 114, are in West Virginia”).

²⁸⁵ *Coal Waste Practices*, *supra* note 263, at 170. The 1972 Buffalo Creek disaster killed 125 people and injured nearly 2,000 others. Safety issues associated with the slurry impoundments include embankment collapse and coal slurry escaping into underground voids due to mine subsidence. In Kentucky, in 1994, thirty-two million gallons of coal slurry poured into a closed underground mine. In Inez, Kentucky, in 2000, one million liters of decant water and 130 million liters of coal waste drained into underground strata and surface waters as a result of subsidence. *Id.*

²⁸⁶ *Id.*

²⁸⁷ *Id.*

2. Underground Injection of Coal Waste

In addition to disposing of waste in surface coal slurry waste impoundments or ponds, some companies inject waste into abandoned underground mines.²⁸⁸ A joint state and federal report examining underground injection of coal slurry explains that the waste is “gravity fed into the underground mine via a network of slurry pipelines and injection wells.”²⁸⁹ “Under most conditions,” the authors explain, “the solid portion of slurry settles to the bottom of the mine void, while the liquid portion migrates.”²⁹⁰ Injecting this chemical- and metal-laden mixture underground is problematic, as it often contains lead, arsenic, barium, beryllium, selenium, iron, manganese, aluminum, sulfate and zinc, manganese, and iron that could ultimately end up in groundwater used as a source of domestic water supply.²⁹¹

D. Contamination of Residential Springs and Wells

A significant number of rural residents in the coalfields of Appalachia obtain drinking water from untreated wells and springs rather than public drinking water sources.²⁹² While little firm data exists, a report of the Appalachian Regional Council found that, in 1995, one in four Appalachians relied on well water and up to two out of three people drank from their wells in many counties where MTR mining operations were active.²⁹³ In 2012, the New York Times reported on coal slurry injection into abandoned mines near Prenter, a small community in the southern West Virginia coalfields:

²⁸⁸ See generally Shannon Elizabeth Bell, *Coal Slurry Impoundments Environmental Injustice and the Pursuit of a Post-Carbon World: The Unintended Consequences of the Clean Air Act as a Cautionary Tale for Solar Energy Development*, 82 BROOK. L. REV. 529, 538–44 (2017) (discussion of coal slurry impoundments and contamination of drinking water).

²⁸⁹ ANDREW NICK SCHAEER, PROC. AM. SOC'Y MINING & RECLAMATION, FINDINGS OF THE WVDEP AND OSMRE/SCR-15 “PHASE I” STUDY ON THE UNDERGROUND INJECTION OF COAL SLURRY 964 (2010), <https://www.asmr.us/Portals/0/Documents/Conference-Proceedings/2010/0963-Schaer.pdf> [<https://perma.cc/TV9L-G3QN>].

²⁹⁰ *Id.*

²⁹¹ See INJECTION REPORT, *supra* note 245, at 41. See also Holzman, *supra* note 140, at A477.

²⁹² APPALACHIAN REG. COMM'N, DRINKING WATER AND WASTEWATER INFRASTRUCTURE: AN ANALYSIS OF CAPITAL FUNDING AND FUNDING GAPS 27 (Aug. 2005), https://www.arc.gov/assets/research_reports/DrinkingWaterandWastewaterInfrastructure.pdf [<https://perma.cc/T649-C4CX>].

²⁹³ HUMAN RIGHTS WATCH, *supra* note 22, at 60.

Coal companies have injected more than 1.9 billion gallons of coal slurry and sludge into the ground since 2004, according to a review of thousands of state records. Millions more gallons have been dumped into lagoons. These underground injections have contained chemicals at concentrations that pose serious health risks, and thousands of injections have violated state regulations and the Safe Drinking Water Act, according to reports sent to the state by companies themselves . . . 93 percent of the waste they injected near this community had illegal concentrations of chemicals including arsenic, lead, chromium, beryllium or nickel. Sometimes those concentrations exceeded legal limits by as much as 1,000 percent. Those chemicals have been shown to contribute to cancer, organ failures and other diseases.²⁹⁴

Author Shannon Elizabeth Bell interviewed Prenter resident Maria Lambert about her concerns regarding well water in the community that was believed to have been contaminated with injected coal slurry.²⁹⁵ Lambert described a community meeting during which she first realized the possible health risks of exposure to local well water:

Everybody was showing [samples of] their water. Different people stood up and told about their water and told about what they believed was happening, and told about the different illnesses—the brain tumors, the gallbladder problems, stomach problems, children’s teeth falling out, and all of these things. . . . And it’s like, a light bulb going off all here, there, yonder, everywhere. And it’s like my whole life flashing before my eyes, because my children had lost

²⁹⁴ Charles Duhigg, *Clean Water Laws Are Neglected, at a Cost in Suffering*, N.Y. TIMES (Sept. 12, 2009), <https://www.nytimes.com/2009/09/13/us/13water.html> [<https://perma.cc/L2KP-RTUK>].

[F]ederal documents and other literature provide reason to believe injection “does not always work as intended” and can contaminate ground and surface water. But there is virtually no useful monitoring data from the 12 active injection sites in West Virginia . . . Nor is there currently an effective way to trace the movement of slurry once it’s injected into the worked-out mines where it hypothetically stays put.

See generally INJECTION REPORT, *supra* note 245.

²⁹⁵ SHANNON ELIZABETH BELL, OUR ROOTS RUN DEEP AS IRONWEED: APPALACHIAN WOMEN AND THE FIGHT FOR ENVIRONMENTAL JUSTICE 72 (2013).

their teeth, my parents had had cancer, we'd had our gall-bladders removed, and all of these things was, it's just like, oh no, it's not just us—it's the whole community²⁹⁶

State regulators, however, denied that the coal slurry injected into abandoned mines under Prenter and its environs had contaminated wells that served hundreds of families in the community.²⁹⁷ Residents filed a class-action lawsuit seeking to hold coal companies responsible for the pollution of their drinking water, alleging that the contaminated water flowed from the pipes in their homes.²⁹⁸ They also alleged some had suffered from cancer and other illnesses as a consequence of their exposure to injected coal slurry, or that such exposure substantially increased the risk that they would suffer from a serious illness in the future.²⁹⁹

Although the companies vigorously denied these claims, they eventually entered into a confidential settlement agreement with the plaintiff residents.³⁰⁰ A suit filed by residents in a neighboring county made similar allegations that Massey Energy Company had contaminated their wells by injecting 1.4 billion gallons of toxic coal slurry into worked-out underground mines between 1978 and 1987.³⁰¹ Massey settled the claims just before trial, agreeing to fund medical monitoring plans for the residents and to pay \$35 million in damages—without admitting liability.³⁰²

Part IV, below, discusses a growing body of epidemiological research developed over the last decade that identifies significant correlations

²⁹⁶ *Id.*

²⁹⁷ TRIAD ENG'G, INC., HYDROLOGIC EVALUATION PRENTER ROAD AREA (Jan. 27, 2012), <https://dep.wv.gov/dmr/studies%20and%20investigations/Documents/Prenter%20Road%20Study/Report%20Text%20w%20Tables-Small%20Figs.pdf> [<https://perma.cc/HHV9-9D3R>] (“In summary, our investigation did not reveal evidence of widespread human-induced impacts to groundwater quality in the study area”).

