Millennium Coal Export Terminal DEIS (MBT DEIS)
(Proposed for Longview, WA)

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MAY 20 2016

Hearing: 5/26/2016 1pm Spokane Convention Center

My name is David Hunt (615 W. 23rd, Spokane, WA. 99203)
I own homes in both Spokane and North Idaho.

I wish to offer the following comments on the MBT DEIS

A few general notes, followed by my specific comments / testimony and inclusions for the DEIS Hearing and body of knowledge:

My general comments & notes:

No one: not those proposing the Millennium Bulk Terminal, not BNSF or UP, not the Port of Longview, not the EFSEC, not the State of Washington has ANY right or (statistical percentage of a right) - to impose a hazard or potential for hazard - death, injury, or environmental destruction - upon other human beings. This may sound very simplistic, however, for the sake of profit - all of the statistics, calculations, and formulas in the MBT proposal and a DEIS / EIS are no more than a sophisticated attempt to rationalize that very thing - that, for the sake of profit, these parties want the right to impose safety, health, and environmental hazards upon others who live along the rail lines or near the proposed facility site.

The corporate capitalist model of the last century is neither democratic nor sustainable. And neither, for that matter is humankind's continuation of a fossil fuel based economy and lifestyle. We know that now. It is foolishness to sacrifice our health, safety, and environment for very short term profit that benefits a very limited few - and in consideration of the inevitable - the end of the coal industry.

As the coal economy is near-dead, as has been well evidenced, and as anyone who has been paying attention fully understands - It is long past time to "Leave It In The Ground."

My specific comments:

It would be an egregious error to consider the MBT proposal in isolation - i.e., without also including the potential for impacts, risks, and hazards from the (also currently proposed

and under consideration) Tesoro Savage Energy Distribution Terminal DEIS which has been proposed for the Port of Vancouver. Many concerns for one proposal are the same as for the other and a significant **compounding** of impacts, risks and hazards would most definitely occur if both proposals were to be permitted. The significance of this cannot be overstated and should not be overlooked.

The Draft EIS fails to incorporate a Health Impact Assessment (HIA). The failure to include an HIA (which is a critical component for decision making) is unacceptable and must be remedied prior to issuance of the Final EIS by including an HIA, with ample opportunity for public review and comment.

Even without an HIA, however, the DEIS confirms human health risks sufficiently to warrant the No Action alternative, and I encourage WA DOE and Cowlitz County to select the NO Action alternative in the Final EIS.

Coal Dust and Air Pollution Impacts from the proposed MBT and the associated transportation of coal to "feed" the facility warrant selection of a No Action alternative.

Diesel particulate matter was identified as the most likely contributor to cancer risk in Washington State.

In Longview, all rail traffic in the study area is projected to increase emissions for all air pollutants by about 11%,

Locomotive emissions in Cowlitz County are estimated to increase by about 6% overall with the proposed action. The largest emissions increase for a single pollutant would be for PM10, which would increase by approximately 15%.

Vessel emissions in Cowlitz County with the proposed action are estimated to increase by about 12%.

Cumulative vessel_traffic in 2038 is projected to increase air emissions by about 24%.

Table 5.6-10. Estimated Maximum Annual Emissions *in Washington State* for Locomotive and Commercial Marine Vessels for the Proposed Action in Comparison with the 2011 Statewide Emissions Inventory:

Locomotives will emit 47 tons/year DPM (46 tons/year PM2.5 and 47 tons/year 10 DPM)

Marine vessels will emit 10 tons/year DPM (11tons/year PM 2.5 and 13 tons/year of PM 10)

Table 6-25. Estimated Maximum PM10 and PM2.5 Concentrations—BNSF Main Line in *Eastern Washington* will exceed the 24-hour PM10 and annual PM2.5 ambient air quality

standard at 100 feet from the rail line.

With respect to hazardous air pollutants, the 2005 EPA National-Scale Air Toxics Assessment was used by Ecology to estimate cancer risk (Washington State Department of Ecology 2011). Inhalation cancer risks were highest in the major population centers along the rail route (Vancouver and Spokane), with a cancer risk of up to 500 cancers per million. For the smaller communities (Kelso-Longview, Spokane, Yakima, and Pasco), cancer risks were up to 300 cancers per million.

Table 6-21 shows violations of the National Ambient Air Quality Standards (NAAQS) for particulate matter (PM2.5) from coal dust in Cowlitz County.

"The estimated maximum monthly coal dust deposition along the BNSF main line in Cowlitz County would exceed the trigger level for certain residential receptors (Table 5.7-7)." Chap. 5 at 5.7-21.

"Residents who live along the main line could experience nuisance levels [of coal dust] which may visible soiling on window sills, outdoor furniture, and other property." Chap. 5 at 5.7-21.

"The average and maximum deposition of coal dust on the BNSF main line in Cowlitz County was estimated to be above the nuisance thresholds at 50 and 100 feet, and because no state or federal standards apply, this an unavoidable but not significant impact." Chap. 5 at 5.7-25.

Table 6-22. Estimated Average Maximum and Maximum Monthly Coal Dust Deposition—BNSF Main Line *in Cowlitz County* PM 2.5 and PM 10 are expected to exceed NAAQS.

Table 6-24. Estimated Average Maximum and Maximum Monthly Coal Dust Deposition—BNSF Main Line *in Columbia River Gorge* Average maximum and maximum monthly coal dust deposition for Columbia Gorge would be exceeded.Chap. 6 at 6-69.

Table 6-26. Estimated Average Maximum and Maximum Monthly Coal Dust Deposition—BNSF Main Line in *Eastern Washington*. The estimated average maximum monthly coal dust deposition is above the trigger level at 100 feet from the rail line.

Toxic constituents of coal include polycyclic aromatic hydrocarbons (PAHs) and trace metals, which are present in coal in variable amounts and combinations dependent on the type of coal.

The concentration of PAHs in Powder River Basin coal was not investigated.

Seventy percent of the Cowlitz County air toxic cancer risk is due to just three air toxics: PAHs, formaldehyde, and benzene. p. 694

Water Pollution Concerns:

Groundwater in the study area is confirmed to have benzene and petroleum/gasoline contamination above cleanup levels. 3.6-13

"Day-to-day rail operations could release contaminants to water resources immediately adjacent to the rail line, resulting in the potential for water quality impairment from increased rail transportation." Summary at S-24.

There is significant, unacceptable potential for hazards to water quality and fisheries from a failure or spill during loading of marine transport vessels.

Accidents:

There will be Unavoidable and Significant Adverse Environmental Impacts: "Proposed Action-related trains could increase the number of potential train accidents along in the rail routes in Cowlitz County and Washington State."

There will be Unavoidable and Significant Adverse Environmental Impacts: Without improvements to increase capacity, the Reynolds Lead; BNSF Spur; and three segments on the BNSF main line routes in Washington State (Idaho/Washington State Line–Spokane, Spokane– Pasco, and Pasco–Vancouver) are not projected to have the capacity to handle the projected baseline rail traffic and Proposed Action-related rail traffic in 2028.

The DEIS predicts over 11 additional rail-related accidents every year statewide, and an additional accident every year in Longview. When looked at in terms of cumulative risk including other proposed project, the DEIS predicts 19 coal train accidents per year.

Because of the health impacts that will be a direct result of the MBTL project, I respectfully request that the Final EIS include a Health Impact Assessment that addresses the following questions and includes a public comment process.

I. Health Impacts of Diesel Particulate Matter (DPM)

1. How much DPM and toxins will people be exposed at 50 feet, 100 ft, 200 ft, etc. up to 2 miles from the tracks when a train goes by? We request this data to be shown in an easy-to-understand format, including maps with "pollution contours" (isopleths).

2. How much DPM and toxins will result from the ships, including ships that are at anchor (staging), at the dock, andin transit?

3. What will the impact of temperature inversion weather conditions be on air pollutants?

4. How many people live within 50 ft, 100 ft, 200 ft, 500 ft, 1000 ft, 1 mile, and 2 miles along the transportation routesfrom the Powder River Basin and the Uinta Basin to Longview, from there to the mouth of the Columbia River, and from Longview to Pasco via Stampede Pass, including current and projected populations?

5. How many of the people living, going to school, or working within the distances above are children (including current and projected populations), and elderly? How many and whom have any form of pulmonary or cardiovascular disease?

6. How many increased asthma attacks, ER visits, and hospitalizations will result, including current and projected populations, and including under temperature inversion conditions? What is the economic cost? Who pays for the costs?

7. How many increased strokes will result, including current and projected populations, and including under temperature inversion conditions? What is the economic cost? Who pays for the costs?

8. How many increased myocardial infarctions (heart attacks) will result, including current and projected populations, and including under temperature inversion conditions? What is the economic cost? Who pays for the costs?

9. How many COPD exacerbations will result, including current and projected populations, and including under temperature inversion conditions? What is the economic cost? Who pays for the costs?

10. How much cancer will result, including current and projected populations? What is the economic cost? Who pays for the costs?

11. How much acrolein, acetaldehyde, formaldehyde, heavy metals (including but not limited to mercury, lead, and arsenic), 1,3-Butadiene, polycyclic aromatic hydrocarbons, or other toxins will be deposited cumulatively? This should be analyzed in a cumulative fashion, (i.e. additive) over the next 50 years (the operating life of the terminal).

12. What are the effects of chronic exposure of the above compounds on: Neonatal and childhood development? Neuro Developmental disorders? Blood and lymphatic systems? Respiratory system? Cardiovascular system? Reproduction? Cancer? What are the economic costs of these? Who pays the cost?

13. What is the cost of cleanup of the cumulative environmental contaminants? How effective is the cleanup? Who pays the cost?

14. Medical research comes forth at an intense pace. When new health impacts are

inevitably identified or quantified, how can the public be assured that their health will be weighed in the balance of ongoing risks/benefits to MBTL operations?

15. How many people in Cowlitz County, in Longview and in the Highlands neighborhood have pediatric asthma, adult asthma, COPD, cardiovascular disease, diabetes, are under 18 or over 65 years of age, and/or live in poverty?

II. Health Impacts of Coal Dust

1. How much coal dust from the mining and transportation of coal can be expected along each section of the transportation corridors from the Powder River Basin and Uinta Basin to the proposed terminal and then to the mouth of the Columbia River

2. How much accumulation will result after 50 years of transport or the operating life of the terminal

3. How many children and adults can be expected to have increased risk of asthma and

other respiratory diseases, including current and projected populations

4. How many coal train derailments can be expected along the rail corridor per year of operation of the proposed export terminal?

