The mining and burning of coal: effects on health and the environment

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MJA 2011; 195: 333–335
doi: 10.5694/mja11.10169

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Summary

- Australia's coal conundrum is that all political parties say they are concerned about climate change while sanctioning an unprecedented expansion of coalmining and coal seam gas extraction in Australia.
- Australia's coal contributes to climate change and its global health impacts.
- Each phase of coal's lifecycle (mining, disposal of contaminated water and tailings, transportation, washing, combustion, and disposing of postcombustion wastes) produces pollutants that affect human health.
- Communities in which coalmining or burning occurs have been shown to suffer significant health impacts.
- The health and climate costs of coal are unseen, and when costs to health systems are included, coal is an expensive fuel.

Coalmining and health

Concerns about the expansion of coalmining are growing and, as a result, medical practitioners and other health experts are being asked about coal and its effects on health. While there has been no Australian overview of the health effects of coalmining on inhabitants of coalmining areas, evidence from the United States indicates that coalmining communities in West Virginia had an increased risk for developing cardiopulmonary disease, chronic obstructive pulmonary disease (COPD), hypertension, other lung diseases and kidney disease.[1] Mortality rates for these diseases were higher in coalmining areas compared with non-mining areas of the region.[2] Potentially confounding risk factors, such as smoking rates, were not reported. Coal-processing chemicals, fumes from diesel powered equipment, explosives, toxic impurities in coal and dust from uncovered coal trucks could all have affected the health of respondents.

Deaths and injuries

Mining is a dangerous occupation. Coalminers die and suffer more lost time from injuries than all other miners,[3] most often from fires and structural instability of underground mines. Hazards arise from collapse of parts of a mine, explosions and gaseous asphyxiation, as well as machinery malfunction and misuse. The risks to coalminers from suffocation or explosion from release of methane and other toxic gases were demonstrated at the Pike Hill coalmine near Greymouth in New Zealand on 19 November 2010 when 29 miners died. Despite some evidence that fatalities and injuries are decreasing in Australia with tighter legislation, there are still significant health and safety concerns.[4]

Pneumoconiosis, dust and contamination

However careful the operator, miners' lungs can be damaged by coal dust. According to the National Institute for Occupational Safety and Health, pneumoconiosis was responsible for about 10 000 deaths in the US in the 10 years to November 2009.[5] In Australia, the incidence of coal workers' pneumoconiosis has fallen with diligent monitoring of dust levels and better occupational health measures.[6] Dust exposure in 33 longwall coalmines in New South Wales exceeded the Australian National Standard of 3 mg/m^3 in 6.9% of measurements, and the risk of pneumoconiosis and lung fibrosis was estimated to be about 2% after a 40-year working life.[7]

Road trauma

Coal is transported from mine to railhead, or mine to port, by road, increasing the risk of accidents and traffic fatalities and releasing greenhouse gases. Data on coal-related road trauma for Australia are unavailable; however, in Kentucky, between 2000 and 2004, 53 people were killed and 536 injured as a result of accidents with vehicles licensed to transport coal.[8]

Environmental damage, water and health

Coalmining poses a significant threat to the integrity of aquifers, which may be hydrologically connected to other groundwater-dependent ecosystems including farm dams, bores and rivers. Water from coalmines must be disposed of and waste material is often held within the surface lease of a mine, introducing a risk of contamination of human food sources. Pollution of the environment can also occur through windblown dust during transportation, where coal is washed and at export ports. In 2010, coal seam gas operations in Queensland were held up at two sites because groundwater had become contaminated with a potentially dangerous combination of benzene, toluene, ethylbenzene and xylene (BTEX).[9] Similar contamination occurred after an underground coal gasification trial near Kingaroy.[10] The Queensland government has recently banned BTEX chemicals from coal-bed fracturing fluids.

Social and mental health impacts

Coalmining can change the lifestyle and character of a community. Higginbotham and colleagues detailed the social and political consequences that result.[11] Medical practitioners in coalmining areas have reported that increases in asthma, stress and mental ill health have become more common.[12] As more coalmines are opened, as has occurred in parts of the Hunter Valley in New South Wales, the social fabric of a region changes, the role and function of a township alters, and many inhabitants of these regions have developed depression, anxiety and ill health.[13]

Coal combustion: coal-fired power generation

Once coal is mined, it is burned, usually to generate electricity or to make steel. Burning coal emits many pollutants that harm human health and increase the major public health problems facing the industrialised world. An

Australian review of air pollution by Kjellstrom and colleagues, while not specifically focusing on the effects of coal combustion, summarises the effects of particle exposure on health.[14] These include respiratory symptoms such as cough, aggravated asthma, the development of chronic bronchitis and decreased lung function; arrhythmias, non-fatal heart attacks and premature death in people with heart or lung disease; the effects of absorption of toxic material; and allergic or hypersensitivity effects. The smallest particles, particulate matter (PM) 2.5, are the most damaging.[15]

Many PM 2.5 particles are produced during coal-fired power generation. Specific data in Australia are lacking; however, in the US, the Physicians for Social Responsibility examined the evidence for health damage caused by coal.[5] The risk of premature death for people living within 30 miles of coal-burning power plants has been quoted to be three to four times that of people living at a distance.[8] Fifty thousand deaths each year have been attributed to air pollution,[5] and in Canada, it is estimated to cause more than 5000 deaths each year.[16,17] In the US, air pollution from combustion of coal, diesel fuel and wood was estimated to account for 5% of male and 3% of female cancer deaths between 1970 and 1994.[18]

