The Harmful Effects of Vehicle Exhaust

A Case for Policy Change

Environment & Human Health, Inc.

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Environment and Human Health, Inc.

Mission Statement

Environment and Human Health, Inc., founded in 1997, is a non-profit organization made up of doctors, public health professionals and policy experts dedicated to the purpose of protecting public health from environmental harms through research, education and the promotion of sound public policy. We are committed to improving public health and to the reduction of environmental health risks to individuals.

Our mission is:

(1.) To conduct research to identify environmental harms affecting human populations.

(2.) To promote public education concerning the relationships between the environment and human health.

(3.) To promote effective communication of environmental health risks to those exposed and to responsible public and private officials, thereby empowering individuals and groups to take control over the quality of their environment and be more protective of themselves and their families.

(4.) To promote policies in all sectors that ensure the protection of human and environmental health with fairness and timeliness. Environment and Human Health, Inc. has put human health at the center of its environmental agenda.

The Harmful Effects of Vehicle Exhaust

A Case for Policy Change

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Overview

Most people assume that the U.S. Environmental Protection Agency is sufficiently protecting air quality by setting limits for chemicals released from vehicles, requiring newer engines to be less polluting, and restricting levels normally found in outdoor air. It is clear, however, that these efforts are not enough to protect health, as they limit only a small percentage of all chemicals that are emitted from engines, leaving hundreds of pollutants unmonitored and unregulated. While the government monitors pollutants at fixed stations, these measurements bear little resemblance to the pollution you and your family experience while moving through daily life. EPA also requires that measured concentrations of regulated pollutants be averaged over long periods of time to determine compliance with standards. Particulate matter, for example, is averaged over three years, and this practice masks high-pollution episodes of short duration that can damage health.

Although we have grown to accept the smell of engine exhaust as a part of everyday life, our nation is experiencing an epidemic of illnesses made worse by air pollution. Over the past ten years, hundreds of studies have been published in the peer-reviewed literature demonstrating special vulnerability to air pollution among those with serious illnesses, including asthma, chronic obstructive pulmonary disease (COPD), cardiovascular disease, diabetes, and lung cancer. Tens of millions of Americans suffer from these illnesses. Children, the elderly, those with compromised immune systems, and those with specific genetic traits are at special risk. We estimate that hundreds of thousands of Connecticut's residents are at heightened risk due to these background illnesses. During the past decade, scientists have also confirmed a relationship between two forms of pollution—ozone and particulate matter—and increased rates of mortality, especially among those with cardiovascular disease. These studies are reviewed and summarized in the report that follows.

Although we have grown to accept the smell of engine exhaust as a part of everyday life, our nation is experiencing an epidemic of illnesses made worse by air pollution.

Connecticut's air quality is exceptionally poor. Polluted air flows into the state from densely populated areas in the Northeast Corridor and the Midwest. In addition, Connecticut residents now drive 31 billion miles in three million vehicles each year. Vehicle use is the largest contributor to the state's air pollution problem, although power plant emissions, heating fuel combustion, and industrial wastes also contribute to our pollution burden. Several billion gallons of fuel are burned in the state each year, and the amount consumed is increasing. Heavy truck traffic is also increasing, and older diesel engines are especially polluting. Diesel engines have exceptionally long life spans—often several millions of miles for long distance trucks—and engines are commonly rebuilt. This means that we cannot rely on improvements in new engine design to solve the problem, since the current fleet will remain on the road for a decade or more. Fuels burned in the state release hazardous pollutants each year into the air in close proximity to residential, occupational, educational and recreational facilities.

The dirtiest part of the day for many children is the bus ride to and from school as they sit in a string of cars and buses, often in rush hour traffic. The problem is especially severe where major highways intersect with urban centers such as New Haven, Hartford, Bridgeport and Stamford. Connecticut's air pollution levels violate the federal Clean Air Act standards for both particulate matter and ozone. Both forms of pollution are produced from fuel combustion, and even the current limits are not sufficient to protect human health. The particulate problem is most severe in the southwestern part of the state, due to population density, traffic intensity, and proximity to the New York metropolitan area. New engine designs to reduce emissions have been overwhelmed by the increasing numbers of vehicles, and the increasing miles traveled per vehicle per year. Connecticut is also the nation's fourth-highest consumer of home heating oil, which is nearly identical to diesel fuel used for transport. More heating oil is consumed per square mile in Connecticut than in any other state.

Most of Connecticut's growth during the past 50 years has occurred in suburban and rural regions, increasing the population's dependence on personal vehicles. More than three million vehicles are registered in a state with only 3.5 million residents. Many people assume that their individual contributions are insignificant, yet the collective effect is damaging to health. The costs of medical care for pollution-aggravated illness fall disproportionately on the poor, since they are less likely to be under the routine care of a physician to prevent severe attacks that often require hospitalization.

Overview

New engine designs to reduce emissions have been overwhelmed by the increasing numbers of vehicles, and the increasing miles traveled per vehicle per year.

Summary of Findings

The American Academy of Pediatrics has concluded that levels of ozone and particulate matter are high enough in many parts of the U.S. to threaten children's health.[1]

Summary of Findings

- **Air Pollution and Human Health**

  Scientific experts now believe the nation faces an epidemic of illnesses that are exacerbated by air pollution. These illnesses include cardiovascular disease, asthma, chronic obstructive pulmonary disease, lung cancer, and diabetes.

- **Children at Special Risk**

  The American Academy of Pediatrics has concluded that levels of ozone and particulate matter are high enough in many parts of the U.S. to threaten children's health.[1] Eleven million U.S. children live in areas that exceed one or more federal air quality standards; 9 million children live in areas where ozone standards are exceeded; 3.5 million children live in areas where the particulate standards are exceeded, and 2.8 million children live in counties where the carbon monoxide standard is exceeded.[2]

- **Elderly at Special Risk**

  Cardiovascular disease, hypertension, diabetes and cancer are all illnesses disproportionately borne by the elderly. Nearly one-half million Connecticut residents are over 65 years of age.

- **Asthma**

  Chemicals in vehicle exhaust are harmful to asthmatics. Exhaust can adversely affect lung function[3,4,5,6] and may promote allergic reactions and airway constriction.[7] All vehicles, especially diesel engines, emit very fine particles that deeply penetrate lungs and inflame the circulatory system, damaging cells and causing respiratory problems.[8] Even short-term exposure to vehicle exhaust may harm asthmatics.[9,10,11,12] Asthmatic children are particularly sensitive to air pollution. New England states have some of the highest asthma rates in the country. About 9 percent of Connecticut's youth have the disease.[13] Inhalation of vehicle emissions, even for short periods, may be harmful to asthmatics. One study found that children are 40 percent more likely to have an attack on high outdoor pollution days.[14]

- **Chronic Obstructive Pulmonary Disease**

  Vehicle emissions are particularly harmful to people afflicted with chronic obstructive pulmonary disease (COPD), such as chronic bronchitis. Significant and replicated associations have been found between increased ozone levels and a range of adverse effects on the lungs,[15] and several studies have shown increased risk of hospital admission from COPD associated with high ozone levels.[16] There is also a relationship between the levels of PM_{10} and morbidity[17] in patients with COPD. These associations were noted in Philadelphia, where the major source of these particles is motor vehicles.[18] Fine particle matter is especially harmful to people with COPD[19, 20] and has been found to increase their hospital admission rates.[21] High levels of PM_{10} are also associated with increased morbidity among those with the illness.

- **Cardiovascular Disease**

  Mortality and hospital admissions for myocardial infarction, congestive cardiac failure and cardiac arrhythmia increase with a rise in the concentrations of particulate and gaseous pollutants.[22] As concentrations of airborne particles increase, those with cardiovascular disease may experience increasing severity of symptoms, rates of hospitalization, and mortality.[23] The risk of having a heart attack is greater for people exposed to pollution from heavy traffic, as well as for those living near air-polluted roadways.[24]

- **Cancer**

  Vehicles emit numerous carcinogenic chemicals. Diesel contains benzene, formaldehyde, and 1,3-butadiene—all three are well recognized carcinogens. EPA estimates that vehicle emissions account for as many as half of all cancers attributed to outdoor air pollution.[25]

- **Diabetes**

  Increasing levels of air pollution are associated with rising mortality rates among diabetics. Because of the overlap between diabetes and cardiovascular disease, the nature of this association is not yet clear.[26]

- **Air Pollution Increases Mortality Among Susceptible Groups**

  Air pollution kills more Americans than breast and prostate cancers combined,[27] and the premature deaths associated with particulate matter pollution alone are comparable to deaths from traffic accidents.[28] Air pollution is a serious and growing threat to the health of Connecticut residents. We estimate that nearly one million of Connecticut's 3.5 million residents experience one or more of these illnesses, some without knowing it.

Summary of Findings

As concentrations of airborne particles increase, those with cardio-vascular disease may experience increasing severity of symptoms, rates of hospitalization, and mortality.[23]

Summary of Findings

Diesel exhaust is especially dangerous, containing nearly 40 hazardous pollutants....

Diesel emissions increase the severity and duration of asthma attacks.

- **Vehicle Emissions**

  Mobile emissions that are believed to present the greatest health risk to Connecticut residents include ozone, particulate matter, acetaldehyde, acrolein, benzene, 1,3-butadiene, formaldehyde, and diesel exhaust.

- **Ozone and Motor Vehicles**

  Motor vehicles emit millions of pounds of hazardous pollutants into the air each year in the U.S., including volatile organic compounds and oxides of nitrogen (NO_x). These chemicals form ozone in the presence of sunlight.

- **Fine Particulate Matter**

  Fine particulate matter is a serious threat to human health. Fine particles can aggravate both heart and lung diseases. Those with diabetes, older adults, and children are especially sensitive. Fine particulate matter is responsible for several tens of thousands of premature deaths annually in the U.S.[29] and is measured at levels above federal air quality standards in Connecticut.[30]

- **Diesel Exhaust**

  Diesel exhaust is especially dangerous, containing nearly 40 hazardous pollutants. The mixture contains carbon particles that are exceptionally small in size, less than one micron. These fine particles may be deeply inhaled into the lung and carry with them a collection of attached hazardous compounds. Diesel emissions increase the severity and duration of asthma attacks.

- **Diesel Emissions**

  The California Air Resources Board concluded that diesel emissions account for the majority of cancer risk created by all outdoor air pollution sources in the state. The American Academy of Pediatrics recommends that children's exposure to diesel exhaust particles should be decreased and that idling of diesel vehicles in places where children live and congregate should be minimized to protect their health.[31] School bus particulate emissions sometimes exceed the federal $PM_{2.5}$ standards by as much as ten-fold.

- **Averaging Air Pollution**

  The government is allowed to average some pollutants across long periods of time. For example, $PM_{2.5}$ is permitted to be averaged over 24 hour intervals, and the 24-hour averages are then averaged over three years, before compliance with federal standards is determined. The results mask serious high pollution episodes. Medical scientists have determined that much shorter-term exposures, measured in hours or minutes, are potentially dangerous to susceptible populations, such as those with cardiovascular, respiratory, and other illnesses.

- **Air Quality Monitoring Deficiencies**

  Government understanding of the severity of air pollution depends upon what is being monitored and where the monitoring occurs. Air quality varies across space and time, and is dependent upon climatic conditions. It is poorest, but may not be monitored, where traffic is most intense, normally where highways slow near urban areas, near construction sites, and where trucks, buses, and cars tend to concentrate and idle: schools, hospitals, shopping centers, truck stops, warehouses, ports and shipping facilities, oil tank farms, rail stations, bus terminals, and where gas and diesel powered vehicles are used within warehouses or ships.

- **Diesel Fuel Consumption**

  Use of diesel fuel doubled in the U.S. between 1982 and 1998. The demand for transportation fuel continues to rise throughout the nation, particularly for diesel fuel.

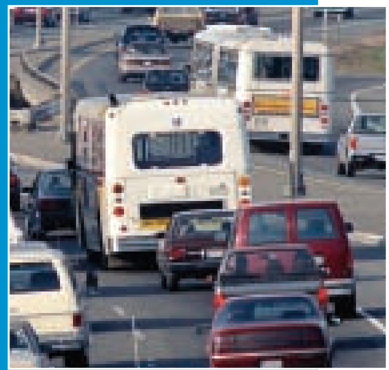
- **Fuel Economy Stagnation**

  In the last 15 years, there has been little improvement in the miles per gallon (MPG) rating of cars and light trucks. The average MPG achieved by trucks has remained the same for the last 30 years at approximately 5.5 miles per gallon.

- **Highways as Air Pollution Corridors**

  Highways are recognized by scientific experts to act as three-dimensional corridors of air pollution containing many hazardous chemicals.

Summary of Findings



Use of diesel fuel doubled in the U.S. between 1982 and 1998. The demand for transportation fuel continues to rise throughout the nation, particularly for diesel fuel.

Summary of Findings

The increase in the vehicle miles traveled in recent years has overwhelmed the technological advances made with respect to vehicle emissions reductions.[41]

- **Fuel Oil Consumption**

  Home heating fuel is essentially the same as diesel fuel, although the sulfur content is higher. Connecticut is exceptionally dependent on No. 2 fuel oil for heating purposes, and last year ranked fourth in the nation in raw consumption at more than 660 million gallons. By contrast, 230 million gallons of diesel fuel were used for transport purposes. Connecticut ranks first in the nation in fuel oil consumption per square mile of state area. This means that diesel pollution will be most severe where residential and traffic density are highest. It also explains the high particulate counts routinely measured in areas where population density is high and where multiple traffic lanes funnel into single lanes. Chronic traffic congestion leads to chronic human exposure to known hazardous air pollutants.

- **$PM_{2.5}$ Non-Compliance**

  Fine particulate matter in Connecticut exceeds federal air quality standards.[32] During the first six months of 2005, levels of fine particulates, or $PM_{2.5}$, in New Haven, Connecticut, exceeded the federal standard for 70 days, roughly 40 percent of the time.

