

# Cleaner Diesel Handbook



BRING CLEANER FUEL AND DIESEL RETROFITS  
INTO YOUR NEIGHBORHOOD

APRIL 2005

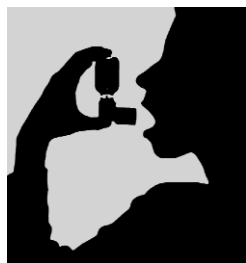
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ENVIRONMENTAL DEFENSE

finding the ways that work



## The dangers of diesel emissions



According to recent EPA data, about half of all Americans now live in counties that fail to meet basic healthy air standards. On April 15, 2004, EPA found 474 counties, home to 159 million Americans, out of full compliance with the health-based eight-hour ozone standard.<sup>5</sup> In April 2005, EPA also found 208 counties representing more than 57 million Americans out of full compliance with the health-based particulate pollution standard.<sup>6</sup>

For the states and local communities that are struggling to trim every possible ton of pollution to meet federal health-based air quality standards, reducing pollution from existing diesel vehicles and equipment now is vitally important. Retrofits and the use of clean fuels are one of the most cost-effective ways to reduce diesel emissions and restore healthy air.

Diesel engines, including the construction engines that are the focus of this handbook, emit nearly 40 toxic substances (Table 1), smog-forming oxides of nitrogen and fine particulate matter (PM<sub>2.5</sub>), which can penetrate the lungs and enter the bloodstream. Due to their small size, particulates are easily inhaled and reach deep into the lungs where they can trigger an inflammatory response. Exposure to particulate matter is associated with heart attacks, irregular heartbeat, asthma attacks, reduced lung function and bronchitis.

Several organizations, including EPA, have designated diesel exhaust as a probable or potential human carcinogen (Table 2). It is estimated that diesel exhaust contributes more than 70% of the cancer risk from air toxics in the United States.<sup>7</sup> Diesel emissions are also estimated to be the hazardous air pollutant with the highest contribution to cancer risk in many areas across the

country;<sup>8</sup> according to Environmental Defense's Scorecard, this is true in New York, Los Angeles, Houston, Denver, Chicago and Atlanta.<sup>9</sup>

### Smog-forming nitrogen oxides

Nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs) that are created by diesel exhaust are precursors to ground-level ozone, or smog. Non-road engines, as a vehicle class, also emit more than 4 million tons of NO<sub>x</sub> each year—this is approximately 19% of the total national NO<sub>x</sub> emissions from all sources (22,349,000 tons).<sup>10</sup> As well as being significant contributors to ground-level ozone or smog, nitrogen oxides are also significant contributors to acid deposition, eutrophication of coastal bodies of water, fine particulate emissions and haze.

### Fine particulate matter

There is a well-researched body of epidemiological studies from around the world that documents the serious threats associated with exposure to PM<sub>2.5</sub>. These studies have linked PM<sub>2.5</sub> to adverse health effects, such as asthma, cardiovascular and respiratory problems, strokes, heart attacks<sup>11</sup> and lower birth weight<sup>12</sup> leading to increased use of asthma medications, doctor visits, emergency room visits, hospital admissions, school absenteeism and premature death.<sup>13</sup> Researchers estimate that as many as 60,000 Americans die prematurely each year because of exposure to fine particles.<sup>14</sup> Children, the elderly and the ill are particularly vulnerable. National PM<sub>2.5</sub> emissions from mobile sources totaled approximately 452,000 short

tons in 2001. Nonroad vehicles created the majority of those emissions, 64%, and almost 50% of total PM<sub>2.5</sub> emissions originated from nonroad diesel sources (221,000 short tons). Construction and surface mining equipment was the largest contributor (30%) to nonroad diesel source PM<sub>2.5</sub> emissions.

