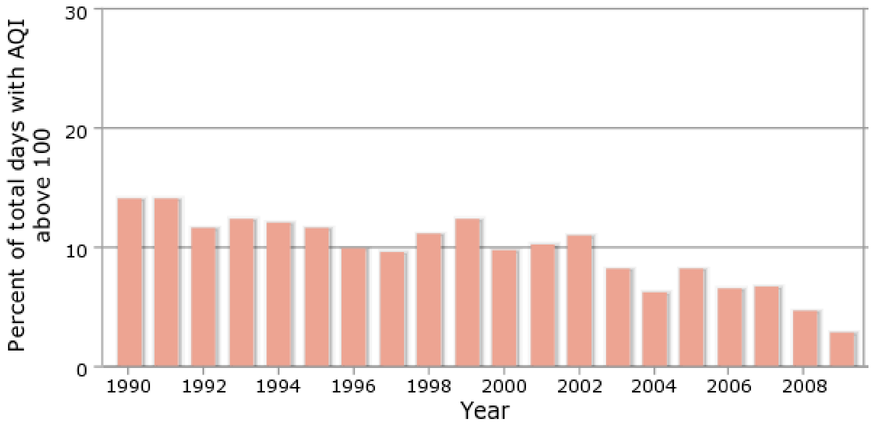
Percent of Days with Air Quality Index Values Greater Than 100

Exhibits

Exhibit 1. Percent of days with Air Quality Index (AQI) greater than 100 in selected U.S. metropolitan areas, 1990-2009

Based on all criteria pollutants



Coverage: 87 metropolitan areas for AQI trend based on all criteria pollutants.

For each metropolitan area, the percentage of days with AQI greater than 100 was calculated by dividing the number of days per year with AQI greater than 100 by 365 total days. However, because PM2.5 is not monitored daily in some areas, the actual percentage of days with AQI greater than 100 might be higher than what is shown in this graph.

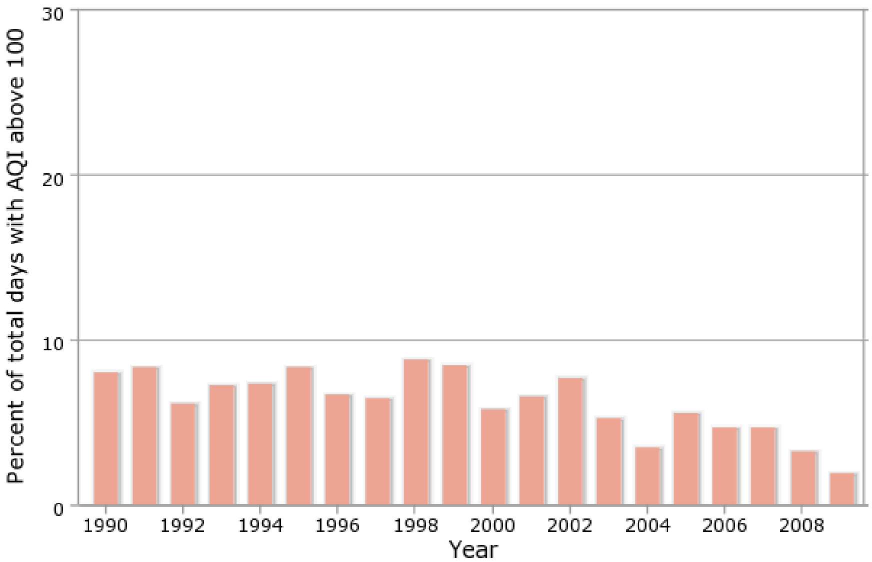
Lead does not factor into the AQI calculation for all criteria pollutants; and PM2.5 does not factor into the AQI between 1990 and 1998, because 1999 was the first year that PM2.5 was included in the index.

Information on the statistical significance of the trend in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2010

Exhibit 1. Percent of days with Air Quality Index (AQI) greater than 100 in selected U.S. metropolitan areas, 1990-2009

Based on ozone



Coverage: 84 metropolitan areas for AQI trend based on ozone.