²⁹⁸ Ken Ward, Jr., *Deal Reached in Prenter Coal Slurry Lawsuit*, CHARLESTON GAZETTE-MAIL (June 12, 2012), https://www.wvgazette.com/news/special_reports/deal-reached-in-prenter-coal-slurry-lawsuit/article_a0243fe8-06cd-54af-b1d2-856c9e42d70b.html [<https://perma.cc/86BF-YM8V>].

²⁹⁹ *Id.*

³⁰⁰ Vicki Smith, *AP Newsbreak: Massey settles WV coal slurry case*, DESERET NEWS (July 27, 2011, 12:45 PM), <https://www.deseretnews.com/article/700166332/AP-Newsbreak-Massey-settles-WV-coal-slurry-case.html> [<https://perma.cc/66ET-2MAF>].

³⁰¹ Vicki Smith, *Mining firm offers \$35m to settle*, BOSTON.COM (Aug. 10, 2011), http://archive.boston.com/news/nation/articles/2011/08/10/coal_slurry_case_to_cost_massey_35m/ [<https://perma.cc/F3CG-VUCN>] (“[T]he \$35 million is in addition to the \$5 million that Massey and its subsidiary, Rawl Sales & Processing, had previously agreed to put into a medical monitoring fund.”).

³⁰² *Id.*

between coal mining pollution and numerous health issues in nearby Central Appalachian communities. Part V that follows suggests an analogy can be drawn between the historic coal industry denial of medical science that confirmed that coal dust causes coal miner respiratory disease and the industry's denial that pollution from coal mines is related to community health outcomes. Part V suggests that the industry's rejection of epidemiological research is reminiscent of the strategy the industry used to dispute scientific evidence revealing correlation and causation regarding coal dust and miners' lung disease.

IV. COAL MINING EXTERNALITIES: IMPACTS ON COMMUNITY HEALTH

While a nascent body of epidemiological research and attendant scholarship identifies and discusses correlations between living in coal mining areas and negative health outcomes, the seminal research to date has not yet focused directly on causation. These peer-reviewed findings cannot be viewed as a surprise. The fact that serious health issues plague men, women, and children who live in coal mining communities has long been recognized and condemned. Four and a half decades ago, a congressional report recognized and embraced the reality of the degraded health and quality of life in Appalachian coal communities.³⁰³ The language used by Congress was direct and emphatic:

As a consequence of the hazardous environment associated with both underground and surface mining of coal, *the health and safety of people living and working near the coal mines of the region are in more or less constant peril*. . . . Tragically, coal mining in America has left its crippling mark upon the very communities which labored most to produce the energy which once impelled the Nation's industrial plant and now generates much of its electrical power.³⁰⁴

³⁰³ H.R. REP. NO. 93-1072, at 56–57 (1974). *See* H.R. REP. NO. 95-218, at 58–59 (1977) (detailing the devastating impacts of surface mining which inspired Congress to pass SMCRA), reprinted in 1977 U.S.C.C.A.N. 539, 596–97 and 30 U.S.C. 1201(c), (Pub. L. 95-87, tit. I, § 101, Aug. 3, 1977, 91 Stat. 447) (many coal-mining operations cause erosion and landslides, contribute to floods, water pollution, destruction of fish and wildlife habitats, damage property of citizens, create hazards dangerous to life and property and degrade the quality of life in local communities).

³⁰⁴ H.R. REP. NO. 93-1072, at 56–57 (1974) (emphasis added).

No objective person with knowledge of the history of the Central Appalachian coal region can dispute these fundamental historical facts. But, as the discussion of black lung disease above makes clear, the coal industry and those aligned with it continue to deny and minimize this history.

Ultimately, whether objective scientific inquiry finds causation as well as correlation between coal mining and community health outcomes, Congress's 1977 finding that "*the health and safety of people living and working near the coal mines of the region are in more or less constant peril*" remains true today.³⁰⁵ The discussion below examines the recent research, and identifies obstacles and resistance to scientific inquiry that impede efforts to fully investigate possible causal links between exposure to coal mining-related environmental externalities and community health.

A. *Epidemiological Human Health Impact Studies*

In the last decade, epidemiological studies have shown correlations between underground, MTR mining, or coal waste disposal and disproportionate rates of disease and other adverse health issues among populations living nearby. Residents of those communities experience higher rates of blood abnormalities, cancers of numerous sorts, increased rates of birth defects, neurological problems, cardiovascular problems, asthma, and tooth decay. Concerning negative mental health and reduced quality of life issues accompany these findings of correlation. Considered together, these correlations paint an alarming picture of Central Appalachian coalfield community health. The following discussion identifies the findings of the last decade from what are essentially the first serious epidemiological investigations of connections between coal mining environmental externalities and Central Appalachian coalfield community health.³⁰⁶

³⁰⁵ *Id.*; see NAT'L ACAD. OF SCI., ENG'G & MED., *supra* note 221, at 15–16.

³⁰⁶ As discussed above in Section IV.A, what little coalfield health research that has been undertaken was limited to evaluations of impacts of respirable dust in underground coal mines and the incidence of occupational respiratory disease among coal miners. For all the professed concerns of coal industry managers and politicians for the well-being, health, and safety of American coal miners, the parties have never acknowledged or encouraged scientific analysis to determine the causes of the inordinate incidence of illness and disease that has blighted coal communities. Identifying remedies and a credible action plan is impossible without professional medical research and analysis to identify possible causal connections and the scope of community health degradation.

B. *Blood-Related Impacts*

In 2015, researchers from the School of Public Health at Indiana University conducted a study examining the relationship between blood inflammation and living in areas near surface mining sites.³⁰⁷ The study involved collecting blood samples from residents living within three miles of active surface mining operations in West Virginia and Indiana and comparing the results to control samples from participants living in areas farther away in each state.³⁰⁸ The study tested for C-reactive protein, a marker predictive of increased risk of cardiovascular disease and lung cancer when found in high levels.³⁰⁹ Researchers also collected indoor and outdoor air particulate samples from participants' homes.

