California Energy Commission
DOCKETED
08-AFC-8A
TN # 66427
AUG 02 2012

To: DOC and CEC
DOC 08-AFC-8A
From: Douglass

The American Lung Association's, State of the Air 2012, is a summation of many long-term studies on the quality of the air and the effect of polluted air on the population in the United States. They looked at ozone levels and particle levels from official monitoring sites across our nation for the years 2008, 2009, and 2010.

Pollution information by cities in the United States:
1. Bakersfield and Delano, California are tied for worst in "Cities Most Polluted by Short-term Particle Pollution". A total of 7 San Joaquin Valley cities are mentioned in ranks 1-5. (p.1)
2. Bakersfield is ranked worst in "Cities Most Polluted by Year-round Particle Pollution". A total of 4 San Joaquin Valley cities are mentioned in ranks 1-5. (p.2)
3. Bakersfield and Delano are in third place for worst "Most Ozone-Polluted Cities". A total of 8 San Joaquin Valley cities are mentioned in ranks 1-5. (p.3)

Pollution information by counties in California:
1. Kern County is ranked worst for "Counties Most Polluted by Short-term Particle Pollution". 3 San Joaquin Counties are in ranks 1-5. (p.4)
2. Kern County is ranked worst for "Counties Most Polluted by Year-round Particle Pollution". 3 San Joaquin Counties are in ranks 1-5. (p.5)
3. Kern County is in third place for worst "Most Ozone-Polluted County". 3 San Joaquin Counties are in ranks 1-6. (p.6)

High ozone days in Kern County 2008-2010:
1. 209 Orange-Unhealthy for Sensitive Groups
2. 48 Red-Unhealthy
3. 2 Purple-Hazardous (p.7)

High particle days in Kern County 2008-2010:
1. 126 Orange-Unhealthy for Sensitive Groups
2. 21 Red-Unhealthy
3. 2 Purple-Very Unhealthy (p.8)

Unhealthy air quality is harmful for the whole population but, the Lung Association says that children birth-18 and adults 65 and older are the most at risk. Lung diseases are the first to be listed: pediatric and adult asthma, chronic bronchitis, and emphysema. (p8-19) People living in areas with high ozone and particle pollution and who have cardiovascular disease and/or diabetes risk premature death. One study is finding that fine particle levels are associated with lung cancer in people who have never smoked. (p.11) New EPA guidelines will look at even smaller particles than what is now measured.

According to the San Joaquin Air Pollution Control Board's 2011 report the people of the San Joaquin Valley are working to comply with the EPA regulations. Our air quality

is better than it has been in 10 years. Our efforts are achieving cleaner air. A coal/coke gasification factory will erase what progress we have made. We have complied with EPA recommended no burn days. You must mandate that HECA follow the same rules we do. If you approve this proposal our families will have to endure the loss of many more loved ones and deal with lung diseases that rob vitality and joy from life. The coke and coal will be combusted 24 hours a day, 7 days a week, 365 days a year, adding 520 million tons of pollution to the air, raising even higher our levels of ozone and particles.

The Lung Association has written a report Toxic Air: The Case for Cleaning Up Coal-fired Power Plants . Coal-fired plants are among the largest contributors to particulate pollution, ozone, mercury, and global warming. You cannot tell me that gasification and sequestration are a clean solution for air quality. The Tupman facility will not even sequester the greenhouse gas, CO2. HECA will turn it over to Occidental Petroleum to play with. This plant will add more than 520 million tons of pollution a year for 30 years. The only clean solution is not to build this factory. The whole of Kern County is to be the test for this technology. Our lives are too high a price to pay for a science experiment that can only increase pollution of our bodies, air, land, water, and vegetation. 84 known hazardous pollutants are released from coal some of those are: arsenic, mercury, dioxins, formaldehyde, and hydrogen chloride. HECA will use an "old-school" fuel with a technology "face lift" but, coke and coal will still leave a poisonous and deadly residue.(p.10) Why isn't this project powered by natural gas?

You must be familiar with the topography of our valley and the unhealthy air that is trapped here. To permit SCS Energy to build this chemical factory fueled by coke and coal would be both irresponsible and criminal. The 520 million tons of pollution projected (not including the CO2) for each year is just the tip of the ice berg. No one really knows how well this process will work. This figure does not even include the cars, trucks, and trains transporting people and materials in and out of the site or the CO2 that will not be sequestered.

To protect the lives of our children and our Senior Citizens please say no to SCS Energy. To protect our agricultural business, please say no to HECA. To protect the whole San Joaquin Valley, please say no to this chemical factory.

Trudy Douglass
5408 Inverrary Ct.
Bakersfield, CA
93309

People at Risk In 25 U.S. Cities Most Polluted by Short-term Particle Pollution (24-hour $PM_{2.5}$)

2012 Rank[1]	Metropolitan Statistical Areas	Total Population[2]	Under 18[3]	65 and Over[3]	Pediatric Asthma[4,8]	Adult Asthma[5,8]	Chronic Bronchitis[6,8]	Emphysema[7,8]	CV Disease[9]	Diabetes[10]	Poverty[11]
1	Bakersfield-Delano, CA	839,631	254,081	75,437	16,855	44,572	24,047	9,398	173,566	47,097	172,531
2	Fresno-Madera, CA	1,081,315	320,356	110,683	21,251	57,991	31,596	12,865	231,750	63,239	276,242
3	Hanford-Corcoran, CA	152,982	42,548	12,030	2,822	8,348	4,423	1,619	31,019	8,299	29,606
4	Los Angeles-Long Beach-Riverside, CA	17,877,006	4,565,478	1,951,619	302,853	1,017,973	557,067	228,858	4,109,426	1,125,917	2,869,935
5	Modesto, CA	514,453	147,158	54,831	9,762	28,134	15,444	6,401	114,432	31,427	100,554
6	Pittsburgh-New Castle, PA	2,447,393	494,323	424,210	47,100	192,733	88,118	42,691	702,228	210,278	292,906
7	Salt Lake City-Ogden-Clearfield, UT	1,744,886	533,826	153,471	36,709	110,172	49,331	19,048	353,672	79,802	210,795
8	Logan, UT-ID	125,442	40,137	10,337	2,658	7,717	3,345	1,228	23,253	5,195	18,653
9	Fairbanks, AK	97,581	25,001	6,375	1,731	7,184	2,919	1,026	20,296	3,491	8,804
10	Merced, CA	255,793	80,698	23,960	5,353	13,302	7,191	2,853	52,121	14,142	58,212
11	Provo-Orem, UT	526,810	185,814	34,500	12,777	30,927	12,976	4,395	87,084	18,883	75,775
12	Visalia-Porterville, CA	442,179	144,124	41,779	9,561	22,675	12,297	4,931	89,570	24,362	108,143
13	Eugene-Springfield, OR	351,715	69,689	52,781	5,256	26,830	12,309	5,587	95,028	20,424	65,849
14	Green Bay, WI	306,241	75,104	38,204	6,671	19,118	10,013	4,367	76,174	16,251	31,524
15	Stockton, CA	685,306	200,724	71,181	13,315	37,106	20,338	8,380	150,333	41,250	128,331
16	Las Cruces, NM	209,233	55,858	25,881	4,456	14,971	6,503	2,806	48,910	12,556	52,262
17	Harrisburg-Carlisle-Lebanon, PA	683,043	152,398	102,609	14,521	52,634	23,488	10,866	183,301	54,575	71,977
18	Chicago-Naperville-Michigan City, IL-IN-WI	9,686,021	2,431,946	1,110,997	236,714	668,440	307,949	129,526	2,300,130	626,492	1,304,822
18	San Diego-Carlsbad-San Marcos, CA	3,095,313	724,168	351,425	48,038	181,080	99,026	40,726	730,127	199,827	445,556
20	Milwaukee-Racine-Waukesha, WI	1,751,316	431,446	221,571	38,324	109,226	57,101	24,984	434,587	92,773	267,038
21	Sacramento—Arden-Arcade—Yuba City, CA-NV	2,461,780	610,637	306,306	40,690	143,119	79,611	34,539	603,037	166,939	361,014
22	Davenport-Moline-Rock Island, IA-IL	379,690	89,568	57,111	7,347	24,569	12,863	5,987	100,626	25,407	49,380
22	Philadelphia-Camden-Vineland, PA-NJ-DE-MD	6,533,683	1,526,723	871,837	149,002	483,714	217,185	96,168	1,660,434	479,061	821,977
22	Washington-Baltimore-Northern Virginia, DC-MD-VA-WV	8,526,282	2,013,794	928,610	219,161	554,909	275,715	113,600	2,045,032	568,526	770,807
25	South Bend-Elkhart-Mishawaka, IN-MI	563,834	146,933	74,786	13,197	39,968	18,121	8,102	139,037	41,734	87,904
25	Yakima, WA	243,231	74,038	28,122	4,453	16,242	7,193	3,096	54,119	12,716	57,612

Notes:

1. Cities are ranked using the highest weighted average for any county within that Combined or Metropolitan Statistical Area.
2. **Total Population** represents the at-risk populations for all counties within the respective Combined or Metropolitan Statistical Area.
3. Those **18 and under** and **65 and over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
4. **Pediatric asthma** estimates are for those under 18 years of age and represent the **estimated** number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
5. **Adult asthma** estimates are for those 18 years and older and represent the **estimated** number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
6. **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2010, based on national rates (NHIS) applied to population estimates (U.S. Census).
7. **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to population estimates (U.S. Census).
8. Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
9. **CV disease** is cardiovascular disease and estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to population estimates (U.S. Census).
10. **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on state rates (BRFSS) applied to population estimates (U.S. Census).
11. **Poverty** estimates come from the U.S. Census Bureau and are for all ages.