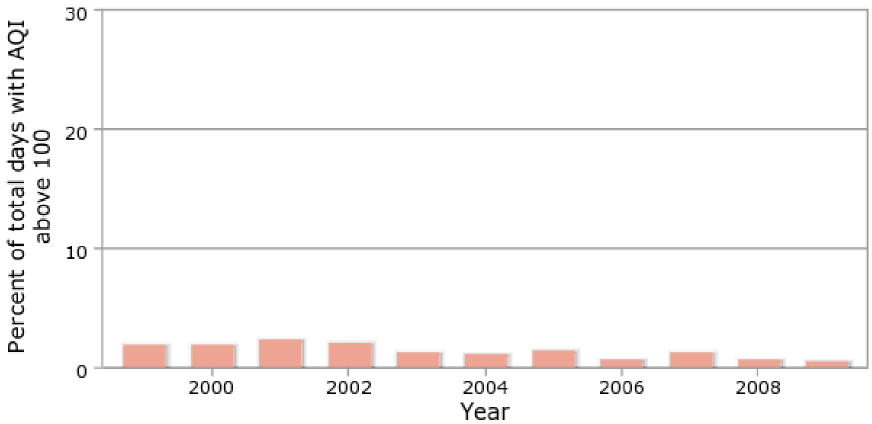
For each metropolitan area, the percentage of days with AQI greater than 100 was calculated by dividing the number of days per year with AQI greater than 100 by 365 total days.

Information on the statistical significance of the trend in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2010

Exhibit 1. Percent of days with Air Quality Index (AQI) greater than 100 in selected U.S. metropolitan areas, 1990-2009

Based on PM2.5



Coverage: 82 metropolitan areas for AQI trend based on PM2.5.

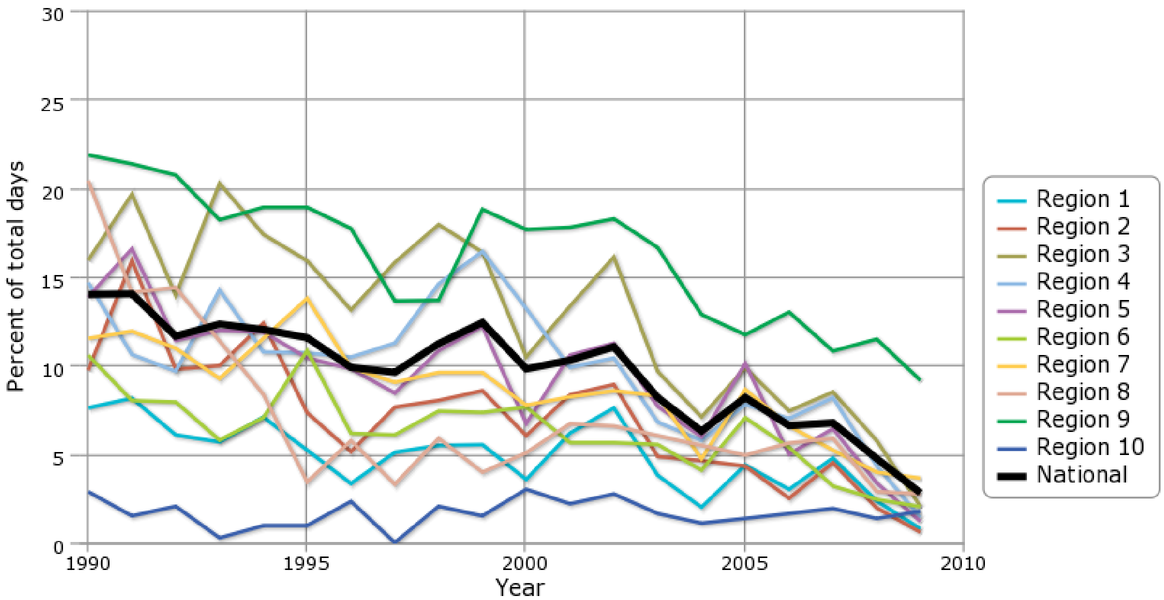
For each metropolitan area, the percentage of days with AQI greater than 100 was calculated by dividing the number of days per year with AQI greater than 100 by 365 total days. However, because PM2.5 is not monitored daily in some areas, the actual percentage of days with AQI greater than 100 might be higher than what is shown in this graph.