5. What will be the effect of contamination from coal dust and spills on farmland along the rail corridor?

6. What will be the effect of contamination from coal dust and spills on grazing animals used for human consumption?

7. What will be the effect of contamination from coal dust and spills on fresh water supplies for humans and animals?

8. What will be the effect of contamination from coal dust and spills on marine habitat for fish and other seafood?

9. What is the cost of cleanup of the cumulative environmental contaminants? How effective is the cleanup? Who pays the cost?

10. How many people can be expected to be affected by the increased exposure to mercury and other heavy metal contaminants of coal, such as by cancer, including current and projected populations?

11. Medical research comes forth at an intense pace. When new health impacts are inevitably identified or quantified, how can the public be assured that their health will be weighed in the balance of ongoing risks/benefits to MBTL operations?

12. What is the loss of coal dust from residual dust still on the cars on the return journey back to the Powder River Basin and the Uinta Basin (so called "carryback coal")? How much of the "carryback coal" is expect to be lost in Cowlitz County in particular? If coal dust is, as is claimed by the proponents of the project, a near mine issue, is the terminal itself considered similar to a near mine site, with the coal lost from loose residual coal

matter still on the rail cars from which most of the coal has just been shaken loose and dumped at the terminal site?

III. Health Impacts of Noise Pollution

1. How loud are train engines? Squeaking wheels? Hornblasts? Federal regulations require that the horns sound at levels of 96 to 110 dBA measured at 100 feet for 15 to 20 seconds in advance of all public grade crossings. How loud are horn blasts at 50 feet, 100 ft, 200 ft, etc. up to 2 miles from the tracks? We request this data to be shown in an easy-to-understand format, including maps with "sound contours" (noise isopleths).

2. How much vibration does a coal train produce? How intense is this at 50 feet, 100 ft, 200 ft, etc. up to 2 miles from the tracks?

3. How many people live within 50 ft, 100 ft, 200 ft, 500 ft, 1000 ft, 1 mile, and 2 miles along the entire route from PRB to Longview and back to the PRB?

4. How much noise and/or vibration wakes an average person? A light sleeper?

5. How much noise or vibration distracts a working person? A concentrating student?

6. For each train along the entire route, how many at-grade crossings are there? How many horn blasts per crossing? How many horn blasts in total for a single train traveling from Montana to Longview? How many whistle blasts per day in all (x 16 trains)? How many of these are at night during sleeping hours (8 PM to 8 AM)?

7. For each train, including engine noise, vibration, screeching wheels, and whistle blasts, how many people will be awakened, based on current and projected populations? How many children? How many adults? How many elderly? All calculations must include projected populations as well, since the terminal has an operating span of 50 years.

8. How many times per night will a person be awakened, from noise or vibration, who lives various distances from the tracks (including distances: 50 ft, 100 ft, 250 ft, 500 ft, 1000 ft, 0.5 miles, 1 miles, and 2 miles) in all areas and communities along the route to and from the PRB, including but not limited to Helena, Missoula, Spokane, Pasco, Camas, Hood River, Portland and Longview?

9. How many awakenings per night, including all people along the entire route up to 2 miles away from tracks, including all trains, based on current and projected populations?

10. Considering the noise and vibration, multiple awakenings and resultant fatigue, how many people may potentially have increased blood pressure, or elevated stress hormones, including current and projected populations?

11. What is the total economic cost of increased blood pressure, elevated stress hormones? Who pays for the economic costs?

12. Considering the noise and vibration, multiple awakenings and resultant fatigue, how many arrhythmias, or heart attacks could potentially result from the increased noise, including current and projected populations? What is the total economic cost of the arrhythmias, or heart attacks? Who pays for the economic costs?

13. Considering the noise and vibration, multiple awakenings and resultant fatigue, how many strokes could potentially result from the increased noise, including current and projected populations? What is the total economic cost of the strokes? Who pays for the economic costs?

14. Considering the noise and vibration, multiple awakenings and resultant fatigue, how much increased mental disease may result from associated stress, including but not limited to: depression, mental instability, neurosis, hysteria, and psychosis, including current and projected populations? What is the potential economic cost of the increased mental disease? Who pays for the economic costs?

15. What is the potential impact of noise, vibration, multiple awakenings, and fatigue on childhood learning? On childhood test scores? What is the total economic cost of the learning impairment? Who pays for the economic costs?

16. What is the potential impact of noise, vibration, multiple awakenings, and fatigue on workplace performance? What is the total economic cost of the impaired workplace performance? Who pays for the economic costs?

17. How many increased traffic accidents may result from fatigue- associated sleep disturbance, including current and projected populations? What is the total economic cost of the accidents? Cost in terms of human morbidity? Who pays for the costs?

IV. Health Impacts of Delays in Emergency Medical Services

1. How many rail crossings are there along potential rail corridors from the Powder River Basin and the Unita Basin to Longview and back to the Powder River Basin and Unita Basin? How many of these are at-grade crossings? Why did you only select 44 at-grade crossings in the state of Washington to review?

2. How many of these rail crossings are unprotected?

3 What are the costs to provide protective barriers at these crossings and who will bear these costs?

4. How often and for how long will each of these crossings be blocked by the increased rail traffic en route to MBTL? Delay should be calculated for each crossing to account for differences in local circumstances.

5. How many times daily do EMS vehicles, including police, fire and medic units, cross rail lines? Please note that an ambulance often needs to cross twice to get a patient to a hospital.

6. What will be the cumulative and per incident delay in access to these services caused by rail traffic en route to MBTL (including actual blockage of the crossing, as well as alleviation of resultant congestion)? Please again note that an ambulance often needs to cross twice to get a patient to a hospital.

7. How many people are affected at each crossing, based on current and projected population as shown in relevant planning documents?

8. What crossings and locations are most likely to result in significant delays at crossings

9. How often are there alternative crossings? How much time is lost to route through alternate crossings, rather than the shortest route?

10. Is there any current established system to alert EMS vehicles of impending crossing closures?

11. How much would such a system cost and who would bear the cost of developing such systems?

12. How does backed up traffic at crossings and the dispersion of that traffic effect EMS response times throughout the entire state of Washington?

13. How often and to what severity will these delays in EMS response times lead to delays in care and to otherwise avoidable outcomes such as death or permanent disability?

14. What is the amount of healthcare cost attributable to patients receiving delayed EMS services as a result of increased rail traffic?

15. How will the project applicant mitigate these impacts (grade separation at crossings, construction of new hospitals, support for additional paramedics, medivac services, etc.?) What percent of the total cost will the project applicant pay for grade separation at crossings, etc.?)

16. How many rail crossing accidents, injuries, and deaths will be attributable to increased rail traffic en route to MBTL?

17. What is the anticipated cost of these accidents, including anticipated litigation and long term care costs?

18. How many coal train derailments would be anticipated to occur across the states of Washington and Oregon over the lifetime of the project?

19. Where are the likely sites of these derailments, and are any of these potentially dangerous or inadequately designed rail lines in major population densities?

V. Health Impacts to Drinking Water

1. Does the Wellhead Protection Program (WHPP area) for the City of Longview's Mint Farm Wellfield encompass the project area? Does the project lie within and above the 6-month WHPP Source area? The 1-year WHPP Source Area? The 5-Year WHPP Source area? The 10-year WHPP Source Area? Does water from those Source Areas flow beneath the project area en route to city wells?

2. What impact will pre-operation wicking and compression have on the movement of surface water? On the movement of legacy pollutants like benzene and arsenic? Can that ultimately impact the quality of groundwater?

2. What is the relationship of the unconfined aquifer to the deep aquifer depicted in the technical reports? What is the relationship to the drinking water source?

3. What is the tidal influence on the Columbia River at the project area and how will that affect movement of waterborne pollutants discharged at the project site?

4. What will be the influence of MBTL's heavy pumping of private wells during the dry season (for purposes of dust suppression) on City of Longview wells?

5. What contaminants and pollutants can be expected to flow into to the Columbia River as treated wastewater, untreated surface water or overflow from storms? Diesel pollution, toxic coal dust, fuel spills? Abestos, lead and arsenic from demolition projects ? Leaks and spills from associated barges, tugs, Panamax-class and Handymax-class vessels?

6. What is the transit time from the Columbia River to the deep aquifer that serves as the drinking water source for residents of Longview?

6. Who will pay if the drinking water source for the City of Longview is contaminated with pollutants as a result of this project and must be permanently replaced? What is the cost of temporary purchase or replacement of drinking water for residents?

7. Will you identify by name and location all domestic and municipal water systems that could be harmed with a derailment and spill of coal trains and/or coal vessel fire and fuel spill. How many people are served by those systems? Who will pay for monitoring and cleanup when and if other municipal drinking water sources are fouled in Washington? In Oregon? In Idaho? In Montana?

VI. Environmental Justice Impacts

1. What will be the cost to culture, tradition and food sources for First Nations if mercury accumulate in water (from blow-back from coal-fired power plants in Asia) and result in harm to salmon?

2. What are the impacts of mercury neurotoxicity and who is most likely to suffer?

3. What will be the impacts to traditional culture and foods if this project leads to a decrease in the number of salmon and other fish available for harvest?

4. Whose access to tribal treaty fishing sites will be lost,made more difficult or result in injury because of the increasing number of long unit trains on the UP and BNSF lines?

5. Will you analyze all census tracts running 2 miles along all rail corridors, all vessel corridors, including rail and vessel corridors in Cowlitz County and in Longview, for health impacts from this project that may be experienced by communities of color and low income communities, children under 18, adults 65 and over, and individuals with pre-existing disease including pediatric asthma, adult asthma, COPD, cardiovascular disease, and diabetes?

VI. Health Impacts of Climate Change

What will be the human health impacts to climate change under a scenario with MBTL activities resulting in 27 million metric tons/year net CO2 emissions (see Greenhouse Gas Appendix Table 47)? With 3.2 million metric tons/year? With 37.6 million metric tons of Co2 emitted between 2018 and 2038?

What could be the impact on Cowlitz County and Washington residents and fire fighters from forest fires, smoke, injury, death and dislocation?

What are the impacts from increased heat, increased ozone levels and degraded air quality? How will this impact pediatric populations? Adults over 65? Those with pre-existing disease like asthma, bronchitis, COPD? Who will most suffer? Who will pay?

