Exposure To Hazardous Air Pollutants in Los Angeles

Prepared for Rep. Henry A. Waxman

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EXECUTIVE SUMMARY

Under the 1990 Clean Air Act, 188 chemicals have been designated as hazardous air pollutants because of their potential to cause adverse environmental and health effects, including cancer, neurological damage, and birth defects. Although the federal Environmental Protection Agency and others have reported on the level of emissions of hazardous air pollutants, little is known about the level of hazardous air pollutants in ambient air. Few reports have examined the extent to which the public is actually exposed to these toxic pollutants.

Rep. Henry A. Waxman asked the minority staff of the Committee on Government Reform of the U.S. House of Representatives to investigate the public's exposure to hazardous air pollutants in Los Angeles. This congressional staff report presents the results of this investigation. It finds that many residents of Los Angeles may be exposed to levels of hazardous air pollutants that are hundreds of times higher than the goals of the Clean Air Act.

The findings in this report are based on data from three air quality monitors operated in Los Angeles from 1995 to 1998. These data contain over 2,000 monitoring results collected for ten hazardous air pollutants. While previous reports have discussed the level of emissions of hazardous air pollutants in Los Angeles, this is the first report to reveal the concentrations of these pollutants in the ambient air based on recent monitoring data. It is also the first report to estimate the potential health risks from exposure to these hazardous air pollutants.

The quantification of health risks from exposure to hazardous air toxics is an imprecise science. In general, hazardous air pollutants have not been as well studied as ozone, carbon monoxide, and other "criteria" air pollutants subject to national ambient air quality standards. Moreover, the risks examined in this report are cancer risks, and considerable scientific uncertainty surrounds cancer risk estimates. Most cancer risk estimates are based on studies that expose animals to high doses of the hazardous air pollutant. Conservative assumptions are used to extrapolate "upper bound" estimates of the cancer risk to humans. These risk estimates assume that individuals are exposed to the hazardous air pollutant for a lifetime (70 years).

Despite these substantial uncertainties, the results of this study show that many residents of Los Angeles are exposed to excessive levels of hazardous pollutants in the air they breathe. The 1990 Clean Air Act established a goal of reducing the lifetime cancer risk from exposure to major sources of hazardous air pollutants to one additional cancer case per million exposed individuals. The data examined in this report show that residents of Los Angeles are exposed to levels of hazardous air pollutants that, in combination, may be 426 times higher than this goal. The three pollutants that appear to pose the greatest cancer risks are 1,3-butadiene, formaldehyde, and benzene. At the levels measured in Los Angeles, the lifetime cancer risks for these hazardous air pollutants could be as high as 258 in a million for butadiene, 72 in a million for formaldehyde, and 49 in a million for benzene. In total, nine of the ten hazardous air pollutants analyzed in this study appear to present cancer risks higher than the Clean Air Act goal (Table 1).

According to the most recent toxicity estimates from the Environmental Protection Agency, ambient concentrations above 0.0036 micrograms per cubic meter (Fg/m^3) for butadiene, 0.077 Fg/m^3 for formaldehyde, and 0.13 Fg/m^3 for benzene could cause lifetime cancer risks to exceed one in one million. The actual concentrations of these three pollutants measured from 1995 to 1998 far exceeded these benchmarks, however. The average monitored concentration was 0.93 Fg/m^3 for butadiene, 5.57 Fg/m^3 for formaldehyde, and 6.32 Fg/m^3 for benzene. On many days, concentrations were even higher. For example, in January 1996 one air sample collected in the city of Los Angeles contained 23.3 Fg/m^3 of benzene -- almost five times higher than the average exposure.

Table 1: Potential cancer risks from ambient exposure to toxic air pollutants in Los Angeles exceed Clean Air Act goals by a wide margin.

Compound	**Average Concentration (Fg/m3)**	**Potential Cancer Risk (X10^{-6})**
1,3-Butadiene	0.93	258
Formaldehyde	5.57	72
Benzene	6.32	49
Perchloroethylene	2.69	16
1,4-Dichlorobenzene	0.87	10
Carbon Tetrachloride	0.60	9
Chloroform	0.27	6
Chromium VI	0.00029	3
Methylene Chloride	4.06	2
Trichloroethylene	0.52	1
Total Potential Cancer Risk		**426**
Clean Air Act Goal		**1**

This report also sought to identify the sources of the hazardous air pollutants posing the highest risks. Under the 1990 Clean Air Act, EPA has issued over 40 standards to control major sources of hazardous air pollutants, such as chemical plants and oil refineries. Since 1990, EPA and the State of California have also established standards for cleaner automobiles and gasoline. Although these actions have substantially lowered emissions, millions of tons of hazardous air pollutants continue to be released into the atmosphere each year. In the case of the hazardous air pollutants studied in this report, the most significant sources of emissions appear to be mobile sources, such as cars, trucks, and off-road vehicles. According to 1993 emissions estimates -- the most recent estimates available -- mobile sources are responsible for 68% of butadiene emissions, 51% of formaldehyde formation, and 67% of benzene emissions.