San Joaquin Valley Cities

(2)

People at Risk In 25 U.S. Cities Most Polluted by Year-Round Particle Pollution (Annual $PM_{2.5}$)

2012 Rank[1]	Metropolitan Statistical Areas	Total Population[2]	Under 18[3]	65 and Over[3]	Pediatric Asthma[4,8]	Adult Asthma[5,8]	Chronic Bronchitis[6,8]	Emphysema[7,8]	CV Disease[9]	Diabetes[10]	Poverty[11]
1	Bakersfield-Delano, CA	839,631	254,081	75,437	16,855	44,572	24,047	9,398	173,566	47,097	172,531
2	Hanford-Corcoran, CA	152,982	42,548	12,030	2,822	8,348	4,423	1,619	31,019	8,299	29,606
3	Los Angeles-Long Beach-Riverside, CA	17,877,006	4,565,478	1,951,619	302,853	1,017,973	557,067	228,858	4,109,426	1,125,917	2,869,935
4	Visalia-Porterville, CA	442,179	144,124	41,779	9,561	22,675	12,297	4,931	89,570	24,362	108,143
5	Fresno-Madera, CA	1,081,315	320,356	110,683	21,251	57,991	31,596	12,865	231,750	63,239	276,242
6	Pittsburgh-New Castle, PA	2,447,393	494,323	424,210	47,100	192,733	88,118	42,691	702,228	210,278	292,906
7	Phoenix-Mesa-Glendale, AZ	4,192,887	1,107,561	514,712	103,850	297,158	130,677	56,150	981,249	250,407	676,590
8	Cincinnati-Middletown-Wilmington, OH-KY-IN	2,172,191	541,640	265,863	52,022	159,476	70,437	30,544	534,359	160,761	297,254
9	Louisville-Jefferson County-Elizabethtown-Scottsburg, KY-IN	1,427,483	344,414	181,225	35,354	110,720	46,992	20,586	358,161	108,671	212,960
10	Philadelphia-Camden-Vineland, PA-NJ-DE-MD	6,533,683	1,526,723	871,837	149,002	483,714	217,185	96,168	1,660,434	479,061	821,977
10	St. Louis-St. Charles-Farmington, MO-IL	2,902,951	691,253	388,478	73,624	197,528	96,454	42,981	740,304	207,624	377,927
12	Birmingham-Hoover-Cullman, AL	1,208,453	288,331	158,949	33,120	72,591	39,865	17,598	304,358	112,760	202,352
12	Steubenville-Weirton, OH-WV	124,454	24,792	23,112	2,020	8,511	4,573	2,282	36,997	11,773	20,060
14	Cleveland-Akron-Elyria, OH	2,881,937	662,604	431,376	62,126	213,261	98,669	45,842	772,244	233,293	432,423
14	Fairbanks, AK	97,581	25,001	6,375	1,731	7,184	2,919	1,026	20,296	3,491	8,804
14	Indianapolis-Anderson-Columbus, IN	2,080,782	537,309	239,468	47,240	147,611	65,880	27,927	494,231	147,661	301,412
17	Charleston, WV	304,284	65,632	48,538	4,292	17,296	10,731	5,088	84,858	28,530	46,065
17	Columbus-Auburn-Opelika, GA-AL	456,564	110,875	50,422	11,202	26,911	14,390	5,876	105,741	36,206	91,276
17	Dayton-Springfield-Greenville, OH	1,072,891	249,314	162,307	23,376	79,087	36,454	16,955	284,970	86,115	169,263
20	Huntington-Ashland, WV-KY-OH	287,702	61,997	46,625	5,241	19,615	10,019	4,736	78,785	25,083	58,538
20	Parkersburg-Marietta, WV-OH	162,056	34,684	27,634	2,635	10,369	5,771	2,802	46,088	14,900	25,008
20	Wheeling, WV-OH	147,950	29,212	26,446	2,303	9,922	5,402	2,650	43,340	13,886	23,309
23	Houston-Baytown-Huntsville, TX	6,051,363	1,683,279	523,789	127,325	322,604	180,163	69,512	1,298,152	411,138	992,603
24	Atlanta-Sandy Springs-Gainesville, GA-AL	5,618,431	1,489,486	515,559	134,057	319,422	171,459	67,219	1,244,401	391,674	851,796
24	Davenport-Moline-Rock Island, IA-IL	379,690	89,568	57,111	7,347	24,569	12,863	5,987	100,626	25,407	49,380
24	Fairmont-Clarksburg, WV	150,614	31,567	25,022	2,064	8,632	5,333	2,547	42,216	14,143	25,906
24	Hagerstown-Martinsburg, MD-WV	269,140	63,595	36,178	5,950	16,130	8,980	4,009	69,007	21,349	31,317

Notes:

1. Cities are ranked using the highest design value for any county within that Combined or Metropolitan Statistical Area.
2. **Total Population** represents the at-risk populations for all counties within the respective Combined or Metropolitan Statistical Area.
3. Those **18 and under** and **65 and over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
4. **Pediatric asthma** estimates are for those under 18 years of age and represent the **estimated** number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
5. **Adult asthma** estimates are for those 18 years and older and represent the **estimated** number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
6. **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2010, based on national rates (NHIS) applied to population estimates (U.S. Census).
7. **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to population estimates (U.S. Census).
8. Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
9. **CV disease** is cardiovascular disease and estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to population estimates (U.S. Census).
10. **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on state rates (BRFSS) applied to population estimates (U.S. Census).
11. **Poverty** estimates come from the U.S. Census Bureau and are for all ages.

San Joaquin Valley Cities

3

People at Risk In 25 Most Ozone-Polluted Cities

2012 Rank[1]	Metropolitan Statistical Areas	Total Population[2]	Under 18[3]	65 and Over[3]	Pediatric Asthma[4,8]	Adult Asthma[5,8]	Chronic Bronchitis[6,8]	Emphysema[7,8]	Poverty[9]
1	Los Angeles-Long Beach-Riverside, CA	17,877,006	4,565,478	1,951,619	302,853	1,017,973	557,067	228,858	2,869,935
2	Visalia-Porterville, CA	442,179	144,124	41,779	9,561	22,675	12,297	4,931	108,143
3	Bakersfield-Delano, CA	839,631	254,081	75,437	16,855	44,572	24,047	9,398	172,531
4	Fresno-Madera, CA	1,081,315	320,356	110,683	21,251	57,991	31,596	12,865	276,242
5	Hanford-Corcoran, CA	152,982	42,548	12,030	2,822	8,348	4,423	1,619	29,606
6	Sacramento--Arden-Arcade--Yuba City, CA-NV	2,461,780	610,637	306,306	40,690	143,119	79,611	34,539	361,014
7	San Diego-Carlsbad-San Marcos, CA	3,095,313	724,168	351,425	48,038	181,080	99,026	40,726	445,556
8	Houston-Baytown-Huntsville, TX	6,051,363	1,683,279	523,789	127,325	322,604	180,163	69,512	992,603
9	San Luis Obispo-Paso Robles, CA	269,637	50,841	41,022	3,373	16,916	9,556	4,342	36,179
10	Merced, CA	255,793	80,698	23,960	5,353	13,302	7,191	2,853	58,212
11	Modesto, CA	514,453	147,158	54,831	9,762	28,134	15,444	6,401	100,554
12	Dallas-Fort Worth, TX	6,697,402	1,850,846	617,125	140,000	357,872	200,820	78,933	960,577
13	Washington-Baltimore-Northern Virginia, DC-MD-VA-WV	8,526,282	2,013,794	928,610	219,161	554,909	275,715	113,600	770,807
14	El Centro, CA	174,528	51,098	18,152	3,390	9,415	5,139	2,104	36,666
15	New York-Newark-Bridgeport, NY-NJ-CT-PA	22,085,649	5,059,741	2,906,533	496,081	1,609,241	733,058	321,030	2,893,957
16	Chico, CA	220,000	46,168	33,817	3,063	13,391	7,563	3,464	43,392
16	Philadelphia-Camden-Vineland, PA-NJ-DE-MD	6,533,683	1,526,723	871,837	149,002	483,714	217,185	96,168	821,977
18	Charlotte-Gastonia-Salisbury, NC-SC	2,402,623	610,448	269,005	55,318	136,032	75,955	31,737	367,170
19	Phoenix-Mesa-Glendale, AZ	4,192,887	1,107,561	514,712	103,850	297,158	130,677	56,150	676,590
20	Pittsburgh-New Castle, PA	2,447,393	494,323	424,210	47,100	192,733	88,118	42,691	292,906
21	Birmingham-Hoover-Cullman, AL	1,208,453	288,331	158,949	33,120	72,591	39,865	17,598	202,352
21	Cincinnati-Middletown-Wilmington, OH-KY-IN	2,172,191	541,640	265,863	52,022	159,476	70,437	30,544	297,254
23	Stockton, CA	685,306	200,724	71,181	13,315	37,106	20,338	8,380	128,331
24	Baton Rouge-Pierre Part, LA	825,905	204,083	89,297	16,955	41,518	26,153	10,735	130,090
25	Atlanta-Sandy Springs-Gainesville, GA-AL	5,618,431	1,489,486	515,559	134,057	319,422	171,459	67,219	851,796

Notes:

1. Cities are ranked using the highest weighted average for any county within that Combined or Metropolitan Statistical Area.
2. **Total Population** represents the at-risk populations for all counties within the respective Combined or Metropolitan Statistical Area.
3. Those **18 and under** and **65 and over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
4. **Pediatric asthma** estimates are for those under 18 years of age and represent the **estimated** number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
5. **Adult asthma** estimates are for those 18 years and older and represent the **estimated** number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
6. **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2010, based on national rates (NHIS) applied to population estimates (U.S. Census).
7. **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to population estimates (U.S. Census).
8. Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
9. **Poverty** estimates come from the U.S. Census Bureau and are for all ages.