What will be the health impacts of severe weather, including heavy rain, wind storms and landslides that lead to dislocation, injury and death? Who will pay?

What will be the impacts from increasing rates West Nile Virus and Lymes disease in Cowlitz County? In Washington?Who will pay?

Will there be disproportionate and adverse effects on low income communities and communities of color? If so, what will they be?

VII. Health Impacts of Surfactant Use

Which chemical surfactants will be used? Which chemicals will beapplied by workers, deposited along the transportation corridors and in communities around the coal pile, from blowing dust and leaching by rainwater. What are the human and environmental impacts of exposures? Have chemical compounds such as GE Powertreat, designed for use on Powder River Coal (and known to be a serious skin, eye and lung irritant), been tested for chronic toxicity? Have these compounds been tested for longer term human and environmental health impacts?

It is imperative that the concerns or our medical community be included in the knowledge bank, questions, and considerations of this proposal and EIS. Recognizing the importance of including this information, I wish to include it herein:

Washington Health Community Position Statement on Proposed Coal Exports:

Large multinational coal companies propose to send coal mined in the Powder River Basin by rail and barge through the Pacific Northwest to be loaded onto large ships and exported to Asia. If current proposals are approved, that could result in more than 100 million metric tons of coal shipped each year. Over 38 uncovered coal trains, each one-mile long (or longer) with over 100 cars propelled by four diesel engines, could pass through Washington and/or Oregon every day.

Our specific, local concerns related to a massive increase in rail and river traffic for coal exports include:

New, major sources of diesel pollution;

Coal dust pollution along train tracks, in river corridors and at port sites;

Traffic delays, including for emergency first responders, at grade-level crossings; and

Noise pollution.

Coal trains traveling through our communities, barges, port storage and export facilities, and massive bulk cargo ships in the Columbia River and on the coast will emit significant amounts of diesel particulate pollution. There are robust correlations between these pollutants and cardiovascular and respiratory disease, reproductive health problems, and malignancy. Chronic exposure to these particulates may affect learning ability, coordination, memory, and judgment in both children and adults.

Coal dust blowing off train cars can be as much as 500 lbs. of coal dust per car per 500 miles travelled. The size and frequency of these trains may make coal dust a public health threat in itself. Exposure to coal dust is linked to asthma and lung disease. Coal particles from trains have been found in the Columbia River. Coal dust contains mercury, arsenic, and lead, elements which have been associated with neurodevelopmental delays in children.

Another concern is the potential for delays in emergency response times. For instance, there are four grade-level crossings in Longview, Washington that could detain first responders for up to 20 minutes each as long coal trains pass through town.

Additionally, coal burned abroad in Asia emits nitrous and sulfur oxides, ozone, and heavy metals such as mercury into the air, which will blow back to us on prevailing westerly winds. Recent studies show that a significant amount of the mercury in water and the environment comes from coal burned in Asia that returns to the Pacific Northwest via atmospheric currents. In addition, burning large amounts of coal and fossil fuels simply to transport the coal will generate huge amounts of greenhouse gasses that promote and intensify climate change, itself a threat to public health and safety.

Washington and Oregon have taken steps to phase out the use of coal- generated electricity at the Transalta plant in Centralia and at the PGE Boardman plant. This is progress for the health of those living in the Pacific Northwest. Yet new, proposed coal exports would undermine this progress.

As health care professionals, providers and public health advocates, we believe the risks to human health from massive coal shipments across our state and through our communities are significant. We want to prevent new sources of morbidity and mortality and increasing costs of health care.

Together, we voice our concerns about coal exports. Specifically, we call for public review of a comprehensive Health Impact Assessment (to include cumulative effects), a region-wide Environmental Impact Statement (EIS), and site-specific EISs for each proposed terminal before any coal export facility or transport is approved by any agency.

Thank you,

Anne Battson, RN et all

I also wish to both cite and include the following knowledge, concerns, and questions from Oregon Physicians for Social Responsibility, and formally request that each of these questions be answered in the Final EIS and that these concerns and questions be considered in the Final EIS decision making process.

Airborne Particulate Matter and Public Health

By Oregon Physicians for Social Responsibility

For more info, contact Oregon PSR Tel: (503) 274-2720 www.oregonpsr.org

BACKGROUND

Outdoor air quality is an increasing concern globally with expanding industrial and transportation emissions. The World Health Organization (WHO) has declared that Particulate Matter (PM) in ambient outdoor air affects more people than any other pollutant. Chronic exposure to particles contributes to the risk of developing or dying from serious disease. (WHO 1) The effects of PM on health occur at levels of exposure currently being experienced by most urban and rural populations in both developed and developing countries. Burning fuel results in two phases of emissions, both containing the highly toxic polycyclic aromatic hydrocarbons (PAHs). In addition to the "particulate phase," there is a "gas phase" containing other air pollutants such as acrolein, benzene, and formaldehyde, which also contribute to disease. (EPA 1, EPA 2) The combustion of fossil fuel for electricity

and transportation, especially coal and diesel, are major contributors to outdoor air pollution.

WHAT IS PARTICULATE MATTER?

Particulate Matter (PM), is composed of very small, solid and liquid particles, formed from the incomplete burning of fossil fuels, such as coal, diesel, gasoline, and biomass. PM2.5 measures 2.5 microns in diameter or less; PM10 are particles 10 microns or smaller. PM consists of a complex mixture of Polycyclic Aromatic Hydrocarbons (PAHs), soot, black carbon, absorbed water, aerosolized sulfuric acid droplets, other acids, nitrogen, sulfur, organic material, metals, and other toxic substances. PAHs are absorbed by the sponge-like particles and carried by them deeply into the smallest compartments of the lung (alveoli) where they gain direct access to the bloodstream and may then contribute to various diseases in organs distant from the lungs, including the fetal placenta.

The World Health Organization (WHO) reports that there is not a threshold below which no damage to human health is observed. Their guidelines for maximizing health within the constraints of a modern world are that PM2.5 should not exceed an average of 25 micrograms per cubic meter of air (25mcg/m3) in a 24-hour period, and not exceed an average annual exposure of 10mcg/m3. (WHO 1)

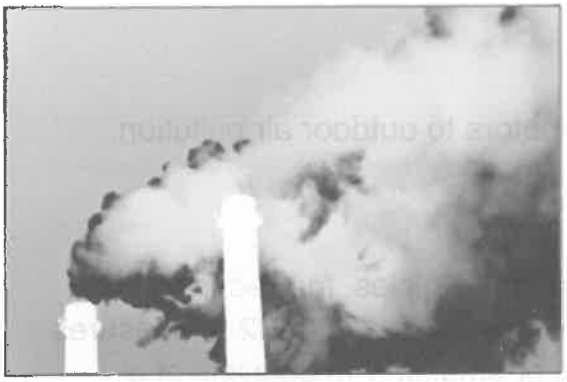
To put this into perspective, the PM2.5 for Portland, Oregon in January, 2014 ranged from 30-76, while, during same month, the PM 2.5 in Beijing, China was over 600. In Harbin, China in October of 2013 (the start of the heating season), the PM2.5 was over 1000mcg/m3 (Guardian). The major

contributors to this astronomically high PM2.5 in China are burning coal and vehicle exhaust.

HOW DOES PARTICULATE MATTER AFFECT PEOPLE?

The ne and ultra ne particles less than 2.5 microns (PM2.5) are particularly important in triggering disease because they penetrate deeply into the alveoli of the lungs. Diesel particulate matter,

submicronic in size, has particularly damaging potential (Li). Some inhaled particles are taken up by macrophages, resulting in lung in ammation. The nal common pathway of the pathologic effects of exposure to particulate matter, as well as gas phase pollutants, appears to be in ammation. (Avogbe, Bellavia, Dominici, Li, Musta c, Peters 2011, Pieters). The effects of in ammation on various body organ systems are complex, but increased levels of particulate matter are associated with a number of ill health effects including: increased cancer rates, especially lung and breast (Beeson, Crouse, Demetriou, Dockery, Pope, Wei, WHO 2), congenital lung, heart and immune system anomalies in children (Gauderman, Picciotto Vrijheid), increased rates of asthma, worsening of preexisting asthma and chronic obstructive pulmonary disease (COPD)



(Carlsten, Gowers, Delamater, HEI Panel, Trasande), higher rates of heart attacks and strokes (Chen, Dominici, Lie, Musta c, Qian, Wellenius, Shaw), and higher rates in children (exposed prenatally) of neuro developmental disorders such as autism spectrum disorder (ASD), attention de cit hyperactivity disorder (ADHD), lowered IQ, and adverse behaviors. (Becera, Chiu, Newman, Perera 2013, Perera 2009, Roberts, Volk 2013, Volk 2011). Not surprisingly, the most vulnerable populations are pregnant women, children, people that already have pulmonary diseases like COPD or asthma, and the elderly.

WHAT ARE CURRENT ISSUES IN THE PACIFIC NORTHWEST?

A recent study from the University of Washington, evaluating air quality as a result of increased coal transportation by rail in the Paci c Northwest, found that living within 25 meters of two rail lines in the Blue Ridge Seattle neighborhood was associated with signi cantly increased exposure to diesel particulate matter (DPM) and airborne coal dust. A proposed 50% increase in diesel train traf c (if coal terminals are built in coastal harbors) is projected to similarly increase small particulate matter exposure. When added to regional background emissions, this increase would bring total concentrations higher than the new US National Ambient Air Quality Standards (NAAQS). (Jaffe) In addition, a sharp increase in mile-long trains already transporting oil through the region has considerably increased airborne diesel emissions. In 2013, 19,065 tank cars moved more than 11 million barrels of oil through Oregon, according to annual reports that railroad companies submitted to the Oregon Department of Transportation, up from 2012 when 5,491 cars moved 2.9 million barrels... In 2007, railroads moved just 659 tank carloads of oil. (Oregon Live) Furthermore, several energy companies are actively pursuing permits to build enormous oil and

gas storage tanks in Northwest ports which, if allowed to proceed, would dramatically increase diesel exhaust from even more trains traversing Oregon and Washington.