I. BACKGROUND

Under the 1990 Clean Air Act, 188 air pollutants are listed as hazardous air pollutants.[1] These pollutants were designated as hazardous because of their potential to cause adverse health effects such as cancer, neurotoxicity, or reproductive toxicity. The Act required EPA to control the emissions of hazardous air pollutants from major sources such as factories and refineries, smaller stationary sources, and motor vehicles.[2] The Act required that over time EPA regulations for major sources should "provide an ample margin of safety to protect public health." In the case of cancer risks from major sources of hazardous air pollutants, this was defined as a lifetime cancer risk no greater than one in a million.[3]

Considerable attention has been focused on reporting releases of hazardous air pollutants from major sources. Each year, over 25,000 large sources provide detailed reports on emissions of over 650 toxic chemicals to EPA's Toxic Release Inventory. According to EPA's National Toxics Inventory, 8.1 million tons of air toxics were released in 1993, the most recent year for which this data is available.[4]

Unfortunately, there has been relatively little attention devoted to the issue of human exposure to hazardous air pollutants. According to EPA, "presently there is no national ambient air quality monitoring network designed to perform routine measurements of air toxics levels."[5]

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[1] Section 112(b)(1) of the Act contains a list of 189 hazardous air pollutants. In 1996, EPA removed the chemical caprolactam from the list, leaving 188 substances designated as hazardous air pollutants.

[2] A major source of hazardous air pollutants is defined in the Act as any stationary source that emits at least 10 tons per year or more of a listed pollutant or 25 tons per year of a combination of listed pollutants. Clean Air Act § 112(a)(1).

[3] Clean Air Act § 112(f)(2). In addition to establishing that lifetime cancer risks from major sources should not exceed one in a million, the Act contains several other requirements for regulating hazardous air pollutants. For mobile sources, the Act requires that EPA establish "reasonable requirements to control hazardous air pollutants from motor vehicles and motor vehicle fuels." Clean Air Act § 202(l). For small stationary sources, the Act requires that EPA develop an urban air toxics strategy with the goal of reducing overall cancer risks from hazardous air pollutants by 75%. Clean Air Act § 112(k).

[4] *National Air Quality and Emissions Trends Report, 1997,* 74 (EPA 454/R-98-016) (Dec. 1998).

[5] *Id.* at 77.

This is a critical data gap. Ultimately, what matters most to human health is the degree to which individuals are actually exposed to these toxic emissions.

Rep. Henry A. Waxman asked the minority staff of the Committee on Government Reform to help fill this gap by investigating exposure to hazardous air pollutants and the risks that this exposure poses to the residents of Los Angeles. This report presents the results of this investigation.

II. METHODOLOGY

A. Sources of Air Quality Monitoring Data and Location of Monitors

The monitoring data used in this analysis were obtained from the Environmental Protection Agency's Aerometric Information Retrieval System (AIRS) database, the Agency's central repository of air quality information. Data on hazardous air pollutants are voluntarily reported to the AIRS system by state air quality agencies, and these state agencies are responsible for the accuracy and reliability of the data reported to EPA.

The air quality information presented in this report is based on data collected at three monitors operated by the California Environmental Protection Agency in Los Angeles County. The monitors are located in Los Angeles, Long Beach, and Burbank. According to the California EPA, the monitors in Los Angeles and Long Beach are located near residential areas, and the monitor in Burbank is located in a commercial area. The locations of the air quality monitors are shown in Appendix B.[6]

In order to ensure that only the most recent data was included, this report analyzed only data collected after January 1, 1995. The AIRS database contains over 2000 daily average monitoring results for ten hazardous air pollutants monitored at these three locations between January 1995 and April 1998. These data were collected in a seasonally representative fashion. The ten hazardous air pollutants monitored at the three locations were benzene, 1,3-butadiene, carbon tetrachloride, chloroform, chromium, 1,4-dichlorobenzene, formaldehyde, methylene chloride, perchloroethylene, and trichloroethylene.

