

Monitored Air Quality: PM 2.5 – Days Above Regulatory Standard

Type of EPHT Indicator	Hazard
Measures	<ol style="list-style-type: none"> 1. Percent of days with PM_{2.5} levels over the National Ambient Air Quality Standard (NAAQS) 2. Number of person-days with PM_{2.5} over the National Ambient Air Quality Standard (NAAQS)
Derivation of Measures	Refer to the How-to Guide (contact CDC for the latest version of this document)
Unit	<ol style="list-style-type: none"> 1. Exceedance Days 2. Population-weighted exceedance days
Geographic Scope	Iowa
Geographic Scale	County (where monitors exist)
Time Period	2001-2009
Time Scale	Calendar year
Rationale	<p>According to the published literature, air pollution is associated with premature death, increased rates of hospitalization for respiratory and cardiovascular conditions, adverse birth outcomes, and lung cancer (2,3,4). Air pollution places a large economic burden on the country. In a report prepared for the American Lung Association, (2) estimated that air pollution related illness was estimated to cost approximately \$100 billion annually (2) (1988 dollars) in the United States, with an estimated number of excess deaths ranging from 50,000 to 100,000 annually (3). More than half of the U.S. population, approximately 159 million persons, live in counties with unhealthy levels of air pollution in the form of either ozone or particulate matter (1). Elevated pollution levels depend on sources, transport, season, geography, and atmospheric conditions. Each part of the country has its own level of pollution concentrations that can be exacerbated by many conditions, including stagnation, fire, or wind. The seasons for peak concentrations also vary between geographical regions.</p> <p>The Clean Air Act, which was last amended in 1990, requires EPA to set NAAQS for widespread pollutants from numerous and diverse sources considered harmful to public health and the environment. The Clean Air Act established two types of national air quality standards. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including visibility impairment and damage to animals, crops, vegetation, and buildings.</p> <p>Our indicator is based on comparing measured levels of PM_{2.5} by county to the 24-hr NAAQS for PM_{2.5}. The Clean Air Act requires periodic review of the science upon which the standards are based and the standards themselves. Primary air quality standards indicate the acceptable level of substances in the air before harm will occur based on proven scientific and medical research. State governments also set air quality standards. In several cases, California's standards or other benchmarks are more stringent than the EPA NAAQS.</p>
Use of the Measure	This indicator can be used to inform the public and policy makers of the degree of potential exposures within a state (for counties with monitors)

	<p>during a year. For example, the percentage of days per year that PM_{2.5} is higher than the NAAQS can be used to communicate to sensitive populations (such as asthmatics) the percentage of days that they may be exposed to unhealthy levels of PM_{2.5}; this is similar to the level used in the Air Quality Alerts that inform these sensitive populations when and how to reduce exposure.</p> <p>The number of person-days may be directed toward policy makers who are interested in roughly comparing population exposure between areas, to determine the areas most in need of prevention and pollution control activities.</p>
<p>Limitations of the Measure</p>	<p>The data for this indicator represent highly populated counties that have PM_{2.5} monitors. As a result, the data tend to reflect urban air quality and longer-term average air quality levels. Populations in counties without monitors may also be exposed to concentrations that exceed a standard.</p> <p>The percentage of days during which the EPA NAAQS or other health benchmarks are exceeded does not provide information regarding the severity (maximum concentrations) of potential exposures. Even with these limitations, trends in PM_{2.5} levels are a useful measure to describe public health concerns within these areas. We identify several limitations with this indicator below.</p> <p>This indicator is based on the percentage of high days rather than the total number of high days to highlight the fact that PM_{2.5} monitors follow different operating schedules. Most operate on a 1-in-3 day schedule, while a small proportion are operated on a daily or 1-in-6 day schedule. Because most of the monitors do not take measurements every day, the number of short-term events (e.g., days in which the NAAQS is exceeded) is uncertain, and except where PM_{2.5} levels vary uniformly throughout the year, estimating short-term measures that are representative of short-term exposures over a year is complex. To address this limitation, the measure can be based on the percentage of monitored days (of ~120 days per year), and be carefully communicated to the public. It should be noted that state air programs will be evaluating the daily PM_{2.5} NAAQS by using a frequency-based analysis to determine whether areas within the state attain this NAAQS.</p> <p>Daily and every-third-day percentages are not comparable because they do not measure the same days. However, all days available from daily monitors were included to achieve the greatest accuracy in these areas.</p> <p>Populations in counties without monitors may be exposed to concentrations that exceed a standard. Person-day estimates for larger, highly populated counties may be higher than estimates for smaller and lower populated counties. The indicator uses the highest value of all monitors in the area so that larger counties with more monitors may have a broader range of pollution values and greater potential to measure a high day than smaller counties with fewer monitors.</p> <p>The relationship between ambient concentrations and personal exposure is largely unknown, and it varies depending upon pollutant, activity patterns, and microenvironments.</p> <p>Because the number of high PM_{2.5} days per year can vary considerably, tracking trends over time needs to be done carefully. The variability results because: the number of high PM_{2.5} days is related to meteorological factors (e.g., temperature and mixing heights), and few events occur per year, so</p>

	that this type of extreme value measure will vary considerably for statistical reasons. When analyzing trends, consider only monitors with 75% complete data every quarter of every year (note: the current "how to" only approximates this).
Data Sources	<p>Air-quality data: EPA Air Explorer http://www.epa.gov/airdata/</p> <p>Population data: county population data can be found at http://www.census.gov/popest/data/historical/2000s/vintage_2006/index.html</p>
Limitations of Data Sources	Air-monitoring data provides information regarding concentrations around the specific location of each monitor. For PM _{2.5} this can be a rather large area, except when unusual local emissions (agricultural fires) occur. Within-county variation in concentrations will likely exist but will not be captured in this measure. Many PM _{2.5} monitors measure every third day (some every sixth day); a few measure every day, taking averages over seasons and then annually addressing the comparability of these data.
References	<ol style="list-style-type: none"> 1. American Lung Association. State of the Air 2004; 2004 [cited 2008 Dec 4]. Available from: http://ephtracking.cdc.gov/docs/SOTA_2004.pdf 2. Cannon J. The Health Costs of Air Pollution: A Survey of Studies Published 1984-1989. New York: American Lung Association; 1990. 3. Dockery DW and Pope CA. Acute respiratory effects of particulate air pollution. Annu Rev Public Health 1994;15:107-132. 4. Schwartz, J. Air pollution and hospital admissions for heart disease in eight U.S. counties. Epidemiology 1999;10:17-2. 5. U.S. Environmental Protection Agency. U.S. EPA Criteria Document for PM. Available from: Volume 1 VOL_I_FINAL_PM_AQCD_OCT2004.PDF and Volume 2 VOL_II_FINAL_PM_AQCD_OCT2004.PDF