KEY AMERICAN MEDICAL SOCIETIES AND THE WORLD HEALTH ORGANIZATION HAVE ISSUED POSITIONS ON PARTICULATE MATTER AND HEALTH:

The American Heart Association (AHA) in 2010 updated and summarized its 2004 Scienti c statement position: "The overall evidence is consistent with a causal relationship between PM2.5 exposure and cardiovascular morbidity and mortality. This body of evidence has grown and has been strengthened substantially since publication of the rst AHA scienti c statement and, ... because the evidence reviewed supports that there is no safe threshold, it appears that public health bene ts would accrue from lowering PM2.5 concentrations even below present-day (EPA standards), if feasible, to optimally protect the most susceptible populations." (Brook)

The American College of Obstetricians and Gynecologists (ACOG) together with the American Society of Reproductive Medicine (ASRM) in October 2013 issued a statement, "The evidence that links exposure to toxic environmental agents and adverse reproductive and developmental health outcomes is suf ciently robust, ... individuals alone can do little about exposure to toxic environmental agents, such as from air and water pollution, ... calling for timely action to identify and reduce exposure." (ACOG)

The American Academy of Pediatrics (AAP) issued a policy statement linking ambient air pollution to adverse health outcomes in children and recommended the National Ambient Air Quality Standards (NAAQS) be promptly reviewed and revised to protect children. (AAP, 2004, reaffirmed 2009)

In October 2013, WHO's International Agency for Research on Cancer (IARC), classified both outdoor air pollution, as a whole, and particulate matter, on its own, as carcinogenic. Therefore, it is vital to implement ef cient policies to reduce exposure to pollution worldwide. (World Health Organization (WHO 2) and American Cancer Society).

SPECIFIC DISEASES ASSOCIATED WITH EXPOSURE TO HIGHER LEVELS OF PARTICULATE MATTER IN AIR POLLUTION

Cancer — Studies relating cancer risk and particulate matter:
• exposure to ozone and PM correlated with development of and mortality from lung cancer (Beeson, Dockery, Pope)

- increased biological markers associated with risk of lung cancer (Demetriou)
- increased oxidative DNA damage predictive of cancer risk (Avogbe)
- increased rates of breast cancer (Crouse, Wei)

Cardiovascular — Studies have linked increased particulate matter with increased cardiac disease:
• increased cardiovascular disease mortality and morbidity in both short term and long term exposures to PM 2.5 (Brook)

- increased hospital admissions for serious cardiac arrhythmias (Peters 2000)

- increased probability of admission for acute myocardial infarction (Musta c, Peters 2001)
- increased ischemic heart disease, arrhythmias, congestive heart failure (Dominici) and bio markers

(HRV) associated with increased cardiac morbidity and mortality (Pieters)

- increased hospital admissions and death from heart failure (Shaw)
- increased risk of congenital cardiac anomalies in children (Vrijheid)

Cerebrovascular — Studies have shown links between particulate matter and adult brain effects:
• increased hospital admissions for strokes(Dominici, Lue, Wellenius 2005)
• signi cant increase in stroke mortality associated with increase in PM (Chen, Qian)
• increased risk of stroke associated with increased exposure to small PM, black carbon, and nitrous dioxide (Wellenius 2012)

• increased risk of stroke and death from stroke for post menopausal women (Miller)
• structural brain damage and cognitive de cits in middle-aged and older adults (Wilker)

Neurodevelopmental — Studies associating in-utero exposure to particulate matter and:

- increased incidence of autism spectrum disorder (ASD) (Becerra, Kalkbrenner, Raz, Roberts, Volk

  2013, Volk 2011)
- increased incidence of behaviors associated with attention de cit hyperactivity disorder (ADHD)

  (Chiu, Newman, Perera 2014, Peterson)
- lowered IQ (Calderón-Garcidueñas, Perera 2009, Jedrychowski)
- increased behavioral symptoms of anxiety, depression, social problems, rule breaking, and aggression

  (Perera 2013)
- neurobehavioral development in children bene ted from the shutdown of a coal-burning plant (Perera

  2008, Tang)

Pulmonary — Studies have demonstrated the effects of particulate matter on the lungs:
• decreased lung function (WHO 3)
• inhibited lung development in children and adolescents and measurable airway in ammation (Gauderman) • increased asthma rates and worsening of preexisting asthma and chronic

obstructive pulmonary

disease (COPD), resulting in increased hospitalization (Carlsten et al., Gowers, Delamater, 2012; HEI Panel, Pandya, Trasande)

General —

- increased mortality from cardiac, respiratory and kidney disease in all members of communities with

  coal exposure (Hendryx 2007, Hendryx 2010, Hendryx 2008, Hendryx 2009)

- long term exposure linked to decreased life expectancy from cardiopulmonary mortality (Krishnan, WHO 4)

- prenatal exposures linked to altered immune system development (Hertz-Picciotto)

WHAT YOU CAN DO TO PROTECT YOUR FAMILY AND COMMUNITY

The World Health Organization has stated, "Most sources of outdoor air pollution are well beyond the control of individuals and demand action by cities, as well as national and international policymakers in sectors like transport, energy, waste management, buildings and agriculture." With that in mind, here are some tips to protect your health:

1. Use a portable air puri er in your home (Look to consumer organizations for speci c product information).

2. Do the best you can to protect your and your family's health from the consequences of in ammation by observing good health habits: Get plenty of sleep and daily exercise, eat six servings of fruits and vegetables daily, consult your health advisors.

3. Push in the air recycle button on your car dash when traveling on motorways around other vehicles.

4. Work for change with environmental and neighborhood groups (examples: The NW District Association of Portland recently negotiated an agreement with local developers to meet EPA's highest standards for diesel exhaust emissions, by using exhaust treatment devices during a local construction project. Neighbors for Clean Air negotiated with an industry in the Northwest Portland neighborhood to reduce its toxic air emissions, by installing giant vacuum cleaner bags to capture particulates, and air monitoring equipment in the neighborhood.)

5. Work for policy change with local and regional governments, and legislatures. Ideas for starters (inspired by the Oregon Environmental Council): Request "No diesel engine idling" policies, retro tting of older diesel engines with pollution control devices, advocate for the use of ultra-low sulfur diesel fuel for Oregon, continue negotiating improvement in the emissions standards of heavy-duty, off-road diesel engines, request that all vehicles are using the best available technology for emission control, and that grant funds are available to assure this, especially for small businesses.

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Finally, It is imperative for decision makers involved in the MBT Permit Application Process to become truly capable of making a well-informed, responsible decision regarding the MBT application and the proposal's potential for impacts, risks, and hazards to human health, human and community safety, and our collective climate and environment.

Towards this end, I also wish to cite the publication entitled: "Coal's Assault on Human Health" from Oregon Physicians for Social Responsibility -

http://www.psr.org/assets/pdfs/coals-assault-executive.pdf . (attached)

- and request that the full text of this article be included in the DEIS and EIS body of knowledge, and that it be read and carefully considered in the decision making process.

Sincerely, also attached NIH abstract on PAH & coal

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COAL's ASSAULT *on* HUMAN HEALTH

By

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Kristen Welker-Hood, ScD MSN RN

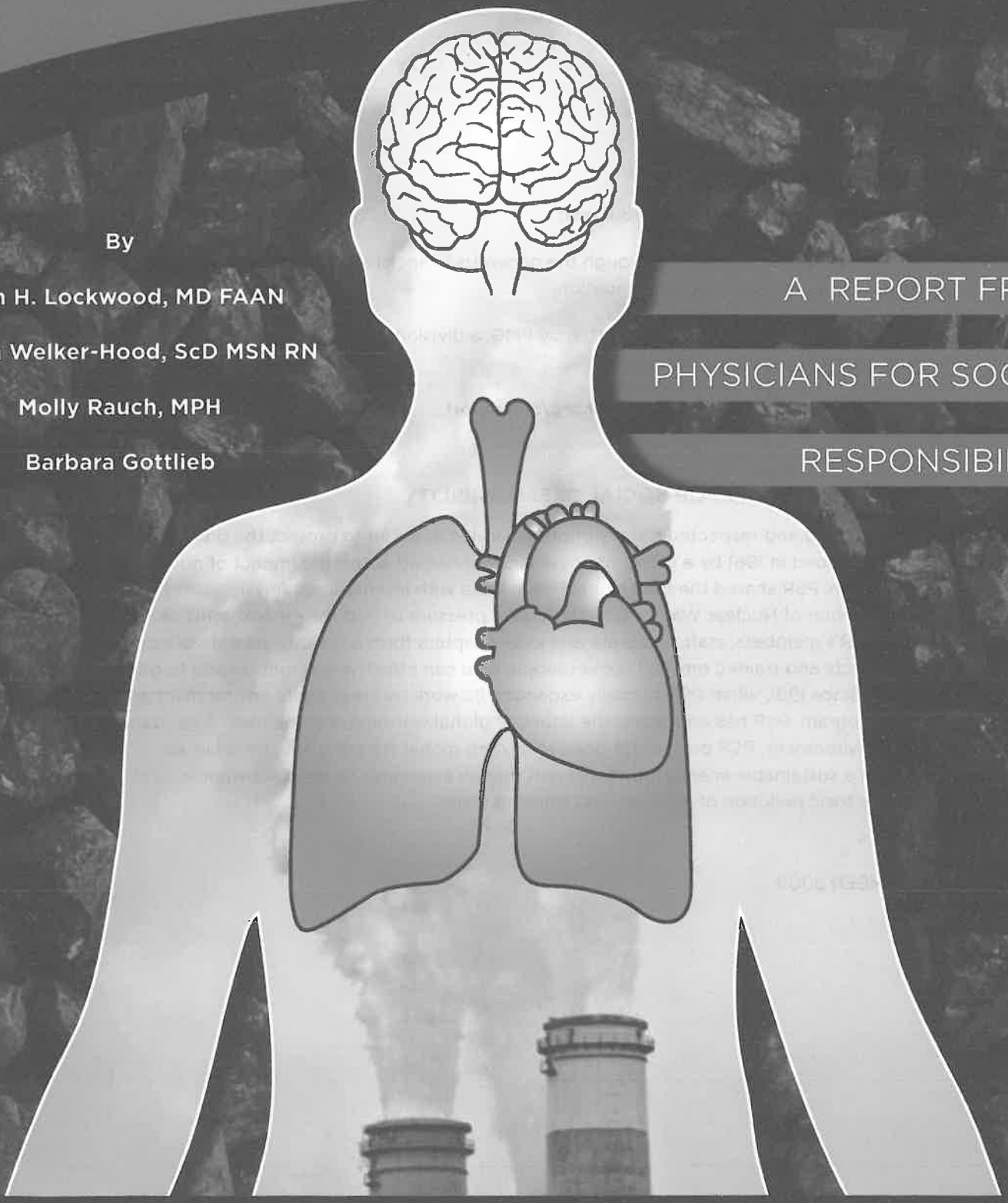
Molly Rauch, MPH

Barbara Gottlieb

A REPORT FROM

PHYSICIANS FOR SOCIAL

RESPONSIBILITY



EXECUTIVE SUMMARY

ACKNOWLEDGMENTS

The authors gratefully acknowledge the following experts who reviewed drafts of this report, sharing their insight and comments:

Paul Epstein, MD MPH
Howard Hu, MD MPH ScD
Philip Landrigan, MD MSc
Michael McCally, MD PhD
Cindy Parker, MD MPH
Jonathan Patz, MD MPH
Katherine Shea, MD MPH

Any remaining errors are entirely our own.