B. Determination of Average Exposures

[6] Although there were limited data available for two other monitors in Los Angeles County, the data from these monitors were excluded from the study because they did not include analytical results for all ten of the hazardous air pollutants. For the hazardous air pollutants for which data were available from these additional monitors, the ambient concentrations recorded by the monitors with incomplete data were similar to those recorded by the monitors included in the analysis.

Exposure estimates for the hazardous air pollutants were based on average ambient concentrations observed at air monitors. Simple average concentrations were determined for each pollutant at each of the three monitoring sites. The exposures for Los Angeles County as a whole were estimated by averaging these three results together. All “nondetects” were treated as being equal to zero, an assumption that tends to underestimate exposure.

C. **<u>Determination of Health Risks from Exposure to Hazardous Air Pollutants</u>**

The primary health impact analyzed in this report is the increased risk of cancer from exposure to hazardous air pollutants. In order to estimate this cancer risk, the report uses risk estimates developed by the U.S. Environmental Protection Agency.[7] This same approach to health risks has been previously used by EPA researchers who have analyzed cancer risks from air pollutants.[8]

For each cancer-causing compound, EPA determines a potency: the relationship between the level of exposure and the cancer risk. In determining these potencies, EPA incorporates conservative assumptions and considers the potencies to be “upper bound” estimates, meaning that actual risks are unlikely to be greater and may be lower. Using these potencies, the Agency then calculates the concentration of the compound that could pose a lifetime risk that exceeds the Clean Air Act goal of one additional cancer case per million exposed individuals. This is known as the benchmark concentration. The benchmark concentrations used in this analysis are shown in Appendix A.

To estimate the potential cancer risks from the exposures observed in this analysis, the average concentration was compared to the benchmark concentration. For example, for 1,3-butadiene, the benchmark concentration is 0.0036 micrograms per cubic meter (Fg/m^3). This means that for an individual exposed for 70 years to an average 1,3-butadiene concentration of 0.036 Fg/m^3 – ten times the benchmark concentration -- the lifetime cancer risk could be as high as ten in one million.

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[7] For three compounds, 1,4-dichlorobenzene, perchloroethylene, and trichloroethylene, quantitative risk assessment information was not available from the U.S. EPA. In these cases, the analysis used benchmark concentrations developed by the California Environmental Protection Agency.

[8] *See* Tracey J. Woodruff, et al., *Public Health Implications of 1990 Air Toxics Concentration across the United States*, Environmental Health Perspectives, 106(5) (May 1998); Jane C. Caldwell, et al., *Application of Health Information to Hazardous Air Pollutants Modeled in EPA’s Cumulative Exposure Project*, Toxicology and Industrial Health, 14(3), 429-454 (1998).

To determine the total cancer risks from exposure to the ten pollutants, the report used an additive model, summing the individual cancer risks from each pollutant together. This methodology is consistent with the National Academy of Science's recommendations for risk assessment, as well as the approach used by EPA.[9]

III. RESULTS

A. <u>Residents of Los Angeles Are Exposed to Multiple Hazardous Air Pollutants in Ambient Air</u>

The data collected for the ten hazardous air pollutants at the three monitoring locations in Los Angeles County showed that all ten of these compounds were frequently detected in ambient air (Table 2).

Benzene was found at the highest average concentration (6.32 Fg/m^3), followed by formaldehyde (5.57 Fg/m^3), methylene chloride (4.06 Fg/m^3), perchloroethylene (2.69 Fg/m^3), and trichloroethylene (0.52 Fg/m^3).

Table 2: Average concentrations of air toxics in Los Angeles.

Compound	Number of Samples Collected	Average Concentration (Fg/m3)	Maximum Concentration (Fg/m3)
Benzene	282	6.32	23.3
Formaldehyde	196	5.57	16.0
Methylene Chloride	254	4.06	15.1
Perchloroethylene	254	2.69	11.6
1,3-Butadiene	257	0.93	4.44
1,4-Dichlorobenzene	254	0.87	4.85
Carbon Tetrachloride	228	0.60	1.27
Trichloroethylene	254	0.52	2.87
Chloroform	253	0.27	3.14
Chromium VI	297	0.00029	0.02

Maximum concentrations were often much higher than average concentrations. The maximum benzene concentration was 23.3 Fg/m^3, detected in January 1996. Formaldehyde was

9 *See* National Research Council, *Pesticides in the Diets of Infants and Children* (1993); National Research Council, *Complex Mixtures: Methods for In-Vivo Toxicity Testing* (1988); Environmental Protection Agency, *Guidelines for the Health Risk Assessment of Chemical Mixtures*, 51 FR 34014 (1986).

found at a maximum concentration of 16.0 Fg/m^3 in September 1996. Maximum concentrations of methylene chloride and perchloroethylene were 15.1 and 11.6 Fg/m^3, respectively.