### Asthma

People working at and living near construction sites are especially affected by nonroad vehicles' emissions. In urban areas, overall asthma prevalence has increased dramatically over the past two decades, rising

75% between 1980 and the average in 1993–4. While the highest prevalence of asthma is in children ages 5 to 14, the greatest increase in asthma prevalence has occurred in children ages 0 to 4 which increased 160% over the 15-year period.<sup>15</sup> For example, New York City residents suffer from alarmingly high asthma rates (1 out of every 8 adults has been diagnosed with asthma at some point in their lives<sup>16</sup>) and New York City air fails to meet many basic health standards. To learn about air quality conditions in your area, visit Environmental Defense's Scorecard web site at: <http://www.scorecard.org/>.

TABLE 1  
**Toxic air contaminants and hazardous air pollutants found in diesel exhaust**

Acetaldehyde*	Chlorine	Methyl ethyl ketone
Acrolein	Chlorobenzene	Naphthalene*
Aluminum	Chromium compounds*	Nickel*
Ammonia	Cobalt compounds*	4-nitrobiphenyl*
Aniline*	Copper	Phenol
Antimony compounds*	Cresol	Phosphorus
Arsenic*	Cyanide compounds	POM (including PAHs)
Barium	Dibenzofuran	Propionaldehyde
Benzene*	Dibutylphthalate compounds*	Selenium
Beryllium compounds*	Ethyl benzene	Silver
Biphenyl	Formaldehyde*	Styrene*
Bis [2-ethylhexyl] phthalate*	Hexane	Sulfuric acid
Bromine	Lead compounds*	Toluene*
1,3-butadiene*	Manganese compounds	Xylene isomers and mixtures
Cadmium*	Mercury compounds*	Zinc
Chlorinated dioxins*	Methanol	

\*This compound or class of compounds is known by the state of California to cause cancer or reproductive toxicity. See California EPA, Office of Environmental Health Hazard Assessment, "Chemicals Known to the State to Cause Cancer or Reproductive Toxicity," May 31, 2002.

Note: Toxic air contaminants on this list either have been identified in diesel exhaust or are presumed to be in the exhaust, based on observed chemical reactions or presence in the fuel or oil. See California Air Resources Board, "Toxic Air Contaminant Identification List Summaries, Diesel Exhaust," September 1997, available online at <http://www.arb.ca.gov/toxics/tac/factshts/diesex.pdf>.

TABLE 2

**History of determinations of the carcinogenicity of diesel exhaust**

<b>Year</b>	<b>Agency</b>	<b>Determination</b>
1988	National Institute for Occupational Safety and Health (NIOSH)	Potential occupational carcinogen
1989	International Agency for Research on Cancer (IARC)	Probable human carcinogen
1990	State of California (under provisions of Proposition 65)	Known by the state to cause cancer
1995	Health Effects Institute (HEI)	Potential to cause cancer
1996	World Health Organization International Programme on Chemical Safety (WHO-IPCS)	Probable human carcinogen
1998	California Air Resources Board (CARB)	Toxic air contaminant (determination based substantially on the cancer risk to humans)
2000	U.S. Department of Health and Human Services National Toxicology Program (U.S. DHHS/NTP)	Reasonably anticipated to be human carcinogen
2001	American Council of Government Industrial Hygienists (ACGIH) (proposed)	Suspected human carcinogen
2002	U.S. Environmental Protection Agency (EPA)	Probable human carcinogen

## Sources:

National Institute for Occupational Safety and Health, "Carcinogenic Effects of Exposure to Diesel Exhaust," Current Intelligence Bulletin 50. August 1988. Available online at [http://www.cdc.gov/niosh/88116\\_50.html](http://www.cdc.gov/niosh/88116_50.html). Last accessed August 13, 2004.

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American Conference of Governmental Industrial Hygienists, "Documentation of the Threshold Limit Values and Biological Exposure Limits, Notice of Intended Changes," 2001.

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"The Toxic Air Contaminant Identification Process: Toxic Air Contaminant Emissions from Diesel-fueled Engines," fact sheet. Online resource, available at: <http://www.arb.ca.gov/toxics/diesel/tac/factsht1.pdf>. Last accessed on August 13, 2004.

