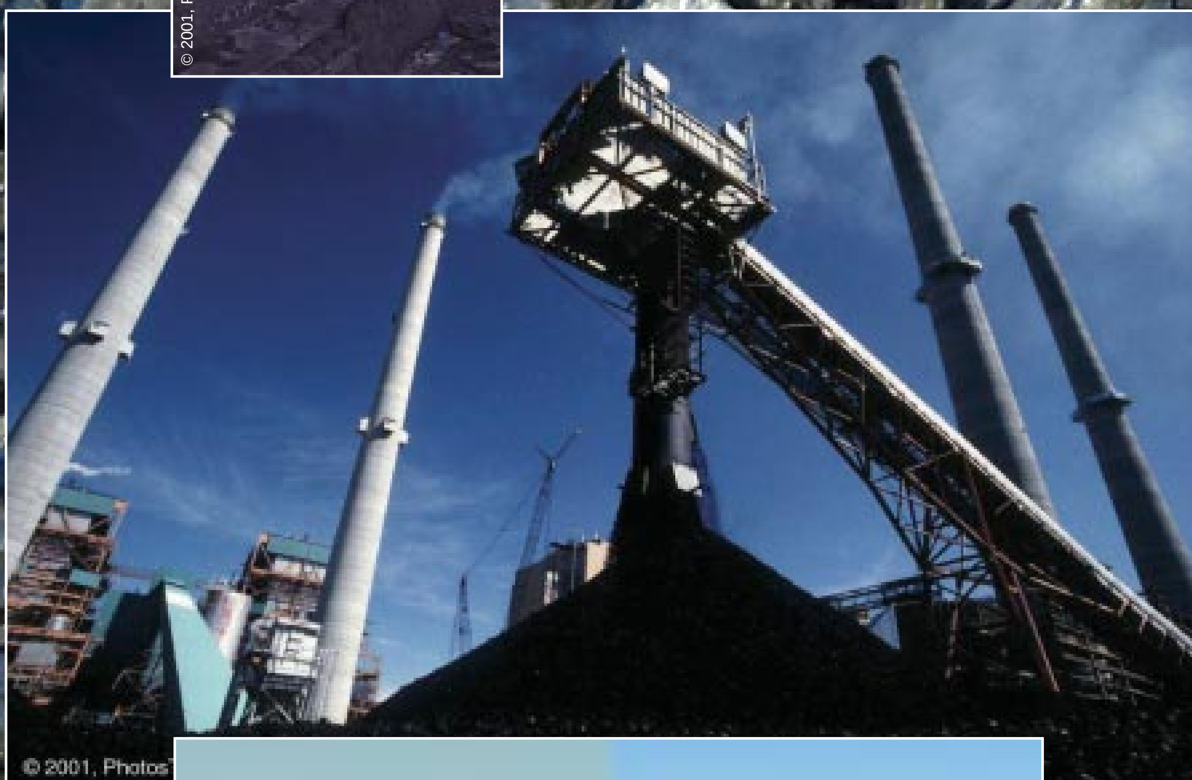
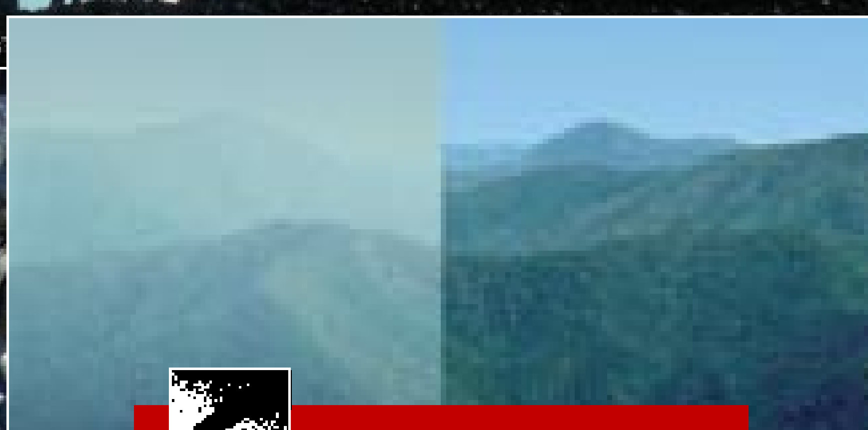
Cradle to Grave: The Environmental Impacts from Coal





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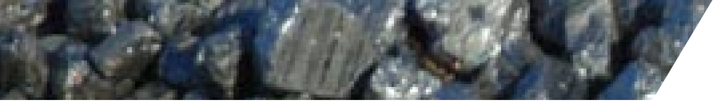

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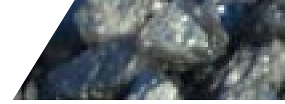


Cradle to Grave: The Environmental Impacts from Coal

The electric power industry is the largest toxic polluter in the country, and coal, which is used to generate over half of the electricity produced in the U.S., is the dirtiest of all fuels.[1] From mining to coal cleaning, from transportation to electricity generation to disposal, coal releases numerous toxic pollutants into our air, our waters and onto our lands.[2] Nationally, the cumulative impact of all of these effects is magnified by the enormous quantities of coal burned each year – nearly 900 million tons. Promoting more coal use without also providing additional environmental safeguards will only increase this toxic abuse of our health and ecosystems.

The trace elements contained in coal (and others formed during combustion) are a large group of diverse pollutants with a number of health and environmental effects.[3] They are a public health concern because at sufficient exposure levels they adversely affect human health. Some are known to cause cancer, others impair reproduction and the normal development of children, and still others damage the nervous and immune systems. Many are also respiratory irritants that can worsen respiratory conditions such as asthma. They are an environmental concern because they damage ecosystems. Power plants also emit large quantities of carbon dioxide (CO_2), the "greenhouse gas" largely responsible for climate change.