B. Levels of Hazardous Air Pollutants Are above the Clean Air Act's Health Goal

Nine of the ten hazardous air pollutants analyzed in this study were detected at levels above the health goal of one additional cancer case per million exposed individuals established for major sources of hazardous air pollutants in the Clean Air Act. One of the hazardous air pollutants, trichloroethylene, was detected at a level equivalent to the Clean Air Act goal. When added together, the total lifetime risk from exposure to these ten compounds in ambient air could be as high as 426 additional cancer cases per million exposed individuals. This represents a risk that is more than 400 times higher than the health goal established in the Clean Air Act (Table 1).

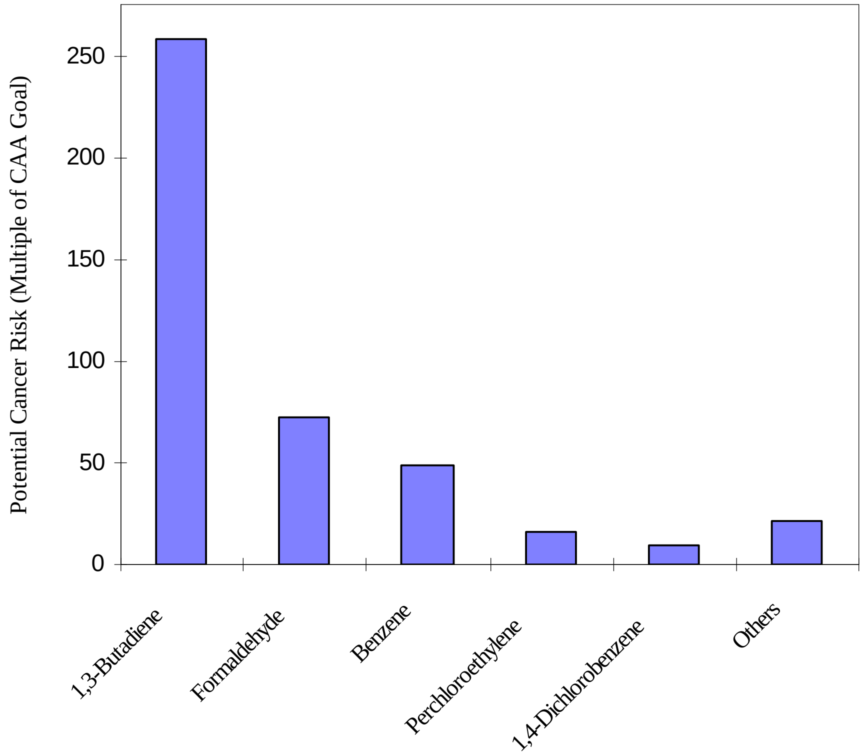
Cancer risks from exposure to hazardous air pollutants were far above the health goal at all three monitoring stations (Table 3). This indicates that the problem is likely to affect the entire Los Angeles region. Potential risks were 483 times higher than the Clean Air Act's health goal at the monitoring site at Burbank, 470 times higher than the Clean Air Act's health goal at the monitoring site in Los Angeles, and 323 times higher than the Clean Air Act's health goal at the monitoring site in Long Beach.

Table 3: Potential cancer risks were above Clean Air Act health goals at all three monitoring locations in Los Angeles County

Monitoring Location	Potential Cancer Risk ($X10^{-6}$)
Burbank	483
Los Angeles	470
Long Beach	323
Average Potential Cancer Risk	**426**
Clean Air Act Health Goal	**1**

The vast majority of the risk comes from three compounds: 1,3-butadiene, formaldehyde, and benzene (Figure 1). The potential cancer risks from exposure to 1,3-butadiene at the average levels monitored in Los Angeles are 258 times the Clean Air Act's health goal. 1,3-butadiene is a

Figure 1: Three compounds account for the majority of cancer risks from hazardous air pollutants in Los Angeles.



by-product of combustion that, in animal studies, has been found to cause cancer in multiple sites, including the heart, lung, mammary glands, ovaries, stomach, liver, pancreas, thyroid, and testes.[10] The potential risks from formaldehyde, a probable human carcinogen that has been found to cause lung cancer in animal studies,[11] are 72 times greater than the Clean Air Act goal. Benzene is a known human carcinogen that has been found to cause leukemia and cancers of the lymphoid system, skin, ovary, lung, and mammary glands.[12] The potential risks from benzene exposure are 49 times the Clean Air Act goal.