- **Ozone Non-Compliance**

  The entire state of Connecticut exceeds the eight-hour ozone standard.[33]

- **Connecticut's Dependence on Motor Vehicles**

  Fewer than three percent of Connecticut residents walk to work,[34] and 45 percent of all Connecticut trips under a half-mile are made in a vehicle.[35] Connecticut residents spend on average 70 minutes a day in their cars, often breathing this polluted air.[36]

- **Connecticut Citizens' Proximity to Highways**

  One in three Connecticut citizens live within a mile of an interstate highway. As many as 70,000 of those residents are under the age of five.[37] In addition, 37 percent of the state's schools are located within a mile of an interstate highway.[38]

- **Vehicle Miles Traveled (VMT)**

  Connecticut residents own nearly three million vehicles, and travel nearly 31 billion miles each year. Each year residents put more miles on their vehicles in a year than ever before. The number of vehicles driven in the state is also growing. Between 1995 and and 2000, state residents increased the miles driven by 10 percent[39] and this trend is expected to continue. The number of Vehicle miles traveled (VMT) in the state is projected to rise by another 12 percent by 2010 and by 27 percent by 2025.[40] The increase in VMT in recent years has overwhelmed the technological advances made with respect to vehicle emissions reductions.[41]

- **Idling and Wasted Fuel**
  The U.S. Argonne National Laboratory estimates that about 20 million barrels of diesel fuel are consumed each year by idling long-haul trucks. Estimated truck emissions total about 10 million tons of CO_2, 50,000 tons of nitrogen oxides, and 2,000 tons of particulates.[42]

- Natural Resources Canada estimates that idling a light duty vehicle for 10 minutes a day uses an average of 26.4 gallons (100 liters) of gas a year. Assuming Connecticut has approximately 2.2 million light duty vehicles, if idling time were reduced by 10 minutes per day for each, nearly 58 million gallons of gas would be saved per year, along with $145 million in fuel costs per year if one assumes that gas costs $2.50 per gallon.

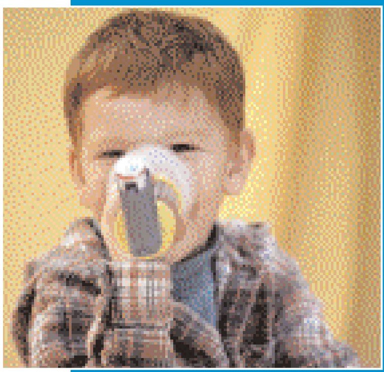
- **Vehicle Emissions and Climate Change**
  Vehicle emissions contribute to air pollution generated from the combustion of fossil fuels from many other sources, including the burning of coal and oil in power plants, incinerators, home heating oil, and construction equipment. The combustion of gas and diesel fuels produce greenhouse gases that are contributing to local, regional and global climatic changes. A recent study published in *Science* analyzed more than 900 scientific articles listed with the keywords "global climate change." Not one disagreed with the consensus view that humans are contributing to global warming.[43] Little initiative is expected on this issue at the national and international levels of government. Connecticut has the potential to become a leader among states in reducing these gases.

- **Carbon Dioxide**
  Carbon dioxide (CO_2), considered the largest contributor to greenhouse climate change, accounts for more than 80 percent of U.S. greenhouse gas emissions. One-third of these emissions come from the transportation sector.[44] Carbon dioxide emissions originate almost entirely from fossil fuel consumption, and two-thirds of U.S. fuel consumption is used for transportation. [45]

Summary of Findings

Carbon dioxide emissions originate almost entirely from fossil fuel consumption, and two-thirds of U.S. fuel consumption is used for transportation.[45]

1. Human Health



We estimate that hundreds of thousands of Connecticut's residents are at heightened risk from air pollution because of their background of chronic illness.

Air Pollution, Vehicle Exhaust, and Human Health

Over the past 10 years, hundreds of studies have been published in the peer-reviewed literature demonstrating the special vulnerability to air pollution that exists among susceptible populations with serious illnesses. Tens of millions of Americans suffer from these illnesses, which include asthma, chronic obstructive pulmonary disease (COPD), cardiovascular diseases, diabetes, and lung cancer. Also at special risk are children, the elderly, those with compromised immune systems, and those with specific genetic traits. During the past decade, scientists have confirmed a relationship between two forms of air pollution, ozone and particulate matter, and increased rates of mortality, especially among those with cardiovascular disease. We estimate that hundreds of thousands of Connecticut's residents are at heightened risk of health loss from air pollution because of their background of chronic illness.

Asthma

- Asthma has reached epidemic proportions in the U.S.[46] and is the most prevalent chronic disease among U.S. children.[47] The CDC National Center for Health Statistics estimates that 31.3 million U.S. residents have been diagnosed with asthma.[48]

- Since the mid-1980s, asthma rates in the U.S. have increased sharply among all races and age groups, both sexes, and in all regions of the U.S. These changes are partly a result of exposure to chemicals in the environment.[49] The most recent estimates published by the CDC indicate that 13 percent of children under the age of 18 in the U.S. have been diagnosed with asthma.[50] Between 1980 and 1995, the asthma prevalence rate for children ages 5-14 increased by 74 percent.[51] Asthma prevalence is highest among urban children,[52, 53] and is the primary cause of childhood hospitalization in urban areas.[54]

- The Connecticut Department of Health estimates that about 9 percent of children and 8 percent of adults 18 years and over have asthma in Connecticut.[55]

- In 2003, the New England Asthma Regional Council found that New England states have some of the highest asthma rates in the country. The adult asthma rate in New England (8.9 percent) is significantly higher than the combined average rate for the other states in the country (7.1 percent). Nearly one million adults in New England currently have asthma. Poor air quality as well as occupational exposures, socioeconomic differences, seasonal changes and regional variation in the criteria used for diagnosing asthma may contribute to regional differences in asthma rates.[56, 57]

- Vehicle exhaust is harmful to asthmatics. It can adversely affect their lung function [58, 59, 60, 61] and may promote allergic reactions and airway constriction.[62] All vehicles, especially diesel engines, emit microscopic particles that can penetrate lungs and inflame the circulatory system, damaging cells and causing respiratory problems such as asthma.[63] Studies have found that even short-term exposure to vehicle exhaust may harm asthmatics.[64, 65, 66, 67]

- Asthmatic children are particularly sensitive to air pollution. They are 40 percent more likely to have an attack on high outdoor pollution days.[68] Children living near high traffic flows are more likely to have more medical care visits per year[69] and a higher prevalence of most respiratory symptoms.[70, 71]

- Studies have found that children in communities with higher levels of urban air pollution in Southern California had decreased lung function growth, and children spending more time outdoors had even larger deficits in the growth rate of lung function.[72]

- Ozone is the pollutant most consistently associated with increased severity of symptoms among asthmatics,[73] as well as with new diagnoses of the illness.[74]

- Even low levels of particulate matter and ozone in ambient air may increase symptoms of asthma in children.[75]

- Asthma in children has been associated with proximity to highways and truck traffic near residences and schools.[76]

- Studies have also associated various childhood cancers with exposure to vehicle exhaust[77] and proximity to traffic.[78]

1. Human Health

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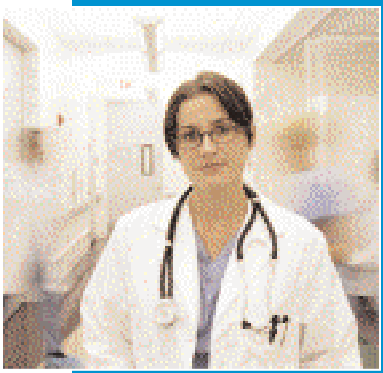
Asthma in children has been associated with proximity to highways and truck traffic near residences and schools.[76]

1. Human Health



Significant associations have been found between increased ozone levels and a range of adverse effects on the lungs,[85] and several studies have shown an increased risk of hospital admission associated with high levels of ozone.[86]

Chronic Obstructive Pulmonary Disease

- Chronic obstructive pulmonary disease (COPD) refers to a group of diseases that cause airflow blockage and breathing problems. It includes emphysema, chronic bronchitis, and in some cases, asthma.[79, 80]

- COPD death rates are rising among women in the U.S. and Connecticut.[81] From 1996 to 1998, COPD was the fourth leading cause of death among Connecticut women of all ages.[82]

- COPD is also the fourth leading cause of death in the U.S. and is predicted to be the third leading cause of death for both males and females by the year 2020.[83]

- The CDC estimates that in 2000 COPD was responsible for about 120,000 deaths, 725,000 hospitalizations, 1.5 million visits to hospital emergency rooms, and eight million additional cases of hospital outpatient or personal physician treatment. An estimated 10 million adults were diagnosed with COPD in 2000, but a national health survey indicated that as many as 24 million Americans are affected.[84]

- Vehicle emissions are particularly harmful to COPD patients. Significant associations have been found between increased ozone levels and a range of adverse effects on the lungs,[85] and several studies have shown an increased risk of hospital admission associated with high levels of ozone.[86] There is also a relationship between the levels of PM_{10} and morbidity[87] in patients with COPD. These associations were noted in Philadelphia, where the major source of PM_{10} is motor vehicles.[88] Fine particle matter is especially harmful to people with COPD,[89, 90] and has been found to have a significant effect on hospital admission rates for COPD.[91]

Heart Disease

- Cardiovascular disease is the leading cause of death in Connecticut, accounting for 42 percent of all deaths in the state. Nearly one-quarter of Connecticut's adult population suffers from some form of cardiovascular disease.[92]

- Risk factors traditionally associated with cardiovascular disease include positive family history, increasing age, gender (male), race (black), cigarette smoking, high blood cholesterol levels, high blood pressure, diabetes, physical inactivity, and being overweight or obese. In the last 10 years, researchers have discovered that air pollution is also a risk factor for heart disease. Although particle pollution is less of a risk factor for heart disease than high cholesterol, more people are exposed to particle pollution than have high cholesterol. A study of cause-of-death data from long-term exposure to particle pollution found the majority of deaths are from cardiovascular disease.[93]

- Fine particles can change the heart's rhythm and cause inflammation.[94] Recent research shows that fine particles can pass through the lungs and enter the bloodstream, causing the blood to coagulate and thicken, as well as increasing the likelihood of inflammation.[95] These findings help to explain why air pollution is linked to increased risk of heart attacks, strokes, and respiratory problems. An American Heart Association scientific panel has labeled fine particles a "serious public health problem."[96] People with heart disease are especially at risk of serious coronary effects from exposure to fine particles.[97]

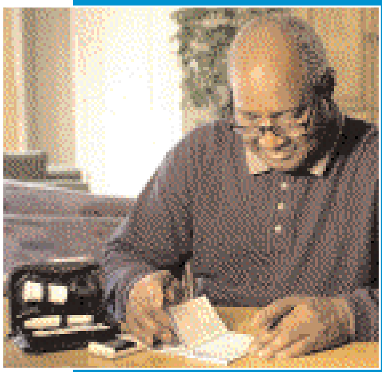
- Mortality and hospital admissions for myocardial infarction, congestive cardiac failure and cardiac arrhythmia increase with a rise in the concentration of particulate and gaseous pollutants.[98] Studies have linked daily changes in concentrations of ambient particles and cardiovascular disease mortality, hospital admissions, and disease exacerbation in patients with cardiovascular disease.[99]

- The risk of having a heart attack is greater for people exposed to heavy traffic and those living near polluted roadways. One study found that exposure to traffic tripled the risk of a heart attack within one hour afterward.[100, 101] Time spent in cars, as well as on public transportation, motorcycles, or bicycles, increases the risk of heart attack. Heart attacks were 2.6 times more common for people in cars, 3.1 times higher for people taking public transportation, and 3.9 times greater for those on bicycles. Another study reported that people living near polluted roadways were twice as likely to die from a heart attack as those living in cleaner areas.[102]

1. Human Health

Fine particles can change the heart's rhythm and cause inflammation.[94]

1. Human Health



People with diabetes are more susceptible to illness from air pollution than those without the disease.[113, 114]

Cancer

- Cancer is the second leading cause of death in the U.S. and Connecticut, accounting for one-fourth of all deaths in the state.[103] While certain genetic and behavioral factors increase the risk of developing cancer, air pollution from vehicle emissions is also a risk factor. EPA estimates that vehicle emissions account for as much as half of all cancers attributed to outdoor sources of air pollution.[104]

- A California study[105] found that motor vehicles and other mobile sources accounted for about 90 percent of the cancer risk in Southern California (about 70 percent of all risk is attributed to diesel particulate emissions and about 20 percent to other toxics associated with other mobile sources, including benzene, 1,3-butadiene, and formaldehyde). Other studies have linked various childhood cancers to motor vehicle exhaust[106] and proximity to traffic.[107] Additional studies have found that mobile sources are responsible for the majority of excess cancer risk associated with exposure to urban air toxics.

