Appalachian Air Quality Fact Sheet

In response to questions asked by community members:

Coal Fired Power Plants

Emissions from coal fired power plants include gases and particulates known to affect air quality and lung function.

Nitrogen Oxides (NOx)

- Nitrogen oxides react with other chemicals in the air in the presence of sunlight to form ground level ozone, or smog. Ozone aggravates asthma and causes lung damage and decreased lung function making people more susceptible to respiratory illness. In an average year, a typical coal plant generates 10,200 tons of nitrogen oxide (NOx).

- Sulfur dioxide – Sulfur dioxide in the air can aggravate respiratory problems such as asthma and can worsen heart disease. Some older power plants built before 1970 are allowed to operate without the pollution control equipment necessary to control emissions of sulfur dioxide. In an average year, a typical coal plant generates 10,000 tons of sulfur dioxide (SO2), which causes acid rain that damages forests, lakes, and buildings, and forms small airborne particles that can penetrate deep into lungs.

- Particulate matter – Particulate matter can cause respiratory problems such as bronchitis and reduced lung function, aggravate asthma and heart disease, and increase the chance of heart attack and stroke. Particulate matter causes thousands of premature deaths every year. In an average year, a typical coal plant generates 500 tons of small airborne particles.

- Carbon Monoxide - In an average year, a typical coal plant generates 720 tons of carbon monoxide (CO), which causes headaches and place additional stress on people with heart disease.

- Hydrocarbons and Volatile Organic Compounds - In an average year, a typical coal plant generates 220 tons of hydrocarbons, volatile organic compounds (VOC), which form ozone with the accompanying health impacts mentioned above.

Indoor Air Pollutions

General

There are many sources of indoor air pollution in any home. These include combustion sources such as oil, gas, kerosene, coal, wood, and tobacco products; building materials and furnishings such as deteriorated, asbestos-containing insulation, wet or damp carpet, and cabinetry or furniture made of certain pressed wood products; products for household cleaning and maintenance, personal care, or hobbies; central heating and cooling systems and humidification devices; and pollutants entering from outdoor sources such as radon, pesticides, and outdoor air pollution, smoking, the use of unvented or malfunctioning stoves, furnaces, or space heaters, the use of solvents in cleaning and hobby activities, the use of paint strippers in redecorating activities, and the use of pesticides Inside the home.

Hydrogen Sulfide

Numerous case-reports identify H_2S at indoor levels of 500 to 1,000 ppm (695 to 1,390 mg/m^3) for even very brief periods as life-threatening potentially causing immediate unconsciousness followed by serious and debilitating neurologic and respiratory distress and death. Levels dangerous to human health may not be detected by odor since high levels of H_2S can paralyze the olfactory nerves making detection impossible. Exposures resulting in temporary unconsciousness (e.g., 15-30 minutes) can cause profound disruption in brain function. Respiratory and ophthalmologic deficits that are persistent with some of these deficits apparently occur even in situations in which the exposed individual remains conscious. Although not clearly established due to complexities of the exposure environment, a few reports exist claiming persistent symptoms (neurobehavioral function, mood state) from intermittent or continuous exposure to "low levels" of H_2S

Manganese inhalation through showering

The potential risk of manganese accumulating in the brain through showering has not been considered by the EPA in setting limits. Elsner and Spangler (researchers at Wake Forest School of Medicine) extrapolated data from rodents to estimate human exposure to manganese during showering. They found that after 10 years of showering in manganese contaminated water, children would be exposed to doses of manganese three times higher than doses that resulted in manganese deposits in the brains of rats. Adults would be exposed to doses 50 percent higher than the rodents.

Concentrations well below 0.05 milligrams might lead to brain injury. Inhaling manganese, rather than eating or drinking it, is far more efficient at delivering manganese to the brain. “The nerve cells involved in smell are a direct pathway for toxins to enter the brain. Once inside these small nerves, manganese can travel throughout the brain.”

Air Quality and Proximity to Coal Activity

There is very limited information on air quality health impacts in Appalachia. *However information below summarized from recent publications by Michael Hendryx and researchers from WVU offers information on public health issues based upon proximity to coal activity (This includes not only the mining of coal, but also its processing, storage and transport).*

Research based upon 16493 telephone surveys indicated that high levels of coal production were associated with worse adjusted health status and with higher rates of cardiopulmonary disease, chronic obstructive pulmonary disease, hypertension, lung disease, and kidney disease.

The results of a follow-up study based upon health information from the CDC found higher mortality rates for cardiopulmonary conditions, increased hospitalization risk for hypertension and chronic obstructive pulmonary disease, and increased rates of self-reported chronic illness and lower health status.

As coal production increased, health status worsened, and rates of cardiopulmonary disease, lung disease, cardiovascular disease, diabetes, and kidney disease increased

Lung cancer mortality for the years 2000-2004 is higher in areas of heavy Appalachian coal mining after adjustments for smoking, poverty, education, age, sex, race/ethnicity, health insurance, physician supply, miner population and other variables. Higher mortality may be the result of exposure to environmental contaminates associated with the coal mining industry, although smoking and poverty are also contributing factors.

However, after adjusting for other contributing factors including poverty and smoking, results indicate that Appalachian coal mining counties are still associated with an excess of 144 deaths from lung cancer over the years 2000-2004. So although lung cancer mortality is higher in Appalachia because of smoking and poverty and low education, living in heavy coal mining areas is an additional risk factor.

Exposure to Appalachian coal mining activity was also significantly related to lung cancer mortality when coal mining was measured separately for surface and underground mines. The suggestion that the results may be stronger for exposure to surface mining operations relative to underground mining suggests the likelihood of greater exposure to airborne particulates from surface mining operations.

Literature supports the hypothesis that the risk for these illnesses increases with exposure to coal byproducts. Toxins and impurities present in coal have been linked to kidney disease and to hypertension and other cardiovascular disease. The effects also may result from the general inflammatory or systemic consequences of inhaled particles. Effects may be due to a combination of many factors such as slurry holdings that leach toxins into drinking water and air pollution effects of coal mining and washing.

Coal contains carcinogenic impurities including zinc, cadmium, nickel, arsenic and many others, and the mining and cleaning of coal at local processing sites creates large quantities of ambient particulate matter and contaminated water. Toxins found in coal are well established carcinogens. The release of particulate matter and toxins from burning coal is a lung cancer risk factor.

igure 1. Age-adjusted lung cancer mortality per 100,000, years 2000-2004.