Other toxic elements released with coal combustion include arsenic, mercury, fluorine, cadmium, lead, selenium and zinc. Mercury is of greatest concern. Over a third of all mercury emissions attributable to human activity come from coal-fired power stations.[5] It enters the environment and accumulates in the food chain, particularly in fish. In 1999–2000, 15.7% of American women of childbearing age had blood mercury levels that could have affected the brain development of an unborn child.[5,19]

Australian data

The limited evidence on the impacts of air pollution from burning coal in Australia suggests that the health impacts are similar to those reported from other developed countries.[20] A 1993 study reported an increase in symptoms of childhood wheeze and asthma-like breathing difficulties from a community near a coal-fired power station.[21]

Climate change, health and the environment

The World Health Organization states that climate change is the greatest emerging threat to public health and to the environment. Coal-fired power stations are potent emitters of greenhouse gases and are important contributors to climate change. Climate change will profoundly affect some of the most fundamental prerequisites for good health: clean air and water, sufficient food, adequate shelter and freedom from disease.[22]

These health impacts are beginning to be felt in Australia. The elderly, the very young and those with existing heart and respiratory disease are vulnerable to the increase in heat waves due to climate change. Drought has affected farming communities who have suffered from stress, social disruption and depression. More extreme weather events can be expected with threats to food and water security; rising sea levels; changes in vector-, food- and water-borne diseases; exacerbation of air pollution; increases in aeroallergens and impacts on mental health. An increase in the number of climate refugees is likely.[23]

Costs of burning coal in Australia

The most recent and comprehensive study on the negative effects of power generation was released by the Australian Academy of Technological Sciences and Engineering (ATSE) in March 2009.[24] ATSE calculated the greenhouse impacts and health damage costs of different power generation technologies including coal, gas, wind, solar photovoltaic, solar thermal, geothermal, carbon capture and storage, and nuclear energy. The health costs of burning coal are equivalent to a national health burden of around $A2.6 billion per annum. Coal-fired power stations also produce more greenhouse gases (such as CO_2) per unit of energy than any other type of power station. Combining greenhouse and health damage costs for Australia gives representative total external costs of $A52/MWh for brown coal, $A42/MWh for black coal and $A19/MWh for natural gas.[24] By the ATSE analysis, carried out before the costs of the 2011 Fukushima nuclear meltdown could begin to be calculated (ATSE specifically excluded nuclear disaster costs), the external costs of nuclear power would have been around $A7/MWh. The external costs of genuinely renewable sources of power generation, such as wind and solar power, are even less. If the external costs of burning coal were recovered by a coal tax, coal would be the most expensive of all energy-generating fuels.

Epstein and colleagues recently reported an analysis of the health and environmental costs of coal in the US and concluded that the damage caused by coal should double or triple the costs of coal-generated electricity.[25]

Discussion

Electricity contributes to economic growth and a higher standard of living. It produces opportunities for better health and gains in longevity, but in Australia, coal produces 84% of the nation's power, and its combustion is responsible for a significant proportion of the country's greenhouse emissions. Australia is the world's largest exporter of coal. Although it may well produce economic benefit, it will also have injurious effects on the health of the populations of recipient countries, and contribute to global greenhouse gas emissions. Under our present accounting system, these external negative factors are excluded; coal-generated power is falsely represented as the cheapest source of electrical power.

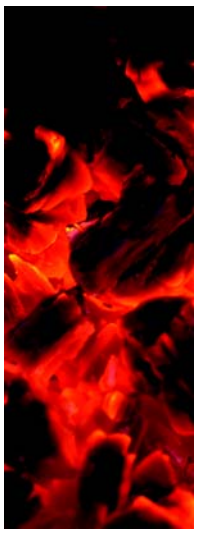
Although burning coal no longer causes London's smogs or cancer of the scrotum in young chimney sweeps, and acid rain from uncontrolled sulfur dioxide emissions has abated (proof that an emissions trading scheme can work), there is overwhelming evidence that coalmining and the burning of coal is harmful to physical and environmental health, and can have a significant impact on local communities. Regrettably, peer-reviewed environmental health studies from Australian coal towns are sparse.

When a new mine is proposed for a particular area, Australian mining Acts (designed for protection and cer-

tainty in the mining industry) do not protect communities who can suffer years of frozen assets, apprehension and future risks to health when a new mine is proposed in their locality. State environmental protection authorities (EPAs) are the statutory independent bodies charged with assessing the environmental safety of proposed mines.

Australia's international obligations under the agreement reached at the United Nations Conference on Environment and Development (UNCED June 1992) give EPAs permission to use the precautionary principle — that an action should not be taken if the consequences are uncertain and likely to be dangerous to the public or the environment — in their assessments. This is rarely, if ever, invoked in the case of approving new coalmines. Health impact statements for proposed mines are not requested by state governments, so the EPAs have, unwittingly, become responsible for the protection of significant aspects of public health. The time has come for EPAs to take the precautionary principle into account during their deliberations on new coalmining applications.

To persist in mining and burning coal will condemn future generations to catastrophic climate change, which is clearly the biggest health problem of the future. Australia is a rich and technologically sophisticated country with the second-highest human development index in the world.[26] It should have the ability to gradually phase out the use of coal and to expand the generation of electricity from renewable energy sources. Such a change will have the greatest benefit for Australian and global health and for protection of the environment. Recently, the Australian government has announced it will introduce a carbon tax to mesh seamlessly into an emissions trading scheme. This initiative to put a price on carbon is an important public health measure.



Competing interests: David Shearman is Honorary Secretary of Doctors for the Environment Australia (DEA). Philip Finch, George Crisp and William Castleden are members of DEA.

Provenance: Not commissioned; externally peer reviewed.

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