After controlling for relevant variables, researchers found that those areas near surface mining sites had higher counts of particulate ambient matter, and participants living in these areas had significantly higher C-reactive protein levels than participants living in areas farther away.³¹⁰ A C-reactive protein level of 3.0 mg/L or greater is considered to be an indicator of increased risk for cardiovascular and other diseases,³¹¹ and those living in areas near surface mines may have an increased risk of developing cardiovascular and other diseases.³¹² This study found that, in areas near surface mining operations, the average C-reactive protein level was 4.9 mg/L, whereas those living in non-mining areas averaged just 0.6 mg/L.³¹³

C. *Cancers*

Numerous studies have been conducted on the relationship between surface mining activities and increased rates of various types of cancer.³¹⁴ Significant correlations have been identified:

³⁰⁷ Michael Hendryx & Jennifer Entwistle, *Association between residence near surface coal mining and blood inflammation*, 2 *EXTRACTIVE INDUSTRIES & SOC'Y* 246 (2015) (studying the presence of C-reactive protein levels in the blood of residents living within three miles of active surface mining operations in West Virginia and Indiana and finding higher levels for these residents than for state residents living farther from active surface mine sites).

³⁰⁸ *Id.* at 247.

³⁰⁹ *Id.* at 249.

³¹⁰ *Id.*

³¹¹ *Id.*

³¹² *Id.*

³¹³ Hendryx & Entwistle, *supra* note 307, at 249.

³¹⁴ Ahern & Hendryx, *supra* note 251, at 64.

Air and water pollutants that result from [mountaintop mining] include some that are known or possible carcinogens. Arsenic in water is a risk for lung, bladder, kidney, liver, and skin cancer. Radon is associated with an increased risk of lung cancer. Air pollution is a risk factor for lung cancer and perhaps for other cancers; however, the exact pollutants and cancers are not well-understood. Cancers other than lung cancer that result from air pollution show mixed effects; but some effects have been seen for leukemia, and for cancers of the bladder, uterus, prostate, colon, stomach, and esophagus.³¹⁵

Researchers have explained that human exposure to coal mining–related toxins has been associated with elevated risk of kidney and lung cancers, and that “nickel, beryllium, and chromium VI are linked to lung cancer.”³¹⁶ In addition, the researchers report that iron and selenium have been found to be higher in polyp vs. control tissue.³¹⁷ They further note that exposure to diesel exhaust from motorized mining equipment might increase bladder cancer risks.³¹⁸ Multiple studies suggest “a correlation between benzene exposure and breast and leukemia cancer risks.”³¹⁹

Lung cancer is one of the leading causes of death in Appalachia.³²⁰ A 2008 study found that residents in areas of top coal production—categorized as Appalachian counties producing over three million tons of coal from 2000–2004—experienced significantly increased lung cancer mortality rates.³²¹ The study also revealed that, after adjusting for relevant covariates, “Appalachian coal-mining counties are still associated with an excess of 144 deaths from lung cancer over the years 2000–2004.”³²² The study concluded that increased rates of mortality were not found in

³¹⁵ *Id.*

³¹⁶ *Id.*

³¹⁷ *Id.*

³¹⁸ *Id.*

³¹⁹ *Id.*

³²⁰ APPALACHIAN REGIONAL COMM'N, SECTION VI. SUMMARY AND CONCLUSIONS 221, 223–24, https://www.arc.gov/assets/research_reports/Summary%20and%20Conclusions_sectionVI.pdf [<https://perma.cc/J2PJ-2EE8>].

³²¹ Michael Hendryx et al. *Lung cancer mortality is elevated in coal-mining areas of Appalachia*, 62 *ELSEVIER* 1, 1–2 (2008) (finding “that lung cancer mortality for the years 2000–2004 is higher in areas of heavy Appalachian coal mining after adjustments for smoking, poverty, education, age, sex, race and other covariates.”).

³²² *Id.* at 4.

other non-Appalachian areas where large amounts of mining occurred; increased mortality was specific to Appalachia.³²³

A 2012 study focused on two periods of time: 1999–2002 and 2003–2007.³²⁴ Researchers examined rates of occurrence of cancers in areas near MTR mines, near sites where other forms of mining occurred, and in non-mining areas.³²⁵ They reported increased rates of lung, colon, bladder, and kidney cancer and leukemia when compared to non-mining areas during the second study period (2003–2007) after controlling for other risk factors.³²⁶ Total cancer rates were higher in areas near MTR operations during both time periods, as compared to both non-mining areas and areas where other forms of mining was conducted.³²⁷ The study also found that, compared to non-mining areas of residence, cancer mortality rates for leukemia, lung, bladder, and colorectal cancer rates were higher near MTR mines.³²⁸

Effects of MTR mining may be linked to exacerbation of health problems of those already afflicted with cancer. West Virginia University, Indiana University, and Madihol University researchers found that airborne particulate matter of the type emitted from MTR mining activities (including blasting and heavy equipment operation) “induces neoplastic transformation of human bronchial epithelial cells and promotes tumor transformation.”³²⁹ They hypothesized that MTR mining impacts could

³²³ *Id.*

³²⁴ Ahern & Hendryx, *supra* note 251, at 63.

³²⁵ *Id.* at 64.

³²⁶ *Id.* at 68. The study’s authors suggest that the increase might be explained by the emergence of large-scale MTR coal mining methodology replacing contour strip mining during the mid- to late-1990s and early 2000s and the extended latency period of growth of many cancers. *See id.*

³²⁷ *See id.* at 63–66.

³²⁸ *Id.* at 68–69. A litigation-related study commissioned by Prenter, West Virginia residents who were plaintiffs in a civil tort action seeking damages and other relief from coal companies alleged that, on a street with ten houses, six people, ranging in age from eleven years old to fifty-five years old had contracted brain cancer, and that four of them later died. SUTTER LAW FIRM, PLLC, STUDY: COAL SLURRY CONTAMINATED PRENTER HOLLOW WATER (Jan. 17, 2012), <https://www.thesutterlawfirm.com/News/2012.01.17.pdf> [<https://perma.cc/QDJ7-WY5Y>].

³²⁹ Sudjit Luanpitpong et al., *Appalachian Mountaintop Mining Particulate Matter Induces Neoplastic Transformation of Human Bronchial Epithelial Cells and Promotes Tumor Formation*, 48 ENVTL. SCI. & TECH. 12912, 12912 (2014) (studying the relation between mountaintop mining particulate matter exposure and human bronchial epithelial cells and finding “that chronic exposure (3 months) to non-cytotoxic, physiological relevant concentration (1 µg/mL) of PM_{MTR}, but not control particle PM_{CON}, induced neoplastic transformation, accelerated cell proliferation, and enhanced cell migration of the exposed lung cells.”).

accelerate degradation of vulnerable individuals residing nearby who have already been diagnosed with cancer.³³⁰

D. Birth Defects

Two epidemiological studies reported correlations linking MTR mining to birth defects in communities located near such operations.³³¹ A 2011 study conducted by university epidemiologists found:

counties in and near mountaintop mining areas had higher rates of birth defects for five out of six types of birth defects, including circulatory/respiratory, central nervous system, musculoskeletal, gastrointestinal, and urogenital defects. These defect rates became more pronounced in the more recent period studied, 2000–2003, suggesting the health effects of mountaintop mining-related air and water contamination may be cumulative.³³²

The study reported birth defects in areas where MTR mining was most prevalent as compared with non-mining areas, and the occurrence of birth defects in the areas where MTR mining operations were located was found to be nearly twice that of non-mining areas.³³³ Even after controlling for variables such as poverty and education level, incidence of birth defects remained higher in areas where MTR activities occurred.³³⁴

Similarly, a contemporary investigation focused on birth defects among populations residing in proximity to MTR operations. It found that “of 1.9 million live births, children born in [MTR] mining counties were 26% more likely to have a birth defect than those born in non-mining areas, after adjusting for other risk factors such as maternal age, maternal alcohol consumption during pregnancy, maternal diabetes, and low socioeconomic status.”³³⁵

³³⁰ *Id.* at 12917.