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[10] California EPA, *Toxic Air Contaminant Identification List Summaries: 1,3-Butadiene*, 144 (Sept. 1997).

[11] California EPA, *Toxic Air Contaminant Identification List Summaries: Formaldehyde* (Sept. 1997).

[12] California EPA, *Toxic Air Contaminant Identification List Summaries: Benzene*, 95 (Sept. 1997).

C. <u>Results from the Monitoring Data Are Consistent with EPA's Estimates of Exposure</u>

This study is based on actual monitoring results taken from 1995 to 1998. In a separate analysis that has not been publicly released by EPA, but is available from the Agency on request, EPA has attempted to model exposure to hazardous air pollutants in localized areas of the United States based on emissions data available from 1990. Unlike this study, which presents exposure results based upon actual monitoring, the EPA analysis relied on modeling results based on emissions by stationary and mobile sources of hazardous air pollutants. While the EPA study used a different methodology designed to investigate the national scope of the problem, and was based on 1990 emissions data, the findings support the scope of the findings on hazardous air pollutants presented in this analysis.

The EPA analysis reported exposure levels for the Los Angeles region for 40 hazardous air pollutants, including all ten hazardous air pollutants analyzed in this report.[13] Using the methodology described in this report, cancer risk estimates can be extrapolated from these exposure levels for the ten hazardous air pollutants examined in the report. These potential cancer risks are 204 times the Clean Air Act goal. Consistent with the findings in this report, the EPA exposure data indicates that the three compounds which pose the greatest risk are 1,3-butadiene, formaldehyde, and benzene.

The EPA exposure analysis serves to confirm the principal findings of this report: on a routine basis, residents of Los Angeles breathe air that contains numerous hazardous air pollutants at concentrations that are far above the Clean Air Act's health goals.

IV. SOURCES OF HAZARDOUS AIR POLLUTANTS

Information on local sources of hazardous air pollutants is not readily available. However, EPA's National Toxics Inventory provides national estimates of emissions of hazardous air pollutants from various sources.[14] This inventory is based on 1993 data but remains the most current national information available on sources of hazardous air pollutants. Overall, large stationary sources, such as chemical plants and oil refineries, account for 61% of all hazardous air pollutant emissions, while mobile sources and smaller area sources contribute 21% and 18% respectively.[15]

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[13] ICF Kaiser, *Modeling Cumulative Outdoor Concentrations of Hazardous Air Pollutants, Volume II: Attachments*, Report to EPA (SYSAPP-98-96/33r1) (Feb. 1998).

[14] Environmental Protection Agency, *1993 National Toxics Inventory* (1999).

[15] *National Air Quality and Emissions Trends Report, 1997*, *supra* note 4, at 71.

Although stationary sources emit more total hazardous air pollutants than mobile sources, they do not appear to be the primary source of the elevated cancer risks in Los Angeles. Table 4 shows the most significant national sources of the three hazardous air pollutants which pose the most risk in the Los Angeles area. On-road motor vehicles are the largest source for all three pollutants. Off-road vehicles and equipment are the second largest source for benzene and 1,3-butadiene and the third largest source for formaldehyde.[16]

Taken together, mobile sources represent the biggest national source of the three hazardous air pollutants. Overall, on- and off-road vehicles account for 68% of 1,3-butadiene emissions, 51% of formaldehyde formation, and 67% of benzene emissions.

Table 4: National Toxics Inventory Emissions Estimates

Compound	Mobile Sources: On-Road Vehicles	Mobile Sources: Non-Road Vehicles	Stationary and Other Sources	Total 1993 Emissions
1,3-Butadiene	36,660 tons (46.9%)	16,630 tons (21.2%)	24,940 tons (31.9%)	78,230 tons
Formaldehyde[17]	96,810 tons (35%)	26,860 tons (10%)	156,130 tons (55%)	279,800 tons
Benzene	207,300 tons (47%)	90,000 tons (20%)	145,100 tons (33%)	442,400 tons

Natural sources can also contribute to exposure to certain hazardous air pollutants. In the case of benzene, natural sources include forest fires, volcanos, and some plants that naturally produce the compound. EPA estimates indicate that these background concentrations may pose a lifetime cancer risk of approximately four in one million.[18] In the case of formaldehyde, natural sources include forest fires, animal waste, and volatile emissions from plants. Background

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[16] The second largest source for formaldehyde is controlled burning and forest fires.

