STATE ENVIRONMENTAL HEALTH INDICATORS COLLABORATIVE (SEHIC) AIR QUALITY INDICATORS	
Indicator:	**AQ2: Exceedances of Air Quality Indices and Standards**
Measure(s):	**AQ2.2: Number of Days and Person-Days of Daily Maximum 8-hr Average Ozone Concentrations in the AQI Unhealthy Range, by County and MSA**

MEASURE DESCRIPTION

AQ2.2: Number of Days and Person-Days of Daily Maximum 8-hr Average Ozone Concentrations in the AQI Unhealthy Range, by County and MSA	
Last updated:	**September 30, 2008**
Derivation of Measures:	**The degree of hazard is related to how many people may be exposed to these high levels. See How-to Guide for details**
Units:	**Days and Person-days**
Geographic scale:	**Counties and MSAs with monitors**
Time scale:	**Annual, 2000 through most recent year**
Rationale:	**According to the published literature, air pollution has been associated with premature death; increased rates of hospitalization for respiratory and cardiovascular conditions; adverse birth outcomes; and lung cancer (Cannon 1990, Dockery and Pope 1994, Schwartz 1999). Air pollution places a large economic burden on the country. In a report prepared for the American Lung Association, Cannon (1990) estimated that air pollution related illness costs approximately $100 billion dollars (1988 dollars) each year in the United States, with an estimated number of excess deaths ranging from 50,000 to 100,000 per year (Dockery and Pope 1994). Additionally, as much as five percent of all hospital admissions for heart disease can be attributed to exposure to air pollution, representing an enormous public health impact (Schwartz 1999). More than half of the U.S. population, approximately 159 million Americans, live in counties with unhealthy levels of air pollution in the form of either ozone or particulate matter (American Lung Association 2004). Elevated pollution levels depend on sources, transport, the season, geography and atmospheric conditions. Each part of the country will have its own level of pollution concentrations which can be exacerbated by a multitude of conditions, including stagnation, fire, or wind. The seasons for peak concentrations also varies between geographical regions.** **The Clean Air Act, which was last amended in 1990, requires EPA to set National Ambient Air Quality Standards (NAAQS) for wide-spread 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 protection against visibility impairment, damage to animals, crops, vegetation, and buildings. The Clean Air Act requires periodic review of the science upon which the standards are based and the standards themselves. Primary Air quality standards tell us how much of a substance can be in the**

	air without causing harm, 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. **Note: these indicators are similar to indicators developed by EPA and state air quality agencies for use in air quality stats and trends analyses and reports (see www.epa.gov/airtrends)**
Use of Measure:	**This indicator is similar to EPA's analyses on number of days with air quality index (AQI) levels above 100 (for ozone). This measure is consistent with the EPA and state AQI program efforts to communicate an area's air quality levels to the public. In addition, this indicator – counting the times per year when air quality is unhealthy compared to the NAAQS – can be used to inform policy makers and the public regarding the degree of hazard within a state (specifically in counties and MSAs with monitors) during a year. For example, the number of person-days may be directed towards policy makers who are interested in comparing population exposure between areas, to determine which areas are most in need of prevention and pollution control activities. In the use of the measure, it would be important to explain that not all counties have monitors (although most populated areas in the US are monitored. Caution: This indicator is not a surrogate measure of exposure and therefore should not be linked with health data. Use of this indicator in such manner can lead to spurious results.**
Limitations:	**There is considerable variability in the number of high ozone days per year so tracking trends over time may be difficult. The variability results from the following: a) the number of high ozone days is related to temperature; there will be more high days in hotter summers; and b) there are a small number of events per year, so for statistical reasons this type of measure will bounce around more than an average. When analyzing trends over time, only consider monitors with 75% complete data every year. Note the relative variation among urban populations in many states may be large enough relative to the variation in the number of days greater than the ozone NAAQS that the population component can dominate the measure for comparisons among cities. Thus, for changes in the measure across geographic areas, careful investigation of the underlying data (to properly identify the changes in population and air quality data) is needed.** **The relationship between ambient concentrations and personal exposure is largely unknown and variable depending upon pollutant, activity patterns, and microenvironments. Variation within MSAs may exist but will not be captured in this measure. The data for this indicator only represents MSAs that have air monitors and tend to reflect urban air quality (where most people live). Thus, although populations in MSAs without monitors may also be exposed to ozone that exceed the standard, they are not counted. The number of days that exceed the EPA NAAQS or other health benchmarks does not provide information regarding the severity (max concentrations) of potential exposures. Within these areas, the monitor with the highest reading on any day is used in the measure. Results for larger MSAs may be biased higher than results for smaller MSAs because the indicator uses the highest value of any monitor in the area. Larger areas will have a broader range of pollution values and likely more monitors that may measure a high value on a given day. At the state level, this indicator may underestimate the number of person-days of potential exposure, since all people in the state are not included in the analysis.**