- Long-term exposure to fine particulate air pollution emitted from vehicles has been linked to lung cancer mortality.[108] Epidemiological studies over the past fifty years have found associations between ambient air pollution from incomplete combustion of fossil fuels and increased rates of lung cancer.[109] Compared to cigarette smoking, the excess lung cancer risk associated with ambient air pollution is small. However, given the prevalence of combustion-source ambient air pollution exposure, exposure to air pollution from vehicle exhaust across a population may be of public health importance.[110]

Diabetes

- About 18 percent of the U.S. population over 60 has diabetes.[111] In Connecticut, about 173,000 residents are estimated to suffer from the disease, although one-third of them may not know it. It is the seventh leading cause of death in the state and is considered by the Connecticut Department of Public Health to be a significant risk factor for cardiovascular disease, the leading cause of death in the state.[112]

- People with diabetes may be more susceptible to illness from air pollution than those without the disease.[113, 114] The American Lung Association recently added diabetics to the list of groups most at risk from particle pollution, based on their vulnerability to fine particulates.[115]

- Epidemiological studies have found that the ability of blood vessels to control blood flow is impaired in diabetic adults on days with elevated levels of particles from traffic. This may increase cardiovascular risk.[116]

- Adults with diabetes have death rates from heart disease two to four times higher than adults without diabetes. Nearly 65 percent of deaths among people with diabetes are due to heart disease and stroke.[117]
- An association has been found between many air pollutants and daily mortality among diabetics.[118] The authors suggest that this finding may be interpreted in light of toxicological findings that inhalation of urban particles in animals increases blood pressure and enhances vasoconstriction.[119]
- In addition to the risk of cardiovascular disease from exposure to air pollution among diabetics, air pollution may be associated with the development of Type 1 diabetes in young children. Increased ozone exposure may be a "contributory factor" to the increased incidence of Type 1 diabetes and PM_{10} may be a "specific contributory factor" to the development of Type 1 diabetes in children under the age of five.[120] Environmental triggers in infancy and early childhood may accelerate the onset of diabetes. Differences in exposure to environmental air pollutants in early-onset diabetes have only recently begun to be studied.[121] The incidence of Type 1 diabetes is increasing disproportionately in infants and very young children.[122]

Susceptible Populations in Connecticut

- The numbers of Connecticut residents at high risk from exposure to ozone and particulate matter, including the elderly, children, and those with asthma and chronic lung disease, cardiovascular disease (particle pollution only) and diabetes in Connecticut are presented in Table 1. These estimates were developed by the American Lung Association based on national rates and applied to county population estimates. Infants and

Table 1. Connecticut Populations at Elevated Risk[136]

CONNECTICUT COUNTY	TOTAL POPULATION[137]	18 AND UNDER	65 AND OVER	CHILDHOOD ASTHMA[138]	ADULT ASTHMA[139]	CHRONIC BRONCHITIS[140]	EMPHYSEMA[141]	CARDIO-VASCULAR DISEASE[142]	DIABETES[143]
FAIRFIELD	899,152	227,375	117,301	19,350	55,845	27,531	10,525	233,016	46,603
HARTFORD	871,457	208,294	124,861	17,726	55,220	27,318	10,718	233,677	46,873
LITCHFIELD	187,801	43,450	26,593	3,698	11,913	6,027	2,392	52,137	10,486
MIDDLESEX	161,439	36,091	21,962	3,071	10,454	5,148	1,975	43,638	8,739
NEW HAVEN	841,873	200,593	117,092	17,070	53,842	26,172	10,064	221,171	44,262
NEW LONDON	263,992	61,861	34,412	5,264	17,078	8,206	3,077	68,591	13,693
TOLLAND	145,039	31,116	15,075	2,648	10,160	4,483	1,511	35,171	7,020
TOTAL	3,370,753	808,780	457,296	68,827	214,512	104,885	40,262	887,401	177,676

1. Human Health

Studies have found that children in communities with higher levels of urban air pollution have decreased lung function growth, and children who spend more time outdoors have even larger deficits in the growth rate of lung function.[126]

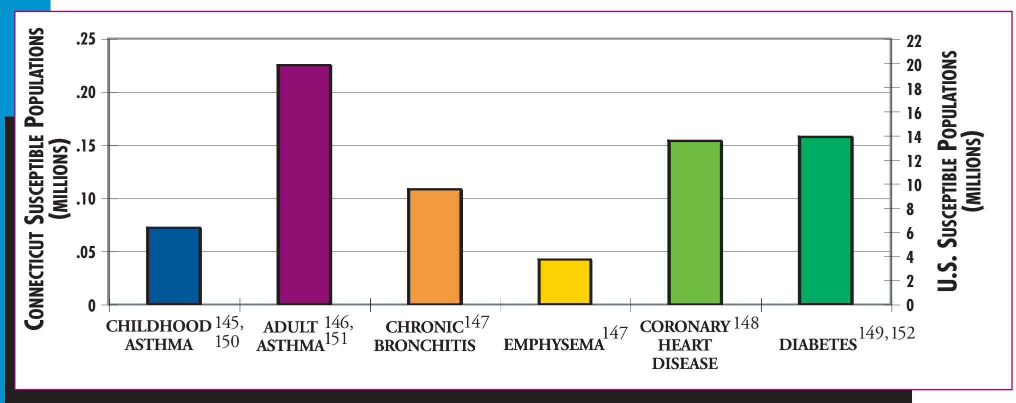
1. Human Health

children are especially vulnerable to adverse effects of air pollution. After exposure to environmental toxicants, the developing lung may be highly susceptible to damage.[123] Children have increased exposure to many air pollutants because of their higher ventilation and levels of physical activity compared to adults.[124] They also tend to spend more time outdoors than adults, increasing their exposure to outdoor air pollutants.[125]

- Studies have found that children in communities with higher levels of urban air pollution have decreased lung function growth rates, and children who spend more time outdoors have even larger deficits.[126]
- Air pollution has also been associated with several adverse birth outcomes, including sudden infant death,[127] and has been identified as a factor in the increased incidence of Type 1 diabetes.[128] A recent study of nonsmoking New York City women found that exposure to exhaust pollutants can result in chromosomal abnormalities in fetal tissues. The women wore air monitors during the third trimester of pregnancy to measure their exposure to combustion-related urban air pollutants, including emissions from vehicles.[129]
- Increased respiratory tract complications have been found in children living near areas of high traffic density, particularly truck traffic[130] near residences and schools.[131] The incidence of new diagnoses of asthma has been associated with heavy exercise in communities with high concentrations of ozone.[132] Some studies have also linked various childhood cancers to motor vehicle exhaust[133] and proximity to traffic.[134]
- The American Academy of Pediatrics Committee on Environmental Health has concluded that levels of ozone and particulate matter are high enough in many parts of the U.S. to threaten children's health.[135]

The American Academy of Pediatrics Committee on Environmental Health has concluded that levels of ozone and particulate matter are high enough in many parts of the U.S. to threaten children's health.[135]

FIGURE 1. CONNECTICUT AND U.S. POPULATIONS SUSCEPTIBLE TO HARMFUL EFFECTS FROM AIR POLLUTION

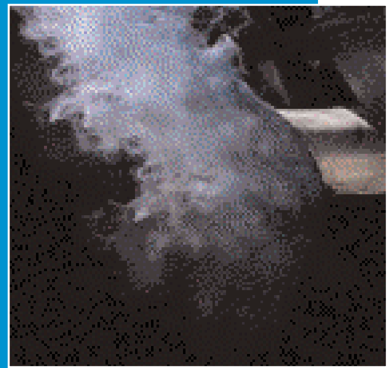


Vehicle Emissions, Federal Regulations, and Health

This section reviews air pollutants from vehicle emissions that may threaten human health. Some of these are regulated as **Criteria Pollutants,** *others are regulated as* **Hazardous Air Pollutants (HAPs).** *Both categories of pollutants are regulated under the Clean Air Act (CAA) and both threaten human health.*

Criteria Pollutants are regulated under Title I of the Clean Air Act and have established standards for compliance. States set up monitoring networks, monitor the air for each pollutant, and report the data to EPA. Hazardous Air Pollutants are regulated under Title III of the Clean Air Act. EPA and states do not maintain an extensive monitoring network for HAPs as they do for criteria pollutants. HAPs are regulated using a technology-based approach and require Maximum Achievable Control Technology standards to control emissions.

Air pollutants from mobile sources that are believed to present the greatest health risks to Connecticut residents include two criteria pollutants, ozone and particulate matter, and six HAPs, acetaldehyde, acrolein, benzene, 1,3-butadiene, formaldehyde, and diesel exhaust. These pollutants are discussed below.



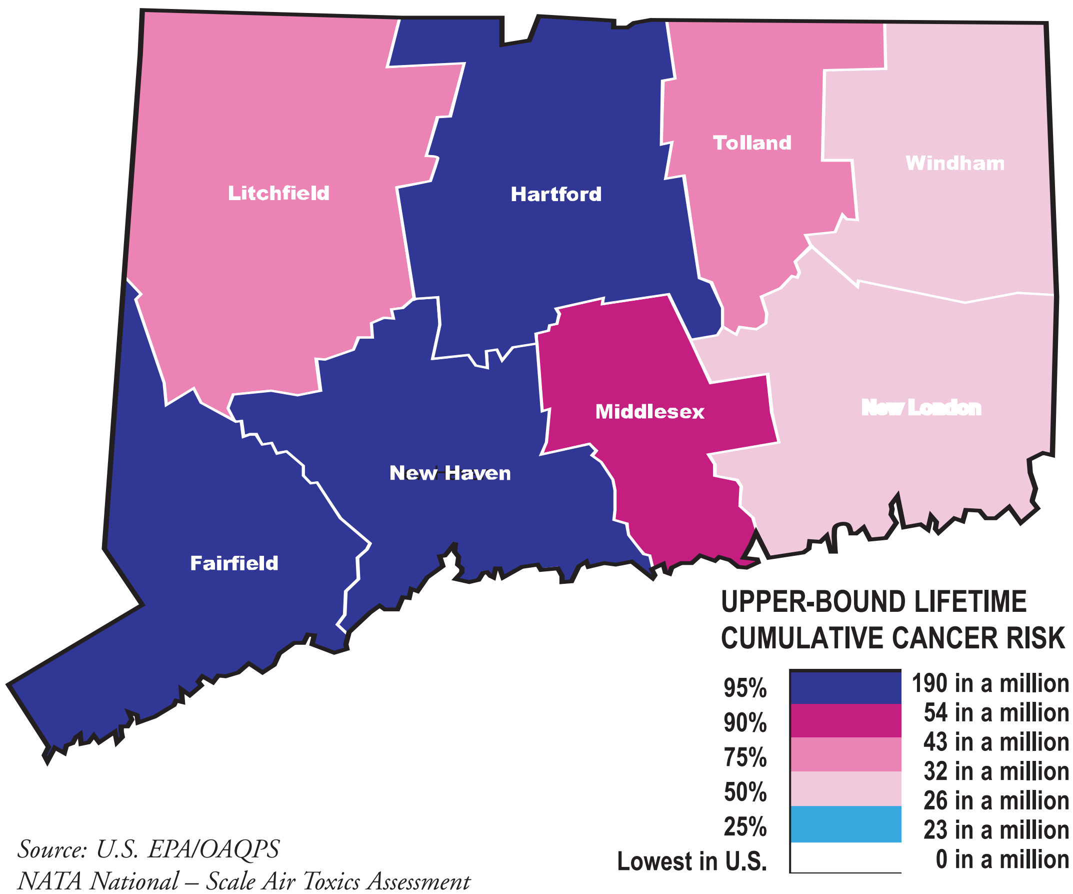
Researchers estimate that about half the potential health risk from toxic air pollutants in Connecticut comes from mobile sources.[153]

2. Vehicle Emissions

- Exhaust from vehicles is responsible for most of Connecticut's air pollution problem. About half the potential health risk from toxic air pollutants in Connecticut comes from mobile sources.[153] Figure 2 shows EPA cancer risk estimates for Connecticut. The estimates are based on inhalation only, and on 1996 air air emission data. While air emissions have changed since then, the figure demonstrates that the cancer risk is highest along the heavily traveled portions of I-95, I-91, and I-84.

FIGURE 2. ESTIMATED COUNTY MEDIAN CANCER RISK, 1996
ALL CARCINOGENS – CONNECTICUT COUNTIES

Estimated Median Cancer Risk, 1996, for all carcinogens by county in the state of Connecticut.[154]



Source: U.S. EPA/OAQPS
NATA National – Scale Air Toxics Assessment

Criteria Pollutants of Concern: Ozone and Particulate Matter

Like all states, Connecticut has fixed monitoring sites to measure the concentration in the air of each of these Criteria Pollutants. Levels of carbon monoxide,[155] nitrogen dioxide, and sulfur oxides are in compliance with the federal primary standards. Ozone and $PM_{2.5}$ levels in Connecticut are not in compliance with federal air quality standards.[156]

Ozone

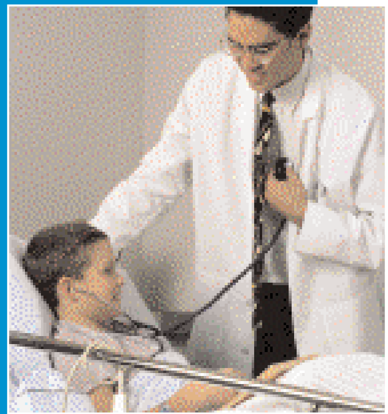
- Repeated exposure to ozone may cause permanent damage to the lungs, especially in children whose lungs are still developing, as well as reproductive and genetic damage. Exposure to ozone may increase the risk of damage to a developing fetus.[157]

- Exposure to ozone can aggravate chronic lung diseases, reduce the immune system's ability to fight off infections in the respiratory system, and aggravate heart disease.[158] The association between ambient ozone and increased asthma-related emergency room visits is well-documented.[159, 160, 161, 162]

- One of the largest ozone pollution studies ever conducted found a connection between short-term changes in ground-level ozone and mortality in 95 large U.S. urban areas, which include 40 percent of the U.S. population. The study linked day-to-day variations in ambient ozone levels and daily mortality in urban areas. The study provides strong evidence of short-term effects of ozone on mortality. The authors found that a reduction of 10 parts per billion, or about 35 percent of the average ground-level ozone on any day, could save an average of 4,000 lives per year in the 95 large urban areas.[163]

- Connecticut has a more severe ozone problem than most regions in the United States. Surface-level ozone is primarily a result of chemical reactions starting with various emissions from automobiles. Levels are highest in the summer, when the sun and hot temperatures react with pollution to form ozone.

2. Vehicle Emissions



Exposure to ozone can aggravate chronic lung diseases, reduce the immune system's ability to fight off infections in the respiratory system, and aggravate heart disease.[158]

2. Vehicle Emissions

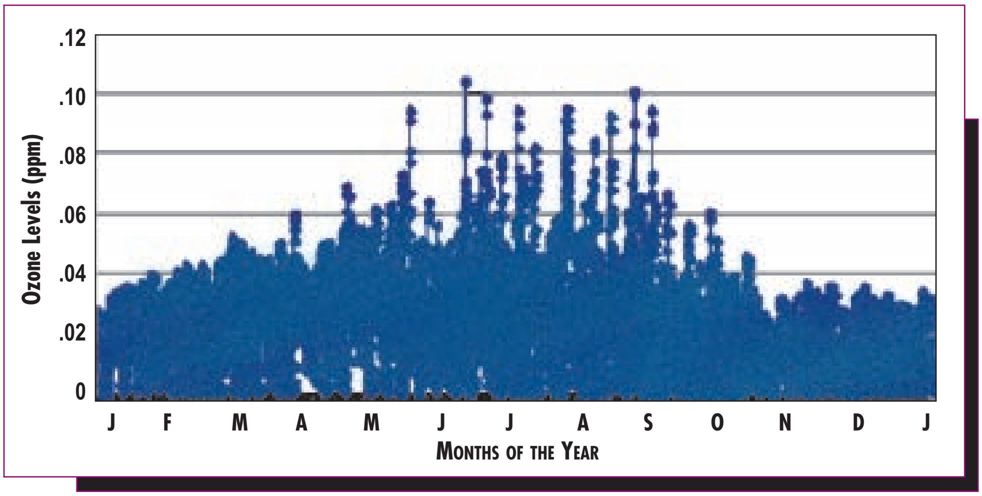
Ozone levels in the New England region are some of the highest in the nation and have been getting worse.

