

The following summarizes peer-reviewed published studies that concluded a link between traffic-related air pollution and health risks. I organized things with particular focus on the bulleted points on the cards we will be passing out at the walk on Saturday. Be very careful not to use language that suggests “cause” as most of these studies only demonstrate “associations” or “increased likelihood.” Please thank Mark Heilesen for the references (I excerpted most of this from Sierra Club materials) and excuse any typos.

Studies Supporting the Association Between Air Pollution and Cancer

Children Living Near Busy Roads More Likely to Develop Leukemia and Cancer

A 2000 Denver study showed that children living within 250 yards of streets or highways with 20,000 vehicles per day are six times more likely to develop all types of cancer and eight times more likely to get leukemia. The study looked at associations between traffic density, power lines, and all childhood cancers with measurements obtained in 1979 and 1990. It found a weak association from power lines, but a strong association with highways. It suggested that Volatile Organic Compound pollution from traffic may be the cancer promoter causing the problem.

Pearson, Wachtel; Robert L. Pearson, and Kristie Ebie. (2000). Distance-weighted traffic density in proximity to a home is a risk factor for leukemia and other childhood cancers. *Journal of Air and Waste Management Association* 50:175-180.

Road Traffic Contributes to the Origin of Childhood Leukemia

A 2004 Italian study found that childhood leukemia is partially caused by roadside emissions in the Province of Varese. The authors conducted a population-based, case-controlled study in the Province of Varese, northern Italy, which was covered by a population-based cancer registry. Their study found that the risk of childhood leukemia was almost four times higher for heavily exposed children compared to children whose homes were not exposed to road traffic emissions of benzene. Children either inhale benzene as a gas or particulate matter which has absorbed benzene. Their model included traffic density divided into two groups—one greater and one less than 10,000 vehicles per day, distance, and weather conditions to estimate benzene concentration. The researchers’ data suggests that motor vehicle traffic emissions are involved in the origin of childhood leukemia.

“Childhood Leukemia and Road Traffic: A population-based Case-Control study.” Crosignani P ;Tittarelli A; Borgini A; Codazzi T; Rovelli A; Porro E; Contiero P; Bianchi N; Tagliabue G; Fissi R; Rossitto F; Berrino F. *International Journal of Cancer*, 2004, V108, N4 (FEB 10), P 596-599.

Exposure to Cancer-Causing Benzene Higher for Children Living Near High Traffic Areas

German researchers compared 48 children who lived in a central urban area with high traffic density with 72 children who lived in a small city with low traffic density. They found that the blood levels of benzene in children who lived in the high-traffic-density

area were 71 percent higher than those of children who lived in the low-traffic-density area. Blood levels of toluene and carboxyhemoglobin (formed after breathing carbon monoxide) were also significantly elevated (56 percent and 33 percent higher, respectively) among children regularly exposed to vehicle pollution. Aplastic anemia, a serious condition in which bone marrow stops producing blood cells, and leukemia were associated with excessive exposure to benzene.

Jermann E, H. Hajimiragha, A. Brockhaus, I Freier, U. Ewers, A. Roscovanu: Exposure of children to benzene and other motor vehicle emissions. *Zentralblatt für Hygiene und Umweltmedizin* 189:50-61, 1989.

Motor Vehicle Pollution Dominates Cancer Risk

The most comprehensive study of urban toxic air pollution ever undertaken shows that motor vehicles and other mobile sources of air pollution are the predominant source of cancer-causing air pollutants in Southern California. Overall, the study showed that motor vehicles and other mobile sources accounted for about 90 percent of the cancer risk from toxic air pollution, most of which is from diesel soot (70 percent of the cancer risk). Industries and other stationary sources accounted for the remaining 10 percent. The study showed that the highest risk is in urban areas where there is heavy traffic and high concentrations of population and industry.

South Coast Air Quality Management District. Multiple Air Toxics Exposure Study-II. March 2000.

Cancer Risk Higher Near Major Sources of Air Pollution, Including Highways

A 1997 English study found a cancer corridor within three miles of highways, airports, power plants, and other major polluters. The study examined children who died of leukemia or other cancers from the years 1953-1980, where they were born and where they died. It found that the greatest danger lies a few hundred yards from a highway or polluting facility and decreases as you get further away from the facility.

Knox and Gilman (1997). Hazard proximities of childhood cancers in Great Britain from 1953-1980. *Journal of Epidemiology and Community Health*. 51: 151-159.