Counties in the San Joaquin Valley

4

People at Risk in 25 Counties Most Polluted by Short-term Particle Pollution (24-hour $PM_{2.5}$)

2012 Rank[1]	County	ST	Total Population[2]	At-Risk Groups									High $PM_{2.5}$ Days in Unhealthy Ranges, 2008–2010	
				Under 18[3]	65 and Over[3]	Pediatric Asthma[4,8]	Adult Asthma[5,8]	Chronic Bronchitis[6,8]	Emphysema[7,8]	CV Disease[9]	Diabetes[10]	Poverty[11]	Weighted Avg.[12]	Grade[13]
1	Kern	CA	839,631	254,081	75,437	16,855	44,572	24,047	9,398	173,566	47,097	172,531	53.8	F
2	Fresno	CA	930,450	277,507	93,421	18,409	49,721	27,034	10,932	197,670	53,861	245,330	41.2	F
3	Kings	CA	152,982	42,548	12,030	2,822	8,348	4,423	1,619	31,019	8,299	29,606	29.8	F
4	Riverside	CA	2,189,641	620,108	258,586	41,135	120,166	66,447	28,441	498,296	137,270	354,768	28.8	F
5	Stanislaus	CA	514,453	147,158	54,831	9,762	28,134	15,444	6,401	114,432	31,427	100,554	26.8	F
6	Allegheny	PA	1,223,348	241,663	205,059	23,026	96,938	43,705	20,759	344,552	102,934	141,453	26.3	F
7	Hawaii	HI	185,079	42,280	26,834	4,662	13,426	6,404	2,964	50,212	12,390	33,285	23.5	F
8	Los Angeles	CA	9,818,605	2,402,208	1,065,699	159,352	566,147	308,756	125,611	2,266,565	619,371	1,699,264	20.3	F
9	Salt Lake	UT	1,029,655	299,781	89,367	20,614	66,384	29,531	11,231	210,224	47,227	139,675	19.3	F
10	Cache	UT	112,656	35,639	8,694	2,451	6,988	2,985	1,062	20,466	4,503	17,323	15.0	F
11	Shoshone	ID	12,765	2,660	2,537	122	915	474	245	3,910	985	2,606	12.7	F
12	Fairbanks North Star Borough	AK	97,581	25,001	6,375	1,731	7,184	2,919	1,026	20,296	3,491	8,804	11.8	F
13	Merced	CA	255,793	80,698	23,960	5,353	13,302	7,191	2,853	52,121	14,142	58,212	11.7	F
14	Utah	UT	516,564	181,977	33,457	12,514	30,344	12,705	4,280	85,060	18,413	74,539	11.5	F
15	Weber	UT	231,236	69,311	23,388	4,766	14,730	6,698	2,713	48,982	11,201	31,542	10.0	F
16	Tulare	CA	442,179	144,124	41,779	9,561	22,675	12,297	4,931	89,570	24,362	108,143	9.8	F
17	Muscatine	IA	42,745	11,164	5,843	695	2,476	1,393	635	10,809	2,403	5,782	9.2	F
18	Lane	OR	351,715	69,689	52,781	5,256	26,830	12,309	5,587	95,028	20,424	65,849	8.7	F
19	Brown	WI	248,007	61,823	28,789	5,491	15,440	7,963	3,378	59,793	12,676	24,829	7.0	F
20	San Joaquin	CA	685,306	200,724	71,181	13,315	37,106	20,338	8,380	150,333	41,250	128,331	6.8	F
21	Lemhi	ID	7,936	1,576	1,758	73	582	308	167	2,602	659	1,660	6.7	F
21	Doña Ana	NM	209,233	55,858	25,881	4,456	14,971	6,503	2,806	48,910	12,556	52,262	6.7	F
23	Plumas	CA	20,007	3,601	4,154	239	1,308	784	410	6,527	1,886	3,012	6.5	F
23	Lewis and Clark	MT	63,395	14,376	8,757	990	4,455	2,189	996	17,049	3,474	7,041	6.5	F
25	San Bernardino	CA	2,035,210	594,588	181,348	39,442	109,976	59,433	23,199	429,655	116,882	362,099	6.3	F
25	Cumberland	PA	235,406	48,712	36,745	4,641	18,484	8,232	3,818	64,210	19,126	16,451	6.3	F

Notes:

1. Counties are ranked by weighted average. See note 12 below.
2. **Total Population** represents the at-risk populations in counties with $PM_{2.5}$ monitors.
3. Those **18 and under** and **65 and over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
4. **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
5. **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
6. **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2010, based on national rates (NHIS) applied to population estimates (U.S. Census).
7. **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to population estimates (U.S. Census).
8. Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
9. **CV disease** estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to population estimates (U.S. Census).
10. **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on state rates (BRFSS) applied to population estimates (U.S. Census).
11. **Poverty** estimates come from the U.S. Census Bureau and are for all ages.
12. The **Weighted Average** was derived by counting the number of days in each unhealthful range (orange, red, purple, maroon) in each year (2008-2010), multiplying the total in each range by the assigned standard weights (i.e., 1 for orange, 1.5 for red, 2.0 for purple, 2.5 for maroon), and calculating the average.
13. **Grade** is assigned by weighted average as follows: A=0.0, B=0.3-0.9, C=1.0-2.0, D=2.1-3.2, F=3.3+.

Counties in San Joaquin Valley

5

People at Risk in 25 Counties Most Polluted by Year-round Particle Pollution (Annual $PM_{2.5}$)

2012 Rank[1]	County	ST	Total Population[2]	At-Risk Groups									$PM_{2.5}$ Annual, 2008–2010	
				Under 18[3]	65 and Over[3]	Pediatric Asthma[4,8]	Adult Asthma[5,8]	Chronic Bronchitis[6,8]	Emphysema[7,8]	CV Disease[9]	Diabetes[10]	Poverty[11]	Design Value[12]	Grade[13]
1	Kern	CA	839,631	254,081	75,437	16,855	44,572	24,047	9,398	173,566	47,097	172,531	21.2	Fail
2	Hawaii	HI	185,079	42,280	26,834	4,662	13,426	6,404	2,964	50,212	12,390	33,285	18.4	Fail
3	Kings	CA	152,982	42,548	12,030	2,822	8,348	4,423	1,619	31,019	8,299	29,606	17.1	Fail
4	Riverside	CA	2,189,641	620,108	258,586	41,135	120,166	66,447	28,441	498,296	137,270	354,768	17.0	Fail
5	Tulare	CA	442,179	144,124	41,779	9,561	22,675	12,297	4,931	89,570	24,362	108,143	16.5	Fail
6	Fresno	CA	930,450	277,507	93,421	18,409	49,721	27,034	10,932	197,670	53,861	245,330	16.4	Fail
7	Allegheny	PA	1,223,348	241,663	205,059	23,026	96,938	43,705	20,759	344,552	102,934	141,453	16.0	Fail
8	Pinal	AZ	375,770	99,700	52,071	9,348	26,593	11,852	5,331	90,685	23,143	51,500	15.4	Fail
9	San Bernardino	CA	2,035,210	594,588	181,348	39,442	109,976	59,433	23,199	429,655	116,882	362,099	14.5	Pass
10	Los Angeles	CA	9,818,605	2,402,208	1,065,699	159,352	566,147	308,756	125,611	2,266,565	619,371	1,699,264	14.4	Pass
10	Hamilton	OH	802,374	189,640	106,863	17,781	58,986	26,553	11,754	202,912	61,013	144,741	14.4	Pass
12	Clark	IN	110,232	26,109	14,055	2,295	8,021	3,640	1,591	27,699	8,299	13,632	14.1	Pass
13	Madison	IL	269,282	61,246	38,428	6,026	18,844	9,096	4,119	70,216	19,162	38,068	13.8	Pass
13	Chester	PA	498,886	124,055	63,875	11,820	37,427	16,456	7,308	126,487	37,464	31,172	13.8	Pass
15	Jefferson	AL	658,466	154,528	86,443	17,750	39,726	21,754	9,558	165,636	61,402	119,809	13.7	Pass
15	Brooke	WV	24,069	4,577	4,602	299	1,411	895	449	7,255	2,432	3,402	13.7	Pass
17	Fairbanks North Star Borough	AK	97,581	25,001	6,375	1,731	7,184	2,919	1,026	20,296	3,491	8,804	13.6	Pass
17	Marion	IN	903,393	226,505	96,102	19,914	64,968	28,268	11,496	207,757	61,762	184,537	13.6	Pass
17	Cuyahoga	OH	1,280,122	290,262	198,541	27,215	95,026	44,014	20,639	345,470	104,479	227,716	13.6	Pass
20	Butler	OH	368,130	92,604	42,484	8,683	26,590	11,775	4,989	88,365	26,449	48,197	13.4	Pass
20	Westmoreland	PA	365,169	72,611	68,877	6,919	28,801	13,508	6,795	109,780	33,020	37,017	13.4	Pass
22	Summit	OH	541,781	123,575	78,968	11,586	40,213	18,517	8,509	144,235	43,524	82,194	13.3	Pass
23	Muscogee	GA	189,885	48,598	22,082	4,368	10,973	5,950	2,500	44,288	13,916	36,998	13.2	Pass
23	Jefferson	KY	741,096	171,807	99,095	18,239	59,161	24,702	10,939	188,884	57,395	125,861	13.2	Pass
23	Montgomery	OH	535,153	123,279	81,041	11,559	39,549	18,186	8,441	141,939	42,886	93,697	13.2	Pass
23	Kanawha	WV	193,063	39,734	32,315	2,598	11,111	6,919	3,322	54,988	18,465	28,101	13.2	Pass

