Short Title: Fine Particulate Air Pollution
Full Title: Annual Mean Ambient Concentration of Fine Particulate Matter ($PM_{2.5}$)

1. **Healthy Community Framework:** Quality and sustainability of environment

2. **What is our aspirational goal:** Minimize toxics, greenhouse gas emissions, and waste

3. **Why is this important to health?**

Description of significance and health connection

Clean air is a fundamental building block of human health. Air pollution from fixed and mobile sources (e.g. factories and cars, respectively) is a complex mixture of gases, fumes, and particles released into the atmosphere from the combustion of fossil fuels and evaporation of solvents. Ozone that forms at the ground-level (described elsewhere) and fine particulate matter (PM) are two indicators of air pollution that are linked to short- and long-term adverse health effects. Particulate matter that has an aerodynamic diameter of 2.5 microns or less is called $PM_{2.5}$ and is capable of reaching deep into the lungs causing a host of diseases including lung cancer, heart disease, respiratory disease, and acute respiratory infections, particularly in children. In California, the Air Resources Board estimated that, given the $PM_{2.5}$ levels between 2004 and 2006, over 9300 deaths could be prevented each year if California met its current statewide $PM_{2.5}$ standard of 12 $\mu g/m^3$.

Summary of evidence

Based on numerous community-based epidemiologic studies, both short-term and long-term exposures to $PM_{2.5}$ increase the risk of cardiovascular disease and mortality, and are linked to adverse respiratory outcomes such as chronic obstructive lung disease, hospital and emergency department admissions for asthma, increased respiratory symptoms, altered pulmonary function, and pulmonary inflammation among asthmatic children. While not definitive, evidence is accumulating for $PM_{2.5}$ effects on low birth weight and infant mortality, especially due to respiratory causes during the post-neonatal period.

References:

1. Tran HT, Alvarado A, Garcia C, Motallebi N, Miyasato L, Vance W. Methodology for Estimating Premature Deaths Associated with Long-term Exposures to Fine Airborne Particulate Matter in California (Draft: Staff Report). Sacramento, CA: California Air Resources Board; 2009. www.arb.ca.gov/research/health/pm-mort/pm-mort_final.pdf. Accessed on 8/16/12.
2. Drechsler D, Garcia C, Tran H, Mehadi A, Nystrom M, Propper R, et al. Review of the California Ambient Air Quality Standard For Ozone. Vol 4. Table B-5: California Annual Health Impacts of Current Ozone Concentrations Compared to the State 8-hour Ozone Standard of 0.070 ppm.. Sacramento, CA: California Environmental Protection Agency, Air Resources Board; 2005. http://www.arb.ca.gov/carbis/research/aaqs/ozone-rs/rev-staff/vol4.pdf. Accessed on January 4, 2013.
3. Particulate Matter Integrated Science Assessment Project Team. Integrated Science Assessment for Particulate Matter. Research Triangle Park, NC: U.S. Environmental Protection Agency; 2009.

http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=216546#Download. Accessed on January 4, 2013.

4. What is the indicator?

Detailed definition: Three-year annual mean concentration of $PM_{2.5}$ (average of quarterly means, 2007-2009)

Data Description

- Data source: Air Monitoring Network, Air Resources Board (CARB) http://www.arb.ca.gov/aqmis2/aqmis2.php
- Years available: 3-year average of 2007-2009
- Updated: Not stated
- Geographies available: Zip codes, and population-average place, county, region, California
- Stratification: Race/ethnicity (8 Census groups)

A network of approximately 300 air monitoring stations is maintained in California by the California Air Resources Board, local air pollution control districts, tribes and federal land managers. Of these, approximately 80 measure $PM_{2.5}$ concentrations. A statistical average of 12 quarterly means (2007 to 2009) was calculated for each zip code based on these monitoring stations. To calculate averages for cities, places, and regions, the mean $PM_{2.5}$ concentration by zip code was weighted by the population in the zip code based on U.S. 2010 Census files that parsed zip codes by place and county. To calculate race/ethnicity specific weighted averages, the proportion of race/ethnicities by zip were calculated from U.S. 2010 Census files. Regional estimates were based on county groupings associated with California metropolitan planning organizations as reported in the *2010 California Regional Progress Report* (http://www.dot.ca.gov/hq/tpp/offices/orip/Collaborative%20Planning/Files/CARegionalProgress_2-1-2011.pdf).

5. Limitations

Geographic coverage was not complete because of the limited number and geographic extent of monitoring stations. The uncertainty of the interpolated values increases with distance from the nearest monitor. According to the Air Resources Board, values for areas greater than 50 km from the nearest monitor are very imprecise, and should be regarded as speculative. They are included for the sake of completeness, but should not be relied upon. Even within populated areas, monitoring stations are often located in areas that cannot detect highly localized areas of pollution that significant numbers or sensitive subgroups (daycare centers, schools, hospitals, etc.) in the population may encounter. Data were not available to present standard errors.

6. Projects using this indicator

Draft California Communities Environmental Health Screening Tool (CalEnviroScreen) http://oehha.ca.gov/ej/cipa073012.html. Accessed January 4, 2013.

Map 1: Annual Mean* Ambient Concentration of Fine Particulate Matter (PM2.5), by County, California, 2007-2009

Table 1. Annual Mean Ambient Concentration of Fine Particulate Matter ($PM_{2.5}$) by Zip Code in Sonoma County, 2007-2009

Zip Code	City	Pop.	$PM_{2.5}$ Concentration $\mu g/m^3$
94923	Bodega Bay	1,077	6.18
94922	Bodega	200	6.33
95421	Cazadero	354	5.91
95425	Cloverdale city	8,618	5.65
94931	Cotati city	7,200	7.11
95442	Eldridge	874	7.85
95436	Forestville	3,293	6.46
95439	Fulton	507	6.88
95441	Geyserville	858	6.05
95444	Graton	748	6.61
95446	Guerneville	4,012	6.23
95471	Guerneville	522	6.30
95448	Healdsburg	11,254	6.33
95452	Kenwood	984	7.70
95462	Monte Rio	1,090	6.23
95486	Monte Rio	62	6.23
95465	Occidental	575	6.24
94951	Penngrove	2,486	7.39
94952	Petaluma	21,968	6.84
94954	Petaluma	35,973	7.80
94928	Rohnert Park	40,957	7.21
95401	Santa Rosa	32,198	6.88
95403	Santa Rosa	34,232	6.94
95404	Santa Rosa	32,165	7.32
95405	Santa Rosa	21,397	7.33
95407	Santa Rosa	22,319	7.06
95409	Santa Rosa	25,504	7.47
95497	Sea Ranch	1,305	NA
95472	Sebastopol	7,379	6.62
95476	Sonoma	10,648	8.25
95450	Timber Cove	143	6.04
95492	Windsor	26,456	6.69

* Not available

Source: California Air Resources Board

Note: California standard for $PM_{2.5}$ is an annual average of 12 $\mu g/m^3$