- Ozone levels in the New England region are some of the highest in the nation and have been getting worse. Between May and September of 2005, there were 26 days when ozone monitors recorded concentrations considered unhealthy. In 2004 and 2003, there were a total of 13 and 17 unhealthy ozone days, respectively. There were 20 days in Connecticut in 2005 that were considered to have unhealthy levels of ozone, compared to six in 2004. The increase in the number of hot days per year contributed to the high ozone levels in 2005.[164]

- In 1997, EPA announced a new 8-hour standard for ozone emissions. The new standard, more stringent than the previous 1-hour standard, requires that the average 8-hour ozone level be no greater than .08 parts per million (ppm), or 80 parts per billion (ppb).[165] The former and less stringent 1-hour standard specified ozone levels no greater than .12 ppm for one hour.[166]

- The entire state of Connecticut exceeds the federal 8-hour ozone standard.[167]

FIGURE 3. HOURLY OZONE LEVELS, 2004, EAST HARTFORD, CONNECTICUT



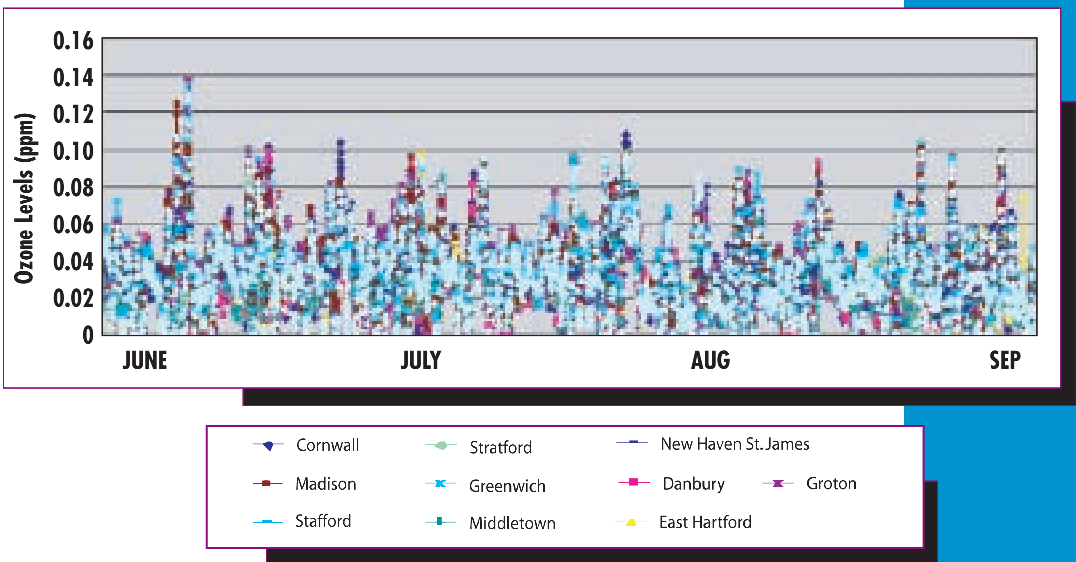
Ozone is a problem primarily during the summer months in Connecticut. Late fall 2004 had the lowest levels, while winter had moderate levels, and the summer had the highest recorded values.

- Fairfield County has been ranked the 13th most ozone-polluted county in the nation and the New York-Newark-Bridgeport metropolitan area is ranked the 9th most ozone-polluted metropolitan area in the nation.[168] In 2001, portions of the state exceeded the 8-hour limit on 26 days, and the 1-hour limit on nine days.[169]

- When an area does not meet the air quality standard for one of the criteria pollutants, the area may be subject to the formal rulemaking process that designates the area as non-attainment.[170] Under the 1-hour standard, the state had two non-attainment areas. One area—Bridgewater, New Milford, and Fairfield County except Shelton—was designated as a *severe* non-attainment area. The other area—which includes the rest of the state—was designated as a *serious* non-attainment area.

- Under the 8-hour standard, Fairfield, New Haven and Middlesex counties and the Greater Connecticut Non-Attainment area, which includes Hartford, New London, Tolland, Windham and Litchfield counties, are designated as a *moderate* non-attainment area.[171]

Figure 4. Hourly Ozone Levels at Connecticut Monitoring Sites

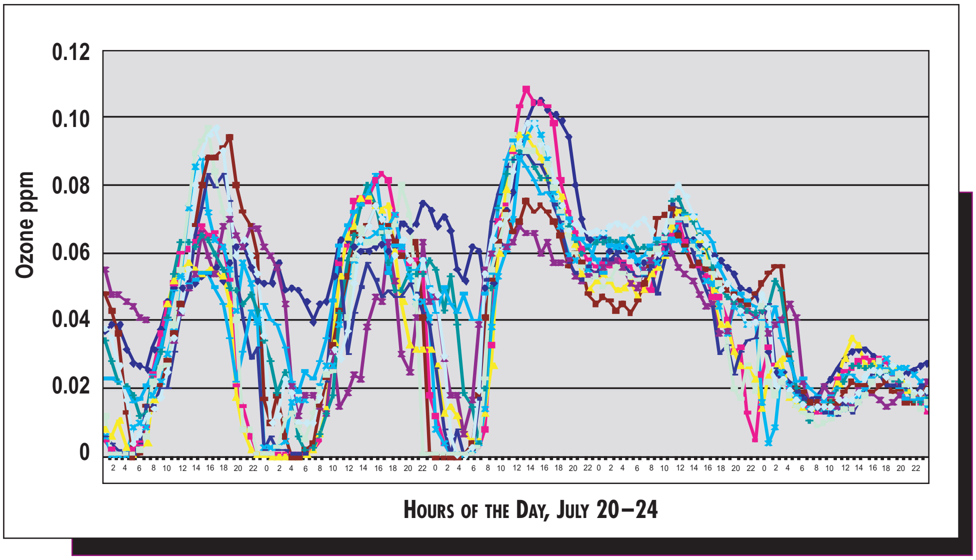


The figure demonstrates the periodic excursion of measured ozone levels above the federal standard of 80 ppb between June 1 and September 1, 2004. The entire state of Connecticut is beyond federal 8-hour ozone limits, with levels near the New York metropolitan area designated by EPA to be "severe." Levels in the remainder of Connecticut are classified as "serious." Ozone levels are highest in Connecticut from April 1 to October 1.

2. Vehicle Emissions

The chart at right shows a high pollution episode between July 20 and July 24, 2004. Note the daily variation in levels, with peaks occurring between mid-afternoons and early evenings.

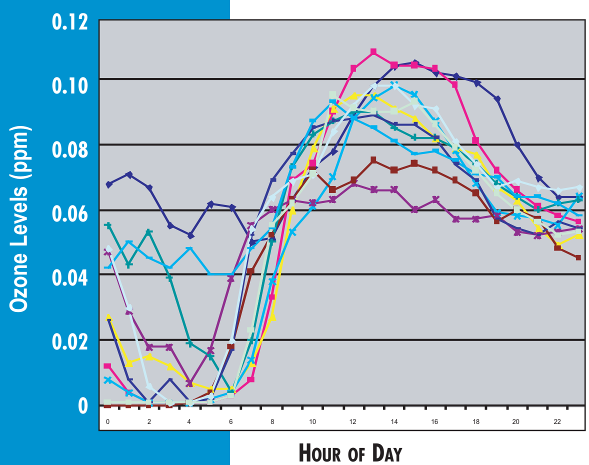
Figure 5. Connecticut High Pollution Episode, July 20-24, 2004



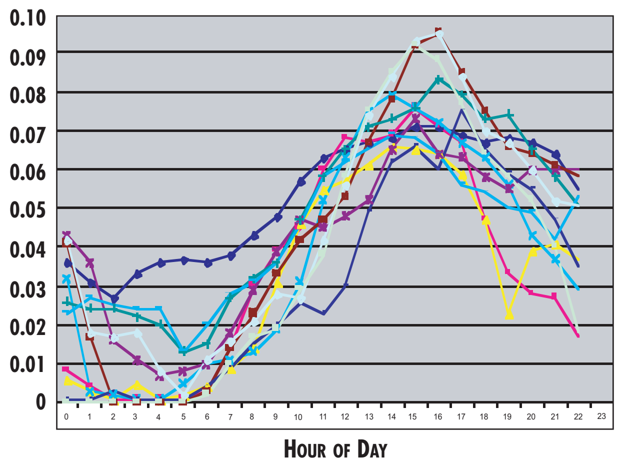
Above, the chart shows a high pollution episode between July 20 and July 24, 2004. Note the daily variation in levels, with peaks occurring between mid-afternoons and early evenings. Also note the rapid decline at the right of the chart when a high pressure weather system brought cleaner air to the region. Also significant is the regional variability of measured levels. Even very rural areas, such as Mohawk Mountain in Cornwall, recorded a significant excursion above the federal standard.

Below, variability is more apparent if a shorter period of time is plotted. Note the high levels recorded on July 22, 2004, in Danbury and Mohawk Mountain (left), and in the late afternoon of August 23, 2004.

July 22, 2004



August 23, 2004



Particulate Matter

Particulate matter (PM) includes particles found in air, such as dust, dirt, soot, smoke, or liquid droplets. Particulates are emitted from vehicles as well as factories, construction sites, tilled fields, unpaved roads, stone crushing operations, and from the burning of wood and home heating oil.

- The two most studied particle sizes are PM_{10} and $PM_{2.5}$, each of which is associated with different health effects. PM_{10} refers to coarse particles with a diameter of 10 micrometers or less, and $PM_{2.5}$ refers to fine particles with a diameter of 2.5 micrometers or less. As particle size diminishes, the threat to human health increases. Fine particles have been found to have much stronger acute respiratory effects than coarse particles.[172]

- Particulate matter levels vary according to the weather and are highest in the summer. Particulate matter is especially harmful to people with lung or heart diseases, children, and the elderly.

- Exposure to fine particulate matter in vehicle exhaust, even briefly, can irritate the lungs, particularly in asthmatics. Volunteers with mild allergic asthma were exposed to vehicle exhaust in a car within a road tunnel for 20 minutes. Subjects exposed to $PM_{2.5}$ at levels above 100 ug/m^3 (micrograms per cubic meter) had an increased reaction to an allergen administered four hours after the tunnel exposure.[173]

- Short-term exposure to particulate matter can also aggravate respiratory conditions such as asthma and cause coughing, wheezing, respiratory irritation, and painful breathing.[174] An association between short-term particulate levels and the occurrence of asthmatic symptoms has been noted in children. Children experience increased severity of asthmatic symptoms following short-term increases in PM_{10}. One hour maximum PM_{10} levels have been found to be more strongly associated with increased symptoms than 24-hour mean levels.[175]

- Long-term exposure to particulate matter can cause increased respiratory disease, chronic bronchitis, decreased lung function, and premature death caused by respiratory problems, cardiovascular problems, and cancer. The risk of dying prematurely from cardio-respiratory diseases and lung cancer is higher in more polluted areas.[176]

2. Vehicle Emissions

Exposure to fine particulate matter in vehicle exhaust, even briefly, can irritate the lungs, particularly in asthmatics.

2. Vehicle Emissions

Recent research shows that ultra-fine PM can pass through the lungs and go directly into the bloodstream, causing the blood to coagulate and thicken, as well as increasing the likelihood of inflammation.

- The relationship between increased exposure to particulate matter and adverse cardiovascular effects is well documented in epidemiological studies.[177, 178, 179] Fine particles have been linked to cardiovascular symptoms, cardiac arrhythmias, heart attacks and premature death from heart disease.[180, 181] Long-term exposure to fine particulate air pollution at levels that occur in North America has been associated with increased risk for cardiovascular mortality by 12 percent for every 10 micrometers of particulate matter within 1 cubic meter of air. Heart attacks account for the largest portion of this increased mortality. Other causes, such as heart failure and fatal arrythmias, also increased. [182, 183]

- Recent research shows that ultra-fine PM can pass through the lungs and go directly into the bloodstream, causing the blood to coagulate and thicken, as well as increasing the likelihood of inflammation. These findings help to explain why air pollution is linked to increased risk of heart attacks, strokes, and respiratory problems.[184]

- Analysis of data from an American Cancer Society cohort study found that for each 10 ug/m^3 elevation in fine particulate air pollution, the risk of lung cancer mortality increased by 8 percent.[185]

PM Levels in Connecticut

- The city of New Haven was designated as a non-attainment area for PM_{10} in the 1980s and 1990s. The PM_{10} non-attainment status in New Haven was considered by the Connecticut Department of Transportation to be a local problem resulting from activities of several businesses located in the Stiles Street section of the city. Corrective actions were subsequently identified in the state, and there have been no violations of the PM_{10} National Ambient Air Quality Standards (NAAQS) since the mid-1990s.[186]

- Fairfield and New Haven counties are included in the New York-Northern New Jersey-Long Island, NY-NJ-CT $PM_{2.5}$ non-attainment area.[187]

- The New York-Newark-Bridgeport metropolitan area has been ranked the 25th most polluted in the U.S. by short-term particle pollution and the 12th most polluted by long-term particle pollution.[188]