	Person day estimates for larger, highly populated counties may be biased higher than estimates for smaller and lower populated counties: (1) the indicator uses the highest value of all monitors in the area, so larger counties with more monitors may have a broader range of pollution values and greater potential to measure a high day then smaller counties with fewer monitors. It is important to understand that this indicator is not for use compliance determination with NAAQS or reasonable further progress toward attaining compliance.
Data sources:	**Air quality data: EPA Air Explorer http://www.epa.gov/airexplorer/**
Limitations of data sources:	**The effort to obtain all the data may indicate that a central system is needed to gather the data and calculate the measures**
Related indicators:	**1) EPA Report on the Environment. 2) SEHIC indicators 3) HP2010; Percent of Population in MSA across United States that Exceed the EPA NAAQS**
Recommendations:	**Consider how well MSAs represent regions of similar air quality (based on the monitors within these areas), how well these areas are comparable, and whether they capture the vast majority of elevated exposure within a state.**

References

ALA (American Lung Association). 2004. State of the Air 2004. Available: http://lungaction.org/reports/sota04_full.html

Cannon J. 1990. The Health Costs of Air Pollution: A Survey of Studies Published 1984 – 1989. New York: American Lung Association.

Dockery DW, Pope CA. 1994. Acute respiratory effects of particulate air pollution. Annu Rev Public Health 15:107-132.

Schwartz, J. 1999. Air pollution and hospital admissions for heart disease in eight U.S. counties. Epidemiol 10:17-22.

EPA general site on ozone effects. **http://www.epa.gov/air/ozonepollution/health.html**

Criteria document for ozone NAAQS: **http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=149923**

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AIR QUALITY INDICATORS

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HOW-TO GUIDE: AQ2.2

Obtain data from the EPA website:

1. Go to the EPA AIR Explorer web site: **http://www.epa.gov/airexplorer/**
2. Under **DATA** on the upper right side of the page, select **Query Concentrations** by clicking on the table icon, or click on Query Concentrations from the menu on the left side of the page.
3. You should be on the Query Concentrations page.
   - Under **Step 1: Select Pollutant**, select **Ozone**.
   - Under **Step 2: Select a County, MSA or State**, select your **State**.
   - Under **Step 3: Select a Site**, select **All Sites**.
   - Under **Step 4: Select Dates**, select the dates of interest **(1/1/2000 through 12/31/2006)**.
   - Under **Step 5: Select Options**, **keep the defaults** (Include Exceptional Events? = Yes And Download or View Online? = Download)
   - Under **Step 6: Submit Selection**, select **Submit**.
4. Save the data file to your computer by selecting **Save** from the Open or Save Options on the Pop-up window that appears. Name the file [state abbreviation]**Data_AQ2.2**.