PM2.5 data for 1990–1998 are not shown because 1999 was the first year that PM2.5 was included in the AQI.

Information on the statistical significance of the trend in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2010

Exhibit 2. Percent of days with Air Quality Index (AQI) greater than 100 in selected U.S. metropolitan areas by EPA Region, 1990-2009



Coverage: 87 metropolitan areas.

Trend is based on AQI data for all criteria pollutants, except for lead. Note that 1999 was the first year that PM2.5 was included in the AQI.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2010

Introduction

The Air Quality Index (AQI) provides information on pollutant concentrations of ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. Formerly known as the Pollutant Standard Index, the nationally uniform AQI is used by state and local agencies for reporting daily air quality and air quality related health advisories to the public.

In 1999, the AQI was updated to reflect the latest science on air pollution health effects and to make it more appropriate for use in contemporary news media (U.S. EPA, 2003a). It also serves as a basis for community-based programs that encourage the public to take action to reduce air pollution on days when levels are projected to be of concern. The index has been adopted by many other countries (e.g., Mexico, Singapore, Taiwan) to provide the public with information on air quality.

The AQI is based on pollutant concentration data measured by the State and Local Air Monitoring Stations network and by other special purpose monitors. For purposes of this indicator, AQI data are presented for metropolitan areas known as Core-Based Statistical Areas (CBSAs), which are defined by the Office of Management and Budget. For most pollutants in the index, the concentration is converted into index values between 0 and 500, “normalized” so that an index value of 100 represents the short-term, health-based standard for that pollutant as established by EPA (U.S. EPA, 1999). The higher the index value, the greater the level of air pollution and health risk. An index value of 500 reflects a risk of imminent and substantial endangerment of public health. The level of the pollutant with the highest index value is reported as the AQI level for that day. An AQI value greater than 100 means that at least one criteria pollutant has reached levels at which people in sensitive groups may experience health effects. A complete description of how AQI values are calculated and what they represent is documented in many publications (e.g., U.S. EPA, 2003b).

This indicator is based on the percent of days across 87 metropolitan areas (CBSAs with 500,000 people or more) during the year that recorded an AQI greater than 100 at one or more monitoring sites. While the AQI indicator is calculated from ambient concentration data for criteria pollutants, this indicator's trends should not be expected to mirror the trends in the other ambient concentration indicators, due to the differing spatial coverage of monitoring stations across the various indicators.

The percent of days with AQI greater than 100 was calculated in two steps. First, for each year, the total number of days with AQI above 100 in each of the 87 metropolitan areas (CBSAs) was summed in order to get a national total. Then, the national total was divided by the total number of days in the annual sample (365 $\times$ 87, or 31,755 days) to obtain the percentage of days with AQI above 100 in a year. Note that this calculation will understate the actual percentage of days with AQI above 100 for pollutants that are not measured daily (e.g., $PM_{2.5}$).

Data are presented for 1990 through 2009. However, because meteorology can strongly influence AQI values in a given year, the change in AQI over time is evaluated by comparing the 3-year average observation at the beginning of the period of record (i.e., 1990-1992) to the 3-year average at the end (i.e., 2007-2009). Comparing 3-year averages reduces the potential for biases introduced by years with unique meteorological conditions. The air quality data that go into the index consist of daily (24-hour) measurements for PM_{10} and $PM_{2.5}$ and continuous (1-hour) measurements for CO, NO_2, ozone, and SO_2. Lead measurements do not factor into the AQI. AQI values in this indicator are based on the current NAAQS, which include the 2010 standards for NO_2 and SO_2. Of the pollutants considered, four (ozone, SO_2, NO_2, and PM) account for most instances with AQI values greater than 100.