The health and environmental effects caused by power plant emissions may vary over time and space, from short-term episodes of coal dust blown from a passing train to the long-term global dispersion of mercury, to climate change. Because of different factors like geology, demographics and climate, impacts will also vary from place to place. For example, effects from coal mining may be the biggest concern in the coal-field regions of the country, while inhalation exposure may be the foremost risk in an urban setting and, in less populated rural America, visibility impairment and haze may be of special concern.

Figure 1 illustrates the numerous ways that contaminants from coal end up in the environment. In the sections below, each of these pathways and the pollutants associated with them is described.

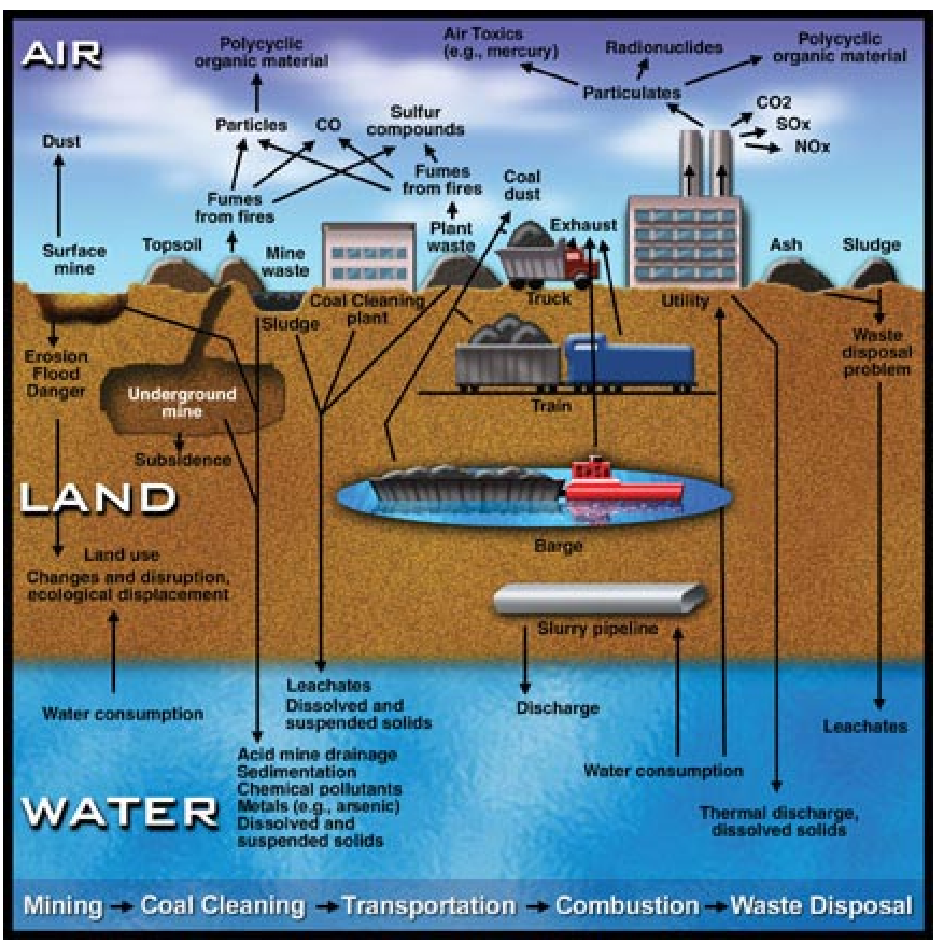
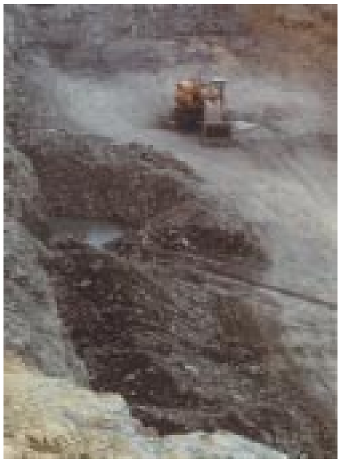


Figure 1 *Impacts and contaminants from coal affect our land, water and air. Illustration: Alan Morin (adapted from OTA, 1979)*

Coal Mining

Coal mining harms land, surface waters, groundwater and even our air.[4] Impacts to the land from mining cause drastic changes in the local area. Damage to plants, animals and humans occurs from the destruction and removal of habitat and environmental contamination. Surface mining completely removes land from its normal uses.

Property and scenic values are degraded as agricultural crops, forests, rangeland and deserts are replaced by pits, quarries and tailing piles. Restoring or reclaiming a surface mine by replacing vegetation and restoring the landscape to its original contours helps minimize any permanent disruption. However, hundreds of thousands of acres of surface mines have not been reclaimed, and reclamation of steep terrain, such as found in Appalachia, is difficult.[5] Finally, despite reclamation efforts, ecosystems may be destroyed and replaced by a totally different habitat.


Coal mining irreparably damages the environment.

Mining impacts both surface waters and groundwater. In underground mining, waste materials are piled at the surface creating runoff that both pollutes and alters the flow of local streams. As rain percolates through these piles, soluble components are dissolved in the runoff and cause the elevation of total dissolved solids (TDS) in local water bodies. The presence of TDS in a stream usually indicates that sulfates, calcium, carbonates and bicarbonates are present. While not a direct threat to human health, these pollutants make water undrinkable by altering its taste and can also degrade water to the point where it can't be used for industry or agriculture.[6]

Acid mine drainage is a particularly severe byproduct of mining especially where coal seams have abundant quantities of pyrite. When pyrite is exposed to water and air, it forms sulfuric acid and iron. The acidity of the runoff is problematic by itself, but it also dissolves metals like manganese, zinc and nickel, which then become part of the runoff.[7] The resulting acidity and presence of metals in the runoff are directly toxic to aquatic life and render the water unfit for use.[8] Some metals bioaccumulate in the aquatic food chain. Additionally, bottom-dwelling organisms can be smothered by iron that settles out of the water.