This report was made possible through the generous financial support of the Energy Foundation and the Compton Foundation.

Production was generously underwritten by PMG, a division of The Production Management Group, Ltd.

For the full report, please see **www.psr.org/coalreport**.

ABOUT PHYSICIANS FOR SOCIAL RESPONSIBILITY

PSR has a long and respected history of physician-led activism to protect the public's health. Founded in 1961 by a group of physicians concerned about the impact of nuclear proliferation, PSR shared the 1985 Nobel Peace Prize with International Physicians for the Prevention of Nuclear War for building public pressure to end the nuclear arms race. Today, PSR's members, staff, and state and local chapters form a nationwide network of key contacts and trained medical spokespeople who can effectively target threats to global survival. Since 1991, when PSR formally expanded its work by creating its environment and health program, PSR has addressed the issues of global warming and the toxic degradation of our environment. PSR presses for policies to curb global warming, ensure clean air, generate a sustainable energy future, prevent human exposures to toxic substances, and minimize toxic pollution of air, food, and drinking water.

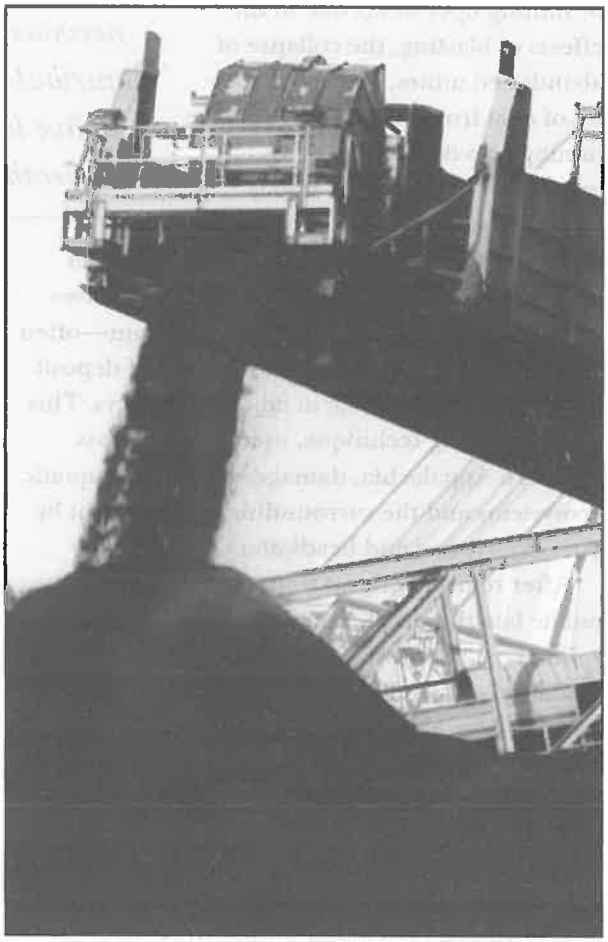
NOVEMBER 2009

Coal's Assault on Human Health

Executive Summary

Coal pollutants affect all major body organ systems and contribute to four of the five leading causes of mortality in the U.S.: heart disease, cancer, stroke, and chronic lower respiratory diseases. This conclusion emerges from our reassessment of the widely recognized health threats from coal. Each step of the coal lifecycle—mining, transportation, washing, combustion, and disposing of post-combustion wastes—impacts human health. Coal combustion in particular contributes to diseases affecting large portions of the U.S. population, including asthma, lung cancer, heart disease, and stroke, compounding the major public health challenges of our time. It interferes with lung development, increases the risk of heart attacks, and compromises intellectual capacity.

Oxidative stress and inflammation are indicated as possible mechanisms in the exacerbation and development of many of the diseases under review. In addition, the report addresses another, less widely recognized health threat from coal: the contribution of coal combustion to global warming, and the current and predicted health effects of global warming.



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THE LIFE CYCLE OF COAL

Electricity provides many health benefits worldwide and is a significant contributor to economic development, a higher standard of living, and an increased life expectancy.[1] But burning coal to generate electricity harms human health and compounds many of the major public health problems facing the industrialized world. Detrimental health effects are associated with every aspect of coal's life cycle, including mining, hauling,

preparation at the power plant, combustion, and the disposal of post-combustion wastes. In addition, the discharge of carbon dioxide into the atmosphere associated with burning coal is a major contributor to global warming and its adverse effects on health worldwide.

Coal mining leads U.S. industries in fatal injuries[2] and is associated with chronic health problems among miners, such as black lung disease, which causes permanent scarring of the lung tissues.[3] In addition to the miners themselves, communities near coal mines may be adversely affected by mining operations due to the effects of blasting, the collapse of abandoned mines, and the dispersal of dust from coal trucks. Surface mining also destroys forests and groundcover, leading to flood-related injury and mortality, as well as soil erosion and the contamination of water supplies. Mountaintop removal mining involves blasting down to the level of the coal seam—often hundreds of feet below the surface—and depositing the resulting rubble in adjoining valleys. This surface mining technique, used widely across southern Appalachia, damages freshwater aquatic ecosystems and the surrounding environment by burying streams and headwaters.[4]

Coal combustion emissions damage the respiratory, cardiovascular, and nervous systems and contribute to four of the top five leading causes of death in the U.S.

After removal of coal from a mine, threats to public health persist. When mines are abandoned, rainwater reacts with exposed rock to cause the oxidation of metal sulfide minerals. This reaction releases iron, aluminum, cadmium, and copper into the surrounding water system[5] and can contaminate drinking water.[6]

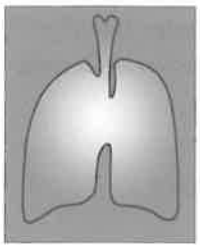
Coal washing, which removes soil and rock impurities before coal is transported to power plants, uses polymer chemicals and large quantities of water and creates a liquid waste called slurry. Slurry ponds can leak or fail, leading to injury and death, and slurry injected underground into old mine shafts can release arsenic, barium, lead, and manganese into nearby wells, contaminating local water supplies. Once coal is mined and washed, it must be transported to power plants. Railroad engines and trucks together release over 600,000 tons of nitrogen oxide and 50,000 tons of particulate matter into the air every year in the process of hauling coal, largely through diesel exhaust.[7] Coal trains and trucks also release coal dust into the air, exposing nearby communities to dust inhalation.[8]

The storage of post-combustion wastes from coal plants also threatens human health. There are 584 coal ash dump sites in the U.S.,[9] and toxic residues have migrated into water supplies and threatened human health at dozens of these sites.[10]

The combustion phase of coal's lifecycle exacts the greatest toll on human health. Coal combustion releases a combination of toxic chemicals into the environment and contributes significantly to global warming. Coal combustion releases sulfur dioxide, particulate matter (PM), nitrogen oxides, mercury, and dozens of other substances known to be hazardous to human health. Coal combustion contributes to smog through the release of oxides of nitrogen, which react with volatile organic compounds in the presence of sunlight to produce ground-level ozone, the primary ingredient in smog.

Table 1 (see pages 8–9) describes the major health effects linked to coal combustion emissions. These health effects damage the respiratory, cardiovascular, and nervous systems and contribute to four of the top five leading causes of death in the U.S.: heart disease, cancer, stroke, and chronic lower respiratory diseases. Although it is difficult to ascertain the proportion of this disease burden that is attributable to coal pollutants, even very modest contributions to these major causes of death are likely to have large effects at the population level, given high incidence rates. Coal combustion is also responsible for more than 30% of total U.S. carbon dioxide pollution, contributing significantly to global warming and its associated health impacts.

RESPIRATORY EFFECTS OF COAL POLLUTION



Pollutants produced by coal combustion act on the respiratory system to cause a variety of adverse health effects. Air pollutants—among them nitrous oxide (NO_2) and very small particles, known as $PM_{2.5}$—adversely affect lung development, reducing forced expiratory volume (FEV) among children.[11] This reduction of FEV, an indication of lung function, often precedes the subsequent development of other pulmonary diseases.

Air pollution triggers attacks of asthma, a respiratory disease affecting more than 9% of all children in the U.S. Children are particularly susceptible to the development of pollution-related asthma attacks. This may be due to their distinct breathing patterns, as well as how much time they spend outside. It may also be due to the immaturity of their enzyme and immune systems, which assist in detoxifying pollutants, combined with incomplete pulmonary development.[12] These factors appear to act in concert to make children highly susceptible to airborne pollutants such as those emitted by coal-fired power plants.[13]

Asthma exacerbations have been linked specifically to exposure to ozone, a gas produced when NO_2 reacts with volatile organic compounds in the presence of sunlight and heat.[14] The risk to children of experiencing ozone-related asthma exacerbations is greatest among those with severe asthma. That risk exists even when ambient ozone levels fall within the limits set by the EPA to protect public health.

Coal pollutants trigger asthma attacks in combination with individual genetic characteristics.[15] This gene-environment interaction means that some individuals are more susceptible to the respiratory health effects of coal pollution. The genetic polymorphisms that appear to make people more susceptible include those that control inflammation and those that deal with oxidative stress, or

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OXIDATIVE STRESS

Oxygen free radicals in biological systems are a normal cellular constituent and play critical roles in the control of many cellular functions. (Free radicals are atoms or molecules that contain at least one unpaired electron in an atomic or molecular orbit and are therefore unstable and highly reactive.)