[17] This inventory of formaldehyde emissions does not include formaldehyde precursors, chemicals which are emitted into the atmosphere and react to form formaldehyde. An estimated 3,400 tons of formaldehyde precursors are emitted daily, and mobile sources account for 65% of these emissions. When the contributions from these precursors are taken into account, EPA estimates that mobile sources account for 51% of all formaldehyde formation. ICF Kaiser, *Modeling Cumulative Outdoor Concentrations of Hazardous Air Pollutants, Volume II: Attachments*, Report to EPA, 6-11 (SYSAPP-98-96/33r1) (Feb. 1998).

[18] *Modeling Cumulative Outdoor Concentrations of Hazardous Air Pollutants, Volume I, supra* note 13, at 6-7.

concentrations of formaldehyde may pose a lifetime cancer risk of approximately three in one million.[19] In contrast, in the case of 1,3-butadiene, there are virtually no natural sources.

V. PUBLIC HEALTH SIGNIFICANCE OF EXPOSURE TO HAZARDOUS AIR POLLUTANTS

A. Need for Further Emission Reductions

Since passage of the 1990 Clean Air Act, the focus of EPA's hazardous air pollution program has been to reduce emissions of hazardous air pollutants from major sources. To date, EPA has established standards for 47 major sources of hazardous air pollutants under the Clean Air Act's maximum available control technology (MACT) program. These standards require that facilities meet emission standards that are no less stringent than the emission control that is achieved in practice by the best controlled similar source.[20] EPA estimates that these standards will reduce emissions of hazardous air pollutants by 980,000 tons per year when fully implemented.[21] In addition, EPA has established more stringent emissions standards for automobiles and required the use of reformulated gasoline in some areas. Both of these efforts have reduced the risks from hazardous air pollutants.[22] EPA estimates that from 1993 to 1996, emissions of hazardous air pollutants from mobile sources have decreased by 16%, and emissions from large stationary sources have decreased by 13%.[23] EPA is also beginning several new efforts, such as its Residual Risk Program and its Urban Air Toxics Strategy, to further reduce exposure to hazardous air pollutants.[24]

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[19] *Id.*

[20] Clean Air Act § 112(d)(2).

[21] *National Air Quality and Emissions Trends Report, 1997*, *supra* note 4, at 75.

[22] The use of reformulated gasoline containing MTBE has been found to increase emissions of formaldehyde. However, because reformulated gasoline reduces emissions of 1,3-butadiene, benzene, and other hazardous air pollutants, it has a net effect of reducing risks from emissions of hazardous air pollutants from mobile sources by approximately 11% - 14%. Northeast States for Coordinated Air Use Management, *Relative Cancer Risk of Reformulated Gasoline and Conventional Gasoline Sold in the Northeast* (Aug. 1998).

[23] *National Air Quality and Emissions Trends Report, 1997*, *supra* note 4, at 74.

[24] Environmental Protection Agency, *Second Report to Congress on the Status of the Hazardous Air Pollution Program under the Clean Air Act, Draft* (EPA-453/R-96-015) (Oct. *1997).*

The results from this investigation show that these efforts, while substantially improving air quality, have not reduced potential cancer risks sufficiently to meet the goal of the Clean Air Act. In 1990, Congress established a health-based goal for the Clean Air Act: to reduce lifetime cancer risks from major sources of individual hazardous air pollutants to one in one million. In 1996, Congress reaffirmed this basic goal when it passed the Food Quality Protection Act, which established new standards for cancer-causing pesticides in food. This legislation directed that standards for acceptable pesticide levels in food provide a "reasonable certainty that no harm will result,"[25] which in the case of cancer-causing pesticides, Congress understood to be a "one-in-one million lifetime risk."[26]

Unfortunately, the data examined in this report show that Los Angeles residents face a cancer risk from exposure to hazardous air pollutants that may be more than 400 times higher than the Clean Air Act's health goal.