Format data in Excel:

5. Open your saved file named [state abbreviation]**Data_AQ2.2.csv** in Excel.
6. Go to **File** on the menu at the top of the screen, select **Save As**, and save the file as an Excel file.
7. Working from the newly saved Excel file, copy the following columns into a new worksheet in the same Excel workbook: Date, SITE, Concentration, COUNTY_NAME. Rename the new worksheet **Data1**. Do this by right-clicking on the name of the worksheet (bottom of the page) and selecting rename.
8. In the worksheet **Data1**, create a new column for year:
   - Insert a column before column A by clicking on the column A label to highlight the entire column, go to the drop down menu at the top of the screen and choose **Insert** and then **Column**. Go to cell A1 and label this column **Year**.
   - In the new column, enter the formula for year by clicking in cell A2 and typing **=year(B2)**. Press enter. To copy this formula to the other rows in the new column, click on cell A2, copy the formula (control+C, or do Edit and Copy from the drop down menu). Click in cell A3, hold the shift key, use the scroll bar to go the last row with data, click in the cell for column A, hold down the shift key and paste (control+V or do Edit and Paste from the drop down menu).
9. Create a column for indicating that OZONE is in the unhealthy range:
   - Insert a column before COUNTY_NAME: click on the column header to highlight the entire column, go to the drop down menu at the top of the screen and choose **Insert** and then **Column**.

Label the new column **UnhealthyAQI**.

- In the first cell of the new column, enter the formula for unhealthyAQI by typing =**if(D2>=.096,1,0)**, (this is the 2008 standard) where column D refers to the Concentration column. Copy and paste in all the cells in the column.

10. For the new year column and UnhealthyAQI column, we need to replace the cell contents with values only so that formulas do not recalculate or interfere with sorting and filtering functions in the next steps.
    - Highlight the Year column by selecting on the column header A, do Control+C to copy the data, then go to Edit on the drop down menu, to Paste Special, and select Values in the popup that appears. Click OK. Do this for the UnhealthyAQI column as well.
11. We need to remove multiple counts for unhealthyAQI for counties with more than one monitor:
    - Sort the file by clicking anywhere in the worksheet, go to **Data** on the drop down menu at the top of the screen and choose **Sort**. In the sort popup, sort the data first by **year**, then by **County_name** and then by **Date**. For the option **My list has,** select **Header Row** if not already selected.
    - Note that after sorting, some counties may show more than one monitor value on a given day. Delete the columns **SITE** and **Concentration**. This is necessary in order to delete duplicate rows in the next step.
    - Filter on unique records by clicking anywhere in the worksheet, go to **Data** on the drop down menu, select **Filter**, then choose **Advanced Filter**, check the box for **Unique records only**, and click on OK.
    - Copy the contents of this worksheet. Go to Edit and Insert a new worksheet. In the new worksheet, click in cell A1 and Paste the contents.
12. Now we need to calculate the total number of days that each County has unhealthy AQI for each year. Click anywhere in the worksheet, go to **Data** on the drop down menu, then to **Subtotal**s. In the popup, for the option **At each change in** choose **County_Name**, for the option **Use function** choose **Sum**, and for the option **Add subtotal to** select **UnhealthyAQI**. Leave the options **Replace current subtotals** and **Summary below data** checked. Click OK.
13. Copy the contents of the entire worksheet, go to **Edit** and **Paste Special** on the drop down menu, choose **Values**, then click OK.
14. To show only the rows with totals, click anywhere in the worksheet, go to **Data** on the drop down menu, go to **Filter** and **AutoFilter**. Click on the down arrow box that now appears in the County_Name column and choose **Custom**. In the first box in the popup, choose **contains**. In the next box to the right, type **Total**. Click OK.
15. Note the county labels and totals repeat for each year, beginning with 2000. Use column E to label the year for each repeating section: In Column E to the right of the first county name, enter 2000. Go to the next repeat of county names and enter 2001 in the cell to the right of the first county name, and so on through 2006.

Create a SEHIC report in Excel:

16. Copy and paste the county totals data into the Excel file **SEHIC Indicator Report Template.xls**, worksheet **AQ2.2**.
17. For ozone in MSAs, repeat beginning with section two above, replacing "COUNTY" with "MSA".
18. Compute the person days for a county or MSA: For each county/MSA, multiply the number of days of unhealthy AQI by the population of the county/MSA. Get county populations at http://www.census.gov/popest/counties/CO-EST2006-01.html, and MSA populations at http://www.census.gov/population/www/estimates/CBSA-est2006-annual.html. MSA definitions can be found at http://www.census.gov/population/estimates/metro_general/List1.txt