The concentration of oxygen free radicals can be increased through exposure to environmental substances such as air pollution, tobacco smoke, pesticides, and solvents. When their concentration is excessive, these highly reactive molecules damage lipids, proteins, DNA, cell membranes, and other cellular components. "Oxidative stress" is the term used to describe that physiological state.

Oxidative stress is an important contributing factor in a variety of diseases, including atherosclerosis, hypertension, rheumatoid arthritis, diabetes mellitus, and neurodegenerative disorders such as Alzheimer's disease and Parkinson's disease, as well as normal aging. It is one of several mechanisms implicated in the pathogenesis of diseases caused or made worse by coal pollutants, such as cardiovascular and pulmonary disease.

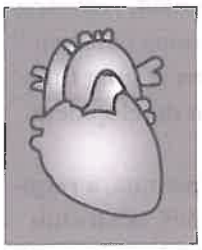
Valko M, Leibfritz D, Moncol J, Cronin MTD, Mazur M, Telser J. Free radicals and antioxidants in normal physiological functions and human disease. Int J Biochem and Cell Biology 2007; 39: 44–84.

the presence of highly reactive molecules, known as free radicals, in cells. (See text box.)

Coal pollutants play a role in the development of chronic obstructive pulmonary disease (COPD), a lung disease characterized by permanent narrowing of airways. Coal pollutants may also cause COPD exacerbations, in part through an immunologic response—i.e., inflammation.[16,17,18] PM exposure disposes the development of inflammation on the cellular level, which in turn can lead to exacerbations of COPD. COPD is the fourth leading cause of mortality in the U.S.

Exposures to ozone and PM are also correlated with the development of[19] and mortality from[20, 21, 22] lung cancer, the leading cancer killer in both men and women.

CARDIOVASCULAR EFFECTS OF COAL POLLUTION



Pollutants produced by coal combustion damage the cardiovascular system. Coronary heart disease (CHD) is a leading cause of death in U.S., and air pollution is known to negatively impact cardiovascular health.[23] The mechanisms by which air pollution causes cardiovascular disease have not been definitively identified but are thought to be the

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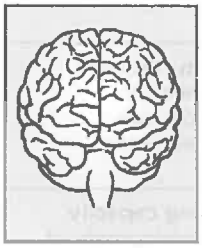
same as those for respiratory disease: pulmonary inflammation and oxidative stress. Studies in both animals and humans support this theory, showing that pollutants produced by coal combustion lead to cardiovascular disease, such as arterial occlusion (artery blockages, leading to heart attacks) and infarct formation (tissue death due to oxygen deprivation, leading to permanent heart damage).

Recent research suggests that nitrogen oxides and $PM_{2.5}$, along with other pollutants, are associated with hospital admissions for potentially fatal cardiac rhythm disturbances.[24] The concentration of $PM_{2.5}$ in ambient air also increases the probability of hospital admission for acute myocardial infarction,[25] as well as admissions for ischemic heart diseases, disturbances of heart rhythm, and congestive heart failure.[26] Additionally, cities with high NO_2 concentrations had death rates four times higher than those with low NO_2 concentrations.[27] These studies show important immediate effects of coal pollutants on indicators of acute cardiovascular illness.

There are cardiovascular effects from long-term exposure as well. Exposure to chronic air pollution over many years increases cardiovascular mortality.[28] This relationship remains significant even while controlling for other risk factors, such as smoking. Conversely, long-term improvements in air pollution reduce mortality rates. Reductions in $PM_{2.5}$ concentration in 51 metropolitan areas were correlated with significant increases in life expectancy,[29] suggesting that air quality improvements mandated by the Clean Air Act have measurably improved the health of the U.S. population. Reducing exposure to the pollutants emitted by coal combustion is therefore an important aspect of improving cardiovascular health for the population at large.

NERVOUS SYSTEM EFFECTS OF COAL POLLUTION



In addition to the respiratory and cardiovascular systems, the nervous system is also a target for coal pollution's health effects. The same mechanisms that are thought to mediate the effect of air pollutants on coronary arteries also apply to the arteries that nourish the brain. These include stimulation of the inflammatory response and oxidative stress,

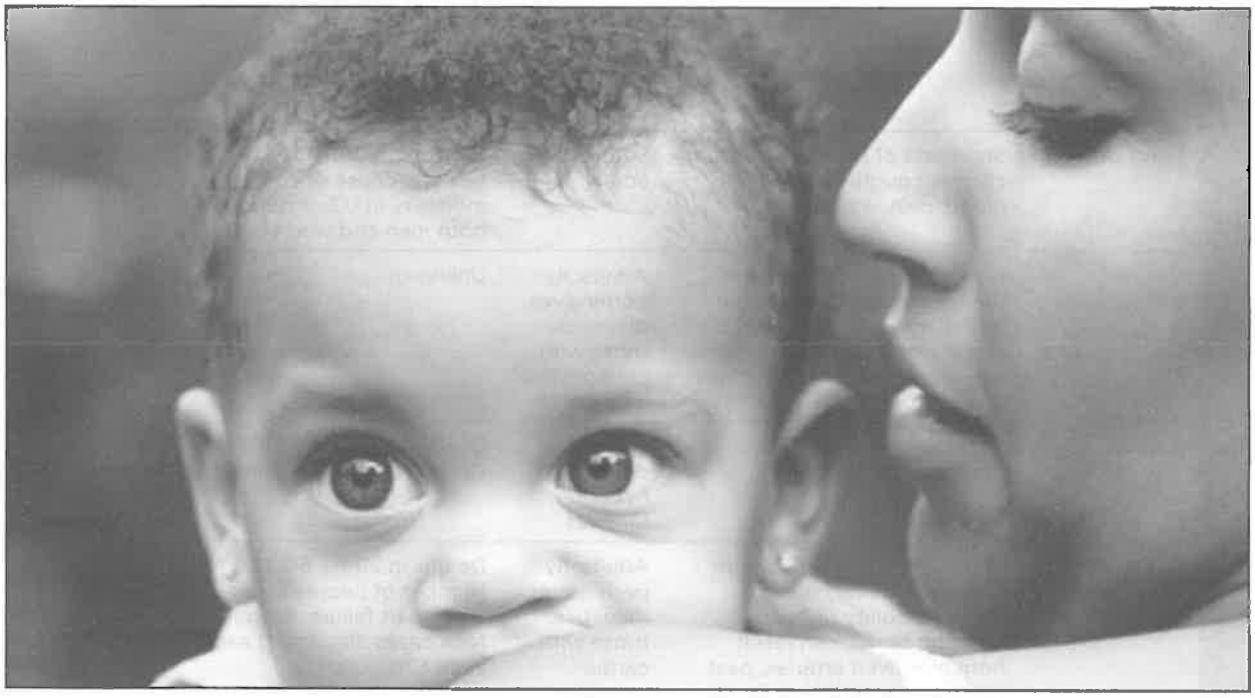


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Table 1: Coal's contributions to major health effects

	Disease or condition	Symptoms or result	Most-vulnerable populations	Total disease burden (coal is a suspected contributing factor in an unknown number of cases)	Coal pollutants implicated
RESPIRATORY	Asthma exacerbations	Coughing, wheezing, shortness of breath, and breathlessness with a range of severity from mild to requiring hospitalization	Children, adults	Number of visits to office-based physicians for asthma: 10.6 million in 2006. Number of hospitalizations with asthma listed first as diagnosis: 440,000.[30] School days missed per year attributable to asthma: 11.8 million.[31]	NO_2 Ozone Particulate Matter (PM)[32,33,34]
	Asthma development	New cases of asthma, resulting in coughing, wheezing, shortness of breath, and breathlessness with a range of severity from mild to requiring hospitalization	Children	Children with asthma: 6.7 million (9.1%). Adults with asthma: 16.2 million (7.3%).[35]	Suspected but not confirmed:[36,37,38] NO_2 Ozone $PM_{2.5}$
	Chronic Obstructive Pulmonary Disease (COPD)	Emphysema with chronic obstructive bronchitis; permanent narrowing of airways; breathlessness; chronic cough	Smokers, adults	Adults with COPD diagnosis in 2006: 12.1 million.[39] Deaths in 2005: 126,000.[40] Fourth leading cause of mortality in U.S.	NO_2 PM[41,42,43]
	Stunted lung development	Reductions in lung capacity; risk factor for development of asthma and other respiratory diseases	Children	Unknown	NO_2 $PM_{2.5}$[44]
	Infant mortality (relevant organ system uncertain; may be respiratory)	Death among infants age < 1 year	Infants	Deaths in 2005: 28,384. Almost 25% may have had respiratory causes: 2,234 deaths attributed to Sudden Infant Death Syndrome (SIDS), and 4,698 deaths attributed to short gestation and low birth weight.[45]	NO_2 PM[46,47]
	Lung cancer	Shortness of breath, wheezing, chronic cough, coughing up blood, pain, weight loss[48]	Smokers, adults	Deaths in 2005: 159,217. Leading cause of cancer mortality in U.S. among both men and women.[49]	PM[50,51,52]
CARDIOVASCULAR	Cardiac arrhythmias	Abnormal rate or rhythm of the heart; palpitation or fluttering; may cause fatigue, dizziness, lightheadedness, fainting, rapid heartbeat, shortness of breath, and chest pain[53]	Adults, hypertensives, diabetics, those with cardiovascular disease	Unknown	NO_2 $PM_{2.5}$[54]
	Acute myocardial infarction	Chest pain or discomfort; heart attack	Adults, diabetics, hypertensives	Deaths in 2006: 141,462.[55] Cases in 2006: 7.9 million.[56]	$PM_{2.5}$[57]
	Congestive heart failure	Shortness of breath, fatigue, edema (swelling) due to impaired ability of heart to pump blood; can result from narrowed arteries, past heart attack, and high blood pressure; can lead to death[58]	Adults, hypertensives, diabetics, those with cardiovascular disease	Deaths in 2006: 60,337.[59] Number of people living with heart failure: 5.7 million. New cases diagnosed each year: 670,000.[60]	$PM_{2.5}$[61]

Table 1: Coal's contributions to major health effects, *continued*

Disease or condition	Symptoms or result	Most-vulnerable populations	Total disease burden (coal is a suspected contributing factor in an unknown number of cases)	Coal pollutants implicated
Ischemic stroke	Artery supplying blood to the brain becomes blocked due to blood clot or narrowing;[62] may cause sudden numbness or weakness, especially on one side of body, confusion, trouble speaking, trouble seeing, trouble walking, dizziness, severe headache;[63] effects can be transitory or persistent	Elderly, hypertensives, diabetics	Deaths in 2005: 143,579. Number of strokes occurring each year: 795,000. NOTE: 87% of all strokes are ischemic; statistics are for all strokes.[64]	NO_2 $PM_{2.5}$ PM_{10} SO_2[65,66,67,68]
Developmental delay	Reduced IQ; mental retardation; clinical impairment on neurodevelopmental scales; permanent loss of intelligence	Fetuses, infants, children	Babies born each year with cord blood concentrations of mercury >5.8 µg/L, the level above which mercury exposure has been shown to reduce IQ: 637,233 (15.7% of all babies born).[69]	Mercury[70]

which in turn can lead to stroke and other cerebral vascular disease.