The dam for a 72-acre lagoon burst, releasing 250 million gallons of coal waste into the Big Sandy River and its tributaries.

Also of concern is the impact mining has on groundwater, including contamination and physical dislocation of aquifers. These are typically localized effects. Acid mine drainage that seeps into groundwater is a common cause of contamination.[9] Physical disruption of aquifers can occur from blasting which can cause the groundwater to seep to a lower level or even connect two aquifers (leading to contamination of both). When a mine is located below the water table, water seeps into the mine and has to be pumped out. This can lower the water table and even dry up nearby wells. The process of mining, followed by reclamation, changes the permeability of overlying soil, alters the rate of groundwater discharge and increases flooding potential.[10]

Underground mines not only impact groundwater hydrology, they are prone to subsidence.[11] Subsidence occurs when the ground above the mine sinks because the roof of the mine either shifts or collapses. Subsidence can alter ground slopes to such an extent that roads, water and gas lines and buildings are damaged. Natural drainage patterns, river flows and aquifers can also be altered. The extent and severity of the subsidence depends on numerous factors including how thick the overlying soil and rock layers are and the mining method. These problems can be addressed by preventive methods such as leaving enough coal in place to provide structural support to the mine roof. Deliberately collapsing the mine after the coal is extracted causes subsidence to occur sooner, but more evenly. For existing mines, one "corrective" measure that has been used is backfilling the mine with either mine wastes or combustion wastes. While this approach may seem to solve both subsidence and waste disposal problems, it is actually expensive and dangerous and releases contaminants to the groundwater.[12] In addition, these wastes often lack the structural strength to support the mine roof.

Mine wastes are generated in huge quantities – on the order of tens of millions of tons per year.[13] These wastes include the solid waste from the mine, called "gob," refuse from coal washing and coal preparation, and the sludge from treating acid mine drainage. There are a number of environmental impacts from this waste generation. First, the land where these wastes are dumped is no longer useable for other purposes. Second, the piles are flammable and susceptible to spontaneous combustion. Third, they are prone to erosion which is a major concern because the runoff and seepage from these piles is highly acidic. As noted above, this acidic runoff contains heavy metals which can end up in local


Acid mine drainage pollutes rivers and wetlands, Indian Creek Watershed, PA. (Photo: Debra Adams, Mountain Watershed Assoc.)

surface waters and seep into groundwater. These wastes also increase sediment build-up in local waters.

Mine wastes have also been used to construct dams around disposal lagoons for liquefied coal wastes. But mine wastes are poorly suited for this purpose because they aren't strong enough. In 1971, the collapse of such a dam in Buffalo Creek, WV, caused flooding that claimed 125 lives and resulted in millions of dollars in property damage.[14] A similar accident in October 2000 occurred in Martin County, Kentucky. The dam for a 72-acre lagoon burst, releasing 250 million gallons of coal waste into the Big Sandy River and its tributaries. More than 75 miles of the river were choked with lava-like sludge that killed all fish and river life. The spill affected 4,500 people in 1,500 residences. Cleanup is expected to cost millions of dollars.[15]

Coal Preparation

At the preparation plant (which is commonly located at or near the mine), impurities that are removed from the coal by screening and washing are placed in waste piles. As with the mining waste, rain percolates through these piles dissolving soluble components and elevating TDS in local water bodies. This runoff is also acidic and contains heavy metals.

Transportation

Trucks, rail, coal slurry pipelines and barges transport coal. All of these either directly or indirectly affect air and water quality.[16] In addition to the ambient air and public health impacts from blowing coal dust, there is also the air pollution from the vehicles themselves. Constant heavy truck traffic damages roads, and clearing transportation of rights of way can increase sediment loading of streams and alter the local landscape. Maintaining rights of way by using herbicides can contaminate surface and ground waters. Waterways for barges require at least a 200-foot wide passage that may produce flooding over a much wider distance and require extensive areas for disposal of spoil from dredged areas. Slurry pipelines may also disturb large areas during construction.

Worker Exposure

National dependence on coal as a fuel source also involves worker exposure to high-risk conditions at various stages during mining, processing and burning of coal. Although increased mechanization and oversight of the mining industry has increased worker safety over the last century, workers – whether unionized or not – often work long hours under strenuous conditions.

Some of the potential safety and human health hazards include: inhalation of dust containing crystalline silica during highwall drilling and mining which can lead to black lung disease; exposure to mercury through inhalation of vapors or mercury-containing dust; inhalation of toxic fumes and gases and exposure to ultraviolet and infrared radiation at welding operations; noise-induced hearing loss as a result of prolonged exposure to processing and mining equipment; as well as heat stroke and exhaustion.[17]

Coal Mining Laws Must be Enforced

We know that adverse impacts from coal mining are occurring today and past practices have ruined some areas beyond any use. There are laws governing mining practices. The land impacts of coal production and use are regulated primarily under the federal Surface Mining Control and Reclamation Act (SMCRA). Other laws cover the land impacts of transportation, transmission and waste disposal.