The Presidential/Congressional Commission on Risk Assessment and Risk Management recommended in 1997 that EPA establish a tiered approach for addressing environmental cancer risks. The Commission recommended that EPA give priority to lifetime cancer risks to individuals that are greater than ten in one million.[27] This recommendation suggests that, because of the exposure to the hazardous air pollutants examined in this study, the Los Angeles area should be a priority for EPA attention.

EPA is taking additional steps to further reduce emissions of hazardous air pollutants. The Office of Management and Budget is presently reviewing EPA-proposed rules that would establish stricter emissions standards for automobiles and sport utility vehicles, potentially reducing hydrocarbon emissions by more than 50% for some vehicles.[28] These new standards would also require cleaner fuels, reducing the levels of sulfur in fuel by almost 90%, from an average of 330 parts per million (ppm) to an average of 30 ppm.[29] Because sulfur interferes with catalytic converters on automobiles, reducing their efficiency and increasing emissions, reducing sulfur

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[25] *Federal Food, Drug, and Cosmetic Act* § 408(b)(2)(a).

[26] *Food Quality Protection Act of 1996*, 104th Congress, House Report 104-169, 41 (Aug. 1996).

[27] The Presidential/Congressional Commission on Risk Assessment and Risk Management, *Risk Assessment and Risk Management in Regulatory Decision-Making*, 2, 109 (June 1997).

[28] *EPA Wants Light Trucks to Meet Car Standards; Air Quality, Costs Could Be Affected*, Washington Post, E1 (Feb. 18, 1999).

[29] *Id.*

levels in gasoline will make motor vehicles run cleaner. According to EPA analyses, establishing the new sulfur standard would reduce hydrocarbon emissions by 13% (for older vehicles) to 46% (for newer vehicles).[30]

The State of California and the South Coast Air Quality Management District (SCAQMD) have also acted to reduce emissions of hazardous air pollutants. Under the Clean Air Act, California is given authority to establish automobile emissions standards that are more stringent than EPA's national standards, and the California Air Resources Board has used this authority to reduce exposure to air toxics. The California Low-Emission Vehicle (LEV) program requires that automobiles sold in California meet emissions standards for hydrocarbon emissions that are more stringent than the comparable EPA standards. Since 1996, state regulations have required the use of cleaner-burning, low-sulfur gasoline which has substantially reduced benzene emissions from automobiles.[31] SCAQMD regulations have also reduced emissions from stationary sources. Without these actions, the public's exposure to hazardous air pollutants in Los Angeles would be even higher than the levels found in this analysis. In fact, SCAQMD recently estimated that benzene levels in the Burbank area have been reduced by 40% since the introduction of cleaner gasoline.[32]

Like the federal EPA, California is continuing to move forward to reduce exposure to hazardous air pollutants. In November 1998, the California Air Resources Board announced that the Board would require more stringent emissions and evaporative standards for automobiles and light trucks, further reducing emissions of hazardous air pollutants in California.[33]

B. <u>Need for Additional Data</u>

There are many gaps in scientific understanding of both the health effects of hazardous air pollutants and their average concentrations in ambient air. This report examines risks from only 10

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[30] Environmental Protection Agency, *EPA Staff Paper on Gasoline Sulfur Issues* (EPA-420-R-98-005) (May 1, 1998). EPA has not, however, implemented § 202(l)(2) of the Clean Air Act, which directs EPA to promulgate "reasonable requirements to control hazardous air pollutants from motor vehicles and motor vehicle fuels."

[31] California Air Resources Board, *California Reformulated Gasoline: A Cleaner Burning Gasoline, Facts and Frequently Asked Questions*, 3 (Nov. 8, 1995).

[32] Testimony of Paul Wuebben, South Coast Air Quality Management District, to the California Environmental Protection Agency (Feb. 19, 1999).

[33] California Air Resources Board, *Summary of Proposed Amendments to California's Low-Emission Vehicle Regulations "LEV II"* (Aug. 1998) (available online at www.arb.ca.gov/msprog/levprog/levii/overview.htm).

hazardous air pollutants. There is no recent data on the level of other hazardous air pollutants in the air in Los Angeles. In particular, this report does not include the potentially significant cancer risks from exposure to diesel particulates. Diesel particulates were designated as a toxic air contaminant by the California EPA in August 1998.[34]

In addition, this analysis includes only cancer risks. It does not consider acute risks or reproductive risks such as birth defects. According to EPA, however, there is some evidence of reproductive or developmental effects for nearly 30% of hazardous air pollutants, and approximately 60% may affect the central nervous system.[35]