Several studies have shown a correlation between coal-related air pollutants and stroke. In Medicare patients, ambient levels of $PM_{2.5}$ have been correlated with hospital admission rates for cerebrovascular disease,[71] and PM_{10} has been correlated with hospital admission for ischemic stroke.[72] (Eighty-seven percent of all strokes are ischemic.) $PM_{2.5}$ has also been associated with an increase in the risk of—and death from—a cerebrovascular event among post-menopausal women.[73] Even though a relatively small portion of all strokes appear to be related to the ambient concentration of PM, the fact that nearly 800,000 people in the U.S. have a stroke each year makes even a small increase in risk a health impact of great importance.[74]

Coal pollutants also act on the nervous system to cause loss of intellectual capacity, primarily through mercury. Coal contains trace amounts of mercury that, when burned, enter the environment. Mercury increases in concentration as it travels up the food chain, reaching high levels in large predatory fish. Humans, in turn, are exposed to coal-related mercury primarily through fish consumption. Coal-fired power plants are responsible for approximately one-third of all mercury emissions attributable to human activity.[75]

A nationwide study of blood samples in 1999–2000 showed that 15.7% of women of childbearing age have blood mercury levels that would cause them to give birth to children with mercury levels exceeding the EPA's maximum acceptable dose for mercury.[76] This dose was established to limit the number of children with mercury-related neurological and developmental impairments. Researchers have estimated that between 317,000 and 631,000 children are born in the U.S. each year with blood mercury levels high enough to impair performance on neurodevelopmental tests and cause lifelong loss of intelligence.[77]

GLOBAL WARMING AND COAL POLLUTION

Coal damages the respiratory, cardiovascular, and nervous systems through pollutants acting directly on the body. But coal combustion also has indirect health effects, through its contribution to greenhouse gas emissions. Global warming is already negatively impacting public health and is predicted

to have widespread and severe health consequences in the future. Because coal-fired power plants account for more than one third of CO_2 emissions in the U.S.,[78] coal is a major contributor to the predicted health impacts of global warming.

The effects of global warming already in evidence include increases in global average land and ocean surface temperatures; increases in snow melt and receding glaciers; increases in the mean sea level; and changes in precipitation.[79] These global climate changes are already affecting human health. The World Health Organization estimated global warming to be responsible for 166,000 deaths in 2000, due to additional mortality from malaria, malnutrition, diarrhea, and drowning.[80]

A continued reliance on coal combustion for electricity will contribute to the predicted health consequences of global warming.

In the future, global warming is expected to continue to harm human health. More frequent heat waves are projected to lead to a rise in heat exhaustion and heat stroke, potentially resulting in death, especially among elderly and poor urban dwellers. Declining air and water quality, an increase in infectious diseases, and a shrinking food supply are expected to contribute to disease and malnutrition, increase the migration of affected populations, and increase armed conflict and global instability. Table 2 (see page 14) describes the predicted health effects of global warming.

A continued reliance on coal combustion for electricity production will contribute to the predicted health consequences of global warming.

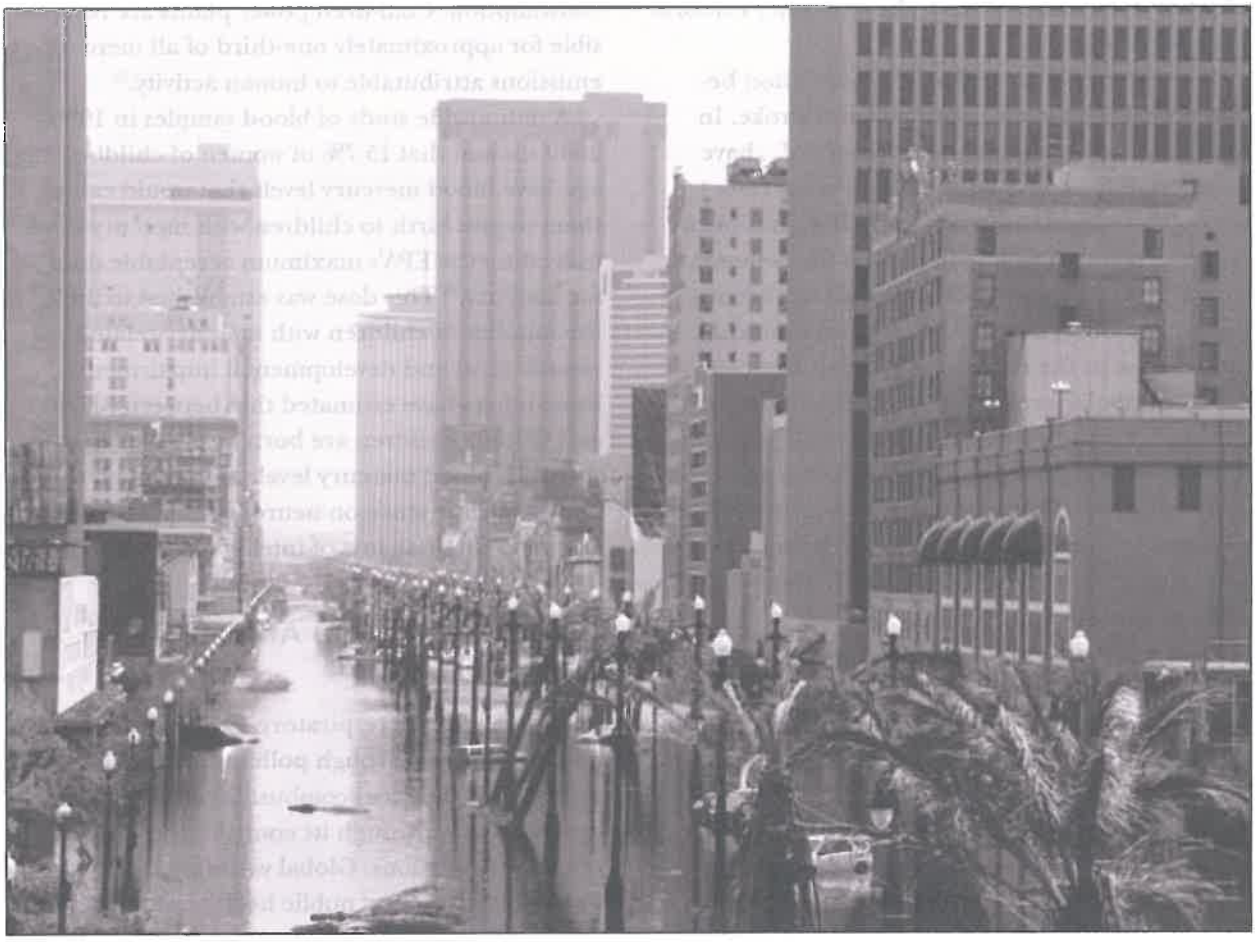

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Table 2: Predicted health effects of global warming

Predicted human health effects	Contributing factors	Global warming mechanism	Most-vulnerable populations
Heat cramps, heat syncope, heat exhaustion, heat stroke	Heat waves	• Greenhouse effect	Children, the elderly, urban dwellers, those with underlying conditions such as cardiovascular disease, obesity, and respiratory disease
Diarrhea spread by water-borne bacteria including E Coli, Shigella, and cholera	Flooding, infrastructure damage	• Increase in extreme weather events and storm surges • Sea level rise	Children most vulnerable to death from diarrheal disease
Drowning	Flooding	• Increase in extreme weather events and storm surges • Sea level rise	Children, the elderly
Exacerbations of asthma, chronic obstructive pulmonary disease, and other respiratory diseases	Worsening air quality, heat waves	• Greenhouse effect • Heat increases production of ground-level ozone • Heat increases electricity demand and resulting particulate emissions from fossil fuel combustion • Airborne allergens (such as pollen) predicted to increase with global warming	Children, the elderly, those with preexisting respiratory disease
Infectious diseases: Malaria, dengue fever, yellow fever, West Nile virus, Lyme disease, and other insect-borne infections, as well as rodent-borne infections	Increased ranges and populations of disease-carrying insects and rodents	• Warming climate expands geographic range of insect and rodent vectors • High temperatures boost reproductive rates, lengthen breeding season, and increase bite frequency of insect vectors • High temperatures boost parasite development	Children, those with impaired immune systems, the developing world
Heart disease, heart attacks, congestive heart failure and other cardiovascular diseases	Worsening air quality	• Heat increases production of ground-level ozone • Heat increases electricity demand and resulting particulate emissions from fossil fuel combustion	Adults and the elderly
Hunger, malnutrition, starvation, famine	Reduced crop yields; crop damage; crop failure; disruptions in forestry, livestock, fisheries	• Changes in the water cycle leading to drought • Heat decreases reproductive lifecycle of some major food crops • Expanded range of some insect pests • Increase in extreme weather events • Changes in ecology of plant pathogens • Loss of agricultural land due to sea level rise	Children, the poor
Mass migration; violence; war	Societal instability; infrastructure damage; reduced crop yields	• All of the above	Children, the elderly, those with other underlying medical conditions
Mental health problems	All of the above	• All of the above	Varied