³³¹ See Melissa M. Ahern et al., *The association between mountaintop mining and birth defects among live births in central Appalachia, 1996–2003*, ENVTL. RESEARCH 838 (2011), <https://ohvec.org/mountaintop-mining-birth-defects/> [<https://perma.cc/5ZQJ-NEUA>] (studying the incidence of birth defects in mining versus non-mining areas, and finding that rates were nearly twice as high in mining areas as compared to non-mining areas).

³³² *Id.*

³³³ Ahern et al., *supra* note 331, at 842–43.

³³⁴ *Id.* at 838.

³³⁵ Holzman, *supra* note 140, at A483.

E. Neurological Impacts

Epidemiological investigations have identified a correlation between residence near MTR mines and impaired cognitive development in children.³³⁶ Headaches, irritability, and poor memory due to chronic ambient exposure to sulfate from nearby mining operations have also been reported.³³⁷ As stated in a 2010 study examining the links between living in coal mining areas and learning outcomes,

[e]nvironmental chemicals present currently or historically in coal, coal extraction, and coal processing—including phthalates, alkylphenols, polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins, bisphenol A, lead, mercury, zinc, aluminum, and cadmium—are known to impact cognitive development and function. Three mechanistic explanations have been proposed for impaired cognitive development and learning capacity: (1) interference with the endocrine system; (2) impairment of the glutamate-nitric oxide-cGMP (cyclic guanosine monophosphate) pathway that influences learning ability; and (3) interference with the central nervous system. Effects may occur from either prenatal or postnatal exposure.³³⁸

2010 research compared learning outcomes of students in coal-mining counties against those in non-mining counties, finding that students living in the former evidenced significantly impaired learning outcomes across all subject areas as compared to students residing in non-mining communities.³³⁹ The authors of the study explained that exposure to certain toxins listed above, such as lead, can have irreversibly detrimental impacts on a child's cognitive development, which includes impairing a child's learning ability, decreasing IQ, and causing behavioral disorders that have long-term impacts on the rest of a child's life.³⁴⁰ Chemicals used in the mountaintop mining process are linked to cardiovascular problems.³⁴¹

³³⁶ Cain & Hendryx, *supra* note 143, at 72 (studying child cognitive development outcomes in coal mining areas of West Virginia and the relation of exposure to chemicals used in coal mining activities, along with other variables).

³³⁷ Holzman, *supra* note 140, at A480.

³³⁸ Cain & Hendryx, *supra* note 143, at 72.

³³⁹ *Id.* at 74–75.

³⁴⁰ *Id.* at 72.

³⁴¹ Laura Esch & Michael Hendryx, *Chronic Cardiovascular Disease Mortality in Mountaintop Mining Areas of Central Appalachian States*, 27 J. RURAL HEALTH 1 (2011).

Arsenic, which is present in domestic well drinking water supplies through parts of Appalachia, is associated with an increase in myocardial infarction, atherosclerosis, and blood pressure among adults. Exposure to cadmium, an impurity in coal that is present throughout Appalachia, has been shown to increase risk of cardiovascular and coronary heart disease mortality among adult males. Exposure to lead, which is also present in coal, is suggestive of cardiovascular outcomes such as elevated blood pressure, future ischemic heart disease, and cardiovascular mortality.³⁴²

Another study reported a spectrum of negative consequences that correlate with mountaintop mining.³⁴³ It noted hospitalization rates for chronic pulmonary disorders and hypertension rose in tandem with rates of coal production within counties.³⁴⁴ Not only were rates of heart disorders greater in coal mining areas as compared to non-mining areas, but chronic cardiovascular disease mortality rates were also significantly higher in areas where coal mining occurs.³⁴⁵ The study indicated that the highest heart disease rates were in mountaintop mining areas, over all other forms of mining.³⁴⁶

F. Mental Health & Quality of Life

Significant correlations have been found between residence near MTR operations and negative mental health and quality of life ratings. Researchers found higher rates of depression in people living in MTR-affected areas when compared with those in non-mining areas.³⁴⁷ A 2011 study focused on health-related quality of life factors impacting residents who also live in proximity to MTR mines.³⁴⁸ Individuals living near MTR

³⁴² *Id.* at 351.

³⁴³ M.A. Palmer et al., *Mountaintop Mining Consequences*, 327 SCI. 148 (Jan. 8, 2010).

³⁴⁴ *Id.*

³⁴⁵ Esch & Hendryx, *supra* note 341, at 1, 5.

³⁴⁶ *Id.* at 6.

³⁴⁷ *Id.*

³⁴⁸ Keith Zullig & Michael Hendryx, *Health-Related Quality of Life Among Central Appalachian Residents in Mountaintop Mining Counties*, 101 AM. J. OF PUB. HEALTH 848, 848 (May 2011) (studying the relationship between mountaintop mining activities and health related quality of life outcomes and finding that “[m]ountaintop mining areas are associated with the greatest reductions in health-related quality of life even when compared with counties with other forms of coal mining”).

mining and related operations were found to be at greater risk of experiencing major depression and severe psychological distress when compared with those in non-mining surrounding areas or across the nation.³⁴⁹

A 2011 community health impact investigation reflects similar conclusions, finding that “people who lived in MTR mining areas had a 31% higher risk of reduced health-related quality of life (HRQOL)—or perceived physical and mental health over time—compared with people living in non-mining areas in the same states.”³⁵⁰

Degraded quality of life near mountaintop mining regions is stronger than in regions where other types of mining occur.³⁵¹ Residents living near MTR operations suffer from eighteen more unhealthy days annually than residents in non-mining areas, totaling “up to nearly 4 additional years’ worth of impaired mental and/or physical health” throughout the course of a seventy-eight-year life span.³⁵²

G. *Additional Health Impact Findings*

Finally, residents’ claims of other human health impacts, including tooth decay, gastrointestinal problems, skin irritation, and asthma, have all been correlated to surface mining operations.³⁵³ Many elements used in the coal production process are known to correlate with tooth decay.³⁵⁴ These include aluminum, zinc sulfate, arsenic, lead, and cadmium.³⁵⁵ A 2011 report authored by researchers at West Virginia University and Washington State University focused on adult tooth loss in coal-mining areas in the United States and Appalachia.³⁵⁶ It found that the likelihood

³⁴⁹ *Id.*

³⁵⁰ Holzman, *supra* note 140, at A483.