FIGURE 6. CONNECTICUT $PM_{2.5}$ JAN. 1–JULY 1, 2005

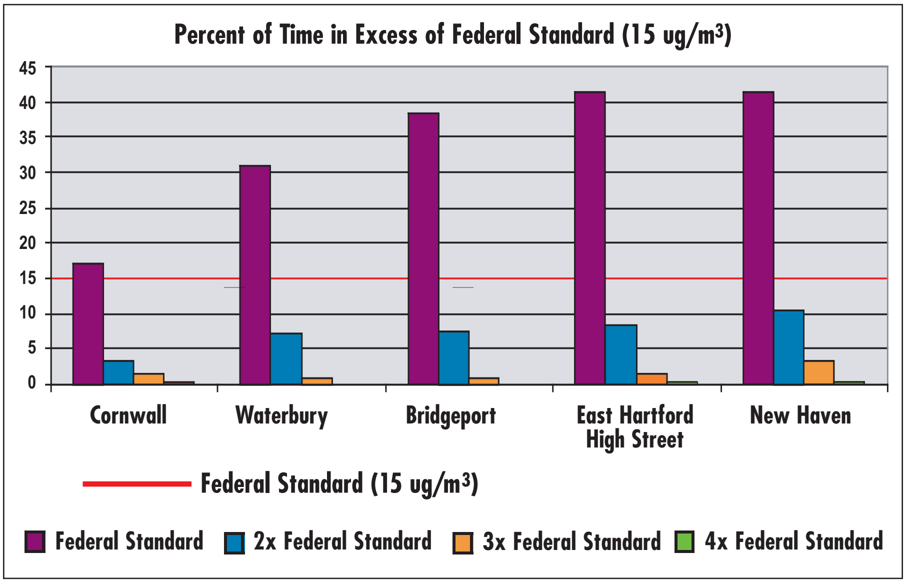
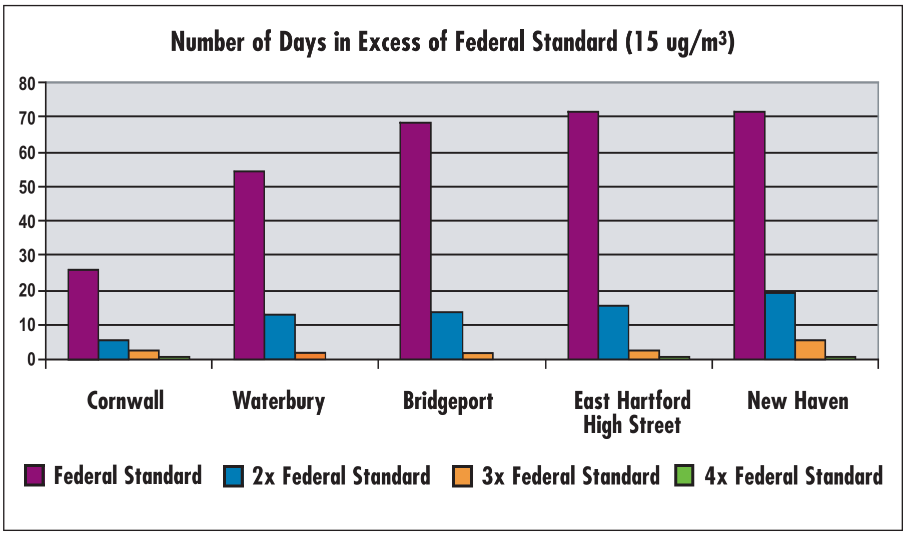


FIGURE 7. CONNECTICUT $PM_{2.5}$ JAN. 1–JULY 1, 2005



These two charts demonstrate that during the six-month period between January 1 and July 1, 2005, $PM_{2.5}$ levels exceeded the federal standard nearly 40 percent of the time in New Haven, East Hartford, and Bridgeport, Connecticut. Experts now believe that the federal standard does not offer public health protection. This does not account for special at-risk populations, such as individuals with cardiovascular disease, COPD, asthma, diabetes, immune deficiencies, or lung cancer.

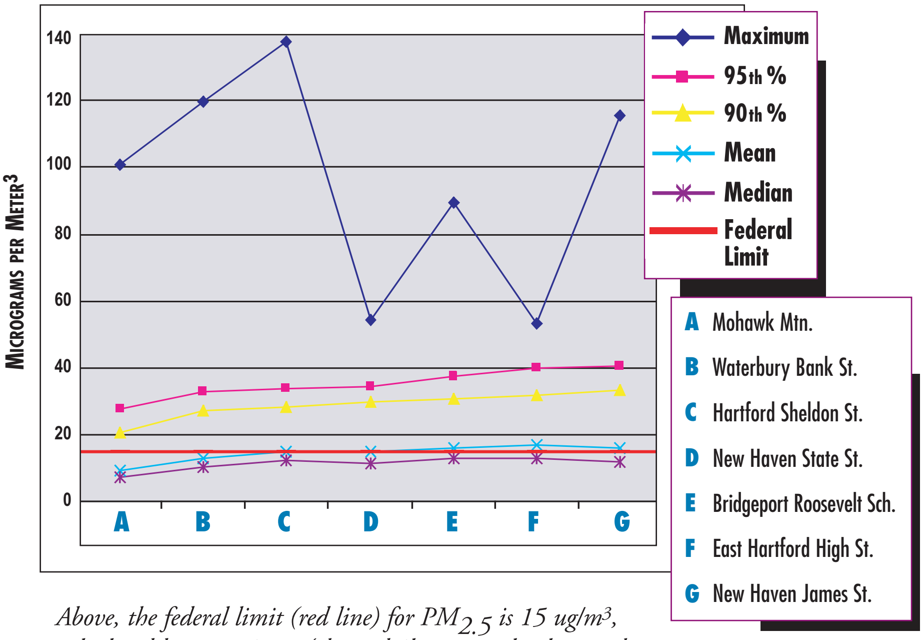
2. Vehicle Emissions

The two charts at left show that during the six-month period between January 1 and July 1, 2005, $PM_{2.5}$ levels exceeded the federal standard nearly 40 percent of the time in New Haven, East Hartford, and Bridgeport, Connecticut.

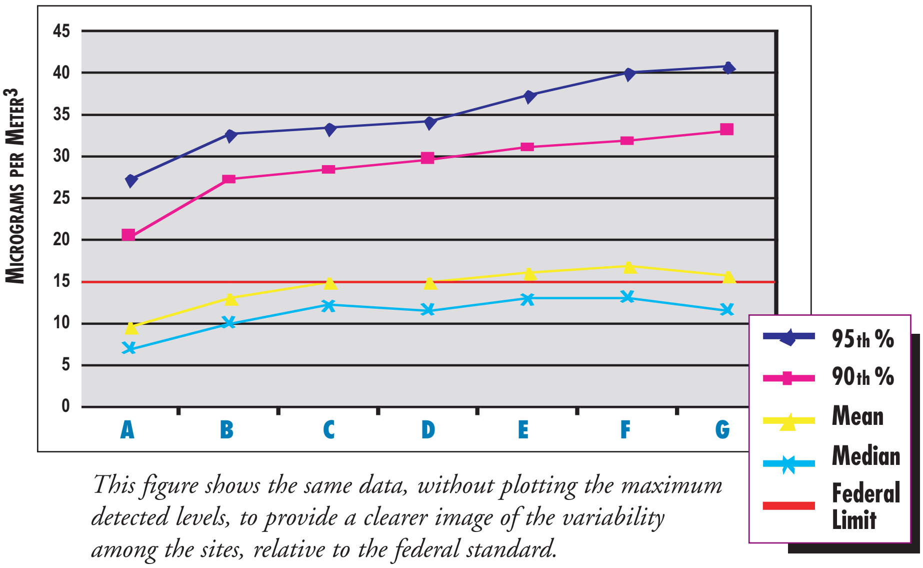
2. Vehicle Emissions

EPA determined that Fairfield and New Haven counties are out of compliance with the current federal standard for $PM_{2.5}$.

Figure 8. Particulate Matter 2.5 Microns and Smaller



Above, the federal limit (red line) for $PM_{2.5}$ is 15 ug/m³, calculated by averaging 24-hour daily average levels over three years. Maximum detected levels are depicted by the blue diamond symbols. The 90th percentile value shows that $PM_{2.5}$ levels exceeded the federal limit for 10 percent of the days measured. For the New Haven James Street site, for example, on 10 percent of the days measured during 2004, the levels exceeded 30 ug/m³, a value twice the federal limit. For the same site, on five percent of the days measured, levels exceeded 40 ug/m³. Based upon these data, EPA determined that Fairfield and New Haven counties are out of compliance with the current federal standard.



This figure shows the same data, without plotting the maximum detected levels, to provide a clearer image of the variability among the sites, relative to the federal standard.

Hazardous Air Pollutants (HAPs)

The 1990 amendments to the Clean Air Act addressed a large number of air pollutants known or thought to cause adverse effects to human health or the environment. Emissions standards for hazardous air pollutants were established to limit the release of specified HAPs from specific industrial sectors. These standards are "technology-based" (based on best available control technology an industrial sector could afford) and are not based on health risk considerations.

- Of the 188 HAPs, 21 are considered "mobile source" air toxics (Table 2). EPA estimates that about 40 percent of air toxic emissions in the U.S. come from mobile sources[189] including cars, trucks, buses, farm equipment, planes, trains. tractors, and lawn motors.[190]

2. Vehicle Emissions

EPA estimates that about 40 percent of air toxic emissions in the U.S. come from mobile sources.[189]

TABLE 2. LIST OF MOBILE SOURCE AIR TOXICS WITHIN HAPs

1,3-Butadiene	Dioxin/Furans	n–Hexane
Acetaldehyde	Ethylbenzene	Naphthalene
Acrolein	Formaldehyde	Nickel Compounds
Arsenic Compounds	Lead Compounds	POM
Benzene	MTBE	Styrene
Chromium Compounds	Manganese Compounds	Toluene
Diesel Exhaust	Mercury Compounds	Xylene

Hazardous Air Pollutants of Concern in Connecticut

- EPA conducted a National Scale Assessment of HAPs using computer models to estimate concentrations of air toxics throughout the U.S. The assessment was based on air toxic emissions estimates from different sources, including mobile sources and industries. It was limited to 33 air toxics (a subset of EPA's list of 188 air toxics identified as priority pollutants in EPA's Integrated Urban Air Toxics Strategy, plus diesel particulate matter) due to limited data for the remaining 155 HAPs.[191]

- EPA has identified 12 air toxics of concern that exceed health-based risk values in at least one New England state.[192] On- and off-road vehicles are the primary sources of five of these air toxics.

2. Vehicle Emissions

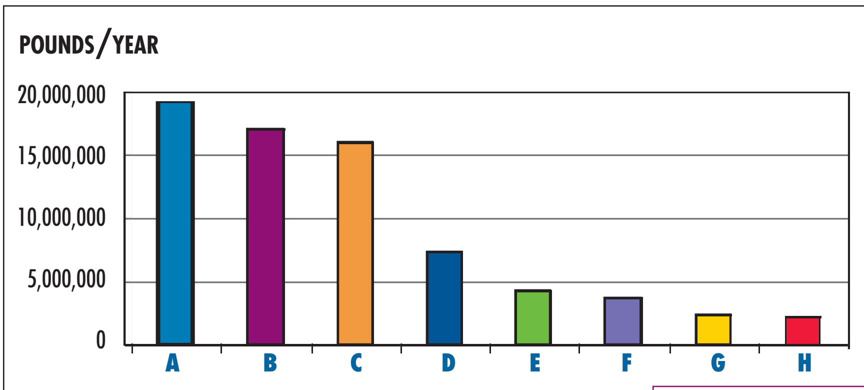
Nationally, benzene, 1,3-butadiene, formaldehyde, and acetaldehyde are responsible for nearly all of the cumulative lifetime cancer risk from highway mobile sources. Diesel was not included in this assessment.[194]

- EPA estimates that light duty gasoline trucks and vehicles are responsible for the majority of the total emissions of five toxic pollutants, not including diesel, from motor vehicles.[193] These five chemicals are acrolein, acetaldehyde, benzene, 1,3-butadiene, and formaldehyde. Information about the sources and health effects of these pollutants, along with the sources and health effects of diesel exhaust, is summarized on the opposite page in Table 3.

- EPA estimates that benzene, 1,3-butadiene, formaldehyde, and acetaldehyde are responsible for nearly all of the cumulative lifetime cancer risk from highway mobile sources. Diesel was not included in this assessment.[194]

- Benzene occurs naturally in gasoline and is emitted into the air as unburned fuel. Formaldehyde, acetaldehyde, diesel particulate matter, and 1,3-butadiene are by-products of incomplete fuel combustion. Formaldehyde and acetaldehyde are also formed through a secondary process when other mobile source pollutants undergo chemical reactions in the atmosphere.

FIGURE 9. 1999 HAPs EMISSIONS BY COUNTY



A	Fairfield County
B	New Haven County
C	Hartford County
D	New London County
E	Middlesex County
F	Litchfield County
G	Tolland County
H	Windham County

Nearly 72 million pounds of chemicals classified by EPA as "hazardous air pollutants" were emitted in Connecticut in 1999, the last year these values were calculated by EPA. These levels vary considerably by county. This chart suggests that urban industrialized areas with the highest traffic intensity produce the highest HAPs emissions. While it is important to recognize that these data are limited in quality, they provide the best available estimate of regional variance in emissions.

Table 3. Air Toxics of Greatest Concern in Connecticut [195]

Pollutant	Chronic Health Effects (Inhalation)[196]	Contribution from On- and Off-Road Mobile Sources	Other Sources
Acetaldehyde	*Probable human carcinogen. Increased incidences of nasal tumors and laryngeal tumors in animals in inhalation studies.*	95%	*Produced from incomplete combustion (vehicle exhaust, coal refining, wood burning, cigarette smoke). Vehicles are responsible for about 33% of the Connecticut emissions, mostly light duty gasoline vehicles.*
Acrolein	*Possible human carcinogen. General respiratory congestion and eye, nose and throat irritation. No data on reproductive or developmental effects.*	76%	*Formed from breakdown of pollutants in outdoor air, burning tobacco or gasoline. Vehicles are responsible for about 40% of Connecticut emissions, mostly light duty gasoline vehicles.*
Benzene	*Known human carcinogen (leukemia). Also associated with: aplastic anemia, excessive bleeding, damage to the immune system, menstrual and reproductive disorders in women and some developmental effects in fetuses.*	93%	*Emissions from burning gas and diesel fuel. Vehicles (mostly light duty gasoline trucks and cars) are responsible for 63% of the benzene emissions in Connecticut.*
1,3-Butadiene	*Probable human carcinogen. Chronic exposure associated with an increase in cardiovascular diseases. Increase in ovarian and testicular atrophy, increased skeletal abnormalities, decreased fetal weight, tumors at a variety of sites (inhalation exposure in animal studies).*	89%	*Motor vehicle exhaust is a constant source. Vehicle exhaust (mostly from gasoline trucks and light duty vehicles) is responsible for 74% of the 1,3-butadiene emissions in Connecticut.*
Diesel Exhaust	*Likely carcinogen. Lung inflammation and cellular changes and immunological effect (animal studies). Association with increased lung cancer rates in occupational settings (epidemiological studies). Acute effects include eye, nose, and throat irritation; neurological effects such as lightheadedness, cough or nausea; and asthma exacerbation.*	EPA did not include data	*Emitted from on-road diesel engines of trucks, buses and cars, and off-road diesel engines including locomotives, marine vessels and heavy equipment.*
Formaldehyde	*Probable human carcinogen; breathing relatively low levels of formaldehyde can irritate eyes, nose and throat and cause respiratory problems, menstrual disorders, and pregnancy problems.*	71%	*Power plants, manufacturing facilities, incinerators, and automobile exhaust emissions. About 40% of the formaldehyde emissions in Connecticut are from mobile sources, mostly light duty gasoline trucks and cars.*

2. Vehicle Emissions

In addition to asthma, the risk of developing cancer from diesel exposure is a concern.