Soot Particulate Matter Linked to Lung Cancer and Cardiopulmonary Mortality

A recent study appearing in the *Journal of the American Medical Association* showed that day-to-day exposure to soot or fine particulate matter, a major component of tailpipe pollution increased the risk of various adverse health effects. More specifically the study shows that each 10 microgram/m³ elevation in fine particulate air pollution leads to an 8 percent increased risk of lung cancer deaths, a 6 percent increased risk of cardiopulmonary mortality (heart attacks and strokes) and 4 percent increased risk of death from general causes.

Pope, Clive Arden III; Richard P. Burnett, et al. Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution. *Journal of the American Medical Association*, March 6 2002— Vol. 287, No. 92.

Studies Supporting the Association Between Air Pollution and Asthma

Increasing Public Transportation and Cutting Traffic Reduces Asthma Attacks

This 2001 Journal of the American Medical Association study found that increasing public transportation along with other traffic control measures during the 1996 Atlanta Olympics reduced acute asthma attacks by up to 44 percent in children, reduced ozone concentrations by 28 percent, and morning peak traffic by 22.5 percent. These data provide support for efforts to reduce air pollution and improve health via reductions in motor vehicle traffic.

Friedman, Michael; Kenneth Powell MD; Lori Hutwagner; Leroy Graham; Gerald Teague. Impact of Changes in Transportation and Commuting Behaviors During the 1996 Summer Olympic Games in Atlanta on Air Quality and Childhood Asthma, *Journal of the American Medical Association*, 2001; 285:897-905.

Truck Traffic Linked to Childhood Asthma Hospitalizations

A study in Erie County, New York (excluding the city of Buffalo) found that children living in neighborhoods with heavy truck traffic within 220 yards of their homes had increased risks of asthma hospitalization. The study examined hospital admission for asthma amongst children ages 0-14, and residential proximity to roads with heavy traffic. Lin, Shao;

Jean Pierre Munsie; Syni-An Hwang; Edward Fitzgerald; and Michael R. Cayo; (2002). Childhood Asthma Hospitalization and Residential Exposure to State Route Traffic. *Environmental Research, Section A*, Vol. 88, pp. 73-81.

Traffic-Related Air Pollution Associated with Respiratory Symptoms in Two Year Old Children

This cohort study in the Netherlands found that two year old children who are exposed to higher levels of traffic-related air pollution are more likely to have self-reported respiratory illnesses, including wheezing, ear/nose/throat infections, and reporting of physician-diagnosed asthma, flu or serious cold.

Brauer, Dr. Michael J. et al. (2002). Air Pollution from Traffic and the Development of Respiratory Infections and Asthmatic and Allergic Symptoms in Children. *American Journal of Respiratory and Critical Care Medicine*. Vol. 166 pp 1092-1098.

Asthma Symptoms Caused by Truck Exhaust

A study was conducted in Munster, Germany to determine the relationship between truck traffic and asthma symptoms. In total, 3,703 German students, between the ages of 12-15 years, completed a written and video questionnaire in 1994-1995. Positive associations between both wheezing and allergic rhinitis and truck traffic were found during a 12 month period. Potentially confounding variables, including indicators of socio-economic status, smoking, etc., did not alter the associations substantially.

Duhme, H.; S.K. Weiland, et al. (1996). The association between self-reported symptoms of asthma and allergic rhinitis and self-reported traffic density on street of residence in adolescents. *Epidemiology* 7(6):578-82.

Proximity of a Child's Residence to Major Roads Linked to Hospital Admissions for Asthma

A study in Birmingham, United Kingdom, determined that living near major roads was associated with the risk of hospital admission for asthma in children younger than five years of age. The area of residence and traffic flow patterns were compared for children admitted to the hospital for asthma, children admitted for non-respiratory reasons, and a random sample of children from the community. Children admitted with an asthma diagnosis were significantly more likely to live in an area with high traffic flow (more than 24,000 vehicles/ 24 hrs) located along the nearest segment of main road.

Edwards, J.; S.Walters, et al. (1994). Hospital admissions for asthma in preschool children: relationship to major roads in Birmingham, United Kingdom. *Archives of Environmental Health*. 49(4): 223-7.

Asthma More Common for Children Living Near Highways

A study of nearly 10,000 children in England found that wheezing illness, including asthma, was more likely with increasing proximity of a child's home to main roads. The risk was greatest for children living within 90 yards of the road.

Venn et al. (2001). Living Near A Main Road and the Risk of Wheezing Illness in Children. *American Journal of Respiratory and Critical Care Medicine*. Vol. 164, pp 2177-2180.