³⁵¹ Zullig & Hendryx, *supra* note 348, at 848.

³⁵² Holzman, *supra* note 140, at A483.

³⁵³ Medical professionals treating patients from Prenter, West Virginia—discussed above—reported that local residents drawing well water contaminated by chemicals associated with coal slurry had experienced abnormal rates of health afflictions. A survey of one hundred people, commissioned by a law firm representing Prenter residents, reported that as many as 30% of people contacted had their gallbladders removed and as many as half had experienced significant tooth enamel damage, chronic stomach problems and other illnesses. A New York Times reporter interviewed Prenter residents and confirmed the survey results. Duhigg, *supra* note 294; INJECTION REPORT, *supra* note 245, at 90, 130.

³⁵⁴ Michael Hendryx et al., *Adult Tooth Loss for Residents of US Coal Mining and Appalachian Counties*, 40 COMM. DENTISTRY & ORAL EPIDEMIOLOGY 488, 489 (2012).

³⁵⁵ *Id.*

³⁵⁶ *Id.* at 488.

“of reporting any adult tooth loss [was] significantly higher for Appalachian coal county residents compared with the non-mining referent area after adjustment for age, race/ethnicity, sex, income, education, supply of physicians and dentists, receipt of dental care, smoking, alcohol consumption, diabetes, health insurance, BMI, and rural setting.”³⁵⁷

Referring to West Virginia coal communities impacted by underground injection of coal slurry, a member of the faculty of the West Virginia University Department of Community Medicine observed that “[p]eople exposed to the water in their homes, both from consumption and showering, get what I call ‘slurry syndrome,’ a mixture of diarrhea, rash, some changes in their teeth, and increasing frequency of kidney stones.”³⁵⁸ “Fortunately,” he reported, “most of this went away when they got municipal water in the area.”³⁵⁹

Outside of Appalachia, correlation between surface coal mining operations and asthma have been proposed in both Australia and Great Britain. In Australia in 2010, a government report found that 40% of children in two areas located near surface mining operations suffered from some form of asthma, 12% higher than the national average.³⁶⁰ A 1992 study of possible links between coal mining and community health in the United Kingdom found that children exposed to coal dust exhibited significantly higher rates of respiratory problems.³⁶¹ Subsequent studies also identified significant links between surface mining operations and children’s respiratory health.³⁶²

³⁵⁷ *Id.* at 494.

³⁵⁸ Holzman, *supra* note 140, at A480.

³⁵⁹ *Id.*

³⁶⁰ *Australia’s coal mines blamed over asthma*, BBC NEWS (May 18, 2010), <http://news.bbc.co.uk/2/hi/8688820.stm> [<https://perma.cc/VXH3-8VU8>]. A recently published article concluded that “[r]esults highlight the need to consider both urban and rural sources of pollution in air quality studies, and appropriate policy steps to address likely rural air pollution from coal mining.” M. Hendryx et al., *Air Quality in Association With Rural Coal Mining and Combustion in New South Wales Australia*, J. RURAL HEALTH 1–10 (2019) (“a rural region characterized by intensive coal mining and burning had poorer air quality than other rural areas or urban areas, and thus that coal mining and burning activities might impact pollution levels in rural areas potentially even more than pollution levels in densely populated urban areas”).

³⁶¹ J.M.F. Temple & A.M. Sykes, *Asthma and open cast mining*, BRITISH MED. J. 305, 396–97 (1992) (finding that “[b]efore mining operations[,] the mean weekly number of new episodes of asthma was 4–4 (95% confidence interval 3–6 to 5 2), and after mining began it was 7–9 (7–0 to 8 6).”).

³⁶² See, e.g., Tanja Pless-Mullooli et al., *Living near opencast coal mining sites and children’s respiratory health*, 57 OCC. ENVTL. MED. 145 (2000).

V. THE BLACK LUNG DENIAL STRATEGY RESURRECTED:
DISPUTE, DENIAL, AND OBSTRUCTION OF EPIDEMIOLOGICAL
ASSESSMENTS OF IMPACTS OF COAL MINING ON APPALACHIAN
COMMUNITY HEALTH

As discussed above, a decade of peer-reviewed epidemiological investigations shows correlations between environmental externalities of coal-mining-related operations in Central Appalachia and coalfield community health risks.³⁶³ This is unsurprising given the industry's history of denying that coal dust causes miners' debilitating and often fatal lung disease. The coal industry and its supporters have actively sought to discredit and cast aspersions on the accumulating scientific data about community health risks in coal-mining towns.

Following the publication of the study showing higher rates of birth defects in counties where MTR mining operations were located, lawyers representing the National Mining Association suggested in a post on the firm website that coalfield inbreeding might be the source of genetic defects, rather than exposure to mine-generated toxins.³⁶⁴ In a West Virginia newspaper opinion piece, the communications director of the West Virginia Coal Association—who had no training or education in science or epidemiology—responded to the types of studies referenced above that found a correlation between coal mining pollution and community health.³⁶⁵ He labeled such studies “a classic example of prostitution of

³⁶³ See Part IV, *supra*.

³⁶⁴ The law firm quickly removed the letter from its website after it drew significant attention and criticism and issued an explanation:

Our website alert is not intended to reflect views of the National Mining Association, but is an attempt to identify certain potential weaknesses of the study in question. *Consanguinity is one of a number of commonly addressed issues in studies of this type, regardless of geography. . . .* We did not raise this issue with particular reference to any region, and we did not mean to imply any such thing. That said, we apologize for any offense taken, as none was intended. We can appreciate the view that our alert may not have provided enough context to explain the scientific points we aimed to address, and so have removed it from our site.

(emphasis added) To view an excerpt of the letter and discussion, see Ken Ward, Jr., *Mountaintop removal and birth defects: Just what are the coal industry's lawyers talking about?*, CHARLESTON GAZETTE-MAIL: COAL TATTOO (July 11, 2011), <http://blogs.wvgazette.com/coalatattoo/2011/07/11/mountaintop-removal-and-birth-defects-just-what-are-the-coal-industrys-lawyers-talking-about/> [https://perma.cc/8MMS-9GM7]. See PRINCIPLES & PRACTICE OF CLINICAL RES. (John I. Gallin & Frederick P. Ognibene, eds., 3d ed. 2012) (“Consanguinity (i.e., mating between blood relatives) increases the likelihood that a child will inherit two copies of the same deleterious allele”).