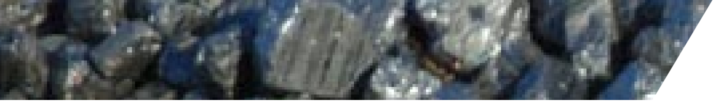
> *...federal funding of inspection programs and staff have suffered significant cutbacks, providing little assurance that SMCRA can be properly enforced.*

The primary purposes of SMCRA are to ensure that surface coal mining operations are conducted in a manner that protects the environment and communities where coal is being mined; to ensure that adequate procedures are undertaken to reclaim surface areas as quickly as possible, and to strike a balance between protection of the environment and agricultural productivity and America's need for coal as an essential energy source.[18] To achieve these purposes, SMCRA mandates a state permit system, in accordance with federal guidelines, that includes comprehensive performance standards for surface mining operations and for the control of surface effects of underground mining.

There are also numerous provisions within SMCRA providing enforcement mechanisms at the state and federal levels. As with any law, the provisions of SMCRA are meaningful only if they are enforced and funded. In recent years, federal funding of inspection programs and staff have suffered significant cutbacks, providing little assurance that SMCRA can be properly enforced.

Coal Combustion and Air Pollution

Air emissions from power plants are subject to requirements of the Clean Air Act (CAA). Coal contains many trace elements that are released during combustion[19] and end up in the atmosphere, in local surface waters and in combustion waste residues. Some of the trace elements in coal are metals, including nickel, mercury, arsenic, chromium and cadmium. Other contaminants are sulfur, nitrogen, chlorine and fluorine. Because of the enormous amounts of coal burned each year – nearly 900 million

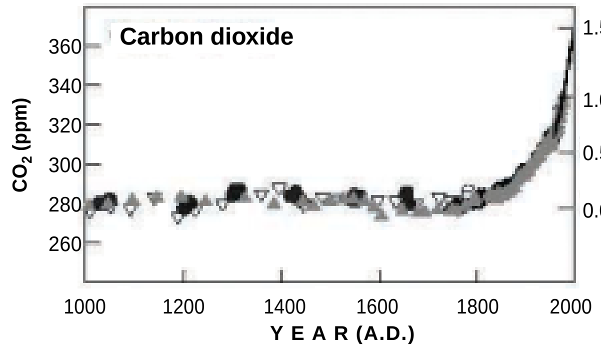


tons – all of these pollutants are released in significant quantities.

Under the CAA, National Ambient Air Quality Standards (NAAQS) have been set for six so-called "criteria" pollutants: nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM), lead, carbon monoxide and ozone. In 1990, the CAA was amended to require additional cuts in SO_2 emissions. However, despite steps underway to reduce emissions, a loophole in the CAA exempts many of the nation's old coal-fired power plants from modern pollution standards for NO_x and SO_2. These "grandfathered" plants emit up to 10 times more pollution than modern coal plants. As a result, millions of tons of these pollutants are released to the atmosphere each year.[20]

An increased reliance on coal will mean increased releases of toxic chemicals to the environment.

In addition to the loophole for grandfathered power plants, until recently a different provision in the CAA exempted all power plants from any emission limits for hazardous air pollutants (like mercury, other metals and acid gases). The EPA decided in December 2000 to develop standards by 2004 for hazardous air pollutants. However, as discussed below, after being collected by pollution control devices to prevent emissions to the air, these pollutants are merely shifted to another waste stream as either liquid or solid wastes. In the absence of air standards and standards addressing other waste streams, an increased reliance on coal will mean increased releases of toxic chemicals to the environment.



Graph showing exponential increase in carbon dioxide in the atmosphere since the industrial revolution. Coal-fired power plants are responsible for almost 1/3 of the CO2 released in the U.S. annually (source: IPCC) [21]

Coal-fired power plants are among our largest sources of CO_2 emissions, which have been linked to climate change. Atmospheric CO_2 admits incoming sunlight, but traps the heat radiating from Earth's surface (the way heat is trapped in a greenhouse, hence the "greenhouse effect").[22] The greenhouse effect is predicted to result in higher temperatures that may affect the global distribution of rainfall and subsequent land use (including agriculture) as well as ecological effects on forests, lowering of lake levels and waterways from increased evaporation rates and rising ocean levels due to melting ice caps.[23] An increased reliance on conventional coal

TABLE 1

Selected Pollutants Emitted from Coal-Fired Power Plants

Pollutant	**1990 Emissions** (tons)[a,b]	**1998 Emissions** (tons)[b]	**Projected 2010 Emissions** (tons)[a,c]
Sulfur Dioxide	15,220,000	12,426,000	8,600,000
Nitrogen Oxides	5,642,000	5,395,000	3,900,000
Particulate Matter (PM_{10})	265,000	273,000	–
Arsenic	61	–	71
Beryllium	7.1	–	8.2
Cadmium	3.3	–	3.8
Chromium	73	–	78
Hydrogen Chloride	143,000	–	155,000
Hydrogen Fluoride	19,500	–	27,500
Lead	75	–	87
Manganese	164	–	219
Mercury	46	–	60

a U.S. EPA, 1998. Study of hazardous air pollutant emissions from electric utility steam generating units – final report to Congress. February. 453/R-98-004a.

b U.S. EPA, National Air Quality and Trends Report, 1998. www.epa.gov/oar

c MSB Energy Associates

technology in electricity production will ensure that CO_2 emissions continue to increase.[24]

Continual loading of pollution to the environment is of special concern for contaminants that are either metals and/or persist in the environment because of their chemical structure (e.g., mercury and dioxin). These pollutants either never go away or do not degrade for an extremely long time. Over a long period of time, a large fraction of these contaminants may become buried in sediments; however, even small residual amounts of these contaminants are a concern. For instance, a persistent bioaccumulative toxin like mercury accumulates and concentrates in the food chain, which leads to human and wildlife exposure to methylmercury.

Table 1 shows emission estimates for the major criteria and hazardous pollutants emitted from coal-fired power plants.