Exposure to Nitrogen Dioxide (NO₂) from Vehicles Exacerbates Asthma Attacks

Researchers at St. Mary's Hospital in Portsmouth, England determined that while 80 percent of asthma attacks are initially caused by viral infections, exposure to traffic pollution can increase symptoms as much as 200 percent. The team measured the exposure of 114 asthmatic children between ages eight-eleven from nonsmoking families over almost a whole year. They found a strong correlation between higher NO₂ pollution and the severity of an attack.

Chauhan, A.J., et al. Personal exposure to nitrogen dioxide (NO₂) and the severity of virus-induced asthma in children. *Lancet*. Volume 361 Issue 9373 Page 1939.

A School's Proximity to Highways Associated with Asthma Prevalence

A study of 1,498 children in 13 schools in the Province of South Holland found a positive relationship between school proximity to highways and asthma occurrence. Truck traffic intensity and the concentration of pollutants measured in schools were found to be significantly associated with chronic respiratory symptoms.

Van Vliet, P., M. Knape, et al. (1997). Motor vehicle exhaust and chronic respiratory symptoms in children living near freeways. *Environmental Research*. 74(2): 122-32.

Diesel Exhaust Linked to Asthma

This study found that particulate matter from diesel trucks can act as an irritant in the airway causing asthma. The authors show that diesel exhaust can trigger asthma attacks in individuals with no pre-existing asthmatic history. When a natural allergen,

such as pollen, was added to the situation, the reaction was even more dramatic.

Pandya, Robert, et al. "Diesel Exhaust and Asthma: Hypothesis and Molecular Mechanisms of Action." *Environmental Health Perspectives Supplements* Volume 110, Number 1, February 2002.

Low Levels of Air Pollution Cause Asthma Attacks

Exposure to miniscule amounts of ozone and soot particulate matter 2.5 µm or less (PM2.5) in air at levels above current U.S. Environmental Protection Agency (EPA) standards is a risk factor for respiratory symptoms in children with asthma. Daily respiratory symptoms and medication use were examined prospectively for 271 children younger than 12 years with physician-diagnosed, active asthma residing in southern New England. Exposure to ambient concentrations of ozone and PM 2.5 from April 1 through September 30, 2001, was assessed using ozone (peak 1-hour and 8-hour) and 24-hour PM 2.5. Logistic regression analyses using generalized estimating equations were performed separately for maintenance medication users (n = 130) and nonusers (n = 141). Associations between pollutants (adjusted for temperature, controlling for same- and previous-day levels) and respiratory symptoms and use of rescue medication were evaluated. Mean (SD) levels were 59 (19) ppb (one-hour average) and 51 (16) ppb (8-hour average) for ozone and 13 (8) µg/m³ for PM2.5. In co-pollutant models, ozone level but not PM2.5 was significantly associated with respiratory symptoms and rescue medication use among children using maintenance medication; a 50-ppb increase in one-hour ozone was associated with increased likelihood of wheeze (by 35 percent) and chest tightness (by 47 percent). The highest levels of ozone (one-hour or eight-hour averages) were associated with increased shortness of breath and rescue medication use. No significant, exposure-dependent associations were observed for any outcome by any pollutant among children who did not use maintenance medication. Asthmatic children using maintenance medication are particularly vulnerable to ozone, controlling for exposure to fine particles, at levels below EPA standards.

Gent, Janneane PhD; Elizabeth W. Triche, PhD; Theodore R. Holford, PhD; Kathleen Belanger, PhD; Michael B. Bracken, PhD; William S. Beckett, MD; Brian P. Leaderer, PhD, Association of Low-Level Ozone and Fine Particles With Respiratory Symptoms in Children With Asthma, *Journal of the American Medical Association*. 2003; 290:1859-1867.

Studies Supporting the Association Between Air Pollution and Prematurity and Low Birth Weight

Pregnant Women Who Live Near High Traffic Areas More Likely to Have Premature and Low Birth Weight Babies

Researchers observed an approximately 10-20 percent increase in the risk of premature birth and low birth weight for infants born to women living near high traffic areas in Los Angeles County. In particular, the researchers found that for each one part-per-million increase in annual average carbon monoxide concentrations where the women lived, there was a 19 percent and 11 percent increase in risk for low-birth weight and premature births, respectively.

Wilhelm, Michelle and Beate Ritz. (2002). Residential Proximity to Traffic and Adverse Birth Outcomes in Los Angeles County, California, 1994-1996. *Environmental Health Perspectives*. doi: 10.1289/ehp.5688.