Notes:

1. Counties are ranked by design value. See note 12 below.
2. **Total Population** represents the at-risk populations in counties with $PM_{2.5}$ monitors.
3. Those **18 and under** and **65 and over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
4. **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
5. **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
6. **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2010, based on national rates (NHIS) applied to population estimates (U.S. Census).
7. **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to population estimates (U.S. Census).
8. Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
9. **CV disease** is cardiovascular disease and estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to population estimates (U.S. Census).
10. **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on state rates (BRFSS) applied to population estimates (U.S. Census).
11. **Poverty** estimates come from the U.S. Census Bureau and are for all ages.
12. The **Design Value** is the calculated concentration of a pollutant based on the form of the National Ambient Air Quality Standard, and is used by EPA to determine whether the air quality in a area meets the standard. The source for the Design Values is http://www.epa.gov/air/airtrends/pdfs/PM25_DesignValues_20082010_FinalRevised.xlsx, downloaded September 29, 2011.
13. Grades are based on EPA's determination of meeting or failure to meet the NAAQS for annual $PM_{2.5}$ levels during 2008-2010. Counties meeting the NAAQS received grades of Pass; counties not meeting the NAAQS received grades of Fail.

People at Risk in 25 Most Ozone-Polluted Counties

2012 Rank[1]	County	ST	Total Population[2]	At-Risk Groups							High Ozone Days in Unhealthy Ranges, 2008–2010	
				Under 18[3]	65 and Over[3]	Pediatric Asthma[4,8]	Adult Asthma[5,8]	Chronic Bronchitis[6,8]	Emphysema[7,8]	Poverty[9]	Weighted Avg.[10]	Grade[11]
1	San Bernardino	CA	2,035,210	594,588	181,348	39,442	109,976	59,433	23,199	362,099	127.8	F
2	Riverside	CA	2,189,641	620,108	258,586	41,135	120,166	66,447	28,441	354,768	111.3	F
3	Tulare	CA	442,179	144,124	41,779	9,561	22,675	12,297	4,931	108,143	95.7	F
4	Kern	CA	839,631	254,081	75,437	16,855	44,572	24,047	9,398	172,531	95.0	F
5	Los Angeles	CA	9,818,605	2,402,208	1,065,699	159,352	566,147	308,756	125,611	1,699,264	86.2	F
6	Fresno	CA	930,450	277,507	93,421	18,409	49,721	27,034	10,932	245,330	61.5	F
7	Kings	CA	152,982	42,548	12,030	2,822	8,348	4,423	1,619	29,606	42.3	F
8	Sacramento	CA	1,418,788	363,053	158,551	24,083	81,006	44,570	18,564	234,470	41.5	F
9	El Dorado	CA	181,058	41,175	26,524	2,731	11,057	6,392	3,002	16,825	27.2	F
10	San Diego	CA	3,095,313	724,168	351,425	48,038	181,080	99,026	40,726	445,556	25.2	F
11	Harris	TX	4,092,459	1,147,835	333,487	86,823	217,153	119,788	44,982	758,916	24.3	F
12	Placer	CA	348,432	85,085	53,562	5,644	20,512	11,765	5,556	31,489	24.2	F
13	San Luis Obispo	CA	269,637	50,841	41,022	3,373	16,916	9,556	4,342	36,179	23.0	F
13	Ventura	CA	823,318	211,915	96,309	14,057	47,178	26,210	11,194	89,880	23.0	F
15	Merced	CA	255,793	80,698	23,960	5,353	13,302	7,191	2,853	58,212	22.5	F
16	Nevada	CA	98,764	19,106	19,174	1,267	6,321	3,754	1,922	11,456	22.0	F
17	Stanislaus	CA	514,453	147,158	54,831	9,762	28,134	15,444	6,401	100,554	21.5	F
18	Tarrant	TX	1,809,034	507,061	161,385	38,355	96,149	53,843	20,989	258,595	21.2	F
19	Mariposa	CA	18,251	3,242	3,821	215	1,196	717	376	2,665	19.8	F
20	Harford	MD	244,826	60,410	30,564	7,155	15,428	8,092	3,566	16,715	19.2	F
21	Uintah	UT	32,588	10,857	2,997	747	1,977	894	356	4,594	18.0	F
22	Madera	CA	150,865	42,849	17,262	2,842	8,270	4,562	1,933	30,912	16.7	F
23	Imperial	CA	174,528	51,098	18,152	3,390	9,415	5,139	2,104	36,666	15.7	F
24	Fairfield	CT	916,829	227,019	124,075	25,492	63,223	30,325	13,680	84,125	13.7	F
25	Amador	CA	38,091	6,393	7,865	424	2,512	1,495	772	4,286	12.7	F

Notes:

1. Counties are ranked by weighted average. See note 10 below.
2. **Total Population** represents the at-risk populations in counties with $PM_{2.5}$ monitors.
3. Those **18 and under** and **65 and over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
4. **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
5. **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma in 2010 based on state rates (BRFSS) applied to population estimates (U.S. Census).
6. **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2010, based on national rates (NHIS) applied to population estimates (U.S. Census).
7. **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to population estimates (U.S. Census).
8. Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
9. **Poverty** estimates come from the U.S. Census Bureau and are for all ages.
10. The **Weighted Average** was derived by counting the number of days in each unhealthful range (orange, red, purple) in each year (2008-2010), multiplying the total in each range by the assigned standard weights (i.e., 1 for orange, 1.5 for red, 2.0 for purple), and calculating the average.
11. Grade is assigned by weighted average as follows: A=0.0, B=0.3-0.9, C=1.0-2.0, D=2.1-3.2, F=3.3+.

CALIFORNIA

American Lung Association in California

424 Pendleton Way
Oakland, CA 94621
(510)638-5864
www.lung.org/california

HIGH OZONE DAYS 2008–2010

County	Orange	Red	Purple	Wgt. Avg	Grade
Alameda	14	2	0	5.7	F
Amador	29	6	0	12.7	F
Butte	31	3	0	11.8	F
Calaveras	29	3	0	11.2	F
Colusa	2	0	0	0.7	B
Contra Costa	16	0	0	5.3	F
El Dorado	63	11	1	27.2	F
Fresno	134	31	2	61.5	F
Glenn	0	0	0	0.0	A
Humboldt	0	0	0	0.0	A
Imperial	47	0	0	15.7	F
Inyo	8	0	0	2.7	D
Kern	209	48	2	95.0	F
Kings	104	14	1	42.3	F
Lake	0	0	0	0.0	A
Los Angeles	185	41	6	86.2	F
Madera	44	4	0	16.7	F
Marin	0	0	0	0.0	A
Mariposa	50	5	1	19.8	F
Mendocino	0	0	0	0.0	A
Merced	52	9	1	22.5	F
Monterey	1	0	0	0.3	B
Napa	5	0	0	1.7	C
Nevada	60	4	0	22.0	F
Orange	29	2	0	10.7	F
Placer	65	5	0	24.2	F