- Although EPA did not include diesel in its assessment, the agency considers it to be an air toxic of concern since the estimated exposure concentrations are highest in most of the New England states.[197]

- More than 40 chemicals in diesel exhaust are listed as Hazardous Air Pollutants under the Clean Air Act.[198] Exposure to diesel particles in Connecticut is of special concern, as it may worsen allergy and asthma symptoms and increase the risk of developing asthma.[199] Even short-term exposure to diesel exhaust has been associated with adverse effects in asthmatic subjects.[200]

- In addition to asthma, the risk of developing cancer from diesel exposure is a concern. A study in Southern California estimates that more than 70 percent of the cancer risk from air pollution is associated with diesel exhaust.[201] Some research suggests that newer diesel engines may produce a higher number of small-diameter particles. These smaller particles have a larger surface area, and may be capable of delivering a higher dose of adsorbed toxic gases to the lung than coarser particles. This may especially threaten the health of children with smaller airways and those with reactive airway disease.[202]

National Ambient Air Quality Standards (NAAQS)

- The Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS) for wide-spread pollutants considered harmful to public health and the environment. The goal of the Act was to set and achieve NAAQS in every state by 1975. The Act was amended in 1977 to set new dates for achieving attainment of NAAQS since many areas of the country had failed to meet the Act's deadlines. In 1990, additional amendments were added to address air quality problems, including ground-level ozone, stratospheric ozone depletion, and air toxics.

- The Clean Air Act establishes Primary Standards to protect public health including the health of sensitive populations (e.g., asthmatics, children, and the elderly) for six criteria pollutants: carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone and sulfur oxides.

- Although these primary standards were required by the Clean Air Act to protect public health with an adequate margin of safety, researchers have identified adverse health effects at levels near or below the current standards for ozone, particulate matter, and nitrogen dioxide.[203] Evidence is mounting that current standards for PM_{10}, $PM_{2.5}$, ozone, and nitrogen dioxide do not assure protection of children's health.[204]

Problems with Averaging Pollution Levels

The government is allowed to average some pollutants across long periods of time. For example, $PM_{2.5}$ is permitted to be averaged over 24-hour intervals, and the 24-hour averages are then averaged over three years, before compliance with federal standards is determined. The results mask serious high pollution episodes. Medical scientists have determined that much shorter-term exposures, measured in hours or minutes, are potentially dangerous to susceptible populations, i.e., those with cardiovascular, respiratory, and other illnesses.

2. Vehicle Emissions

Evidence is mounting that current standards for PM_{10}, $PM_{2.5}$, ozone, and nitrogen dioxide do not assure protection of children's health.[204]

TABLE 4. NATIONAL AMBIENT AIR QUALITY STANDARDS[205]

Pollutant	Primary Standards	Averaging Times
Carbon Monoxide	9 ppm (10 mg/m^3) 35 ppm (40 mg/m^3)	8-hour[1] 1-hour[1]
Lead	1.5 ug/m^3	Quarterly Average
Nitrogen Dioxide	0.053 ppm (100 ug/m^3)	Annual (Arith. Mean)
Particulate Matter (PM_{10})	50 ug/m^3 150 ug/m^3	Annual[2] (Arith. Mean) 24-hour[1]
Particulate Matter ($PM_{2.5}$)	15.0 ug/m^3 65 ug/m^3	Annual[3] (Arith. Mean) 24-hour[4]
Ozone	0.08 ppm	8-hour[5]
Sulfur Oxides	0.03 ppm 0.14 ppm —	Annual (Arith. Mean) 24-hour[1] 3-hour[1]

1 *Not to be exceeded more than once per year.*
2 *To attain this standard, the 3-year average of the weighted annual mean PM_{10} concentration at each monitor within an area must not exceed 50 ug/m^3.*
3 *To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 ug/m^3.*
4 *To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 ug/m^3.*
5 *To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.*

3. Vehicle Trends

Between 1991 and 2000, the number of vehicle miles traveled in Connecticut increased 16 percent to almost 31 billion miles.[206]

Vehicle Transportation Trends

- Highway Vehicle Miles Traveled (VMT) in the U.S. has been on the increase since the 1990s and the trend in Connecticut is similar. Between 1991 and 2000, the number of vehicle miles traveled annually in Connecticut increased 16 percent to almost 31 billion miles.[206]

- Cars and trucks are the largest source of smog and other air pollution in Connecticut. Among the factors causing an increase in total number of miles driven by Connecticut residents are population growth, rising numbers of vehicles and VMT per capita.[207]

- Contributing to the increase in VMT in Connecticut is a trend in the driving patterns of Connecticut residents. About 80 percent of the residents in Connecticut commute to work alone; only 8 percent carpool with another passenger, and fewer than 2 percent carpool with two other passengers.[208]

- A decline in the population in Connecticut's cities and a shift to the suburbs is part of the reason for the increase in VMT. Between 1990 and 2000, cities in Connecticut experienced population declines: Hartford experienced an 11 percent drop, New London a 10 percent drop, and New Haven a 5 percent drop in population.[209] Over the same time period, the state as a whole experienced a population increase of about 4 percent.[210]

- One consequence of the population rise in the suburbs is an increased reliance on vehicles for transportation and an increase in VMT. The most rapid growth in car registrations is occurring in rural areas of the state, according to Connecticut DMV records.[211]

- Passenger VMT in Connecticut is projected to increase by 22.2 percent from 2000 to 2020, according to the Connecticut DOT's Master Transportation Plan.[212, 213]

Vehicle Miles Traveled by Vehicle Type

- In the last decade, the kinds of cars that Americans are driving have changed (Figure 10). The increasing popularity of sport utility vehicles and other light trucks (a classification that includes minivans, pickup trucks, and SUVs) has resulted in a shift in the relative percentage of total VMT between automobiles and light trucks. Although the automobile is still the dominant vehicle type in terms of VMT, its percent of VMT declined from 66 percent of total VMT to 58 percent between 1990 and 2000. During that same time, the percentage of VMT by the light truck classification increased to 34 percent.[214]

FIGURE 10. CHANGES IN VMT BY VEHICLE TYPE[215]

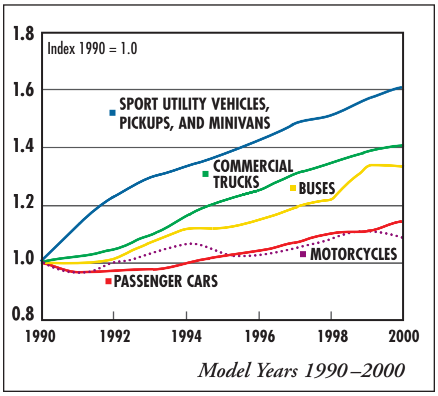
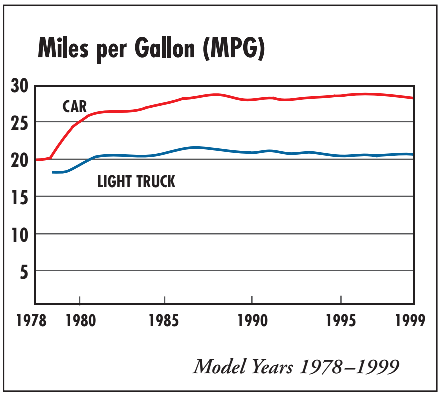


FIGURE 11. FUEL ECONOMY AVERAGES: NEW PASSENGER CAR AND LIGHT TRUCKS[216]



Trends in Fuel Economy

- Fuel economy, measured in miles per gallon (MPG) in the U.S., has improved since 1978, when fuel economy standards were implemented. Between 1978 and 1988, new passenger car average fuel economy went from 19.9 MPG to 28.8 MPG, while light trucks improved slightly, from 18.2 MPG (1979) to 21.3 MPG. Since 1988, new car fuel economy has not increased.

- In the last 30 years the average MPG for cars increased from 13 to 22 MPG and the average MPG for vans, pickup trucks, and SUVs increased from 11 to 18 MPG. In contrast, the average MPG for trucks[217] in the last 30 years has remained the same, at about 5.5 MPG. Even though the 30-year window shows an improvement in fuel rates for passenger cars within the past 15 years, there has been no significant progress in fuel rates.[218]

3. Vehicle Trends

The increasing popularity of sport utility vehicles and other light trucks (a classification that includes minivans, pickup trucks, and SUVs) has resulted in a shift in the relative percentage of total VMT between automobiles and light trucks.

3. Vehicle Trends

The increase in transportation fuel use is mainly attributable to the rising rate of VMT, the growth in number of vehicles on the road, and stagnant vehicle fuel economy.[219]

Trends in Fuel Consumption

- The increase in transportation fuel use is mainly attributable to the rising rate of VMT, the growth in number of vehicles on the road, and stagnant vehicle fuel economy.[219] The demand for transportation fuel continues to rise throughout the U.S., particularly for diesel fuel.
- Figure 12 demonstrates the long-term increasing trend in the demand for diesel fuel throughout the U.S.[220]
- Figure 13 on the opposite page shows the growth in U.S. motor vehicle fuel economy over the past two decades.[221]
- Table 5 on the opposite page highlights the rise in transportation fuel consumption over the last several years in the New England region, where the demand for diesel fuel doubled between 1982 and 1998.
- The Connecticut Department of Transportation estimates that freight traffic will double again in Connecticut in the next 20 years and that trucks will account for most of the increase.[222]

FIGURE 12. TRENDS IN DIESEL FUEL CONSUMPTION IN THE U.S.

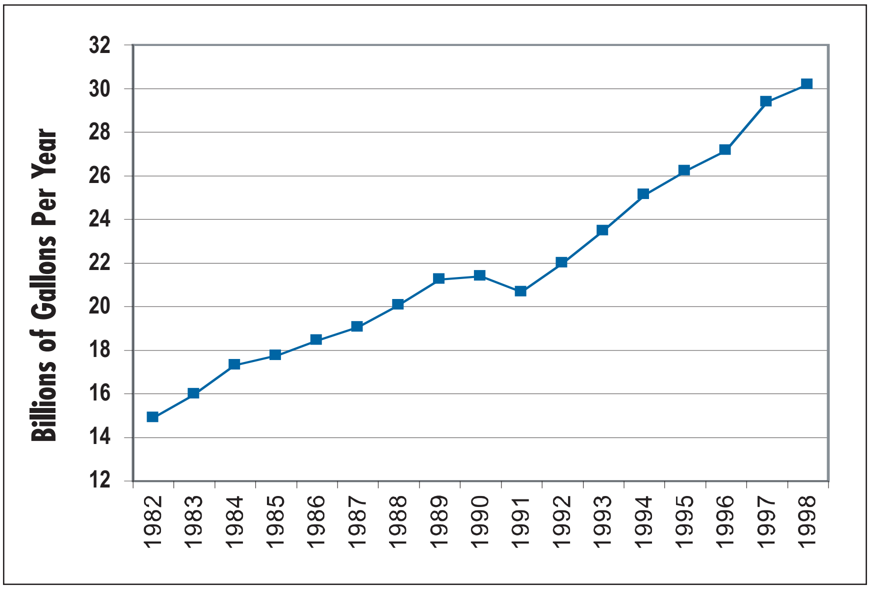


Figure 13. U.S. Motor Vehicle Fuel Economy

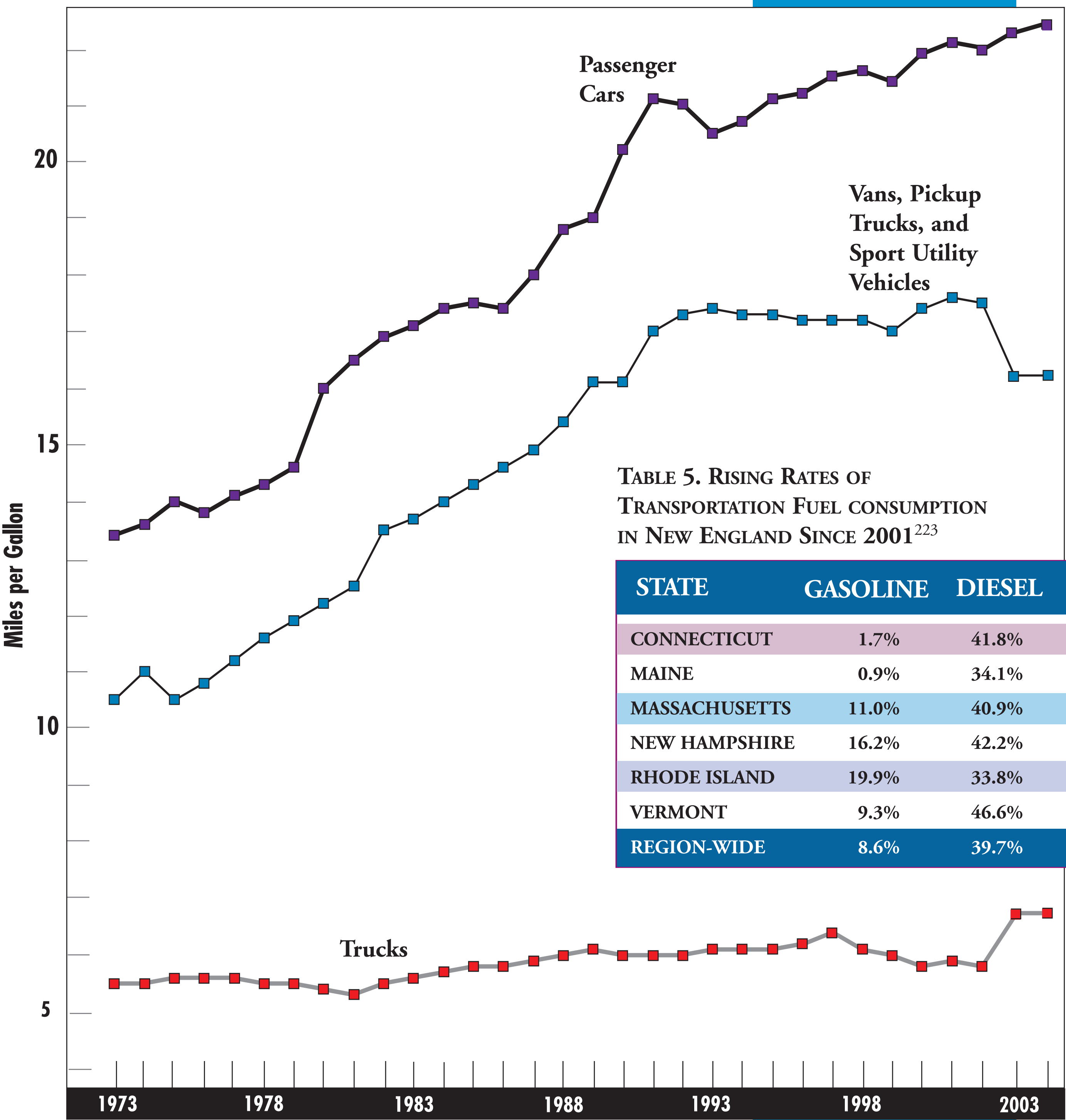


Table 5. Rising Rates of Transportation Fuel consumption in New England Since 2001[223]