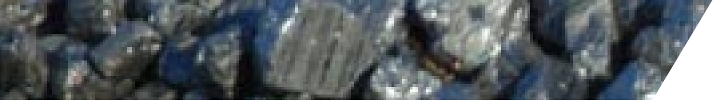
TABLE 2

Health Effects of Selected Power Plant Pollutants[a,b]

	Human Toxicity		
Substance	**Acute**	**Chronic**	**Comments**
Sulfur dioxide	Lung irritant, triggers asthma, low birth weight in infants.	Reduces lung function, associated with premature death.	Also contributes to acid rain and poor visibility.
Nitrogen oxides	Changes lung function, increases respiratory illness in children.	Increases susceptibility to respiratory illnesses and causes permanent alteration of lung.	Forms ozone smog and acid rain. Ozone is associated with asthma, reduced lung function, adverse birth outcomes and allergen sensitization.
Particulate Matter	Asthma attacks, heart rate variability, heart attacks.	Cardiovascular disease, pneumonia, chronic obstructive pulmonary disease, premature death.	Fine particle pollution from power plants is estimated to cut short the lives of 30,000 Americans each year.
Hydrogen chloride	Inhalation causes coughing, hoarseness, chest pain, and inflammation of respiratory tract.	Chronic occupational exposure is associated with gastritis, chronic bronchitis, dermatritis, photo sensitization in workers.	
Hydrogen Fluoride	Inhalation causes severe respiratory damage, severe irritation and pulmonary edema.		Very high exposures through drinking water or air can cause skeletal fluorosis.
Arsenic	Ingestion and inhalation: affects the gastrointestinal system and central nervous system.	Known human carcinogen with high potency. Inhalation causes lung cancer; ingestion causes lung, skin, bladder and liver cancer. The kidney is affected following chronic inhalation and oral exposure.	
Cadmium	Inhalation exposure causes bronchial and pulmonary irritation. A single acute exposure to high levels of cadmium can result in long-lasting impairment of lung function.	Probable human carcinogen of medium potency. The kidney is the major target organ in humans following chronic inhalation and oral exposure.	Other effects noted from chronic inhalation exposure are bronchiolitis and emphysema.
Chromium	High exposure to chromium VI may result in renal toxicity, gastrointestinal hemorrhage and internal hemorrhage.	Known human carcinogen of high potency.	Chronic effects from industrial exposures are inflammation of the respiratory tract, effects on the kidneys, liver, and gastrointestinal tract.
Mercury	Inhalation exposure to elemental mercury results in central nervous system effects and effects on gastrointestinal tract and respiratory system.	Methyl mercury ingestion causes developmental effects. Infants born to women who ingested methylmercury may perform poorly on neurobehavioral tests.	The major effect from chronic exposure to inorganic mercury is kidney damage.

a Agency for Toxic Substances and Disease Registry Online. ToxFAQs. Division of Toxicology, Atlanta, Georgia.

b U.S. EPA, 2000. Integrated risk information system (IRIS). Online. Office of Health and Environmental Assessment, Cincinnati, Ohio.



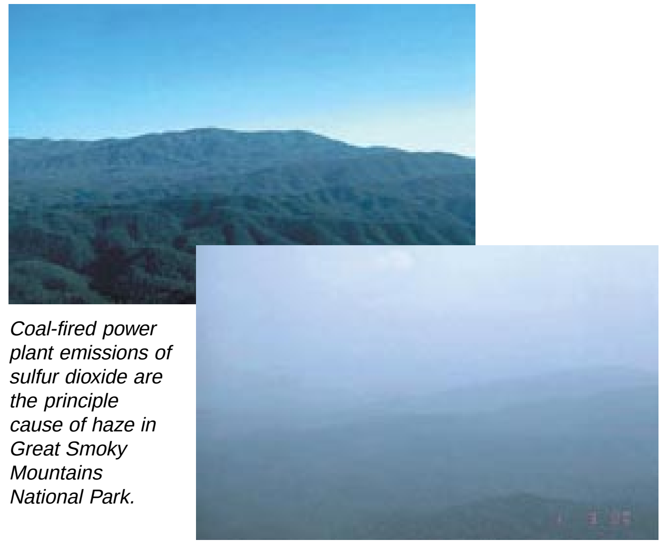
Exposure to air pollutants from power plants may occur from direct inhalation or indirect exposure i.e., subsequent ingestion of water, soil, vegetation, or meat, eggs, dairy products, and fish that became contaminated through accumulation in the food chain.[25] Absorption through the skin (dermal absorption) of power plant pollutants may also occur from direct contact with contaminated soil and water. Children generally younger than age 6 may also be exposed to pollutants by ingesting contaminated soil. Pollutants for which indirect exposure is especially important include mercury, arsenic, dioxins, cadmium and lead. Mercury contamination of fish (and subsequent consumption by humans) is the cause of fish consumption advisories in 40 states for inland waters and advisories for some saltwater species in 10 states.[26] In spite of regulations for criteria pollutants, 141 million Americans live in counties where the federal ozone standard was exceeded in 1999.[27]

Mercury contamination of fish is the cause of fish consumption advisories in 40 states.

Direct inhalation of the various components of power plant air pollution can cause asthma attacks, respiratory infections, or changes in lung function. For example, when inhaled, SO_2 irritates the lungs, triggering bronchial reactions and reducing lung function. The most measurable effects occur in children and in people with an already-compromised lung function.[28] Other pollutants are absorbed and distributed in the body and may produce systemic effects or effects distant from the entry point of the lungs. As a result, organs other than the lungs (e.g. the central nervous system, brain, heart, blood, liver and kidneys) can be affected by air pollutants. Systemic toxicants may cause both cancer and non-cancer effects. Table 2 presents specific health effects information for representative power plant pollutants.

Particulate matter formed from sulfur emissions exacerbates asthma in children and results in school absences and hospitalizations.

