

Air Quality and Human Health

Environmental Effects of Woody Biomass

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Background

Air pollution is the introduction of chemicals, particulate matter, or biological materials into the atmosphere. The two primary sources of air pollution are from natural (e.g., smoke from wildfires, volcanic activity, radon gas) and human sources which are generally related to the burning of different kinds of fuel. To release their stored energy, fossil fuels such as coal must be burned. It is during this combustion process that a variety of emissions and particulates, including sulfur oxide (SO_x), nitrous oxide (NO_x), volatile organic compounds, carbon monoxide (CO), carbon dioxide (CO₂), mercury, other toxic compounds, and particulate matter are released into the atmosphere. NO_x and some volatile organic compounds react to produce ground-level ozone. Particulate matter and ground-level ozone make smog, which can occur locally during a weather inversion or travel long distances with the prevailing winds.

Air pollution from burning coal can affect the environment and human health in many ways with both short-term and long-term effects. The air pollution particles can persist in the atmosphere for several weeks and be moved for many miles with air currents. Environmental effects include acid deposition, loss of atmospheric ozone which absorbs harmful UV-B radiation from the sun, damage to plants, and climate change. Because air pollution particles are small, they can reach deep within the lungs and enter the blood stream. Over a lifetime of continued exposure, a person's ability to transfer oxygen and rid pollutants is impeded. Health effects range from minor irritation of eyes and the upper respiratory system to chronic respiratory disease, heart disease, lung cancer, and death. Some individuals are much more sensitive to pollutants than are others. Young children and elderly people often suffer more from the effects of air pollution. People with health problems such as asthma, heart and lung disease may also suffer more when the air is polluted. The American Lung Association has identified particulate matter and ground-level ozone as contributors to respiratory illness (American Lung Association 2009). Once released into the atmosphere, mercury settles in lakes and rivers, where it moves up the food chain to humans who eat contaminated fish. The Centers for Disease Control reported that six percent of American women have mercury in their blood at levels that would put a fetus at risk of neurological damage (Jones et al. 2004).

Benefits

Conventional wood-fired power plants typically produce some of the same emissions as coal-fired power plants including CO₂ and CO. However, environmentally, biomass has some advantages over fossil fuels such as coal. Biomass use in electricity generation is not likely to pollute the atmosphere as much with SO_x, and NO_x. Biomass contains little mercury, sulfur and nitrogen, so it does not produce the pollutants that cause acid rain. It also has a much lower ash content (1-2 wt. %) than coal (5%) (Kumar and Gupta 1993). Wood-fired plants produce 90% less ash than coal-fired plants.

Growing plants for use as biomass fuels helps keep global warming in check because plants remove CO₂ from the atmosphere as they grow. The plant stores the carbon in the plant until it is released back to the

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atmosphere through decomposition or combustion. While the combustion of woody biomass returns CO₂ to the atmosphere, this carbon is part of the current carbon cycle. That is, the carbon which is released was absorbed during the growth of the plant, therefore carbon emission and absorption is balanced.

Concerns

Wood-fired power plants emit higher levels of particulate matter than is emitted when coal is burned.

Mitigation strategies

Particulate matter is the easiest emission to control and can be managed by using pollution-control devices such as scrubbers, filters, and catalytic converters. The type of wood fuel, power plant, and emissions control technology used determines both the emissions produced and the overall impacts on air quality. Using woody biomass or co-firing (using wood in combination with coal or other fuels) has less of an impact on air quality than using coal alone.

References

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