STATE	GASOLINE	DIESEL
CONNECTICUT	1.7%	41.8%
MAINE	0.9%	34.1%
MASSACHUSETTS	11.0%	40.9%
NEW HAMPSHIRE	16.2%	42.2%
RHODE ISLAND	19.9%	33.8%
VERMONT	9.3%	46.6%
REGION-WIDE	8.6%	39.7%

4. Monitoring Emissions

The government is allowed to average some pollutants across long periods of time.... The results mask serious high-pollution episodes.

Monitoring Vehicle Emissions

Averaging Air Pollution

- The government is allowed to average some pollutants across long periods of time. For example, $PM_{2.5}$ is permitted to be averaged over 24-hour intervals, and the 24-hour averages are then averaged over three years, before compliance with federal standards is determined. The results mask serious high-pollution episodes. Medical scientists have determined that much shorter-term exposures, measured in hours or minutes, are potentially dangerous to susceptible populations, such as those with cardiovascular, respiratory, and other illnesses.

Air Quality Monitoring Deficiencies

- Government understanding of the severity of air pollution depends upon what is being monitored and where the monitoring occurs. Air quality varies across space and time, and is dependent upon climatic conditions. It is poorest, but may not be monitored, where traffic is most intense. Often air pollution occurs where highways slow near urban areas, near construction sites, and where trucks, buses, and cars tend to concentrate and idle: schools, hospitals, shopping centers, truck stops, warehouses, ports and shipping facilities, oil tank farms, rail stations, bus terminals, and where gas and diesel powered vehicles are used within warehouses or ships.

Photochemical Assessment Modeling (PAM)

- Photochemical Assessment Monitoring (PAM) is conducted in accordance with the 1990 Clean Air Act Amendments in areas with persistently high ozone levels. The Connecticut DEP established Photochemical Assessment Monitoring Stations (PAMS) during the 1990s to monitor ozone and its precursors in areas that have persistently high ozone levels. Connecticut operates a network of three PAM sites: East Hartford, New Haven, and Westport.[224]

- The Northeast States for Coordinated Air Use Management (NESCAUM) collects, organizes and validates data from NESCAUM PAM sites. According to NESCAUM, there has been insufficient analysis of the network data to evaluate the effectiveness of its intended objectives: emissions tracking, information on the effectiveness of the control strategies, and trends and exposures.[225]

Monitoring Systems for Vehicle Exhaust in Connecticut

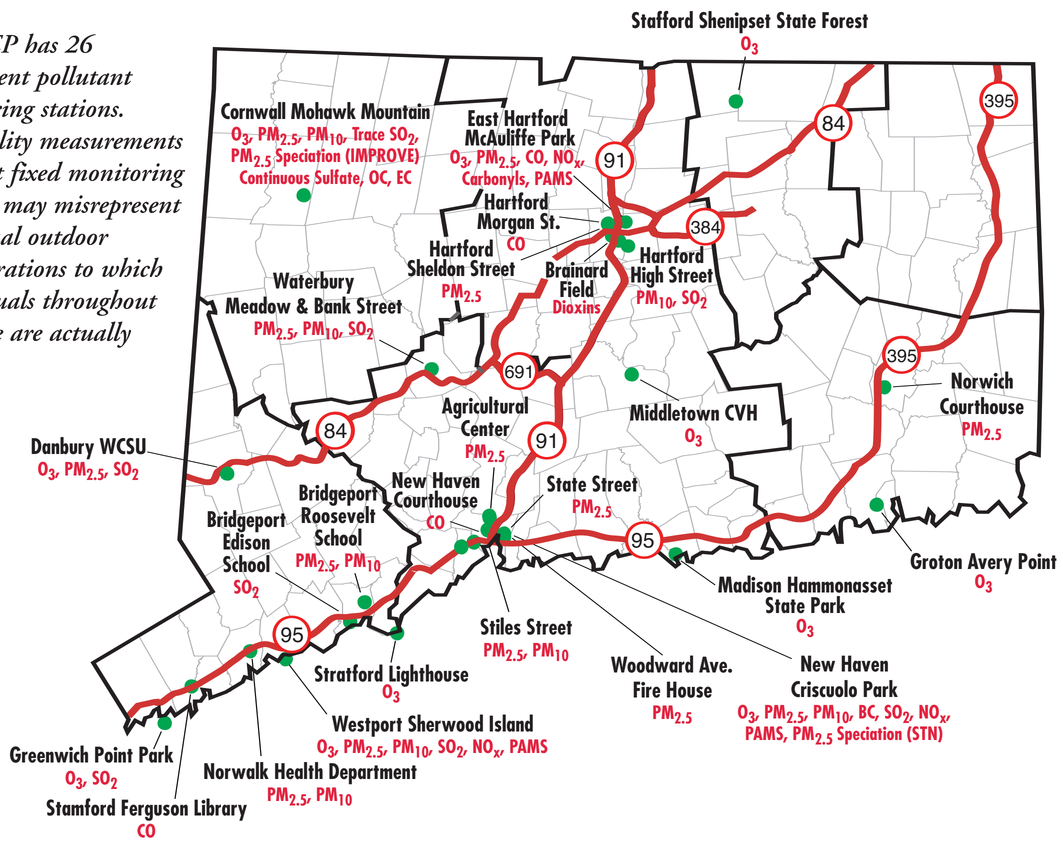
- There are 26 permanent pollutant monitoring stations to monitor criteria pollutants in Connecticut (Figure 14).[226] Air monitoring began in Connecticut in the 1950s, when the Connecticut Department of Environmental Protection (DEP) began to monitor for total suspended particulates. In the 1970s, the DEP installed its first computerized network and started daily pollution forecasting with the Pollution Standards Index.[227] Since the 1970s, Connecticut has had a computerized network that is able to forecast daily pollution and measure ambient levels of lead, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, and PM. Lead is no longer measured because the phase-out of leaded gasoline dramatically lowered lead pollution.
- According to the DEP, ozone continues to be the air pollutant of greatest concern in Connecticut. Both ozone and $PM_{2.5}$ levels exceed federal standards. The entire state is designated as a "non-attainment" area because it exceeds the National Ambient Air Quality Standards (NAAQS) for ozone.[228]

4. Monitoring Emissions

Air quality measurements taken at fixed monitoring stations may misrepresent the actual outdoor concentrations to which individuals are actually exposed.

FIGURE 14. POLLUTANT MONITORING STATIONS[229]

The DEP has 26 permanent pollutant monitoring stations. Air quality measurements taken at fixed monitoring stations may misrepresent the actual outdoor concentrations to which individuals throughout the state are actually exposed.



5. Idling Initiatives

Idling Initiatives

Canada

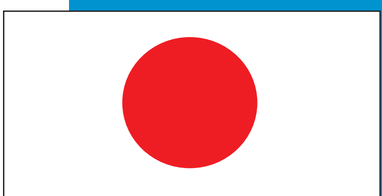
- The Canadian Petroleum Products Institute (CPPI) and the Government of Canada have launched a pilot anti-idling project to remind drivers to turn off their cars if they are stopped for more than 10 seconds. The premise of the campaign is: *"If every Canadian motorist could be encouraged to avoid idling his or her vehicle for just five minutes every day of the year, we could prevent more than one million tons of carbon dioxide from entering the atmosphere."*[230]

- Natural Resources Canada (NRC) estimates that idling a light duty vehicle for 10 minutes a day uses an average of 100 liters of gas a year. At 70 cents a liter, a driver could save $70 a year in gasoline costs by turning off the engine. If every driver of a light duty vehicle in Canada were to avoid idling for five minutes a day, Natural Resources Canada estimates a collective savings of 1.6 million liters of fuel and more than $1 million.[231]

Japan

- The Japanese government is planning to expand its anti-idling campaign from buses, taxis, and other commercial vehicles to the general car-owning population.[232] The Japanese government subsidizes commercial firms that equip vehicles with an automatic "idling stop" device that cuts the engine off when the vehicle is stopped.

The Japanese government is planning to expand its anti-idling campaign from buses, taxis, and other commercial vehicles to the general car-owning population.[232]



- The Energy Conservation Center of Japan tested two cars of the same make and model—one with an automatic idling cut-off and the other without it. They found significant reductions in the consumption of fuel and emissions of carbon dioxide in cars equipped with an idling-prevention device. The vehicle used about 3 percent less gasoline on open roads between cities where there were few stops and saved more than 13 percent in cities.[233]

- Japanese car manufacturers, Toyota and Honda, have incorporated devices into automobiles that automatically stop the engine when the driver brakes with the gearshift in drive. When the driver removes his foot from the brake pedal, the engine restarts. Idling cut-off devices have also been installed in trucks and buses produced by Hino Motors Ltd., Isuzu Motors Ltd., and Nissan Diesel Motor Co.[234]

United States

- EPA has limited legislative authority to mandate idling regulations and therefore has adopted a "voluntary" approach. In response to states struggling with crafting legislation to limit idling, EPA has begun to develop a consensus approach to aid state and local governments. The agency is currently holding workshops around the county to develop a model idling law.[235] EPA is developing this model at the request of states and trucking companies "to bring more consistency to the patchwork of existing laws and to ensure that laws are reasonable for feasible industry compliance."[236]

- Currently the EPA "draft" idling law prohibits diesel vehicles weighing 8,500 pounds or more from idling more than five minutes in any 60-minute period. There are many exemptions for weather conditions, emergencies, safety, and comfort. EPA has said it "is not planning any federal laws with respect to idling times and is not encouraging states to adopt or not to adopt idling laws."[237]

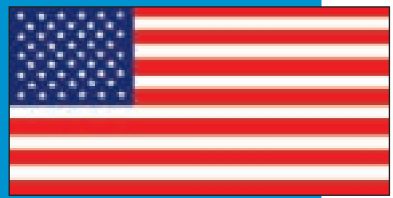
- State and local idling regulations vary and can be confusing to the trucking industry. The American Transportation Research Institute (ATRI) provides and updates both state and local idling regulations for the trucking industry.[238]

- The U.S. Argonne National Laboratory estimates that about 20 million barrels of diesel fuel are consumed each year by idling long-haul trucks. Annual estimated truck emissions total about 10 million tons of CO_2, 50,000 tons of nitrogen oxides, and 2,000 tons of particulates.[239]

- Trucks consume up to one gallon of diesel fuel for each hour they idle, using as much as 2,400 gallons of fuel every year per truck. This totals 1.2 billion gallons of diesel fuel consumed every year from idling.[240] Long-haul trucks idling overnight consume more than 838 million gallons of fuel annually.[241] Many trucks currently idle overnight in truck stops around the country as long-haul truckers try to keep either warm or cool in their cabs as they sleep.

- Each idling truck produces, on average, about 21 tons of carbon dioxide ($C0_2$) and 0.3 tons of nitrogen oxides (NO_x) annually, for a total of more than 11 million tons of CO2 and 150,000 tons of NO_x.[242] A truck consumes about one gallon per hour at idle and emits 135 g/hr of NO_x and 3.68 g/hr of PM. If the truck idled for 10 hours it would emit 1,350 g/hr of NO_x (135 g/hr x 10 hours).[243]

5. Idling Initiatives



Many trucks currently idle overnight in truck stops around the country as long-haul truckers try to keep either warm or cool in their cabs as they sleep.

6. Legislative Efforts

In Connecticut, the Department of Environmental Protection has established a regulation that prohibits vehicles from idling for more than three minutes, except under certain conditions.

Connecticut's Legislative Efforts to Improve Vehicle-Related Air Quality

Mobile Source Idling

- In Connecticut, the Department of Environmental Protection has established a regulation that prohibits vehicles from idling for more than three minutes, except under certain conditions. This requirement can be found in Section 22a-174-18 of the DEP regulations.[244]

- Among the no-idling exemptions: weather temperatures below 20 degrees Fahrenheit, traffic conditions, safety factors, and maintenance.[245] Certain mobile sources are exempt, such as vehicles more than 30 years old, cars used exclusively for racing, vehicles undergoing repair, or testing equipment.

- Visible emissions (20 percent opacity) are prohibited from a gasoline-powered mobile source for longer than five seconds and from a diesel-powered mobile source[246] (40 percent opacity) for more than 10 seconds.[247]

- The DEP regulations referenced above are difficult to enforce. In order for these regulations to be effective, they will need to be incorporated into the state motor vehicle laws, where they can be enforced by police, just like other motor vehicle infractions.

