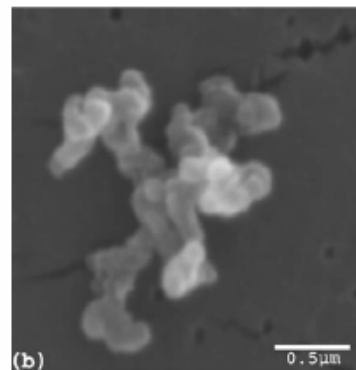
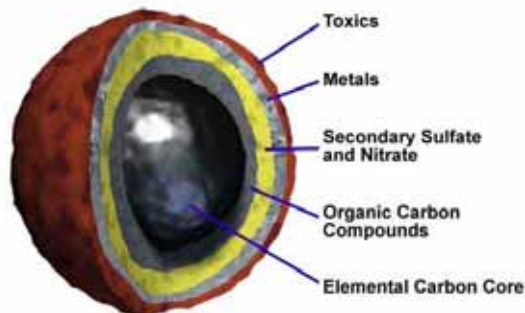


Occupational Exposure to Diesel Exhaust

Introduction. U.S. industries have relied on diesel engines to power equipment and machinery since diesels gained popularity in the 1950s. Yet, only a few decades later scientists were already investigating the health consequences of operating and working around diesel engines for workers such as truck drivers, mechanics and equipment operators. Since then, study after study has affirmed that the particles in diesel fumes are not only unpleasant to breathe but also may cause heart disease, respiratory illness, stroke and lung, bladder and colon cancer and DNA damage. Despite this compelling research, precious little has been done to bring today's 11 million diesel engines up to the stringent modern emissions standards of EPA's 2007 highway and 2010 nonroad diesel rules for newly manufactured engines.

Who is at Risk? Because of their power and reliability, many U.S. industries rely on diesel engines as workhorses. As a result, U.S. workers in many fields are chronically exposed to diesel pollution. While all Americans are exposed to unacceptable risk from diesel exhaust, workers in many industries experience much greater exposures.

What's in Diesel Exhaust? Diesel soot—known to scientists as “particulate matter”— is the most harmful constituent of diesel exhaust and is itself a complex mixture of toxic organic and inorganic substances mixed with toxic organic gases. Diesel fine particles are composed of a carbon core coated in organics, hydrocarbons, sulfates and metals. Diesel ultrafine particles or nanoparticles are so small they can enter the bloodstream from the lungs.



What Are the Health Risks? Studies of occupational exposure to diesel exhaust have been conducted in truck drivers, bus drivers, dock workers and railroad workers over the past three decades. These medical studies have linked diesel exhaust and particles to:

- **Cardiovascular Disease.** A 2007 Harvard study of 54,000 workers in the trucking industry found a higher risk in heart disease in the trucking industry compared to the general U.S. population: a 49 % higher risk in drivers, a 32% higher risk in dock workers, and a 34% higher risk in shop workers.¹ A 2004 study of highway patrolmen particulate matter was linked to irregular heart beats and increases in blood inflammatory markers.² Exposure to particles is a well-known cause of premature death as documented in the two largest air pollution studies ever conducted.³
- **Lung Cancer.** Diesel exhaust is internationally recognized as a *probable, likely or potential* carcinogen based on occupational health studies and animal evidence. In a study of 55,000 railroad workers over

38 years, Harvard researchers found an overall 40% increased risk of lung cancer for workers in 30 job categories.^{4,5} The NIOSH Teamsters (truckers) study concluded that the lifetime excess risk for truckers was 10 times higher than the 1/1000 excess risk allowed by OSHA in occupational settings.⁶ A 2007 Harvard study of 54,000 truckers from 1985-2000 found a 10 % higher risk for lung cancer in drivers and dock workers compared to the general U.S. population.

- Bladder Cancer. A meta-analysis of exposure to diesel exhaust and bladder cancer published in 2001 found a positive association in 10 of 12 studies, with a collective average excess risk of 13%.⁷
- Colon Cancer. A 50% excess risk of colon cancer in men was related to exposure to diesel engine emissions in a 2001 study.⁸
- Premature death. Three of the largest long term air pollution studies ever conducted (one tracking 1 million people in the general population in 150 cities for 16 years) found a strong association between exposure to fine particles with an elevated risk of premature death due to heart and lung disease.⁹
- Nervous system impairment. A study of railroad workers exposed to diesel exhaust concluded: “crews may be unable to operate trains safely.”¹⁰
- Stroke. Diesel exhaust particles may raise the risk of blood clots and stroke.¹¹ Risk more than doubled within 2 hours of exposure to high levels of fine particles in a Japanese study.¹²
- Asthma, respiratory infections, chronic bronchitis and allergic symptoms. Many studies link asthma and allergic sensitization as well as respiratory infections and chronic bronchitis to exposure to diesel particles.¹³

EPA Rules for New Engines Will Not Be Enough. EPA’s highway diesel rule requires that particulate diesel exhaust be reduced by 90 percent in newly manufactured engines starting in 2007. Similar reductions are required by 2010 for offroad diesels. However, EPA estimates that the full benefits of these regulations will not be fully realized until 2030. As a result, the 11 million diesels in the U.S. today will pollute for decades. To reduce occupational exposure and improve worker health, we must retrofit the fleet of older engines to meet the 2007 highway and 2010 offroad emissions standards.

Solutions: The Diesel Particulate Filter (DPF). The filter technology used the 2007 engines to reduce particles by 85 percent or more is a proven technology that can be retrofit on many 1995 and newer highway diesels. The DPF is effective because at its core is a catalyzed honeycomb filter that mechanically traps nearly all particles. In fact, CATF’s field investigations suggest that DPFs virtually eliminate particles from diesel exhaust in school buses, transit buses, garbage trucks and box trucks. Where possible, DPFs should be combined with an inexpensive closed crankcase ventilation device (CCVs) to reduce particles emitted directly from the engine that can infiltrate the cab of the vehicle. For offroad equipment such as construction equipment, locomotives, marine engines, agricultural equipment, the appropriate retrofit will depend on engine specifications. Options include: Level 3 devices (verified for 85% reductions) such as active and passive DPFs; Level 2 devices (50% reduction) such as flow through filters (“FTFs” or high performance DOCs) presently under development for offroad applications; and Level 1 devices such as diesel oxidation catalysts (DOCs) verified for 25% particulate removal.¹⁴



CATF experiment demonstrates that the DPF is as effective as it is easy to install. Left: pollution behind a 23 foot box truck before installation. Middle: installation is simple. Right: reduced particles following DPF installation in same truck same day.

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