Testimony

For

The Kentucky General Assembly

House of Representatives Committee on Health and Welfare

Presented by:

Paul R. Epstein, M.D., M.P.H.
Associate Director
Center for Health and the Global Environment
Harvard Medical School
Landmark Center
401 Park Drive, Second Floor
Boston, MA 02215

Tel. 617-384-8586
Fax. 617-384-8585
Email. paul_epstein@hms.harvard.edu
Website. http://chge.med.harvard.edu

And

Nancy Reinhart, MPH
Staff Researcher
Kentuckians For The Commonwealth

February 25, 2010

Lifecycle Analysis of the Health Impacts of Coal

The public health impact on Kentuckians of both producing and burning coal for electricity is immense. Available information supporting this fact should be considered in any discussions about choices for the state's energy future.

Kentucky has the highest total mortality rate in the U.S., largely due to high cancer and heart disease death rates.[1] Both cancer and heart disease, along with many other diseases and conditions, are linked to the production of coal-based electricity.[2] Evaluating the full impact of coal dependence on public health in Kentucky is especially critical today, when healthier, cleaner energy sources are abundantly available.

A lifecycle analysis is an evaluation of the impacts of a service or product. A complete lifecycle analysis of coal's public health impacts is needed because of the extensive reach of coal in our daily lives. Yet, an enormous body of scientific evidence links exposure to pollutants resulting from the multiple stages in the coal lifecycle to a variety of negative health impacts.

This statement highlights some of the known health impacts in each coal lifecycle step, with a particular geographic focus on Central Appalachia and Kentucky. Each step in the coal lifecycle -- extraction, processing, transportation, burning and waste storage -- generates enormous public health burdens.

While the statistics can be overwhelming, we must remember that behind each number is a story, a family, an individual, a child whose suffering pays the silent costs of our dependence on coal.

Extraction

Occupational health

Occupational health impacts for coal miners include pneumoconiosis (black lung disease), silicosis, injuries, disabilities and death. In the 1990s, over 15,000 former U.S. miners died from coal workers' pneumoconiosis. Approximately 10% of working Eastern Kentucky miners had pneumoconiosis as of 2008 – double the rate of 15 years previous to that.

Mining's impact on public health is not limited to miners. Mining practices adversely impact the health of individuals living in coal-mining communities. Individuals are affected by the degradation of natural systems caused by mining, and by the exposure to pollutants released into the air and water during mining processes.

Surface mining

Valley fill and other surface mining practices associated with mountain top removal (MTR) bury headwater streams and contaminate surface and ground water with carcinogens and heavy metals associated with reports of cancer clusters.[3] Contamination of such extensive amounts of freshwater resources has grave implications for public health throughout the Appalachian region. Once the pollutants enter downstream water supplies, some, such as selenium and manganese, are difficult and in some cases, impossible, to remove with treatment. [4]

Other known effects of surface mining include degraded valleys, species loss, and significant deterioration of the natural systems adjoining destroyed or damaged streams.[5] Furthermore, the

frequency and magnitude of flooding in downstream communities increases as a result of mountaintop mining/valley fill practices.[6]

Homes near mine sites have been damaged or destroyed both from blasting impacts and from flyrock (rock that migrates from mine sites during blasting) in the last decade. When flyrock, often in the form of large boulders, tumbles down from mountaintop areas, residents' lives are threatened as well. Visitors observe a rock-strewn landscape when driving through the area.[7] The collection of downed tress and boulders at the edges of MTR sites present risks for physical and property damage, especially following heavy rain events, which are becoming more common with climate change.[8]

Downstream pollution

Once the air and water are polluted from mining-related activities, people living in down-wind and downstream communities are exposed to these pollutants. Regional studies show that rates of premature death, chronic obstructive pulmonary disease (COPD), hypertension hospitalization, lung cancer, and chronic heart, lung and kidney diseases for both men and women increase as coal production increases, even after adjusting for other factors such as socioeconomic status. Each of these conditions has been scientifically linked to pollutants released during mining processes. [9] Low birth weight and congenital abnormalities are similarly associated with coal production.[10]

