MIDWEST CLEAN DIESEL INITIATIVE

Diesel Exhaust And Your Health

Diesel engines emit ozone precursors, particulate matter, and other toxic substances. The following sections discuss the health impacts of these pollutants and of exposure to diesel exhaust. The language below is drawn from the Health Assessment Document for Diesel Engine Exhaust[1] and the Regulatory Impact Analysis for Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements.[2]

Ozone and its Precursors

Ground-level ozone is the primary component of smog. It is formed from reactions between nitrogen oxides (NOx) and volatile organic compounds (VOC). Diesel engines emit both of these types of compounds. The Environmental Protection Agency (EPA) has identified several health impacts of exposure to ozone.[2] Exposure to high ambient ozone concentrations for 1 to 3 hours has been linked to increased hospital admissions and emergency room visits for respiratory problems. Repeated exposure to ozone can lead to many respiratory system ailments including respiratory infection, lung inflammation, and asthma. Prolonged (between 6 and 8 hours), repeated exposure to ozone can cause irreversible changes in lung structure that can lead to premature lung aging. It can also result in chronic illnesses such as emphysema and chronic bronchitis. Furthermore, the full body of evidence in the scientific literature indicates a positive relationship between ozone exposure and premature mortality.[2] Groups that are most susceptible to the health effects of ozone include children, the elderly, and those with respiratory illnesses.

Diesel emissions contribute to smog.

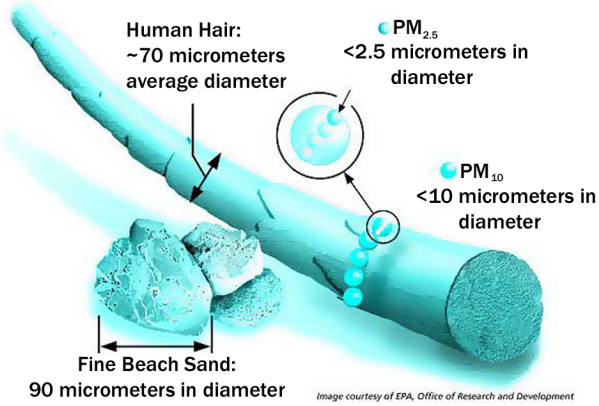
Diesel emissions can exacerbate asthma.

VOCs have detrimental health effects in addition to their role in forming ozone. Some VOCs emitted from diesel engines are toxic compounds and have health impacts that can affect the respiratory and neurological systems, reproductive health, and child development.[2] Some VOCs are air toxics.[2]

NOx also negatively affects human health. For example, nitrogen dioxide can irritate lungs and reduce resistance to respiratory infection.

Particulate Matter

Particulate matter (PM) is chemically and physically diverse; it can exist as liquid droplets or as solid particles. PM is typically classified as either coarse, with a diameter between 2.5 and 10 micrometers (PM_{10}), or fine, with a diameter less than 2.5 micrometers ($PM_{2.5}$). Generally, $PM_{2.5}$ is viewed as a greater health threat than PM_{10} because it more easily penetrates the respiratory system.



The width of a human hair is 30 times larger than the smallest fine particle.

The primary negative health effects linked to PM include premature death, aggravation of cardiovascular and respiratory disease, and changes in lung function and structure.[2] Coarse particles are believed to impact respiratory conditions whereas fine particles are more closely tied to premature death and hospital admissions for cardiopulmonary diseases. Again, the populations most at risk from exposure to PM include children, the elderly, and sufferers of respiratory ailments like asthma.

The scientific evidence that demonstrated these health effects prompted EPA to develop the National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$ in the Clean Air Fine Particle Rule of 2004. EPA estimates that meeting these standards would prevent at least 15,000 deaths per year.[3]

Diesel Exhaust

A great deal of research led EPA to conclude that diesel exhaust is a human health hazard. Based on this research, EPA has concluded that diesel exhaust is likely to be carcinogenic to humans at occupational and environmental (ambient) levels of exposure.[1,2] EPA's Health Assessment Document for Diesel Engine Exhaust[1] provides a full discussion of the data and the uncertainties in those data that led to this conclusion. Diesel exhaust contains gaseous components like benzene that are known carcinogens in addition to gases that are possible or probable carcinogens, including benzene, formaldehyde, acetaldehyde, 1,3-butadiene, acrolein and dioxin.[1] Furthermore, a variety of inorganic and organic compounds can be adsorbed onto PM. $PM_{2.5}$ can therefore act as both a delivery agent of these chemicals into the respiratory tract and a physical irritant.

Exposure to diesel exhaust also likely causes noncancer health impacts. Acute exposures to diesel exhaust can cause symptoms such as headaches, eye irritation, and nausea. Chronic exposure to diesel exhaust constitutes a respiratory system hazard.

Sources:
1) US EPA, Health Assessment Document for Diesel Engine Exhaust (May 2002).
2) US EPA, Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements (December 2000).
3) US EPA. http://www.epa.gov/pmdesignations/documents/120/benefits.htm.