School Bus Idling

- Connecticut adopted Public Act 02-56 that specifically limits the idling of school buses to three minutes except in certain situations, including:[248] where outdoor temperatures are below 20 degrees Fahrenheit; when it is necessary to operate heating, cooling or auxiliary equipment; when motionless because of traffic; and when being repaired. To remind school bus drivers and the general public about their obligation not to idle their vehicles, DEP and the Department of Transportation (DOT) implemented a new anti-idling signage program. Signs have been posted at some New Haven and Norwich schools and will soon be posted in some Hartford schools.[249]

Diesel Emissions

- Special Act 05-7 establishes a Connecticut Clean Diesel Plan[250] and directs the DEP to prepare a plan to reduce health-threatening emissions of diesel fumes and particulates from school buses, transit buses, state-funded construction projects and other sources. The legislation requires the Connecticut DEP to create a plan to reduce particulate matter from diesel engines by 75 percent in 2015 and 85 percent in 2020.[251]

Vehicle Greenhouse Gas Emissions

- Modeled on California's Low Emission Vehicle (LEV II) program to reduce greenhouse gas emissions from cars, SUVs, and light trucks, Connecticut's LEV II Requirements have been sent for final approval to the General Assembly's Regulations Review Committee. An Act Concerning "A Connecticut Clean Car Incentive Program" requires the development of a plan to decrease the sales tax by not more than three per cent for new motor vehicles that have low emissions of greenhouse gases[252] and to increase the sales tax by not more than three percent for new motor vehicles that have high emissions of such gases.[253]

- The regulations will require California-certified vehicles sold in Connecticut beginning with the 2009 model year to reduce emissions of greenhouse gases (GHGs) by up to 30 percent by the year 2016. The new DEP regulations were drafted in response to Public Act 04-84 (2004), which directed the DEP to implement the California LEV II program and to revise the state's emissions standards whenever necessary to keep them identical to California's requirements. Connecticut's implementation of LEV II is likely to deliver reductions in carbon emissions by requiring the sale of advanced technology vehicles such as hybrids.[254]

- In 2005, the Governor's Steering Committee on Climate Change submitted the Connecticut Climate Change Action Plan 2005 to the General Assembly for implementation, fulfilling the requirements of CT Public Act 04-252.[255]

6. Legislative Efforts

Special Act 05-7 establishes a Connecticut Clean Diesel Plan[250] and directs the DEP to prepare a plan to reduce health-threatening emissions of diesel fumes and particulates from school buses, transit buses, state-funded construction projects and other sources.

7. Greenhouse Gases

Carbon dioxide (CO_2), considered the largest environmental contributor to greenhouse gases, is released into the atmosphere when diesel and gasoline fuels are burned.

Greenhouse Gases (GHGs) and Global Warming

- National science academies throughout the world[256] agree that there is strong evidence that significant global warming is occurring and that it is attributable to human activities.[257]

- A study that analyzed more than 900 scientific articles concluded that there is a consensus among scientists that humans are contributing to global warming.[258] Recent measurements of the accumulation of heat in the earth's oceans confirm that heat-trapping pollution is the primary cause of global warming.[259]

- The New England climate has warmed over the past century, and climate models project significant warming over the next century.[260] When temperatures increase, ground level ozone formation increases, placing Connecticut residents at increased risk for adverse health effects associated with ozone.[261]

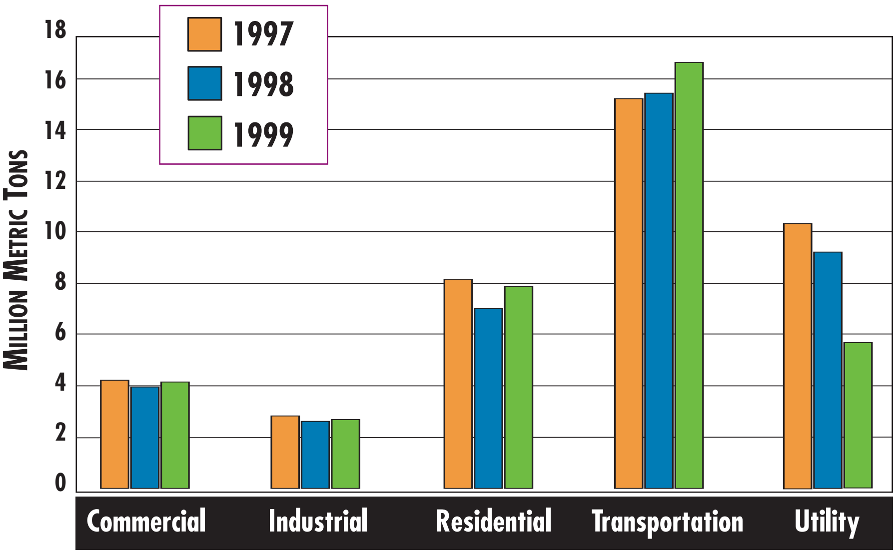
- Carbon dioxide (CO_2), considered the largest environmental contributor to greenhouse gases, is released into the atmosphere when diesel and gasoline fuels are burned. Nearly all CO_2 emissions are generated by the combustion of fossil fuels.[262] CO_2 has been responsible for more than 80 percent of greenhouse gas emissions nationwide.[263]

- Transportation emissions are among the fastest-growing sources of air pollution in the U.S. Greenhouse gas emissions from transportation continue to rise, in large part because travel growth has outpaced improvements in vehicle energy efficiency. CO_2 emissions from transportation fuel grew 21 percent between 1992 and 2002.[264]

- Nearly one-third of CO_2 emissions in the U.S. comes from the transportation sector. In 2002, highway vehicles emitted 79 percent of all transportation CO_2 emissions.[265]

- The transportation sector is responsible for the majority of greenhouse gas emissions in Connecticut. In the 1990s, gasoline from motor vehicles accounted for about 80 percent of transportation CO_2 emissions.[266] Figure 15 shows that CO_2 emissions from transportation sources in Connecticut are rising, largely a result of an increase in the vehicle miles traveled (VMT) per person in the state.

FIGURE 15. CARBON DIOXIDE EMISSIONS IN CONNECTICUT[267]



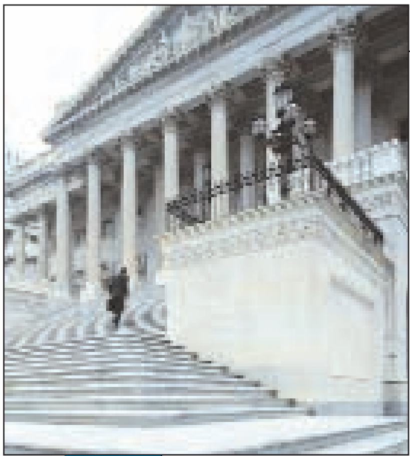
- While the average fuel economy of passenger vehicles decreased by about 6 percent in the 1990s, VMT per person increased by 33 percent.[268] The decline in fuel economy is largely attributable to a shift toward larger and less fuel-efficient vehicles, such as sport utility vehicles and minivans.[269]

- Since 2001, Connecticut has been part of a regional climate change action plan adopted by the Conference of New England Governors and Eastern Canadian Premiers. The plan establishes a region-wide goal of stabilizing total GHG emissions at 1990 levels by 2010, reducing emissions 10 percent below 1990 levels by 2020, and further lowering them in subsequent decades (up to 75 to 85 percent below 1990 levels).[270]

- Improvements in fuel economy have not been enough to compensate for the increase in VMT. CO_2 emissions are directly proportional to fuel consumption. As long as fuel consumption increases, there will be a corresponding rise in carbon dioxide emissions.[271]

7. Greenhouse Gases

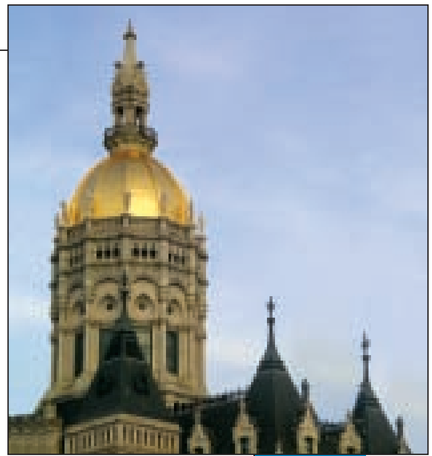
CO_2 emissions are directly proportional to fuel consumption. As long as fuel consumption increases, there will be a corresponding rise in carbon dioxide emissions.[271]



Recommendations for the Federal Government

- The federal government should adopt standards that encourage the production and sale of more fuel-efficient cars in the United States.
- The federal government should allow federal tax deductions for hybrids and fuel-efficient vehicles, while increasing taxes on vehicles that use excessive amounts of fuel.
- The federal government should retain low-sulfur fuel standards for diesel fuel.
- The federal government should subsidize truck stop electrification and on-board auxiliary power units for truck cabin comfort without engine idling.
- The federal government should ensure that the National Ambient Air Quality Standards protect the health of all susceptible groups, including children and the elderly.
- Federal funds and incentives should be increased to provide effective and efficient public transportation options.
- The federal government should support "no idling" signs for schools and other places where cars and trucks tend to idle unnecessarily.
- The federal air quality standards should address the indoor air of vehicles, buildings, and residences. EPA should adjust outdoor air quality standards to account for probable indoor and within-vehicle exposures to air pollution. The Clean Air Act demands that standards be set to provide "an adequate margin of safety," yet government neglects pollution levels within homes, schools, and vehicles and thus makes it impossible to conclude that the current standards are protective of human health.

Recommendations for the State Government



- The state should adopt regulations that prohibit the unnecessary idling of all vehicles. The state should enact into law the Connecticut Department of Environmental Protection regulation that prohibits all vehicles from "unnecessary idling." The DEP "no idling" regulation, known as 22a-174-18 (3)(c), bans unnecessary idling for all cars, buses and trucks, with a few exceptions. The regulation is written much like the Connecticut school bus "no idling" law.

- The state government should allow state tax deductions for hybrids and fuel-efficient vehicles, while increasing taxes on vehicles that use excessive amounts of fuel.

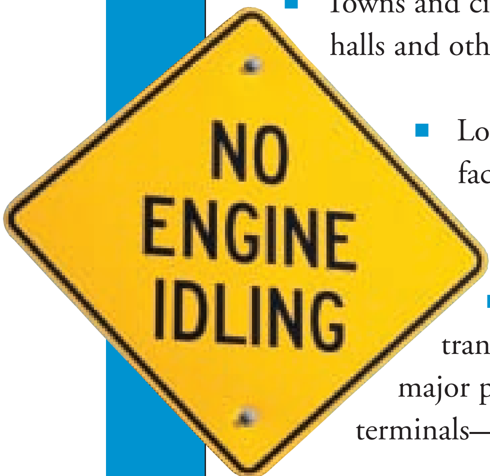
- The state should require low-sulfur fuel for both vehicles and home heating.

- The state should regulate the location of school bus and transit bus parking facilities. Many school bus parking facilities are currently located near residential neighborhoods and adjacent to schools. Because school buses tend to idle for long periods of time when they first start up, they cause significant pollution problems for adjacent neighborhoods and schools.

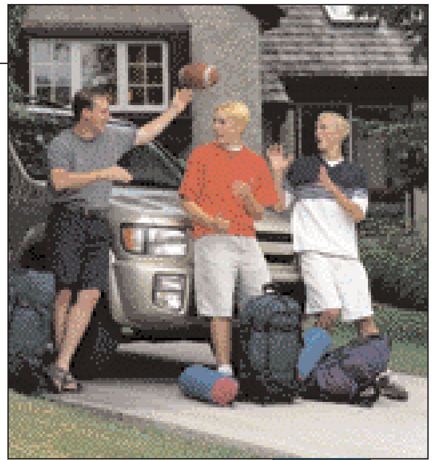
- The state should provide "no idling" signs to be used at schools and other places where cars and trucks tend to idle unnecessarily.

- The state should expand its $PM_{2.5}$ monitoring network to more accurately capture the local variability of air pollutants.

Recommendations for Local Governments



- Local governments should ensure that state "no idling" laws are enforced.
- Towns and cities should install "no idling" signs at schools, libraries, town halls and other town properties.
- Local zoning regulations should prohibit school bus parking facilities from being located in close proximity to residential neighborhoods or adjacent to schools.
- Local governments should provide free parking lots where transportation vans or buses can pick up commuters for the ride to major public transportation sites—such as railroad stations or bus terminals—or to metropolitan areas.
- Local governments should ask the state for guidance on standards that towns and municipalities can use when monitoring for local air pollution problems.



Recommendations for Individuals

- Individuals should turn off their engines when a vehicle is not in use. Eliminating unnecessary idling is a no-cost action motorists can take to help improve air quality. The National Safety Council estimates that idling for more than half a minute burns more gas than it takes to restart the engine.
- When buying a car, consider the following:
  (1) Check the posted fuel-efficiency rating. The greater the efficiency, the lower the carbon dioxide emissions per mile.
  (2) Older cars pollute more. When buying a used car, have a mechanic check the catalytic converter and other pollution controls to be sure they are working properly. Be sure to keep the vehicle well-maintained.
- Keep vehicles in good mechanical condition. Poorly maintained or malfunctioning vehicles can release as much as 10 times the emissions of those that are well-maintained. Keep tires inflated to the proper level to prevent a loss of fuel economy. Fix air conditioning leaks and pay attention to dashboard warning lights.
- Travel at moderate, steady speeds. High speeds result in greater emissions.
- On extremely hot or cold days, pets and individuals who are elderly or infirm should not be taken to places where they need to be left in the car. If passengers wait in the car, the vehicle will need to idle in order to maintain comfortable temperatures for their safety.
- Reduce the number of vehicle miles traveled by carpooling, using public transportation, and planning ahead. One person, using mass transit for an entire year instead of driving to work, can reduce reduce hydrocarbon emissions by 9.1 pounds, carbon monoxide by 62.5 pounds, and nitrogen oxides by 4.9 pounds.

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15 Including decrements in lung function, aggravation of preexisting respiratory disease, increases in respiratory admissions, and premature respiratory deaths.

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17 Including increased symptoms, reductions in lung function and hospital admissions.

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