Subpopulations that may be more sensitive to air pollution include infants and children, elderly people, pregnant women and nursing mothers, and people with chronic diseases, such as asthma. Children are not only more sensitive because they are at critical stages of physical and mental development, but they receive a relatively higher pollutant dose compared to adults because they have a lower body weight and higher breathing rate. People who tend to eat locally grown produce and locally caught fish may also receive higher than average exposure to deposited pollutants if they live close to a facility. In addition, some pollutants are transported in the atmosphere and deposit far from the source. For instance, sulfur dioxide is transformed in the atmosphere to sulfuric acid and sulfates, which deposit up to 1000 miles from the source. Mercury can travel even further. As a result, many locations considered "pristine" are receiving pollutants from the atmosphere.



Coal-fired power plant emissions of sulfur dioxide are the principle cause of haze in Great Smoky Mountains National Park.

Health risks from exposure to air pollution depend on how much of the pollutant a person is exposed to and over what period of time, the exposure pathway, whether the person is especially sensitive to the pollutant and how toxic the pollutant is. Both short-term and long-term (including lifetime) exposure is important in assessing the potential risks. Studies that have attempted to quantify the potential health risks of toxic emissions are limited due to their failure to account for multiple and cumulative exposure to many pollutants at the same time.[29] This has resulted in assessments that generally underestimate the total health risks from exposure to power plant emissions.

We can state with confidence that current coal-fired power plant emissions:

- consist of a variety of toxic metals, organic compounds, acid gases, sulfur, nitrogen, carbon dioxide and particulate matter.
- account for two-thirds of the nation's SO_2 emissions, one-third of national NO_x emissions and one-third of national mercury emissions. Across the nation, 141 million people live in counties where the federal standard for ozone was exceeded in 1999.[30] Coal-fired power plants also account for a significant fraction of the national emissions of a number of other metals like beryllium and nickel. They are the largest industrial source of hydrochloric acid and hydrogen fluoride.[31]
- form fine particles from reactions of NO_x and SO_2 emissions in the atmosphere. Fine particles have recently been implicated in some of the more serious health

impacts from power plant pollution. A recent study found that fine particle pollution from US power plants causes more than 603,000 asthma attacks a year and is cutting short the lives of over 30,000 people each year.[32]

- contribute to ground-level ozone due to emissions of NO_x. Ozone decreases lung function and increases hospitalizations for respiratory problems. Ozone also reduces growth and yields of many economically important agricultural crops.[33] By interfering with a plant's ability to produce and store food, ozone makes sensitive vegetation (trees, crops, native plants) more susceptible to the impacts of disease, insect attack and other pollutants.
- contribute to acid rain due to emissions of sulfur and nitrogen. Acid rain continues to acidify sensitive lakes and streams in eastern North America to such an extent that some are unable to support trout and other fish species.[34] Forests are also impacted via direct damage to foliage and where forest soils have been stripped of nutrients by acid rain.
- contribute to nitrogen deposition that causes overfertilization and eutrophication of coastal and estuarine waters. These conditions lead to a loss of natural habitat and declines in the abundance of commercially and ecologically valuable plants, animals, and fish.
- contribute to mercury contamination of fresh and saltwater fisheries.[35] A recent study of mercury blood levels in women of childbearing age found that 10 percent have blood mercury levels at or above what EPA considers safe.[36]
- are responsible for most of the sulfate particles that cause haze and reduce visibility. The impact of power plant emissions on visibility in parks and wilderness areas has been estimated at $4.3 billion a year.[37]
- account for 37 percent of the CO_2 released from fossil fuel combustion in 1998. Climate change over the past century may be related to the increasing number of extreme weather events that are linked to heat waves, flooding and severe storms. Warmer temperatures also mean enhanced ozone formation, which can trigger cardiovascular and respiratory symptoms in susceptible populations.
- emit more than 60 different hazardous air pollutants. At sufficient exposure levels these pollutants can cause a number of health effects. Some are carcinogens; others can impair reproduction and the normal development of children; while still others damage the nervous and immune systems. Many are also respiratory irritants that can worsen respiratory conditions such as asthma.[38]
- contribute to the environmental loading of numerous persistent, bioaccumulative toxics such as mercury, dioxins, arsenic, radionuclides, cadmium and lead.[39]

Coal Combustion Waste

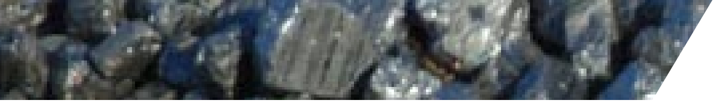
Coal combustion waste (CCW) is largely made up of ash and other unburned materials that are left when fossil fuels, like coal and oil, are burned. These wastes are captured by the pollution control devices. Other combustion wastes are generated by other processes necessary to operate power plants, including cleaning the steam boilers. Most of these other wastes are liquid and are mixed with the solid ash wastes for disposal. In addition, air pollution control devices installed to reduce SO_2 emissions create large volumes of solid waste.

Over 100 million tons of waste materials are generated during coal and oil combustion each year. About 76 million tons are disposed of while the rest is sold for manufacturing uses such as cement, wallboard and fill.[40] As stack emission controls become more effective, and the air becomes cleaner, the amounts and toxicity of these solid wastes are expected to increase.

Coal and oil power plant combustion wastes are typically disposed of in either landfills (for dry wastes) or surface impoundments (for liquid wastes).[41] Disposal of solid combustion wastes is supposedly regulated under the Resource Recovery and Conservation Act (RCRA) while the Clean Water Act (CWA) governs liquid effluent discharges to navigable waters. Unfortunately, the reality is that EPA has exempted these wastes from hazardous waste disposal requirements and instead has stated its intention to develop state guidelines (which cannot be directly enforced by EPA).[42] It is clear from current disposal practices, however, that state rules are inadequate to control or mitigate the public health and environmental risks of CCW disposal.

