

CLEAN AIR TASK FORCE

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Diesel Engines: Health and Environmental Impacts



Diesel emissions pose a serious threat to the health of our families and adversely impact our environment. Eighty three percent of the U.S. population lives in cities with concentrated diesel emission sources such as highways, bus and truck depots, heavy industry and construction sites.¹ This fact sheet documents the health and environmental impacts of diesel emissions and potential benefits of emissions reductions. Companion Clean Air Task Force Diesel fact sheets include: 1) Emissions and Exposures, 2) Emissions Sources and Regulations, and 3) Emissions Controls and Retrofits.

Diesel Emissions: One of the Most Hazardous Substances in Our Environment.

- Diesel engines release a host of harmful substances including directly emitted organic and elemental carbon (soot), toxic metals, nitrogen oxides that form ozone and nitrate particulate matter, volatile organic compounds, carbon monoxide, carbon dioxide, and a variety of toxic metals and gases such as formaldehyde, acrolein, and polycyclic aromatic hydrocarbons²
- Diesel emissions include 40 hazardous air pollutants listed under the Clean Air Act, 15 of which are known or probable carcinogens.^{3,4}
- The 2002 EPA Health Assessment for Diesel Exhaust found diesel to be a “likely” carcinogen.⁵

- Breathing particulate matter (PM) in the most polluted U.S. cities poses the same risk as living with a smoker according to a 2002 American Cancer Society study.⁶ A large proportion of fine particulate matter in most cities is attributable to diesels.⁷
- Particulate matter—a major component of diesel exhaust—has been linked to a wide variety of serious health impacts from upper and lower respiratory impacts such as asthma attacks and possible asthma onset, to heart attacks and premature death.
- Diesel particulate matter contains ultrafine particles that are so small they can invade lung tissue and enter the bloodstream.^{8,9,10}

Diesel Exhaust is Deadly.

Abt Associates, for the Clean Air Task Force, estimates that particulate matter from diesel engines will cause 21,000 premature deaths in the U.S. annually in 2010. (See Clean Air Task Force’s 2005 Report *Diesel and Health in America: The Lingering Threat* at www.catf.us/goto/dieselreport. Find out about health impacts of diesel soot in your community at www.catf.us/goto/dieselhealth.)

National Annual Diesel Health Impacts¹¹	
Annual Cases in the U.S., 2010	
Premature Deaths-Adults	21,000
Case of Lung Cancer	3,000
Non-fatal Heart Attacks	27,000
Asthma Attacks	410,000
Chronic Bronchitis	12,000
Work Loss Days	2,400,000
Restricted Activity Days	14,000,000
Hospital Admissions	15,000
Emergency Room Visits for Asthma	15,000

Diesel Emissions Lead to Heart Attacks, Premature Death, Birth Defects and Impaired Immune and Neurological Systems.

- Particulate matter is associated with abnormal heart rhythms and heart attacks and atherosclerosis.^{12,13,14,15}
- Particulate matter was significantly associated with cardiovascular mortality and lung cancer death in the American Cancer Society study of 150 metropolitan areas across the U.S.¹⁶
- Increased incidence of stroke has been linked to particulate matter and other pollutants.^{17,18}
- In an experimental study, diesel particles caused thromboses (stroke) providing “a plausible explanation for the increase in cardiovascular morbidity and mortality accompanying urban air pollution”¹⁹
- Particulate matter air pollution is associated with permanent respiratory damage—lung airway remodeling.²⁰

- Acrolein, a component of diesel exhaust, is a strong respiratory irritant and poses the highest non-cancer health hazard from air toxics in the U.S, particularly for those with respiratory conditions like asthma. Nearly the entire population exposure exceeds a “safe level.”²¹
- Diesel emissions are associated with reproductive system impacts in animals. Pregnant rats exposed to diesel emissions resulted in elevated testosterone in the mother and reproductive organ changes such as masculinization of fetuses.
- Animal studies suggest diesel emissions may affect the immune system, including reduced immunity to bacterial infections in the lung.^{22,23}
- A study of 16 railroad workers suggested that diesel exposure caused serious and permanent impairment to the central nervous system.²⁴
- Potential health impacts of PM, ozone and carbon monoxide formed from diesel emissions on newborn children include birth defects, growth retardation and sudden infant death syndrome.^{25,26,27,28,29}

Diesel Emissions Cause Cancer.