HIGH PARTICLE POLLUTION DAYS 2008–2010

24 Hour					Annual	
Orange	Red	Purple	Wgt. Avg	Grade	Design Value	Pass/ Fail
6	0	0	2.0	C	9.0	PASS
DNC	DNC	DNC	DNC	DNC	DNC	DNC
4	3	0	2.8	D	11.5	PASS
2	0	0	0.7	B	7.1	PASS
2	0	0	0.7	B	INC	INC
7	0	0	2.3	D	8.3	PASS
DNC	DNC	DNC	DNC	DNC	DNC	DNC
116	5	0	41.2	F	16.4	FAIL
DNC	DNC	DNC	DNC	DNC	DNC	DNC
0	0	0	0.0	A	6.8	PASS
7	0	0	2.3	D	7.5	PASS
11	2	0	4.7	F	7.0	PASS
126	21	2	53.8	F	21.2	FAIL
85	3	0	29.8	F	17.1	FAIL
1	1	0	0.8	B	4.6	PASS
55	4	0	20.3	F	14.4	PASS
INC	INC	INC	INC	INC	INC	INC
INC	INC	INC	INC	INC	INC	INC
DNC	DNC	DNC	DNC	DNC	DNC	DNC
0	0	0	0.0	A	8.7	PASS
35	0	0	11.7	F	INC	INC
0	0	0	0.0	A	6.4	PASS
DNC	DNC	DNC	DNC	DNC	DNC	DNC
5	2	0	2.7	D	7.0	PASS
17	1	0	6.2	F	11.9	PASS
1	0	0	0.3	B	8.4	PASS

CALIFORNIA

American Lung Association in California

424 Pendleton Way
Oakland, CA 94621
(510)638-5864
www.lung.org/california

AT-RISK GROUPS

				Lung Diseases						
County	**Total Population**	**Under 18**	**65 & Over**	**Pediatric Asthma**	**Adult Asthma**	**Chronic Bronchitis**	**Emphysema**	**Cardio-vascular Disease**	**Diabetes**	**Poverty**
Alameda	1,510,271	340,621	167,746	22,595	89,705	49,163	20,160	363,118	99,717	200,273
Amador	38,091	6,393	7,865	424	2,512	1,495	772	12,337	3,549	4,286
Butte	220,000	46,168	33,817	3,063	13,391	7,563	3,464	58,474	16,306	43,392
Calaveras	45,578	8,943	9,565	593	2,924	1,762	933	14,747	4,270	4,996
Colusa	21,419	6,410	2,495	425	1,155	643	279	4,862	1,347	3,161
Contra Costa	1,049,025	260,505	130,438	17,281	61,165	34,299	15,008	261,582	72,993	97,544
El Dorado	181,058	41,175	26,524	2,731	11,057	6,392	3,002	50,672	14,431	16,825
Fresno	930,450	277,507	93,421	18,409	49,721	27,034	10,932	197,670	53,861	245,330
Glenn	28,122	7,865	3,737	522	1,566	883	399	6,805	1,900	4,890
Humboldt	134,623	27,061	17,725	1,795	8,305	4,634	2,011	35,125	9,758	23,752
Imperial	174,528	51,098	18,152	3,390	9,415	5,139	2,104	37,792	10,327	36,666
Inyo	18,546	3,900	3,535	259	1,155	683	348	5,589	1,601	2,535
Kern	839,631	254,081	75,437	16,855	44,572	24,047	9,398	173,566	47,097	172,531
Kings	152,982	42,548	12,030	2,822	8,348	4,423	1,619	31,019	8,299	29,606
Lake	64,665	13,672	11,440	907	4,023	2,359	1,171	19,103	5,461	13,438
Los Angeles	9,818,605	2,402,208	1,065,699	159,352	566,147	308,756	125,611	2,266,565	619,371	1,699,264
Madera	150,865	42,849	17,262	2,842	8,270	4,562	1,933	34,079	9,378	30,912
Marin	252,409	52,214	42,192	3,464	15,773	9,179	4,449	73,566	20,965	22,456
Mariposa	18,251	3,242	3,821	215	1,196	717	376	5,974	1,727	2,665
Mendocino	87,841	19,461	13,493	1,291	5,355	3,079	1,448	24,297	6,876	16,976
Merced	255,793	80,698	23,960	5,353	13,302	7,191	2,853	52,121	14,142	58,212
Monterey	415,057	111,013	44,422	7,364	23,192	12,653	5,168	92,980	25,402	68,031
Napa	136,484	31,486	20,594	2,089	8,149	4,641	2,154	36,235	10,175	14,189
Nevada	98,764	19,106	19,174	1,267	6,321	3,754	1,922	30,888	8,887	11,456
Orange	3,010,232	736,659	349,677	48,867	174,505	96,221	40,413	717,529	197,679	363,924

Over **5.7 million** people in the US live in counties where the outdoor air failed all three tests.

People At Risk

Looking at the nation as a whole, the American Lung Association *State of the Air 2012* finds—

- **More than 4 in 10 people (41%) in the United States live in counties that have unhealthful levels of either ozone or particle pollution.**
  Over 127.2 million Americans live in the 235 counties where they are exposed to unhealthful levels of air pollution in the form of either ozone or short-term or year-round levels of particles.
- **Nearly 4 in 10 people in the United States (38.5%) live in areas with unhealthful levels of ozone.**
  Counties that were graded F for ozone levels have a combined population of almost 116.7 million. These people live in the 195 counties where the monitored air quality places them at risk for decreased lung function, respiratory infection, lung inflammation and aggravation of respiratory illness. The actual number who breathe unhealthy levels of ozone is likely much larger, since this number does not include people who live in adjacent counties in metropolitan areas where no monitors exist.
- **Nearly one in six (16.1%) of people in the United States live in an area with unhealthful short-term levels of particle pollution.**
  Nearly 50 million Americans live in 66 counties that experienced too many days with unhealthy spikes in particle pollution, a decrease from the last report. Short-term spikes in particle pollution can last from hours to several days and can increase the risk of heart attacks, strokes and emergency-room visits for asthma and cardiovascular disease, and most importantly, can increase the risk of early death.
- **Nearly 6.4 million people (2.1%) in the United States live in an area with unhealthful year-round levels of particle pollution.**
  These people live in areas where chronic levels are regularly a threat to their health. Even when levels are fairly low, exposure to particles over time can increase risk of hospitalization for asthma, damage to the lungs and, significantly, increase the risk of premature death.
- **Over 5.7 million people (1.9%) in the United States live in six counties with unhealthful levels of all three: ozone and short-term and year-round particle pollution.**

With the risks from airborne pollution so great, the American Lung Association seeks to inform people who may be in danger. Many people are at greater risk because of their age or because they have asthma or other chronic lung disease, cardiovascular disease or diabetes. The following list identifies the numbers of people in each at-risk group.

- **People with Asthma**—Nearly 2.5 million children and over 7.4 million adults with asthma live in parts of the United States with very high levels of ozone. Over 3.1 million adults and over 940,000 children with asthma live in areas with high levels of short-term particle pollution. Over 382,000 adults and over 125,000 children with asthma live in counties with unhealthful levels of year-round particle pollution.
- **Older and Younger**—Over 13.7 million adults age 65 and over and nearly 29 million children age 18 and under live in counties with unhealthful ozone levels. Over 5.6 million seniors and over 12.5 million children live in counties with unhealthful short-term levels of particle pollution. Over 765,000 seniors and over 1.7 million children live in counties with unhealthful levels of year-round particle pollution.
- **Chronic Bronchitis and Emphysema**—Over 3.7 million people with chronic bronchitis and nearly 1.6 million with emphysema live in counties with unhealthful ozone levels. Over 1.5 million people with chronic bronchitis and over 652,000 with emphysema live in counties with unhealthful levels of short-term particle pollution. Over 196,000 people with chronic bronchitis and more than 84,000 with emphysema live in counties with unhealthful year-round levels of particle pollution.

The nation must

keep the Clean Air Act strong

to protect public health.

- **Cardiovascular Disease**—Over 11.6 million people with cardiovascular diseases live in counties with unhealthful levels of short-term particle pollution; nearly 1.5 million live in counties with unhealthful levels of year-round particle pollution. Cardiovascular diseases include coronary heart disease, heart attacks, strokes, hypertension and angina pectoris.
- **Diabetes**—Over 3.1 million people with diabetes live in counties with unhealthful levels of short-term particle pollution; over 409,000 live in counties with unhealthful levels of year-round particle pollution. Research indicates that because diabetics are already at higher risk of cardiovascular disease, they may face increased risk due to the impact of particle pollution on their cardiovascular systems.
- **Poverty**—Over 16.9 million people with incomes meeting the federal poverty definition live in counties with unhealthful levels of ozone. Over 7.9 million people in poverty live in counties with unhealthful levels of short-term particle pollution, and over 1.1 million live in counties with unhealthful year-round levels of particle pollution. Evidence shows that people who have low incomes may face higher risk from air pollution.

What Needs To Be Done

Many major challenges require the Administration and Congress to take steps to protect the health of the public. Here are a few that the American Lung Association calls for to improve the air we all breathe.