Coal combustion waste fill site near homes.

Most CCW landfills and impoundments are unlined and are located at the same site as the power plant. Ideally these disposal units would prevent the wastes from entering the environment. Unfortunately, the level of protection afforded by these disposal methods varies greatly. Most wastes are disposed of in older surface impoundments that almost never have liners to prevent liquids from leaking (or leaching), underground leachate collection systems, or groundwater monitors. In some states, liquids from impoundments are not only allowed to



percolate to the groundwater, the disposal units are actually designed to allow this.

An industry survey of disposal units revealed that about 40 percent of the coal waste landfills and 80 percent of the coal waste surface impoundments do not have liners, and less than half the landfills and only one percent of impoundments have leachate collection systems.[43] In addition, there are also direct discharges to surface waters either by permitted discharges or overflow drainage from impoundments. These discharges are regulated by the CWA. Under the CWA, limitations have been established for discharges of Total Suspended Particulate (TSP), oil and grease, pH, copper, iron, free chlorine and temperature. Rarely, however, do state regulations limit the discharge of other, more toxic, contaminants known to be in coal and oil combustion waste.

An industry survey of disposal units revealed that about 40 percent of the coal waste landfills and 80 percent of the coal waste surface impoundments do not have liners.

Power plant CCW contains concentrated levels of numerous contaminants, particularly metals like arsenic, mercury, lead, chromium and cadmium, and radioactive elements found naturally in coal.[44] If these contaminants enter the environment, either through dust, leaching into groundwater or from discharges into surface waters, they can contaminate drinking water supplies and accumulate in livestock and crops. As a result, people living in the vicinity of the power plant can be exposed to the pollutants in these wastes by ingesting groundwater into which the contaminants (especially metals) have leached, eating the exposed livestock or crops, inhaling contaminants contained in windblown dust or from coming into contact with, or ingesting soils onto which these wastes have been applied.[45,46] For children who come into contact with dirt during play, soil ingestion is a particularly important route of exposure. People and wildlife are also exposed to selenium and mercury by eating contaminated fish from local waters affected by power plant wastes and air emissions. There are numerous examples of mercury fish consumption advisories in lakes and rivers in proximity to power plants. In Texas and North Carolina, selenium fish consumption advisories in certain reservoirs have been directly linked to power plant combustion waste disposal.[47]

In addition to posing threats to public health, power plant CCW disposal has been documented as causing severe and potentially irreversible ecological damage.[48] The pollutants enter nearby surface water in water discharges from surface impoundments or overflow drainage systems and runoff from coal piles. Research has documented serious impacts on species of amphibians, waterfowl and fish. Some of the contaminants found in power plant wastes accumulate in animal tissues to levels hundreds of times higher than levels found in the environment.

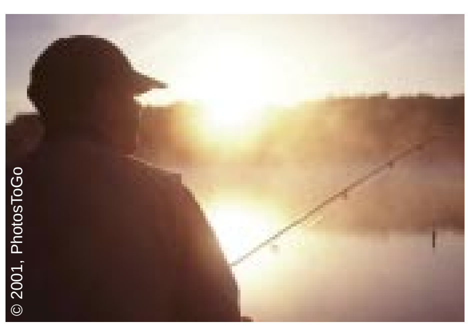
EPA assessed the human health impacts from toxic metals (many of which are known or suspected to cause cancer in humans) in CCW that leach from unlined landfills and surface impoundments and contaminate downgradient drinking water wells.[49] EPA found that if adults and children drink, over a period of years, an average amount of water contaminated with combustion waste, they have a higher risk of cancer. According to EPA, the average health risks to the public due to metals (including arsenic, nickel, chromium and selenium) from power plant waste disposal units could be up to 10,000 times higher than EPA's allowable risk levels for cancer and other illnesses.[50] Some of the metals in CCW (like mercury) also impair the development of fetuses and children.

Local Communities are at Risk

Children living in the vicinity of power plants have the highest health risks. Adults are also at risk from contaminated groundwater and from inhaling dust from the facility. The poverty rate of people living within one mile of power plant waste facilities is twice as high as the national average and the percentage of non-white populations within one mile is 30 percent higher than the national average.[51]

Consequently, there may be other factors that make these people more vulnerable to health risks from these facilities. These include age (both young and old), nutritional status and access to health care. Also, these people are exposed to numerous other air pollutants emitted from the power plant smokestacks and possibly to air pollution from other nearby industrial facilities or lead paint in the home. Similar high poverty rates are found in 118 of the 120 coal-producing counties in America where power plant combustion wastes are increasingly being disposed of in unlined, under-regulated coal mine pits often directly into groundwater.

Mineworkers and their families also often reside in the communities where the coal is being mined. Some of the additional health risks and dangers to residents of coal mining communities include injuries and fatalities related to the collapse of highwalls, roads and homes adjacent to or above coal seams being mined; the blasting of flyrock offsite onto a homeowner's land or public roadway; injury and/or suffocation at abandoned mine sites; and the inhalation of airborne fine dust particles off-site.



In summary, there is nothing

clean about coal. Everything related to mining, combustion, waste disposal, and each activity in between, adversely affects public health and the environment. Coal-fired power plants cause a host of environmental harms; promoting increased reliance on coal without additional environmental safegaurds is certain to increase those harms. The time is now for coal-fired plants to clean up their act.

Endnotes

1 National Environmental Trust, 2000. Toxics Power: what the toxics release inventory tells us about power plant pollution. August. www.cleartheair.org

2 Office of Technology Assessment, 1979.The Direct Use of Coal: Prospects and Problems of Production and Combustion. April.