- Diesel exhaust contains a variety of confirmed carcinogenic compounds such as formaldehyde, acetaldehyde, dioxins and polycyclic aromatic hydrocarbons (PAHs).^{30,31}
- EPA’s 2002 Health Assessment for Diesel Exhaust deemed diesel particulate matter (DPM) a “likely carcinogen,” citing a risk range of one cancer in 1,000 to one cancer in 100,000 people for each microgram³² of annual average exposure - an exposure level that is lower than diesel PM in many U.S. cities.³³
- The California Office of Environmental Health Hazard Assessment (OEHHA) estimates risk from DPM to be 3 in 10,000 persons per each microgram of annual average exposure.³⁴ This estimate is consistent with EPA’s risk range.³⁵
- Applying California’s unit risk of cancer due to diesel exhaust over the U.S. population results in an estimated 1,530 cases of lung cancer per year.³⁶
- The cancer risk from diesel exhaust in California comprises 70 percent of the risk of all air toxics in the state and exceeds the combined risk of all other air toxics.^{37,38}
- California has concluded that: “a level of diesel exhaust exposure below which no carcinogenic effects are anticipated has not been identified.”³⁹
- Over 30 epidemiological studies link diesel exhaust to lung cancers;⁴⁰ Studies have also linked diesel exhaust to bladder cancer.
- In 1988, the National Institute of Occupational Safety and Health (NIOSH) first recommended that diesel exhaust be considered a potential occupational carcinogen.
- Diesel exhaust may be toxic to DNA and human genes, adding to the weight of evidence showing diesel emissions are carcinogenic.⁴¹
- Analyses of occupational studies indicate that the increased relative risk for lung cancer in railroad workers and truckers is only approximately 20-50 percent greater than the relative risk in the general U.S. population,^{42, 43, 44} suggesting that the risk to the general public is significant.

Reducing Diesel Emissions will Result in Major Health Benefits.

- EPA’s regulatory impact analyses for the highway and non-road engine rules illustrate the potential magnitude health benefits of cleaning up diesel engines. Combined these rules will avoid about 19,000 deaths per year in 2030 amounting to billions of dollars in benefits.^{45,46}

- The Clean Air Task Force estimates that a feasible but aggressive program to retrofit today's diesels would avoid approximately 100,000 premature deaths by 2030.⁴⁷

Diesel Emissions Contribute to Global Warming, Water Pollution, Soiling, and Haze.

- Leaked or spilled diesel fuels contribute to non-point source water pollutants.
- Diesel smoke is also composed of organic compounds, (e.g., PAHs and dioxins) and heavy metals that are persistent in the environment and get into the food chain.⁴⁸
- Diesel PM and NO_x contribute to haze in some national parks.
- Diesel soot causes soiling of buildings.
- Black carbon soot from diesels affects cloud cover and is a significant contributor to atmospheric warming.⁴⁹
- Nitrogen deposition from diesel NO_x emissions contributes to eutrophication of waterways leading to harmful algae blooms.

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- ⁵ EPA, Health Assessment Document for Diesel Exhaust: Office of Research and Development, EPA/600/8-90/057F May 2002.
- ⁶ NYU Press release, March 5, 2002. Most Definitive Study Yet Shows Tiny Particles in Air Are Linked to Lung Cancer.
- ⁷ National Air Toxics Assessment.(NATA) <http://www.epa.gov/ttn/atw/nata/natsa3.html>
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- ⁹ Ultrafine PM is 0.005-0.05 microns in size. For reference fine mass PM (PM_{2.5}) contains all particulate matter less than 2.5 microns. Although ultrafine PM makes up a small percent of fine mass, it may constitute a large proportion of the numbers of particles.
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