- **Protect the Clean Air Act.** The continued improvement shown in the State of the Air report is possible because of the Clean Air Act, the nation's strong public health law that the U.S. Congress passed 40 years ago. The Act requires that the EPA and each state take steps to clean up the air. Some members of Congress are proposing changes to the Clean Air Act that could dismantle progress made in the last 40 years. The nation must keep that law strong to continue to protect public health.
- **Clean up dirty power plants.** Over 400 coal-fired power plants in over 40 states are among the largest contributors to particulate pollution, ozone, mercury, and global warming. Their pollution blows across state lines into states hundreds of miles away. They produce 84 known hazardous air pollutants, including arsenic, mercury, dioxins, formaldehyde and hydrogen chloride, as shown in the Lung Association report Toxic Air: The Case for Cleaning Up Coal-fired Power Plants. In 2011, EPA issued the final rules that will cut the emissions that create ozone and particle pollution and, for the first time, set national limits on the toxic pollutants they can emit. However, some have challenged these standards in the courts. The Lung Association has taken legal steps to defend EPA's efforts. Congress needs to support EPA's actions to clean these plants up.
- **Clean up industrial, commercial and institutional boilers and incinerators.** Boilers provide power and fuel processes for industry, commercial facilities and institutions. Similar to power plants, but smaller, boilers are also more numerous: there are 1.5 million of them. Many produce toxic air emissions, including the same toxic emissions that power plants produce. EPA needs to adopt strong final standards to limit emissions from these boilers.
- **Clean up the existing fleet of dirty diesel vehicles and heavy equipment.** Rules EPA put in effect over the past several years mean that new diesel vehicles and equipment must be much cleaner. Still, the vast majority of diesel trucks, buses, and heavy equipment (such as bulldozers) will likely be in use for thousands more miles, spewing dangerous diesel exhaust into communities and neighborhoods. The good news is that affordable technology exists to cut emissions by 90 percent. Congress needs to fund EPA's diesel cleanup ("retrofit") program. Congress should also require that clean diesel equipment be used in federally-funded construction programs.
- **Strengthen the particle pollution standards.** In 2006, EPA failed to strengthen the annual standard for fine particles,

Health Effects of Ozone and Particle Pollution

Ozone and particle pollution are the most widespread air pollutants—and among the most dangerous. Recent research has revealed new insights into how they can harm the body—including taking the lives of infants and altering the lungs of children. All in all, the evidence shows that the risks are greater than we once thought.

Recent findings provide more evidence about the health impacts of these pollutants:

- A major review of particle pollution and other air pollutants concluded that many cause heart attacks, even when people inhale elevated levels for as little as one week.[1] This review looked at evidence from 177 studies and found that particle pollution (both fine and coarse), carbon monoxide, nitrogen oxides, and sulfur dioxide all increased the risk of heart attack.
- Particle pollution that lasts for just a short while may be causing strokes, even at levels considered safe, according to a study of Boston area patients.[2] In particular, researchers found that breathing levels of traffic-related particles were linked to increased risk of stroke within 12 to 14 hours of breathing them.
- Up to 35,700 premature deaths can be prevented in the United States every year if the Environmental Protection Agency (EPA) strengthens the health standards for particle pollution—also known as soot—according to a report, Sick of Soot: How the EPA Can Save Lives by Cleaning Up Fine Particle Pollution, released in November by the American Lung Association, Clean Air Task Force and Earthjustice. That report summarized the findings of an in-depth look at how cleaning up the particles could have powerful, life-saving benefits.[3]
- Good news: Reducing air pollution has extended life expectancy. Thanks to a drop in particle pollution between 1980 and 2000, life expectancy in 51 U.S. cities increased by five months on average, according to a 2009 analysis.[4]
- Growing evidence shows that diabetics face a greater risk from air pollution than once believed. Several studies found increased risk of several factors associated with cardiovascular risks in people with diabetes.[5] Some new research with animals indicates that fine particle pollution may impact insulin resistance and other factors.[6]
- More people may be vulnerable to air pollution than previously understood. Researchers studying people who had received kidney transplants found that long-term exposure to ozone pollution increased their risk of fatal coronary heart disease.[7]
- Lower levels of ozone and particle pollution pose bigger threats. A Canadian study showed that particle pollution levels well below those considered safe in the U.S. for these pollutants caused premature death.[8] An earlier study had found higher risk of asthma attacks and emergency room visits and hospital admissions for children with asthma.[9] Another study found that low levels of these pollutants increased the risk of hospital treatment for pneumonia and chronic obstructive pulmonary disease (COPD).[10]
- Ozone pollution can shorten life, a conclusion confirmed by a 2008 scientific review by the National Research Council.[11] Evidence warns that some segments of the population may face higher risks from dying prematurely because of ozone pollution, including communities with high unemployment or high public transit use and large African-American populations.[12]
- Could particulate matter cause lung cancer in never-smokers? That question is getting closer to being answered with a strong "yes" after researchers looked at the records of 1.2 million volunteers which found that levels of fine particles

measured across the nation in the past few decades are linked to small, but measurable increases in lung cancer in people who never smoked.[13]

- Research is warning that obesity may place people at higher risk from particle pollution. Some studies link particle pollution to increases in measurable reactions in the body that signal harm to health.[14] The increase in the prevalence of obesity in the nation may mean that more people are at risk.
- Busy highways are high risk zones. Not only may they worsen diseases, but some evidence warns that years of breathing the pollution near busy roads may increase the risk of developing chronic diseases.
  - A growing body of evidence suggests breathing pollution from heavy traffic may cause new cases of asthma in children.[15]
  - Emerging research has found particle pollution associated with increasing the risk of new cases of three chronic diseases in adults: adult-onset asthma,[16] diabetes,[17] and COPD, especially in people who already have asthma or diabetes.[18]
  - Research had already connected pollution from heavy highway traffic to higher risks for heart attack, allergies, premature births and the death of infants around the time they are born.[19] Evidence of the impact of traffic pollution, even in a city with generally "cleaner" air, expanded the concern over the health effects of chronic exposure to exhaust from heavy traffic.[20]

Two types of air pollution dominate the problem in the U.S.: ozone and particle pollution. They aren't the only serious air pollutants: others include carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide, as well as scores of toxins such as mercury, arsenic, benzene, formaldehyde, and acid gases. However, ozone and particle pollution are the most widespread pollutants.

Ozone Pollution

It may be hard to imagine that pollution could be invisible, but ozone is. The most widespread pollutant in the U.S. is also one of the most dangerous.

Scientists have studied the effects of ozone on health for decades. Hundreds of research studies have confirmed that ozone harms people at levels currently found in the United States. In the last few years, we've learned that it can also be deadly.

What Is Ozone?

Ozone (O_3) is an extremely reactive gas molecule composed of three oxygen atoms. It is the primary ingredient of smog air pollution and is very harmful to breathe. Ozone attacks lung tissue by reacting chemically with it.

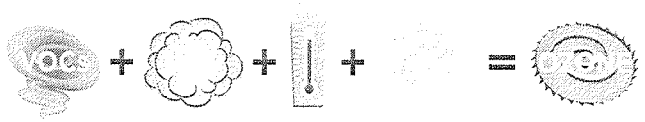
The ozone layer found high in the upper atmosphere (the stratosphere) shields us from much of the sun's ultraviolet radiation. However, ozone air pollution at ground level where we can breathe it (in the troposphere) is harmful. It causes serious health problems.

Where Does Ozone Come From?

What you see coming out of the tailpipe on a car or a truck isn't ozone, but the raw ingredients for making ozone. Ozone is formed by chemical reactions in the atmosphere from two raw gases that do come out of tailpipes, smokestacks and many other sources. These essential raw ingredients for ozone are nitrogen oxides (NO_X) and hydrocarbons, also called volatile organic compounds (VOCs). They are produced primarily when fossil fuels like gasoline, oil or coal are burned or when some chemicals, like solvents, evaporate.

When NO_X and VOCs come in contact with both heat and sunlight, they combine and form ozone smog. NO_X is emitted from power plants, motor vehicles and other sources of high-heat combustion. VOCs are emitted from motor vehicles, chemical plants, refineries, factories, gas stations, paint and other sources. The formula for ozone is simple, and like any

formula, the ingredients must all be present and in the right proportions to make the final product.



You may have wondered why "ozone action day" warnings are sometimes followed by recommendations to avoid activities such as mowing your lawn or refilling your gas tank during daylight hours. Lawn mower exhaust and gasoline vapors are VOCs that could turn into ozone in the heat and sun. Take away the sunlight and ozone doesn't form, so refilling your gas tank after dark is better on high ozone days. Since we can't control sunlight and heat, we must reduce the chemical raw ingredients if we want to reduce ozone.

Who is at risk from breathing ozone?

Five groups of people are especially vulnerable to the effects of breathing ozone:

- children and teens;
- anyone 65 and older;
- people who work or exercise outdoors;
- people with existing lung diseases, such as asthma and chronic obstructive pulmonary disease (also known as COPD, which includes emphysema and chronic bronchitis); and
- "responders" who are otherwise healthy but for some reason react more strongly to ozone.[21]

The impact on your health can depend on many factors, however. For example, the risks would be greater if ozone levels are higher, if you are breathing faster because you're working outdoors or if you spend more time outdoors.