As coal mining increases, hospitalization risk for hypertension and chronic obstructive pulmonary disease (COPD) increase, and both these conditions are sensitive to exposure to coal emissions. The chance of COPD hospitalization increases 1% for each 1462 tons of coal, and the odds of being hospitalized with hypertension increases 1% for each 1873 tons of coal.[11]

Central Appalachian coal mining communities experienced decreased "social capital" in comparison with similar non-mining communities. Social capital includes existence of communal trust, reciprocity among community members, civic engagement, cooperation and strong social networks. Low levels of social capital are related to adverse health outcomes.[12]

People living in coal mining communities suffer disparate rates of psychological distress and depression, but the relationship of these conditions to coal mining is as yet unknown.[13] Research in Australia has linked environmental degradation to increasing rates of depression.[14] Given the rapid environmental degradation occurring from surface mining, the negative impact of coal mining on people's sense of community and the constant threat of harm and even death from stray boulders and trees, the recurrent exposure to the jarring sounds and vibrations from blasting and the impacts of valley flooding, it is likely that a proportion of regional mental health problems are linked to coal mining.

Processing

After coal is mined, it is washed in a chemical mixture to reduce impurities for use in combustion. The liquid by-product from this processing is called slurry. Considered by scientists to be an imminent threat to Appalachian water supplies, coal slurry is stored in impoundments typically situated atop previous mined sites. The dams containing these impoundments are often unlined or contained with dried slurry. The volume and composition of stored slurry is virtually

unknown.[15] The number of known waste and slurry ponds along side MTR sites and processing plants numbers 115 in Kentucky.[16]

Of the known chemicals used and generated in processing coal, 19 are known cancer-causing agents, 24 are linked to lung and heart damage, and several remain untested as to their health effects.[17] Workers cleaning the coal are at risk for airborne exposure to these chemicals. Communities downstream from slurry impoundments risk direct surface water-borne exposure from spills, mudslides and flooding. Fifty-three publicized spills occurred between 1972 and 2008 in the Appalachian region, the largest of which was a 309 million gallon spill the occurred in Martin County, KY in 2000.[18]

Transportation

Coal is transported by train and truck, which, like most forms of transportation, release greenhouse gases and other human health pollutants during fuel combustion. Seventy per cent of all U.S. rail traffic is devoted to transporting coal.[19] In 2006, the Kentucky coal haul road system bore 1,719,351,540 (over 1.7 trillion) ton-miles of coal truck activity.[20] Increased concentrations of air toxins and particulate matter levels are found in the air in communities situated along these railway and truck routes, as a result of coal haul activities.

In one community studied, coal truck dust samples tested along the transport route contained levels of air toxins, including arsenic, lead and mercury, and particulate matter above nationally-recommended levels. Arsenic is known to cause cancer and lung disease, while lead and mercury cause birth defects and central nervous system damage leading to neurological impairment. Breathing the particulate matter found in the coal truck dust is linked to heart disease, lung cancer, respiratory ailments, and premature death.[21]

Coal-related traffic increases road hazards as well. In Kentucky between 2000 and 2004, 53 people were killed and 536 injured as a result of accidents with vehicles licensed to transport coal.[22]

Combustion

There are 22 coal-burning power plants in Kentucky and an additional 22 situated within 30 miles of state borders. Coal burning releases particulates, nitrates, sulfates and, in the U.S. alone, approximately 48 tons of the neurotoxin mercury, each year.[23] Every waterway in Kentucky is under advisory for high mercury levels[24], nearly all of which results from burning coal.[25] Exposure to mercury retards brain development and decreases mental performance.

Fine particle pollution from U.S. power plants, principally coal plants, cuts short the lives of nearly 24,000 people each year, including 2,800 from lung cancer. It is responsible for 38,200 non-fatal heart attacks and tens of thousands of emergency room visits, hospitalizations, and decreased productivity and lost workdays.[26] Breathing power plant pollution is linked to lung cancer and heart disease – two of Kentucky's leading causes of death. Increased attacks of asthma, a condition which one in ten Kentuckians suffer from, are associated with breathing pollution from power plants.[27]

The risk of death for people living within 30 miles of coal-burning plants is three-to-four times that of people living at a distance.[28] In Kentucky, 811,993 children live within 30 miles of a coal-fired power plant.