³⁶⁵ T.L. Headley, *Common sense about coal and health*, CHARLESTON GAZETTE-MAIL (Aug. 15,

science in the service of a political agenda.”³⁶⁶ However, there is no evidence that the epidemiologists engaged in community health concerns had anything but a professional, scientific interest in the matters under study.³⁶⁷ While attributing poor health of coalfield residents to “unhealthy eating habits, overindulging in greasy, fried foods and sweets[,] . . . a much lower college-going rate, and higher incidences of teen pregnancies,” he emphasized that “the most important and effective means to improve someone’s health is a good paying job” in West Virginia’s coal mines, which he claimed paid “fully twice the state average wage.”³⁶⁸

Notwithstanding such unfounded criticism of the evolving epidemiological studies, in August of 2016, in the final months of the Obama administration, the Department of the Interior announced it was funding an initial study of the possible health impacts of coal mining operations in Central Appalachia.³⁶⁹ The planned two-year study was to be administered by the National Academies of Sciences, Engineering, and Medicine (“NASEM”).³⁷⁰

A twelve-member committee of volunteer experts was appointed to conduct the study, none of whom were “active members of the coal industry or any governmental agency that regulates coal mining.”³⁷¹ The charge of the committee was “to examine the potential relationship between increased health risks and living in proximity to sites that have

2011), <https://www.wvgazette.com/opinion/t-l-headley-common-sense-about-coaland-health/article306e5f4c-8441-5465-a779-4243ce798e17.html> [<https://perma.cc/5BUE-S7WY>].

³⁶⁶ *Id.*

³⁶⁷ T.L. Headley, *Applying Some Common Sense to the Issue of Coal Mining and the Health of West Virginians (Part 1)*, WORDPRESS (Aug. 11, 2013), <https://coalfields2030.wordpress.com/2013/08/11/applying-some-common-sense-to-the-issue-of-coal-mining-and-the-health-of-west-virginians-part-1/> [<https://perma.cc/E8SE-9U2R>].

³⁶⁸ *Id.*

³⁶⁹ Press Release, U.S. Dep’t of the Interior Office of Surface Mining Reclamation & Enforcement, OSMRE Funds National Academy of Sciences Study of Potential Health Risks Related to Surface Coal Mining in Central Appalachia (Aug. 3, 2016), <https://www.osmre.gov/resources/newsroom/news/2016/080316.pdf> [<https://perma.cc/PZ7J-3ZUL>]. A similar study had been funded by USGS in 2013, but it was abruptly cancelled by the agency in favor of researching the health and environmental effects of hydraulic fracturing that produces shale gas. Ken Ward, Jr., *USGS Halts Research on Mountaintop Removal’s Public-Health Effects*, CHARLESTON GAZETTE-MAIL (July 26, 2014), https://www.wvgazette.com/news/special_reports/usgs-halts-research-on-mountaintop-removal-s-public-health-effects/article_ceb04417-86d2-5333-b983-e99765ddd3b3.html [<https://perma.cc/KX44-9X9C>].

³⁷⁰ Press Release, U.S. Dep’t of the Interior Office of Surface Mining Reclamation & Enforcement, *supra* note 369.

³⁷¹ *Id.*

been or are being mined or reclaimed for surface coal deposits” in Central Appalachia.³⁷²

However, on August 18, 2017, after the NASEM committee had held four public hearings and had reached the midway point in the project, Trump administration officials abruptly ordered it to halt all further work.³⁷³ Shifting explanations were given for termination of the Committee’s efforts. At first, Department of the Interior claimed it was conducting

³⁷² *Project Information: Potential Human Health Effects of Surface Coal Mining Operations in Central Appalachia*, NAT’L ACAD. SCI., ENG’G. & MED. (2017), <https://www.nationalacademies.org/cp/projectview.aspx?key=49846>. The specific agenda of the study included, in relevant part:

1. Identify and briefly describe the main types of coal deposits in Central Appalachia that are extracted using surface mining techniques. Descriptions will include geologic and geochemical characteristics, mining and reclamation operations, and waste management approaches.
-
3. Systematically search and screen literature to identify relevant scientific publications on the potential human health effects related to surface coal mining operations. The committee will use the selected literature to accomplish the following:
 - a. Identify effects from surface coal mining operations on air, surface water, ground-water, and drinking water quality and on ecologic communities and soil that could potentially lead to human health concerns.
 - b. Evaluate the potential for short-term and long-term human health effects, which will include consideration of potential exposure pathways and relevant environmental contaminants and other stressors.
 - c. Assess the scientific and methodologic quality, rigor, and sufficiency of the scientific research.
4. Identify baseline data and approaches necessary to monitor environmental and human health indicators that may be affected by surface coal mining operations.
5. Identify gaps in research and needs for additional research that may assist in the development of new approaches to safeguard the health of residents living near these types of coal mining operations.

Id.

³⁷³ Letter from U.S. Dep’t of Interior, Office of Surface Mining Reclamation & Enforcement, to Nat’l Acad. of Sci., Eng’g, & Med. (Aug. 17, 2017), <https://thinkprogress.org/trump-cancels-offshore-study-dfa978234a5c/> [<https://perma.cc/Z55X-637X>] [hereinafter Letter to Nat’l Acad. of Sci., Eng’g & Med.]. Interestingly, in December 2017, the Department of the Interior similarly halted another NASEM study examining “and evaluat[ing how the Department of the Interior] conducts its inspections of offshore oil and gas operations.” See Mark Hand, *Administration Halts Scientific Study on Offshore Drilling Safety*, THINK PROGRESS (Dec. 22, 2017), <https://thinkprogress.org/trump-cancels-offshore-study-dfa978234a5c/> [<https://perma.cc/ER8T-PTAD>].

a review of grants and cooperative agreements exceeding \$100,000 to confirm that public funds were being used wisely and effectively.³⁷⁴ However, no other NASEM studies were halted at the time.³⁷⁵ Furthermore, the Department of the Interior's Office of Inspector General was unable to find any information indicating what, if any, criteria the Department of the Interior used in its claimed review of agency-funded grants and cooperatives.³⁷⁶ A second reason came in an audit report: "Departmental officials decided to halt the study because they did not believe it would produce any new information and felt costs would exceed the benefits."³⁷⁷

Human Rights Watch ("HRW") conducted a comprehensive review of the termination of the NASEM study.³⁷⁸ This comprehensive review was based upon interviews with NASEM personnel, the chair of the health study, and public officials, as well as materials produced by the Department of the Interior pursuant to Freedom of Information Act requests.³⁷⁹

HRW's report reveals there was no actual Department "review" of the study funding.³⁸⁰ The decision to terminate had been made within hours, and the top official of the Office of Surface Mining who sent the August 18, 2017, termination letter had consulted with Kate MacGregor, a senior political appointee of the Trump administration.³⁸¹ MacGregor, according to HRW, had been meeting regularly and in private with coal industry executives and lobbyists in the months preceding the termination of the study.³⁸² HRW observed that "the unusual circumstances of

³⁷⁴ See Letter to Nat'l Acad. of Sci., Eng'g & Med., *supra* note 373. See also Lisa Freidman & Brad Plumer, *Coal Mining Health Study is Halted by the Interior Department*, N.Y. TIMES (Aug. 21, 2017), <https://www.nytimes.com/2017/08/21/climate/coal-mining-health-study-is-halted-by-interior-department.html> [<https://perma.cc/VUN2-4GRC>].