3 U.S. EPA, 1998a. Study of hazardous air pollutant emissions from electric utility steam generating units – final report to Congress. February. 453/R-98-004a.

4 Op. cit. Office of Technology Assessment,1979.

5 Ibid.

6 Ibid.

7 Electric Power Research Institute, 1999. Guidance for the Comanagement of Mill Rejects at Coal-Fired Power Plants. Final report. June.

8 Koryak, Michael. 1999. Origins and Ecosystem Degradation Impacts of Acid Mine Drainage, U.S. Army Corps of Engineers. http://www.lrp-wc.usace.army.mil/misc/AMD_Impacts.html

9 Op. cit. Office of Technology Assessment, 1979.

10 Ibid.

11 Ibid.

12 Ibid.

13 Ibid.

14 Michalek, S.J. et al. Accidental releases of slurry and water from coal impoundment through abandoned underground coal mines. Mine Safety and Health Administration, Pittsburgh Safety and Health Technology Center. Undated.

15 Fitzgerald, T., 2000. A Preliminary Analysis of the Martin County coal waste spill. National Citizens' Coal Law Project, Kentucky Resources Council Inc.

16 Op. cit. Office of Technology Assessment, 1979.

17 This brief list is by no means all-inconclusive with regard to worker exposure or safety hazards. For additional information, please refer to the Mine Safety and Health Administration's (MSHA) at: www.msha.gov

18 Op. cit. Office of Technology Assessment, 1979.

19 Advanced coal power plants that gasify (rather than combust) coal are beginning to enter the power market. These plants show potential to have dramatically lower air pollution emissions than even fully controlled conventional power plants that combust coal. These plants also produce substantially lower volumes of solid waste than do new, conventional coal plants.

20 U.S. EPA, 2000. National Air Quality and Emission Trends Report, 1998. March. www.epa.gov/oar.

21 IPCC (2001) Climate Change 2001: Summary for policymakers: the scientific basis. A Report of Working Group I of the Intergovernmental Panel on Climate Change, Shanghai, China, 2001. http://www.usgcrp.gov/ipcc/wg1spm

22 Op. cit. Office of Technology Assessment, 1979.

23 IPCC (2001) Climate Change 2001: Summary for Policymakers: Impacts , adaptation and vulnerability. A Report of Working Group II of the Intergovernmental Panel on Climate Change, Geneva Switzerland, 2001. http://www.usgcrp.gov/ipcc/wg2spm.pdf

24 Advanced coal gasification plants that are beginning to enter the market could potentially be developed or retrofitted with commercially available technology to sequester CO_2 produced by these plants. Thus these plants potentially are more compatible with addressing climate change than conventional plants that combust coal.

25 Op. cit. U.S. EPA, 1998a.

26 http://www.epa.gov/ost/fish

27 American Lung Association, 2001. State of the Air, 2001. May. www.lungusa.org.

28 American Lung Association, 11 Health Effects of Outdoor Air Pollution.

29 Op. cit. U.S. EPA, 1998a.

30 Op. cit. American Lung Association, 2001.

31 Op. cit. National Environmental Trust, 2000.

32 Clean Air Task Force, 2000a. Death, Disease and Dirty Power – Mortality and health damage due to air pollution from power plants. October. www.cleartheair.org

33 U.S. EPA NOx SIP Call Fact Sheet. September 24, 1998

34 Driscoll, C.T., et al., 2001. Acidic deposition in the northeast U.S.: sources and inputs, ecosystem effects and management strategies. Bioscience. March, Vol. 51 No. 3.

35 Op. cit. U.S. EPA, 1998a.

36 U.S. Centers for Disease Control and Prevention. Blood and hair mercury levels in young children and women of childbearing age - United States, 1999. Morbidity and Mortality Weekly, March 2, 2001.

37 Clean Air Task Force, 2000b.Out of Sight: Haze in our National Parks. September. www.cleartheair.org

38 Op. cit. U.S. EPA, 1998a.

39 Ibid.

40 American Coal Ash Association, 1998. 1990 Coal combustion product production and use. Alexandria, VA.

41 U.S. EPA, 1999a. Report to Congress, Wastes from the combustion of fossil fuels. Volume 2 – methods, findings and recommendations. EPA 530-R-99-010. March.

42 Federal Register, Volume 65, number 99, page 32213. Regulatory determination on wastes from the combustion of fossil fuels. Final rule. May 22, 2000.

43 Op. cit. U.S. EPA, 1999a.

44 U.S. EPA, 1999b. Technical background document for the report to Congress on remaining wastes from fossil fuel combustion: waste characterization. March 15, 1999.

45 U.S. EPA, 1998c. Technical background document for the report to Congress on remaining wastes from fossil fuel combustion: groundwater pathway human health risk assessment. June 1998.

46 Research Triangle Institute, 1998. Draft final report. Non-groundwater pathways, human health and ecological risk analysis for fossil fuel combustion phase 2 (FFFC2). Prepared for U.S. EPA, Office of Solid Waste, Washington, D.C. June 5, 1998.

47 Skorupa, J.P., 1998. Selenium poisoning of fish and wildlife in nature; lessons from twelve real-world examples. From: Environmental Chemistry of Selenium. Marcel Dekker, Inc. New York.

48 Hopkins, W.A., C.L. Rowe, J.H. Roe, D.E. Scott, M.T. Mendonta and J.D. Congdon. 1999. Ecotoxicological impact of coal combustion byproducts on amphibians and reptiles. Savannah River Ecology Laboratory, presented at the Society for Environmental Toxicology and Chemistry, 20th Annual Meeting, Philadelphia, PA. November 14-18. Abstract # PMP009.

49 Op. cit. U.S. EPA, 1998c.

50 Ibid.

51 Derived from 1990 census data. http://www.census.gov

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