Lifeguards in Galveston, Texas, provided evidence of the impact of even short-term exposure to ozone on healthy, active adults in a study published in 2008. Testing the breathing capacity of these outdoor workers several times a day, researchers found that many lifeguards had greater obstruction in their airways when ozone levels were high. Because of this research, Galveston became the first city in the nation to install an air quality warning flag system on the beach.[22]

How Ozone Pollution Harms Your Health

Breathing ozone can shorten your life. Two early studies published in 2004 found strong evidence of the deadly impact of ozone in cities across the U.S. and in Europe. Even on days when ozone levels were low, the researchers found that the risk of premature death increased with higher levels of ozone. They estimated that over 3,700 deaths annually in the U.S. could be attributed to a 10-parts-per-billion increase in ozone levels.[23] Another study, published the same week, looked at 23 European cities and found similar effects on mortality from short-term exposure to ozone.[24]

Confirmation came in the summer of 2005. Three groups of researchers working independently reviewed and analyzed the research around deaths associated with short-term exposures to ozone. The three teams—at Harvard, Johns Hopkins and New York University—used different approaches but all came to similar conclusions. All three studies reported a small but robust association between daily ozone levels and increased deaths.[25] Writing a commentary on these reviews, David Bates, MD, explained how these premature deaths could occur:

> "Ozone is capable of causing inflammation in the lung at lower concentrations than any other gas. Such an effect would be a hazard to anyone with heart failure and pulmonary congestion, and would worsen the function of anyone with advanced lung disease."[26]

In 2008 a committee of the National Research Council, a division of the National Academy of Sciences, reviewed the evidence again and concluded that "short-term exposure to

ambient ozone is likely to contribute to premature deaths." They recommended that preventing early death be included in any future estimates of the benefits of reducing ozone.[27]

New research has begun to identify which groups face higher risk of death from ozone. A study published in 2010 examined records from ten cities in Italy and found women, diabetics and older adults to have a higher risk of premature death from high ozone.[28]

Ozone at levels currently in the U.S. causes immediate health problems. Many areas in the United States produce enough ground-level ozone during the summer months to cause health problems that can be felt right away. Immediate problems—in addition to increased risk of premature death—include:

- shortness of breath;
- chest pain when inhaling;
- wheezing and coughing;
- asthma attacks;
- increased susceptibility to respiratory infections;
- increased susceptibility to pulmonary inflammation; and
- increased need for people with lung diseases, like asthma or chronic obstructive pulmonary disease (COPD), to receive medical treatment and to go to the hospital.[29]

Breathing ozone for longer periods can alter the lungs' ability to function. Two studies published in 2005 explored ozone's ability to reduce the lung's ability to work efficiently, a term called "lung function." Each study looked at otherwise healthy groups who were exposed to ozone for long periods: outdoor postal workers in Taiwan and college freshmen who were lifelong residents of Los Angeles or the San Francisco Bay area. Both studies found that the long exposure to elevated ozone levels had decreased their lung function.[30]

Inhaling ozone may affect the heart as well as the lungs. A 2006 study linked exposures to high ozone levels for as little as one hour to a particular type of cardiac arrhythmia that itself increases the risk of premature death and stroke.[31] A French study found that exposure to elevated ozone levels for one to two days increased the risk of heart attacks for middle-aged adults without heart disease.[32]

New studies warn of serious effects from breathing ozone over longer periods. With more long-term data, scientists are finding that long-term exposure—that is, for periods longer than eight hours, including days, months or years—may increase the risk of early death. Examining the records from a long-term national database, researchers found a higher risk of death from respiratory diseases associated with increases in ozone.[33] New York researchers looking at hospital records for children's asthma found that the risk of admission to hospitals for asthma increased with chronic exposure to ozone. Younger children and children from low income families were more likely to need hospital admissions even during the same time periods than other children.[34] California researchers digging into data from their long-term Southern California Children's Health Study found that some children with certain genes were more likely to develop asthma as adolescents in response to the variations in ozone levels in their communities.[35]

Breathing other pollutants in the air may make your lungs more responsive to ozone—and breathing ozone may increase your body's response to other pollutants. For example, research warns that breathing sulfur dioxide and nitrogen oxide—two pollutants common in the eastern U.S.—can make the lungs react more strongly than to just breathing ozone alone. Breathing ozone may also increase the response to allergens in people with allergies. A large study published in 2009 found that children were more likely to suffer from hay fever and respiratory allergies when ozone and $PM_{2.5}$ levels were high.[36]

Even low levels of ozone may be deadly. A large study of 48 U.S. cities looked at the association between ozone and all-cause mortality during the summer months. Ozone concentrations by city in the summer months ranged from 16 percent to

80 percent lower than EPA currently considers safe. Researchers found that ozone at those lower levels was associated with deaths from cardiovascular disease, strokes, and respiratory causes.[37]

Particle Pollution

Ever look at dirty truck exhaust?

The dirty, smoky part of that stream of exhaust is made of particle pollution. Overwhelming evidence shows that particle pollution—like that coming from that exhaust smoke—can kill. Particle pollution can increase the risk of heart disease, lung cancer and asthma attacks and can interfere with the growth and work of the lungs.

What Is Particle Pollution?

Particle pollution refers to a mix of very tiny solid and liquid particles that are in the air we breathe. But nothing about particle pollution is simple. First of all, the particles themselves are different sizes. Some are one-tenth the diameter of a strand of hair. Many are even tinier; some are so small they can only be seen with an electron microscope. Because of their size, you can't see the individual particles. You can only see the haze that forms when millions of particles blur the spread of sunlight. You may not be able to tell when you're breathing particle pollution. Yet it is so dangerous it can shorten your life.

The differences in size make a big difference in how they affect us. Our natural defenses help us to cough or sneeze larger particles out of our bodies. But those defenses don't keep out smaller particles, those that are smaller than 10 microns (or micrometers) in diameter, or about one-seventh the diameter of a single human hair. These particles get trapped in the lungs, while the smallest are so minute that they can pass through the lungs into the blood stream, just like the essential oxygen molecules we need to survive.

Researchers categorize particles according to size, grouping them as coarse, fine and ultrafine. Coarse particles fall between 2.5 microns and 10 microns in diameter and are called $PM_{10-2.5}$. Fine particles are 2.5 microns in diameter or smaller and are called $PM_{2.5}$. Ultrafine particles are smaller than 0.1 micron in diameter[38] and are small enough to pass through the lung tissue into the blood stream, circulating like the oxygen molecules themselves. No matter what the size, particles can be harmful to your health.

Because particles are formed in so many different ways, they can be composed of many different compounds. Although we often think of particles as solids, not all are. Some are completely liquid; some are solids suspended in liquids. As the U.S. Environmental Protection Agency puts it, particles are really "a mixture of mixtures."[39] The mixtures differ between the eastern and western United States and in different times of the year. For example, the Midwest, Southeast and Northeast states have more sulfate particles than the West on average, largely due to the high levels of sulfur dioxide emitted by large, coal-fired power plants. By contrast, nitrate particles from motor vehicle exhaust form a larger proportion of the unhealthful mix in the winter in the Northeast, Southern California, the Northwest, and North Central U.S.[40]

Who Is at Risk?

Anyone who lives where particle pollution levels are high is at risk (you can take a look at levels in your state in this report). Some people face higher risk, however. People at the greatest risk from particle pollution exposure include:

- Anyone with lung disease such as asthma and chronic obstructive pulmonary disease (COPD), which includes chronic bronchitis and emphysema;
- Anyone with heart disease or diabetes[41];
- Anyone over 65;
- Infants, children and teens;
- People with low incomes; and
- People who work or are active outdoors.[42]

Diabetics face increased risk at least in part because of their higher risk for cardiovascular disease. A 2010 study examined prevalence of diagnosed diabetes in relation to fine particle pollution in 2004-2005. The evidence suggested that air pollution is a risk factor for diabetes.[43] Traffic-related air pollution was implicated in two studies. A German study of nondiabetic women found that new cases of diabetes were more likely as levels of traffic-related pollution and particle pollution increased.[44] A similar finding of an increased risk for diabetes in women who lived near roadways came in a large study of nurses and health professionals, although that study did not find a strong association with levels of particle pollution.[45]

What Can Particles Do to Your Health?

Particle pollution can be very dangerous to breathe. Breathing particle pollution may trigger illness, hospitalization and premature death, risks showing up in new studies that validate earlier research.[46]

Good news came in 2009 from researchers who looked at the impact of the drop in year-round levels of particle pollution between 1980 and 2000 in 51 U.S. cities. Thanks to reductions in particle pollution people living in these cities had five months added to their life expectancy on average.[47] This study adds to the growing research that cleaning up air pollution improves life and health. Other researchers estimated that reductions in air pollution can be expected to produce rapid improvements in public health, with fewer deaths occurring within the first two years after reductions.[48]

Researchers are exploring possible differences in health effects of the three sizes of particles and particles from different sources, such as diesel particles from trucks and buses or sulfates from coal-fired power plants. So far, the evidence remains clear that all particles from all sources are dangerous.[49]

Short-Term Exposure Can Be Deadly

First and foremost, short-term exposure to particle pollution can kill. Peaks or spikes in particle pollution can last for hours to days. Deaths can occur on the very day that particle levels are high, or within one to two months afterward. Particle pollution does not just make people die a few days earlier than they might otherwise—these are deaths that would not have occurred if the air were cleaner.[50]

Researchers from Harvard University recently tripled the estimated risk of premature death following a review of the newer evidence from fine particle monitors ($PM_{2.5}$) in 27 U.S. cities.[51]

Particle pollution also diminishes lung function, causes greater use of asthma medications and increased rates of school absenteeism, emergency room visits and hospital admissions. Other adverse effects can be coughing, wheezing, cardiac arrhythmias and heart attacks. According to the findings from some of the latest studies, short-term increases in particle pollution have been linked to:

- death from respiratory and cardiovascular causes, including strokes;[52, 53, 54, 55]
- increased mortality in infants and young children;[56]
- increased numbers of heart attacks, especially among the elderly and in people with heart conditions;[57]
- inflammation of lung tissue in young, healthy adults;[58]
- increased hospitalization for cardiovascular disease, including strokes and congestive heart failure;[59, 60, 61]
- increased emergency room visits for patients suffering from acute respiratory ailments;[62]
- increased hospitalization for asthma among children;[63, 64, 65] and
- increased severity of asthma attacks in children.[66]

Again, the impact of even short-term exposure to particle pollution on healthy adults showed up in the Galveston lifeguard

study, in addition to the harmful effects of ozone pollution. Lifeguards had reduced lung volume at the end of the day when fine particle levels were high.[67]

Year-Round Exposure

Breathing high levels of particle pollution day in and day out also can be deadly, as landmark studies in the 1990s conclusively showed.[68] Chronic exposure to particle pollution can shorten life by one to three years.[69] Other impacts range from premature births to serious respiratory disorders, even when the particle levels are very low.