Coal combustion emits over 90% of Kentucky's carbon dioxide, a primary contributor to global climate change.[29] Furthermore, black carbon (soot) emitted by burning is not only injurious to the lungs, but recent research has demonstrated that these emissions are contributing to climate change as well.[30] Public health threats from climate change, which include asthma, heatwaves, severe winter weather, sequences of severe storms, forced migration, food insecurity, increases in disease-carrying vectors, and deaths have been well documented in thousands of scientific articles.[31]

Burning coal is also responsible for significant portions of regional and national nitrous oxide and sulfur dioxide emissions. These emissions contribute to acid rain, which negatively impacts waterways, the living organisms that live in and along the waterways, and soil composition. One-fifth of Appalachian streams have appeared to be acidifying,[32] And the acidification increases the leaching of naturally-occurring heavy metals into the waterways.

Combustion Waste

Coal combustion waste (CCW) contains toxic chemicals and heavy metals such as arsenic and lead — pollutants known to cause cancer, birth defects, reproductive problems, learning disabilities in children, damage to the nervous system and kidneys, and diabetes.[33] CCW impoundment ponds are often poorly constructed, increasing the risk that waste may leach into groundwater supplies or nearby bodies of water.[34] In the conditions present in coal ash ponds, contaminants, particularly arsenic, antimony and selenium, with serious human health impacts may readily leach or migrate,[35]

Up to 1 in 50 residents, including 1 in 100 children, living near one of Kentucky's 44 ash ponds is at risk of developing cancer as a result of waterborne and airborne exposure to the waste. [Are there two fly ash ponds for each plant?] Other health effects linked to living near ash ponds include damage to vital organs and the central nervous system, especially in children. Seven of Kentucky's ash ponds have been characterized as "high hazard," meaning if one of these pond impoundments breached, it would likely cause significant property damage, injuries and/or deaths.[36]

Carbon Capture and Storage[37]

Significant obstacles lie in the way of continued coal use by means of carbon capture and storage (CCS). Even if significant cost and technological barriers were overcome, CCS comes with an energy penalty of 40%. This means that for each kilowatt-hour of electricity produced using CCS, 25 to 40% (depending on the process) more coal must be burned to produce the same amount of power. This energy penalty means that all the upstream measures depicted – extraction, transport and processing – would be increased, along with their consequences for public health and well-being.

There are additional risks of underground carbon storage that include: acidification of saline aquifers, increasing the leaching of heavy metals, such as arsenic and lead, into ground water; leaks and releases from previously drilled (often unmapped) pathways; toxicity, from releases, to

plants, animals and humans; alteration of microbial communities; and enhanced limestone ($CaCO_3$) dissolution and solubility that can lead to fractures and subsequent CO_2 releases.[38]

Many unanswered legal, financial and technical questions surround the issue of deploying CCS technology. The high costs of constructing new plants and retrofitting old plants with CCS capability are an obstacle. Using today's market estimations, which do not include future regulations that will increase coal-based electricity costs, burning coal with carbon capture is so expensive that renewable energy sources would be cost-competitive by comparison. And, CCS does little to address the enormous public health impacts of continued dependence on coal.

Conclusion

The public health impacts of coal, cumulatively considered, significantly degrade our quality of life and impair the ability of natural systems to support human health. Residents living in Central Appalachian coal mining communities are particularly affected, largely due to the radical nature of mining practices that occur in the area. These public health impacts add enormous costs to the system – and these costs have yet to be completely assessed and complied into a single quantitative measure.

For many reasons, including the public health considerations outlined in this statement, our dependence on coal is not sustainable. "Business-as-usual" must be replaced by bold and transformative changes in the operating rules that drive the state of Kentucky's and the world's economy in order to access the abundance of cleaner, healthier energy options that exist. There are numerous healthy solutions, offering job and entrepreneurial opportunities and the prospect of a clean and stable environment.

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