Diesel, Small Particle Emissions

& Public Health

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BACKGROUND

Outdoor air quality is an increasing global concern as industrial and transportation emissions increase worldwide, and without borders. The World Health Organization (WHO 1) has declared that Particulate Matter (PM) in ambient outdoor air affects more people than any other pollutant. Chronic exposure to small particles in the air we breathe contributes to the risk of developing or dying from serious disease (WHO 1; www.oregonpsr.org).

For many years serious health effects have been documented for fine particulate matter, PM 2.5. For information regarding airborne particulate matter in general, please see the *Airborne Particulate Matter and Public Health* factsheet on the Oregon PSR website (www.oregonpsr.org). Health effects discussed there are also true for diesel emissions which are made up of even finer particles than PM 2.5. A new photometric absorbance method, which distinguishes which emissions come specifically from diesel, has made these studies even more important. Black Carbon is recognized as a signifier of diesel emissions.

New studies have shown that Black Carbon (BC), a component of fine particulate matter (PM 2.5), is even more dangerous than the larger particles that are measured with it in older methods (filtration based). It originates mainly from combustion engines (especially diesel), power stations that use coal and heavy oil, residential burning of wood and coal, field burning of agricultural wastes and forest fires (WHO 2). The World Health Organization classified airborne BC as carcinogenic in 2011, and it was found that a unit of airborne particles measured as BC as compared to a unit of PM 2.5, increases risk by a factor four to nine times (WHO 2; Janssen et al 2011). That means that all the studies, which have shown the dangers of PM 2.5, have probably underestimated how dangerous small particulate matter is to health.

In urban areas of the Unites States, it is estimated that as much as 60% of BC emissions originate from engines used in transport (i.e., busses, cars, trains, etc.), and diesel engines emit eight times more BC than gasoline powered sources (Graeme et al 2014). Importantly, BC from various sources appears to be “causally involved in all-cause, lung cancer, and cardiovascular mortality, morbidity, and perhaps adverse birth and nervous system effects” (Graeme et al 2014).

SPECIFIC DISEASES ASSOCIATED WITH DIESEL EMISSION EXPOSURE

Cancer

- Lung and bladder cancer (WHO 1);
- Decreased lung cancer mortality of 4.9% in people living in Tokyo with diesel emission control after eight years (Yorifuji et al 2016), compared to a city in Japan with no diesel emission control.

Neurodevelopmental

- Associations between prenatal BC exposure and decreased memory in children, especially boys (Cowell et al 2015);
- In children increases in ADHD, Autism, Learning Disabilities, and decreases in IQ documented related to PM 2.5 and associated toxicants like PAHs that they carry (Perera et al 2012);
- In Mexico City, young people exposed to fine particulate matter, including BC, developed "vascular and perivascular damage in the prefrontal white matter" of their brains, which is associated with vascular-based neurodegenerative disorders like Alzheimer's disease (Calderón-Garcidueñas et al. 2016);
- BC and other traffic related air pollution seen to be associated with dementia incidence and cognitive impairment (Oudin et al. 2016; Power et al. 2011; Chen et al. 2017);
- In older adults, BC associated with increases in Parkinson's Disease (Ritz et al 2016).

Cardiovascular

- Heart disease and stroke (WHO 1);
- In regions in Tokyo where diesel emissions had been controlled, mortality rates related to cardiovascular disease were decreased by at least 10%, compared to areas where emissions had not been regulated (Yorifuji et al 2016). This means decreases in heart attacks and strokes and fewer new cases of heart failure;
- Blood pressure in elderly men was adversely affected by increased exposure to BC (Bind et al 2015).

Respiratory

- Inhalation of BC creates inflammation that results in the start of, and exacerbation of asthma in children and adults. It also means increases in prevelance and severity of disease in people with emphysema, COPD, and pneumonia (Ristovski et al 2012);
- In another study in Tokyo total pulmonary disease was decreased by 22% over 12 years when diesel emission control was initiated (Yorifuji et al 2016).

Birth Effects

- Increase in miscarriages, low birth weight babies, infertility and other pregnancy problems in women with exposure to high concentrations of traffic-related air pollution (Frutos et al 2015).

In summary then, decreasing allowable diesel particulate matter in our air will yield many positive health effects, relatively easily and all with one achievable change. There will be decreases in morbidity and mortality from many diseases, and a commensurate decrease in the costs of caring for these chronic and acute illnesses.

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