³⁷⁵ See Letter from House Nat. Res. Comm. Ranking Member Raúl Grijalva to U.S. Interior Dep't Deputy Inspector Gen. Mary L. Kendall (Jan. 10, 2018), <https://naturalresources.house.gov/imo/media/doc/Grijalva%20Letter%20to%20DOI%20Deputy%20IG%20Kendall%20on%20Canceled%20NAS%20Studies%20Jan.%2010%202018.pdf> [<https://perma.cc/4JY7-CFQJ>].

³⁷⁶ Letter from U.S. Dep't of the Interior, Office of Inspector General, to Ranking Member Grijalva (June 7, 2018), <https://naturalresources.house.gov/imo/media/doc/Unmasked.pdf> [<https://perma.cc/QMT9-3ZT2>].

³⁷⁷ U.S. Dep't of the Interior, Office of Inspector General, Rep. No. 2017-FIN-024 AUDIT OF COSTS CLAIMED UNDER NAS COOPERATIVE AGREEMENT WITH OSMRE FOUND NO ISSUES 1 (Sept. 2018), https://www.doioig.gov/sites/doioig.gov/files/FinalAudit_NASCooperativeAgreement_091818.pdf [<https://perma.cc/4GA2-NFTX>].

³⁷⁸ See HUMAN RIGHTS WATCH, *supra* note 22, at 64–67.

³⁷⁹ *Id.* at 65–66.

³⁸⁰ *Id.* at 11.

³⁸¹ *Id.* at 64–65.

³⁸² *Id.* at 66. MacGregor met with Arch Coal and with the National Mining Association.

the study's cancellation raise serious concerns about inappropriate political interference and industry influence."³⁸³

HRW's report also documented other efforts by the coal industry to dispute and undermine epidemiological findings of university researchers who participated in the research.³⁸⁴ Reminiscent of the strategy and tactics the coal industry employed to discredit scientific studies linking miners' respiration of coal dust with black lung disease, coal industry-funded researchers published several articles disputing the findings of scientific studies finding correlations between coal mining and degraded health of nearby residents.³⁸⁵ HRW reported:

In March 2011, just after WVU and other research on mountaintop removal began to receive media attention, Virginia Tech unveiled a new program called the Appalachian Research Initiative for Environmental Studies (ARIES). The

U.S. DEP'T OF THE INTERIOR, *Calendars* (Oct. 19, 2018), <https://psmag.com/environment/a-top-doi-official-had-at-least-six-meetings-with-the-mining-industry-she-then-helped-cancel-a-study-on-the-public-health-effects-of-mining> [<https://perma.cc/F55L-8NTE>] (under "Deputy Assistant Secretary for Lands and Minerals Management Katharine MacGregor"). HRW also cites Jim Tobias, *A Top DOI Official Had at Least Six Meetings with the Mining Industry. She then Helped Cancel a Study on the Public Health Effects of Mining*, PACIFIC STANDARD (June 11, 2018), <https://psmag.com/environment/a-top-doi-official-had-at-least-six-meetings-with-the-mining-industry-she-then-helped-cancel-a-study-on-the-public-health-effects-of-mining> [<https://perma.cc/DNB3-UF3F>].

³⁸³ See HUMAN RIGHTS WATCH, *supra* note 22, at 65.

³⁸⁴ See Ken Ward, Jr., *Does the Coal Industry's New Report 'Debunk' WVU Studies on Mountaintop Removal and Public Health?*, CHARLESTON GAZETTE-MAIL: COAL TATTOO (Feb. 15, 2012), <http://blogs.wvgazette.com/coaltattoo/2012/02/15/does-the-coal-industrys-new-report-debunk-wvu-studies-on-mountaintop-removal-and-public-health/> [<https://perma.cc/UTH8-9ZFA>].

³⁸⁵ See, e.g., Steven H. Lamm et al., *Are Residents of Mountaintop-Mining Counties More Likely to Have Infants with Birth Defects? The West Virginia Experience*, 103 CLINICAL & MOLECULAR TERATOLOGY 76 (Feb. 2015), <https://www.ncbi.nlm.nih.gov/pubmed/25388330> [<https://perma.cc/LJ6Q-UN3C>] ("The data do not demonstrate evidence of a "Mountaintop Mining" effect on the prevalence of infants with reported birth defects in WV."); J. Borak et al., *Mortality disparities in Appalachia: Reassessment of major risk factors*, 54 J. OCCUPATIONAL & ENVTL. MED. 146, 153 (2012) ("Coal mining is not per se an independent risk factor for increased mortality in Appalachia. Nevertheless, our results underscore the substantial economic and cultural disadvantages that adversely impact health in Appalachia, especially in the coal-mining areas of Central Appalachia"); Hamid Ferdosi et al., *Arsenic in Drinking Water and Lung Cancer Mortality in the United States: An Analysis Based on US Counties and 30 Years of Observation (1950–1979)*, 2016 J. ENVTL. & PUB. HEALTH 11 (2016); Hamid Ferdosi et al., *Small-For-Gestational Age Prevalence Risk Factors in Central Appalachian States with Mountain-Top Mining*, INT'L J. OCCUPATIONAL MED. & ENVTL. HEALTH 20 (2018).

initiative would fund researchers from eight universities, including West Virginia University, to study the human and ecological impact of coal. The catch: it was initially funded entirely by a \$15 million grant from coal companies (it now also receives state funding).³⁸⁶

However, the program states that its research is “independent of the interests of its affiliates” and that it expects researchers to follow the research integrity policies of their respective universities.³⁸⁷

It is also reported that the coal industry and energy interests sought to discredit and pressure epidemiological researchers in other ways. For example, Highland Mining Company used the West Virginia Freedom of Information Act to request essentially all documents related to the initiation, preparation, and publication of Professor Michael Hendryx’s articles that suggest a connection between surface coal mining and birth defects, cancer, and poor quality of life in the region.³⁸⁸

The University identified over 240,000 documents that were potentially responsive to Highland’s requests and “made five productions of documents to Highland, producing some 2,364 documents, totaling 11,090 pages.”³⁸⁹ Four of those document productions included a separate *Vaughn* index and corresponding affidavit, explaining WVU’s decision to redact 119 documents and withhold 772 documents.³⁹⁰ The West Virginia Supreme Court ultimately rejected Highland Coal Company’s broad request seeking Professor Hendryx’s research notes and correspondence with other scholars generated in the course of his research and preparation

³⁸⁶ See HUMAN RIGHTS WATCH, *supra* note 22, at 70.