Scientific research is also lacking on whether there are synergistic effects from exposure to multiple hazardous air pollutants. The risk model used for this analysis assumed that there was no interaction between the multiple contaminants to which the public is exposed. Some scientific data, however, indicate that there could be synergistic effects from exposure to many toxics at the same time, further increasing risks.[36]

State air pollution control officials have taken an important first step by monitoring and reporting to EPA the level of the ten hazardous air pollutants examined in this report. These actions were taken voluntarily by the state, as federal law does not require monitoring or reporting of hazardous air pollutants. Without significant additional efforts, however, the public's "right to know" the risks of exposure to hazardous air pollutants will not be fulfilled.

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[34] California Environmental Protection Agency, *ARB Identifies Diesel Particulate Emissions as a Toxic Air Contaminant* (Aug. 27, 1998).

[35] *National Air Quality and Emissions Trends Report, 1996*, 61 (EPA 454/R-97-013) (Jan. 1998).

[36] *Complex Mixtures: Methods for In-Vivo Toxicity Testing, supra* note 9.

C. Appropriate Interpretation of the Health Risks

While the results of this study show a significant exposure to hazardous air pollutants in Los Angeles, there are several important caveats that should be considered in interpreting the estimates of health risks.

First, there is considerable scientific uncertainty about the cancer risk estimates for hazardous air pollutants. Most of the cancer risk estimates for these compounds are based on animal studies which have used high doses of the compounds. EPA uses conservative assumptions in extrapolating risks from animals to humans and from high to low doses. The risk estimates presented in this report therefore represent what could be described as the "upper bounds" of the risk. Moreover, the hazardous air pollutants examined in this analysis have, in general, not been as well studied as ozone, carbon monoxide, and other "criteria" air pollutants subject to national ambient air quality standards. EPA and other public health agencies continue to update the cancer risk estimates in response to new data and new scientific theories.

Second, although some data indicate that hazardous air pollutants are occasionally present at concentrations that can cause acute effects such as respiratory irritation, the vast majority of risks from these toxics are chronic risks, such as cancer, that require long-term exposure. The risk estimates presented in this report are based on the assumption that individuals experience 70 years of exposure. No individual is likely to get cancer from a single day, or even a single year, of exposure to these hazardous air pollutants. Instead, these compounds generally only cause cancer after many years of exposure.

Finally, while the potential cancer risks described in this report are far above the Clean Air Act's health goal and present a serious public health problem, they are still substantially lower than risks from certain other causes of cancer, such as smoking. For example, the risks of lung cancer from smoking a pack of cigarettes a day is approximately 250 times higher than the potential risk of cancer from breathing hazardous air pollutants at the levels monitored in Los Angeles. Unlike other risks, however, the risks from breathing hazardous air pollutants are "involuntary" risks that are imposed on the exposed individuals from sources beyond their control.

Appendix A
Exposure Levels for Hazardous Air Pollutants that Correspond to Potential Lifetime Cancer Risks of One in One Million

Compound	Benchmark Concentration (Fg/m3)	Cancer Classification	Data Source
1,3-Butadiene	0.0036	Class B	U.S. EPA
Formaldehyde	0.077	Class B	U.S. EPA
Benzene	0.13-0.34	Class A	U.S. EPA
Perchloroethylene	0.17	Class B/C	California EPA
1,4-Dichlorobenzene	0.091	Class C	California EPA
Carbon Tetrachloride	0.067	Class B	U.S. EPA
Chloroform	0.043	Class B	U.S. EPA
Chromium VI	0.000083	Class A	U.S. EPA
Methylene Chloride	2.1	Class B	U.S. EPA
Trichloroethylene	0.5	Class B/C	California EPA

Source: Environmental Protection Agency, *Integrated Risk Information System* (1999) (online at http://www.epa.gov/ngispgm3/iris/); California EPA, *Draft Air Toxic Hotspot Program Risk Assessment Guidelines* (1997) (online at www.oehha.org/archive/risk_assess.html). In the risk assessment for benzene, EPA presents a range of benchmark concentrations, from 0.13 to 0.34 Fg/m^3. Consistent with efforts to present the upper bound risk estimates for exposure, the lowest benchmark concentration, 0.13 Fg/m^3, was used in this analysis.

Appendix B:

Location of Air Quality Monitors in Los Angeles County

Prepared by the Geography and Map Division, Library of Congress, January 1999.
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