Year-round exposure to particle pollution has also been linked to:

- increased hospitalization for asthma attacks for children living near roads with heavy truck or trailer traffic;[70, 71]
- slowed lung function growth in children and teenagers;[72, 73]
- significant damage to the small airways of the lungs;[74]
- increased risk of dying from lung cancer;[75] and
- increased risk of death from cardiovascular disease.[76]

Research into the health risks of 65,000 women over age 50 found that those who lived in areas with higher levels of particle pollution faced a much greater risk of dying from heart disease than had been previously estimated. Even women who lived within the same city faced differing risks depending on the annual levels of pollution in their neighborhood.[77]

The Environmental Protection Agency released the most thorough review of the current research on particle pollution in December 2009.[78] The Agency had engaged a panel of expert scientists, the Clean Air Scientific Advisory Committee, to help them assess the evidence, in particular research published between 2002 and May 2009. EPA concluded that particle pollution caused multiple, serious threats to health. Their findings are highlighted in the box below.

EPA Concludes Fine Particle Pollution Poses Serious Health Threats

- Causes early death (both short-term and long-term exposure)
- Causes cardiovascular harm (e.g. heart attacks, strokes, heart disease, congestive heart failure)
- Likely to cause respiratory harm (e.g. worsened asthma, worsened COPD, inflammation)
- May cause cancer
- May cause reproductive and developmental harm

—U.S. Environmental Protection *Agency, Integrated Science Assessment for Particulate Matter.* December 2009. EPA 600/R-08/139F.

Where Does Particle Pollution Come From?

Particle pollution is produced through two separate processes—mechanical and chemical.

Mechanical processes break down bigger bits into smaller bits with the material remaining essentially the same, only becoming smaller. Mechanical processes primarily create coarse particles.[79] Dust storms, construction and demolition, mining operations, and agriculture are among the activities that produce coarse particles. Tire, brake pad and road wear can also create coarse particles. Bacteria, pollen, mold, and plant and animal debris are also included as coarse particles.[80]

By contrast, chemical processes in the atmosphere create most of the tiniest fine and ultrafine particles. Combustion sources burn fuels and emit gases. These gases can vaporize and then condense to become a particle of the same chemical compound. Or, they can react with other gases or particles in the atmosphere to form a particle of a different chemical compound. Particles formed by this latter process come from the reaction of elemental carbon (soot), heavy metals, sulfur dioxide (SO_2), nitrogen oxides (NO_x) and volatile organic compounds with water and other compounds in the atmosphere.[81] Burning fossil fuels in factories, power plants, steel mills, smelters, diesel- and gasoline-powered motor vehicles (cars and trucks) and equipment generate a large part of the raw

materials for fine particles. So does burning wood in residential fireplaces and wood stoves or burning agricultural fields or forests.

Focusing on Children's Health

Children face special risks from air pollution because their lungs are growing and because they are so active.

Just like the arms and legs, the largest portion of a child's lungs will grow long after he or she is born. Eighty percent of their tiny air sacs develop after birth. Those sacs, called the alveoli, are where the life-sustaining transfer of oxygen to the blood takes place. The lungs and their alveoli aren't fully grown until children become adults.[82] In addition, the body's defenses that help adults fight off infections are still developing in young bodies.[83] Children have more respiratory infections than adults, which also seems to increase their susceptibility to air pollution.[84]

Furthermore, children don't behave like adults, and their behavior also affects their vulnerability. They are outside for longer periods and are usually more active when outdoors. Consequently, they inhale more polluted outdoor air than adults typically do.[85]

In 2004, the American Academy of Pediatrics issued a special statement on the dangers of outdoor air pollution on children's health, pointing out the special differences for children.[86]

Air Pollution Increases Risk of Underdeveloped Lungs

Another finding from the Southern California Children's Health study looked at the long-term effects of particle pollution on teenagers. Tracking 1,759 children between ages 10 and 18, researchers found that those who grew up in more polluted areas face the increased risk of having underdeveloped lungs, which may never recover to their full capacity. The average drop in lung function was 20 percent below what was expected for the child's age, similar to the impact of growing up in a home with parents who smoked.[87]

Community health studies are pointing to less obvious, but serious effects from year-round exposure to ozone, especially for children. Scientists followed 500 Yale University students and determined that living just four years in a region with high levels of ozone and related co-pollutants was associated with diminished lung function and frequent reports of respiratory symptoms.[88] A much larger study of 3,300 school children in Southern California found reduced lung function in girls with asthma and boys who spent more time outdoors in areas with high levels of ozone.[89]

Cleaning Up Pollution Can Reduce Risk to Children

There is also real-world evidence that reducing air pollution can help protect children. Two studies published in 2005 added more weight to the argument.

Changes in air pollution from the reunification of Germany proved a real-life laboratory. Both East and West Germany had different levels and sources of particles. Outdoor particle levels were much higher in East Germany, where they came from factories and homes. West Germany had higher concentrations of traffic-generated particles. After reunification, emissions from the factories and homes dropped, but traffic increased. A German study explored the impact on the lungs of six-year olds from both East and West Germany. Total lung capacity improved with the lower particle levels. However, for those children living near busy roads, the increased pollution from the increased traffic kept them from benefiting from the overall cleaner air.[90]

In Switzerland, particle pollution dropped during a period in the 1990s. Researchers there tracked 9,000 children over a nine-year period, following their respiratory symptoms. After taking other factors such as family characteristics and indoor air pollution into account, the researchers noted that during

the years with less pollution, the children had fewer episodes of chronic cough, bronchitis, common cold, and conjunctivitis symptoms.[91]

Disparities in the Impact of Air Pollution

The burden of air pollution is not evenly shared. Poorer people and some racial and ethnic groups are among those who often face higher exposure to pollutants and who may experience greater responses to such pollution. Many studies have explored the differences in harm from air pollution to racial or ethnic groups and people who are in a low socioeconomic position, have less education, or live nearer to major sources,[92] including a workshop the American Lung Association held in 2001 that focused on urban air pollution and health inequities.[93]

Many studies have looked at differences in the impact on premature death. Results have varied widely, particularly for effects between racial groups. Some studies have found no differences among races,[94] while others found greater responsiveness for Whites and Hispanics, but not African-Americans,[95] or for African-Americans but not other races or ethnic groups.[96] Other researchers have found greater risk for African-Americans from air toxics, including those pollutants that also come from traffic sources.[97]

Socioeconomic position has been more consistently associated with greater harm from air pollution. Recent studies show evidence of that link. Low socioeconomic status consistently increased the risk of premature death from fine particle pollution among 13.2 million Medicare recipients studied in the largest examination of particle pollution mortality nationwide.[98] In the 2008 study that found greater risk for premature death for African-Americans, researchers also found greater risk for people living in areas with higher unemployment or higher use of public transportation.[99] A 2008 study of Washington, DC found that while poor air quality and worsened asthma went hand-in-hand in areas where Medicaid enrollment was high, the areas with the highest Medicaid enrollment did not always have the strongest association of high air pollution and asthma attacks.[100] However, two other recent studies in France have found no association with lower income and asthma attacks.[101]

Scientists have speculated that there are three broad reasons why disparities may exist. First, groups may face greater exposure to pollution because of factors ranging from racism to class bias to housing market dynamics and land costs. For example, pollution sources may be located near disadvantaged communities, increasing exposure to harmful pollutants. Second, low social position may make some groups more susceptible to health threats because of factors related to their disadvantage. Lack of access to health care, grocery stores and good jobs, poorer job opportunities, dirtier workplaces or higher traffic exposure are among the factors that could handicap groups and increase the risk of harm. Finally, existing health conditions, behaviors, or traits may predispose some groups to greater risk. For example, diabetics are among the groups most at risk from air pollutants, and the elderly, African-Americans, Mexican-Americans and people living near a central city have higher incidence of diabetes.[102]

Highways May Be Especially Dangerous for Breathing

Being in heavy traffic, or living near a road, may be even more dangerous than being in other places in a community. Growing evidence shows that the vehicle emissions coming directly from those highways may be higher than in the community as a whole, increasing the risk of harm to people who live or work near busy roads.

The number of people living "next to a busy road" may include 30 to 45 percent of the population in North America, according to the most recent review of the evidence. In January 2010, the Health Effects Institute published a major review of the evidence by a panel of expert scientists. The panel looked at over 700 studies from around the world, examining the health