U.S. Environmental Protection Agency, Draft Health Assessment Document for Diesel Exhaust, July 2000, EPA/600/8-90/057E.

California Air Resources Board, "Statewide Portable Equipment Registration Program." Online resource, available at: <http://www.arb.ca.gov/perp/perp.htm>. Last accessed on August 13, 2004.

FIGURE 2  
**National NO<sub>x</sub> emissions by source category, 2001**  
**(22.3 million short tons)**

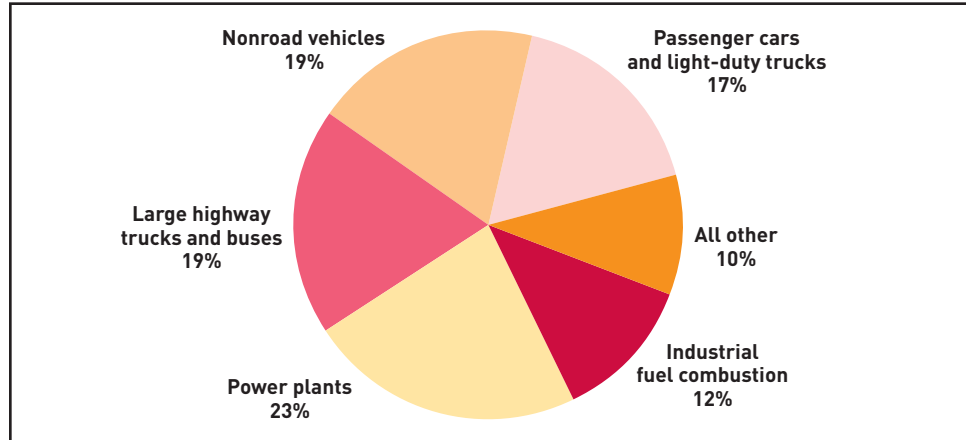
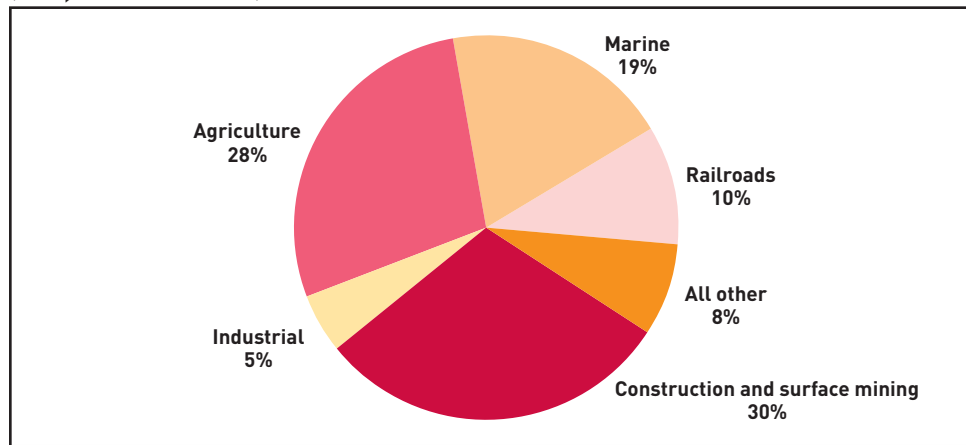


FIGURE 3  
**National PM<sub>2.5</sub> emissions from all nonroad diesel sources, 2001**  
**(221,000 short tons)**



Source (Figures 2, 3, 4):  
 National Emission Inventory (NEI): Air Pollutant Emission Trends, 1999. Online resource, available at: <http://www.epa.gov/ttn/chief/net/1999inventory.html>. Last accessed 03/01/05.

FIGURE 4  
**National PM<sub>2.5</sub> emissions from all mobile sources, 2001**  
**(452,000 short tons)**