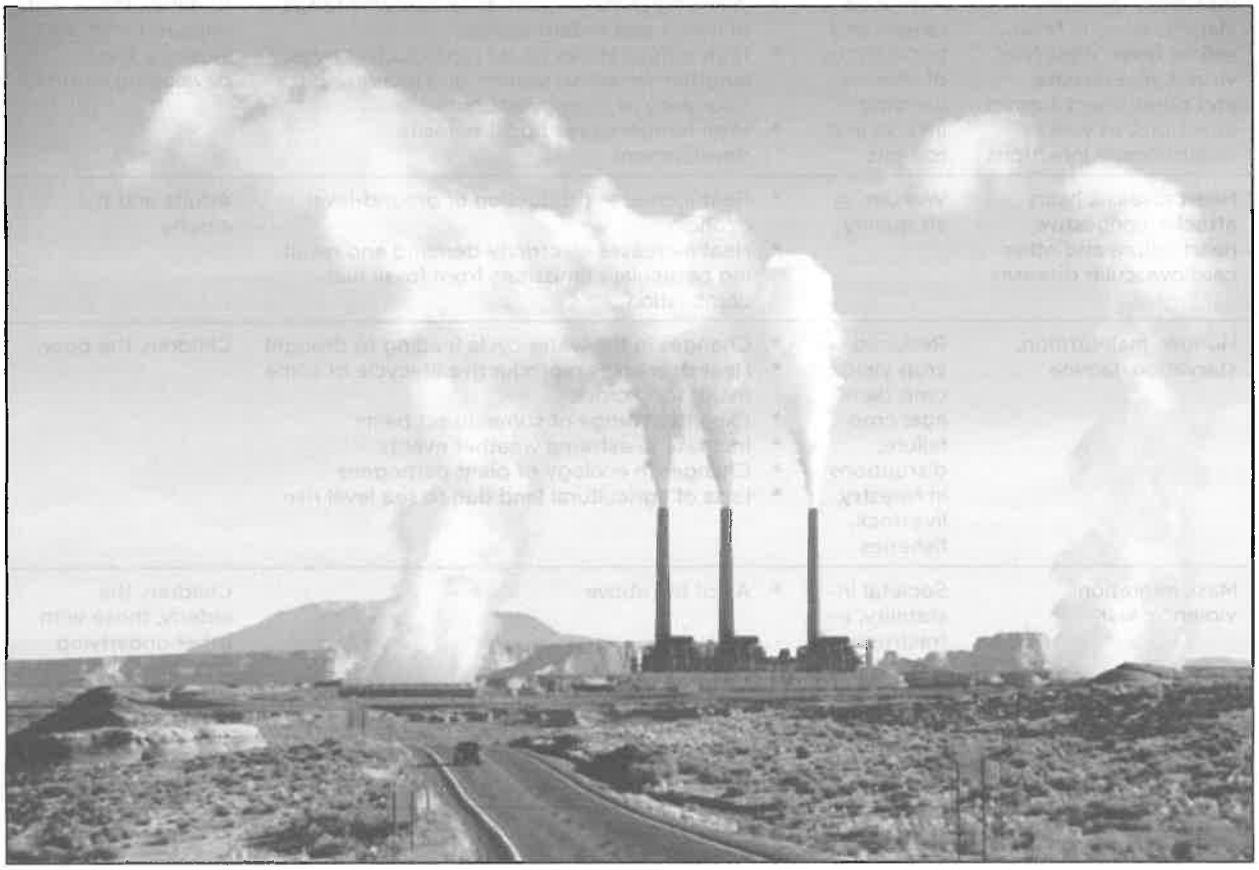
See sources on page 16.

Carbon capture and sequestration (CCS) has been promoted as an effective way to keep CO_2 emissions out of the atmosphere, but substantial research and development are required before it can be used on the scale needed to mitigate global warming. Even then, the danger remains that CCS storage areas, whether underground or under the ocean, could leak, negating the value of CO_2 capture and storage. CCS also incurs other threats to health, including the danger of asphyxiation in the case of a large-scale CO_2 leak and the acidification of ocean waters. Moreover, the application of CCS would require continued coal mining, transportation, combustion, and waste storage, thus prolonging the emission of coal's toxic pollutants that harm human health.

Unless we address coal, the U.S. will be unable to achieve the reductions in carbon emissions necessary to stave off the worst health impacts of global warming.

POLICY RECOMMENDATIONS

The U.S. is at a crossroads for determining its future energy policy. While the U.S. relies heavily on coal for its energy needs, the health consequences of that reliance are multiple and have widespread and damaging impact. Coal combustion contributes to diseases already affecting large portions of the U.S. population, including asthma, heart disease, and stroke, thus compounding the major public health challenges of our time. Coal combustion also releases significant amounts of carbon dioxide into the atmosphere. Unless we address coal, the U.S. will be unable to achieve the reductions in carbon emissions necessary to stave off the worst health impacts of global warming. Based on that assessment, PSR finds it essential to translate our



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concern for human health into recommendations for public policy.

- Emissions of carbon dioxide should be cut as deeply and as swiftly as possible, with the objective of reducing CO_2 levels to 350 parts per million, through two simultaneous strategies:
  - Strong climate and energy legislation that establishes hard caps on global warming pollution coming from coal power plants.
  - The Clean Air Act (CAA). Carbon dioxide and other greenhouse gas emissions from coal plants have been designated pollutants under the CAA. The EPA should be fully empowered to regulate carbon dioxide under the CAA so that coal's contribution to global warming can be brought to an end.

- There should be no new construction of coal-fired power plants, so as to avoid increasing health-endangering emissions of carbon dioxide, as well as criteria pollutants and hazardous air pollutants.

- The U.S. should dramatically reduce fossil fuel power plant emissions of sulfur dioxide and nitrogen oxides so that all localities are in attainment for national ambient air quality standards.

- The EPA should establish a standard, based on Maximum Achievable Control Technology, for mercury and other hazardous air pollutant emissions from electrical generation.

- The nation must develop its capacity to generate electricity from clean, safe, renewable sources so that existing coal-fired power plants may be phased out without eliminating jobs or compromising the nation's ability to meet its energy needs. In place of investment in coal (including subsidies for the extraction and combustion of coal and for capture of carbon and other pollutants), the U.S. should fund energy efficiency, conservation measures, and clean, safe, renewable energy sources such as wind energy, solar, and wave power.

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These steps comprise a medically defensible energy policy: one that takes into account the public health impacts of coal while meeting our need for energy. When our nation establishes a health-driven energy policy, one that replaces our dependence on coal with clean, safe alternatives, we will prevent the deterioration of global public health caused by global warming while reaping the rewards in improvements to respiratory, cardiovascular, and neurological health.

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Native polycyclic aromatic hydrocarbons (PAH) in coals - a hardly recognized source of environmental contamination.

Achten C[1], Hofmann T.

Author information

Abstract

Numerous environmental polycyclic aromatic hydrocarbon (PAH) sources have been reported in literature, however, unburnt hard coal/ bituminous coal is considered only rarely. It can carry native PAH concentrations up to hundreds, in some cases, thousands of mg/kg. The molecular structures of extractable compounds from hard coals consist mostly of 2-6 polyaromatic condensed rings, linked by ether or methylene bridges carrying methyl and phenol side chains. The extractable phase may be released to the aquatic environment, be available to organisms, and thus be an important PAH source. PAH concentrations and patterns in coals depend on the original organic matter type, as well as temperature and pressure conditions during coalification. The environmental impact of native unburnt coal-bound PAH in soils and sediments is not well studied, and an exact source apportionment is hardly possible. In this paper, we review the current state of the art.

By far the most comprehensive scientific study of coal dust in the marine environment is Michael J. Ahrens and Donald J. Morrisey's 2005 literature review of the risks of unburnt coal in the marine environment.

boost the ability of coal pollutants to [redacted] The Washington State [redacted] Department of Natural Resources raises similar concerns about surfactants.

Ahrens and Morrissey point out that coal may pose a less severe chemical hazard in the marine environment than in the terrestrial one. They note that coal has "well documented" physical effects similar to other suspended or deposited sediments. It abrades, smothers, dims light, and clogs both breathing and feeding organs.

One study in Canada found that coal in the water can be a source of acidity, salinity, trace metals, hydrocarbons, chemical oxygen demand, and potentially macronutrients. In fact, Washington's Department of Natural Resources says that materials in coal can react with seawater to produce "localized ocean acidification."

Coal dust deposits sometimes cause spontaneous fires, and in 2005, for example, coal dust that had accumulated in ballast, the layer of crushed rock that supports rail tracks, caused derailments.

BNSF Railway has studied the problem (for liability reasons) and found that as much as a ton of coal, including coal dust, can escape from a single loaded coal car. Other reports show that as much as three percent of a coal car's load, which is typically 100 tons or more, can blow (or bounce) away in transit. The US Department of Transportation classifies coal dust as a "pernicious ballast foulant" that can weaken and destabilize rail tracks. It is not clear how much coal dust might escape in the Pacific Northwest, but one watchdog group has verified that coal and coal dust do escape from open rail cars traveling along Puget Sound coastlines.

Northwest impacts and special PRB problems. This work is very recent:

By contrast, published and peer-reviewed scientific research by Dan Jaffe, a professor of atmospheric science at the University of Washington, casts further doubt on the real-world effectiveness of controlling coal dust from rail transport. In 2013 and 2014, Jaffe installed air monitoring equipment on private property near rail lines in Bellingham, Seattle, and the Columbia River Gorge that enabled him to analyze the emissions from hundreds of trains. He concluded that passing coal trains do in fact spread notable quantities of dust. What's more, a small number of coal trains qualify as "super-dusters," sending prolific volumes of coal dust into the air, clearly visible to the naked eye, as video evidence shows:

Video Player See Sightline Institute for video.

Complicating matters for the Northwest, Powder River Basin (PRB) coal—the type that would be

exported from proposed terminals in the region—is notoriously difficult to handle. One technical analysis finds that "PRB coal is extremely friable and will break down into smaller particles virtually independent of how the coal is transported or handled." According to the study's authors, "PRB coal represents the extremes of handling problems."

The same analysis found that:

Spontaneous combustion of coal is a well-known phenomenon, especially with PRB coal. This high-moisture, highly volatile sub-bituminous coal will not only smolder and catch fire while in storage piles at power plants and coal terminals, but has been known to be delivered to a power plant *with the rail car or barge partially on fire*… [emphasis mine].

Outside of confined environments, PRB coal does not spontaneously explode or burst into full flame, but under the wrong conditions it can self-ignite and burn slowly even while it is riding the rails—a troubling proposition for railroad workers and communities along the tracks throughout the Northwest.

BNSF has said that it's the coal companies that have the responsibility to cover their coal en route on rail. It's expensive to do this. The companies complained to the US Surface Transportation Board, and they sided with the railroads. If you want the link to the decision I can get that for you.

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