³⁸⁷ See *About Appalachian Research Initiative for Environmental Science (ARIES)*, VA. POLYTECHNIC INST. & STATE UNIV., <https://www.research.uky.edu/office-sponsored-projects-administration/industry-sponsored-agreements> [<https://perma.cc/HQB8-DHF4>] (last visited Apr. 3, 2019) (initial funders of ARIES included Alpha Natural Resources, International Coal Group, Massey Energy, Natural Resource Partners, TECO Coal Corporation, Patriot Coal Corporation, Cliffs Natural Resources, Mepco, CSX Corporation, and Norfolk Southern). HRW also reported ARIES’ project director stated that industry funders “would not have a role in selecting specific projects” for funding and they may not “dictate research methodology.” He did not, however, respond to a written inquiry asking whether the program’s corporate funders may communicate with researchers, “a practice that is not only permitted but encouraged by the integrity policy at least one of the universities affiliated with ARIES.” See HUMAN RIGHTS WATCH, *supra* note 22, at 70 (citing *Industry Sponsored Agreements*, UNIV. OF KY., <https://www.research.uky.edu/office-sponsored-projects-administration/industry-sponsored-agreements> [<https://perma.cc/8QAB-GQPN>]).

³⁸⁸ See Zullig & Hendryx, *supra* note 348, at 852.

³⁸⁹ *Highland Mining Co. v. W. Va. Univ. School of Med.*, 774 S.E.2d 36, 44 (2015).

³⁹⁰ *Id.*

for drafting a final report.³⁹¹ The entire process, including litigation, consumed thirty-nine months.³⁹²

Also troubling is the appearance that University officials were pressured, and in turn pressured Professor Hendryx's supervisor, to discourage and disavow the faculty member's epidemiological research.³⁹³ In an interview, Hendryx denied he was ever directly pressured by West Virginia University to end his research.³⁹⁴ However, he explained that he "knew there was tension and that they were super concerned and nervous about it."³⁹⁵ He left the University for a position at Indiana University.³⁹⁶ Before he moved on, Hendryx described meetings with journalists during which "someone from their media office sat in . . . to keep an eye on [him]."³⁹⁷

Moreover, the Acting Dean of WVU's School of Public Health—where Hendryx was a faculty member—told HRW that "[i]t was very clear that the WVU administration was getting feedback from industry[,] which is a major funder."³⁹⁸ The Dean felt growing concern "when people connected with the university warned him that [his own] 'leadership position was in jeopardy' due to [Hendryx's] research."³⁹⁹

³⁹¹ *Id.* at 52–53 ("Because these drafts, data compilations and analyses, proposed edits, e-mails and other communications, and peer review comments and responses relate to the planning, preparation and editing necessary to produce a final published article, they are exempt from disclosure.").

³⁹² The West Virginia Court held that any document that reveals a scholar's analysis underlying a published article is predecisional, and that all prepublication documents relating to a published scientific research article are, by their very nature, predecisional. Documents are deliberative if they expose "the give-and-take of a professor's scientific research consultative process" that reveal how the "researcher[] evaluate[d] possible alternative outcomes." The court held exempted from disclosure "drafts, data compilations and analyses, proposed edits, e-mails and other communications, and peer review comments and responses relate[d] to the planning, preparation and editing necessary to produce a final published article." *Id.*

³⁹³ HUMAN RIGHTS WATCH, *supra* note 22, at 67–68.

³⁹⁴ *Id.*

³⁹⁵ *Id.*

³⁹⁶ *Id.* at 68; see also *Michael Shawn Hendryx*, INDIANA SCHOOL OF PUBLIC HEALTH, <https://info.publichealth.indiana.edu/faculty/current/hendryx-michael.shtml> [<https://perma.cc/TM96-XH5N>] (last visited Apr. 3, 2019).

³⁹⁷ HUMAN RIGHTS WATCH, *supra* note 22, at 68.

³⁹⁸ *Id.*

³⁹⁹ *Id.* Also disquieting was the October 2011 request made by a university public relations official to an environmental reporter of the *Charleston Gazette-Mail* to refrain from calling studies by university faculty "WVU studies" since it "could be interpreted as the institution taking a position." *Id.* (citing Ken Ward Jr., *WVU Tries to Distance Itself from Faculty*

CONCLUSION

Even as medical researchers warn of an insidious increase in black lung disease among both underground and surface coal miners in the Appalachian coalfields, nascent peer-reviewed studies of epidemiologists and other researchers have found extremely worrisome correlations between externalized pollution from large-scale (MTR) coal mining operations and the health of those who live in nearby communities.

Like the connection between respirable dust generated in coal mines and black lung disease, the environmental harm that accrues from coal mining in Appalachia during the last century has been thoroughly and extensively documented. However, until the last decade, similar studies and analysis of the impact of coal mining on the health of those who work in or reside near the mines has received little scrutiny. Generally, these new studies have focused on cardiopulmonary, cancer, reproduction, mortality, and general health status (self-reported illness and serious illness) by examining exposures from pollutants externalized to surrounding communities by MTR mining: impact on air quality, drinking water, water chemistry/quality, and the aquatic ecosystem.

The coal industry's response to these new studies is reminiscent of its disputation of scientific evidence, denial of responsibility, and efforts to minimize the extent of occupational health impacts of respirable dust causing black lung disease. Whether the recent studies documenting correlation between the polluting externalities of coal mining operations and adverse public health outcomes will lead researchers to find causation as well as correlation must await additional research and analysis. However, these attacks on findings signal continuing marginalization of, and disrespect for, coalfield communities and the people whose dangerous, arduous work and sacrifice powered the nation for more than a century.

Sadly, despite its natural resource wealth, Central Appalachia has long suffered from poverty, lack of adequate public services, and a dearth of educational and employment opportunities. Likewise, healthcare in the region has been viewed as problematic—for decades before the recent studies identifying serious health issues plaguing communities located near coal mines. While coal industry managers, civic leaders, and politicians of every stripe have long professed their concerns—even love—for coal

Research, CHARLESTON GAZETTE-MAIL: COAL TATTOO (Oct. 7, 2011), <http://blogs.wvgazette.com/coaltattoo/2011/10/07/wvu-tries-to-distance-itself-from-faculty-research/> [<https://perma.cc/9BYP-XW27>]).

miners, their families, and their communities, these sentiments are belied by the failure to address these long-standing issues. Because “causation” has not yet been affirmatively established by multiple scientific studies is not, however, an excuse to do nothing.⁴⁰⁰ One is left to ask: for how long must coalfield communities continue to “yield to the necessities of a great public industry”?⁴⁰¹

⁴⁰⁰ See Sir Austin Bradford Hill, *The Environment and Disease: Association or Causation?*, PROCEEDINGS OF THE ROYAL SOCIETY OF MED. 12 (Jan. 14, 1965), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1898525/pdf/procrsmed00196-0010.pdf> [<https://perma.cc/M6UA-E9V5>] (“All scientific work is incomplete—whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. This does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time”).

⁴⁰¹ Pa. Coal Co. v. Sanderson, 113 Pa. 126, 149 (1886). See discussion *supra* at note 10 and accompanying text.