Studies Supporting the Association Between Air Pollution and Stunted Lung Development

Children Living Near Highways Suffer Pronounced Deficits in Lung Function

In this prospective study of 3677 children from 12 southern California communities who lived within 500 meters of a freeway had substantial deficits in 8-year growth of forced expiratory volume in 1 second (FEV1) and maximum midexpiratory flow rate (MMEF), compared with children who lived at least 1500 meters from a freeway. Joint models showed that both local exposure to freeways and regional air pollution had detrimental, and independent, effects on lung-function growth.

Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study. *The Lancet*, Volume 369, Issue 9561, Pages 571-577. W. Gauderman, H. Vora, R. McConnell, K. Berhane, F. Gilliland, D. Thomas, F. Lurmann, E. Avol, N. Kunzli, M. Jerrett.

Lung Function Reduced Among Children Living Near Truck Traffic

A European study determined that exposure to traffic-related air pollution, “in particular diesel exhaust particles,” may lead to reduced lung function in children living near major motorways.

Brunekeef, B; N.A. Janssen ; J. DeHartog; H. Harssema ;M. Knape; P. Van Vliet (1997). “Air pollution from truck traffic and lung function in children living near motorways.” *Epidemiology*. 8(3):298-303.

Other Interesting Studies

People Who Live Near Freeways Exposed to 25 Times More Soot Particulate Pollution

Studies conducted in the vicinity of Interstates 405 and 710 in Southern California found that the number of ultra-fine soot particles in the air was approximately 25 times more concentrated near the highways and that pollution levels gradually decrease back to normal (background) levels around 300 meters, or nearly 330 yards, downwind from the highway. The researchers note that motor vehicles are the most significant source of ultra-fine particles, which have been linked to increases in mortality and morbidity. Recent research concludes that ultra-fine soot particles are more toxic than larger particles with the same chemical composition. Moreover, the researchers found considerably higher concentrations of carbon monoxide pollution near the highways.

Zhu, Yifang; William C. Hinds; Kim Seongheon; Si Shen; Constantinos Sioutas. Concentration and size distribution of ultrafine particles near a major highway. *Journal of the Air and Waste Management Association*. September 2002. And, Study of ultrafine particles near a major highway with heavy-duty diesel traffic. *Atmospheric Environment*. 36(2002), 4323-4335.

Air Pollution from Busy Roads Linked to Shorter Life Spans for Nearby Residents

Dutch researchers looked at the effects of long-term exposure to traffic-related air pollutants on 5,000 adults. They found that people who lived near a main road were almost twice as likely to die from heart or lung disease and 1.4 times as likely to die

from any premature cause compared with those who lived in less-trafficked areas. The authors say traffic emissions contain many pollutants that might be responsible for the health risks, such as ultra-fine particles, diesel soot, and nitrogen oxides, which have been linked to cardiovascular and respiratory problems.

Hoek, Brunekreef, Goldbohn, Fischer, van den Brandt. (2002). Association Between Mortality and Indicators of Traffic-related Air Pollution in the Netherlands: A Cohort Study. *Lancet*, 360 (9341): 1203-9.

Five Times More Deaths Due to Air Pollution than Traffic Accidents

This study analyzed the effect of traffic-related air pollution and traffic accidents on life expectancy in the area of Baden-Wurttemberg, Germany. It estimated that almost five times more deaths in this region resulted from motor vehicle pollution than from traffic accidents.

Szgun and Seidel. (2000). Mortality due to road traffic in Baden-Wurttemberg. *Gesundheitswesen*. 62(4): 225-33.

Motor Vehicle Air Toxins Cause High Pollution Levels Inside Homes

An air pollution study was done as a part of the West Oakland Diesel Truck Emissions Reduction Initiative. Researchers measured diesel particulates near mobile and idling trucks at the West Oakland Port. An aethalometer was used to measure indoor toxins and a high level of diesel particulates was found. The people who lived in these homes were exposed indoors to five times the level of diesel particulates that people were exposed to outdoors in other areas of Oakland.

W. Buchan, M.D. and M. Chan Jackson; Container Truck Traffic Assessment and Potential Mitigation Measures for the West Oakland Diesel Truck Emission Reduction Initiative, from "Clearing the Air, Reducing Diesel Pollution in West Oakland," a Report to Pacific Institute, 654 13th Street, Preservation Park, Oakland, California 94612, by TIAX LLC, 1601 S. De Anza Blvd., Suite 100, Cupertino, California 95014, November, 2003