STATE ENVIRONMENTAL HEALTH INDICATORS COLLABORATIVE (SEHIC)
AIR QUALITY INDICATORS

Indicator: **AQ2: Exceedances of Air Quality Indices and Standards**

Measure(s): **AQ2.1: Number of Days and Person-Days of Daily 24-hr Average PM2.5 Concentrations in the AQI Unhealthy Range, by County and MSA**

MEASURE DESCRIPTION

AQ2.1: Number of Days and Person-Days For Daily 24-hr Average PM2.5 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 number of times unhealthy PM2.5 levels occur in a year and further, how many people may be exposed to these high levels.**
Measurement units:	**Days and Person-days**
Geographic scale:	**Counties and MSAs with monitors**
Time scale:	**Annual, 2000 through most recent year**
Rationale:	**Approximately, 28% of the U.S. population lives in areas with unhealthful short-term levels of particle pollution. Nearly one quarter, 23% of the U.S. population lives in areas with unhealthful year-round levels of particle pollution (ALA 2004). Particulate Matter (PM) is a complex mixture of small and large particles of varying origin that can contain hundreds of different chemicals, including cancer-causing agents such as formaldehyde and polycyclic aromatic hydrocarbons (PAHs), and heavy metals such as arsenic and cadmium. Particulate Matter less than 2.5 microns in diameter ($PM_{2.5}$) consists of hundreds of liquid and solid chemicals, including carbon, nitrates, sulfates, metals, and organic compounds. The composition of PM depends on its source, the region of the country, the season, and atmospheric conditions.** **Exposure to PM has been associated with premature death; hospitalizations and emergency department visits for asthma, other respiratory conditions and cardiovascular disease; reduced lung function; adverse birth outcomes; and lung cancer (EPA 1998). Of the approximately 350,000 sudden cardiac deaths each year in the United States, as many as 60,000 deaths could be related to particulate air pollution (Stone and Godleski 1999). Prolonged exposures to particulate pollution are associated with an increase of all causes of mortality by as much as 26 percent. 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).**
Limitations:	**The relationship between ambient concentrations and personal exposure is largely unknown and variable depending upon pollutant, activity patterns, and microenvironments. Variation within counties and MSAs may exist but will not be captured in this measure. The data for this indicator only represents MSAs and Counties that have air monitors and tend to reflect urban air quality (where most people live). Thus, although populations in**

	Counties and MSAs without monitors may also be exposed to PM2.5 concentrations 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. Analytically, there is a need to carefully sum data by counties and MSA to ensure "double counting" does not occur. Within these areas, the monitor with the highest reading on any day is used in the measure. Results for larger MSAs/counties may be biased higher than results for smaller MSAs/counties 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. 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: http://www.epa.gov/airexplorer/**
Limitations of Data Sources:	**This surrogate exposure measure was generated based on air quality monitoring data which has associated uncertainties. With some exceptions, air monitoring data is typically available only for every 1 in 3 or 6 days. The effort to obtain all the data may indicate that a central system is needed to gather the data and calculate the measures**
Related Sets of Indicators:	**1) EPA Report on the Environment. 2) SEHIC indicators 3) HP2010; Percent of Population in Counties or MSA with Monitors that Exceed the EPA NAAQS or Other Benchmark; Number Of Persons In Each MSA, County And State-Wide Number Of Total Person-Days Of Air Which Was Rated Very Unhealthy (Purple), Unhealthy (Red), And Unhealthy For Sensitive Groups (Orange).**
Recommendations:	**Consider how well county boundaries and 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.** **Consider calculating the percent of the population in the state that lived in MSAs and counties with monitors (above and below the standard (i.e., 100* (Population living in MSAs and counties with monitors exceeding standard) / (total population in all MSA and counties with monitors)).**

References

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

EPA. 1998. Particulate matter research needs for human health risk assessment to support future reviews of the National Ambient Air Quality Standards for particulate matter. EPA-600-R-97-132F. Research Triangle Park, NC:U.S. Environmental Protection Agency.

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Stone PH, Godleski JJ. 1999. First steps toward understanding the pathophysiologic link between air pollution and cardiac mortality. Am Heart J 138: 804-807.

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HOW-TO GUIDE: AQ2.1

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 **PM2.5**.
   - 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_AQ2.1**.

Format data in Excel:

5. Open the file named [state abbreviation]**Data_AQ2.1.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 PM2.5 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>55.5,1,0),** 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 cells 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. 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. After you've visually inspected the data, 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 **AQ2.1**.
17. For PM2.5 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.