What The Data Show

AQI Based on All Criteria Pollutants (Except Lead)

The percent of days with AQI greater than 100 in 87 large metropolitan areas based on all criteria pollutants (except lead) decreased from 13.2 over the 1990-1992 time frame to 4.8 over the 2007-2009 time frame (Exhibit 1). The AQI data based on all criteria pollutants are not directly comparable over this time frame, because $PM_{2.5}$ measurements were first included in the index in 1999. For this reason, the indicator also presents AQI trends based strictly on ozone and $PM_{2.5}$ measurements.

The percent of days with AQI greater than 100 based on all criteria pollutants are higher than those reported in previous releases of this indicator because this version of the indicator applies the new 2010 1-hour NAAQS for SO_2 (75 ppb) and NO_2 (100 ppb) retroactively when calculating AQI. The previous releases of this indicator were based on the NAAQS for these pollutants that were available at the time.

AQI Based on Ozone Only

For a nearly identical subset of metropolitan areas, the percent of days with AQI values greater than 100 due to ozone levels alone (based on the 2008 NAAQS) decreased from 7.5 over the 1990-1992 time frame to 3.3 over the 2007-2009 time frame (Exhibit 1).

AQI Based on $PM_{2.5}$ Only

In the 1999-2001 period, the percent of days with AQI greater than 100 due to $PM_{2.5}$ concentrations was 2.1. This percentage decreased in subsequent years, falling to 0.8 percent for the 2007-2009 period.

AQI in the EPA Regions Based on All Criteria Pollutants (Except Lead)

Trends in AQI based on all criteria pollutants (except lead) between 1990 and 2009 varied across the ten EPA Regions (Exhibit 2). For all ten Regions, the percent of days with AQI greater than 100 in 2009 was lower than that in 1990, though substantial year-to-year variability occurred. However, as noted above, the AQI values for 1990 and 2009 are not directly comparable, because $PM_{2.5}$ measurements did not factor into the AQI prior to 1999.

Limitations

- The AQI does not address hazardous air pollutants.
- Air quality can vary across a single metropolitan area. In assigning a single number for each pollutant in each area, the AQI does not reflect this potential variation.
- The data for this indicator are limited to metropolitan areas (CBSAs) comprising urban and suburban areas with populations greater than 500,000. Thus, this indicator does not reflect metropolitan areas smaller than 500,000 or rural areas.
- The AQI does not show which pollutants are causing the days with an AQI of more than 100, or distinguish between days with AQI slightly above 100 and days with much higher AQI.
- This composite AQI indicator does not show which specific metropolitan areas, or how many metropolitan areas, have problems—a specific number of days could reflect a few areas with persistent problems or many areas with occasional problems.
- This indicator only covers the days on which ambient monitoring occurred. Because $PM_{2.5}$ is not sampled daily in some areas, the data presented in this indicator may understate the actual number of days on which AQI values were greater than 100 due to $PM_{2.5}$ concentrations. Although ozone is not sampled throughout the year, the percent of days with AQI greater than 100 is believed to be accurate because monitoring occurs throughout the summer, when ozone concentrations are typically highest.

Data Sources

Summary data in this indicator were provided by EPA's Office of Air Quality Planning and Standards, based on AQI values computed from ambient air monitoring data for criteria pollutants found in EPA's Air Quality System (U.S. EPA, 2010). Spreadsheets with the processed AQI data for the metropolitan areas considered in this indicator are publicly available (http://www.epa.gov/air/airtrends/aqi_info.html) through calendar year 2008; data for 2009 were compiled from queries of the Air Quality System. This indicator aggregates the processed AQI data nationally and by EPA Region.

References

U.S. EPA (United States Environmental Protection Agency). 2010. Data from the Air Quality System. Accessed 2009. http://www.epa.gov/ttn/airs/airsaqs/

U.S. EPA. 2008. EPA's 2008 report on the environment. EPA/600/R-07/045F. Washington, DC. http://www.epa.gov/roe/

U.S. EPA. 2003a. National air quality and emissions trends report—2003 special studies edition. EPA/454/R-03/005. Research Triangle Park, NC. http://www.epa.gov/air/airtrends/aqtrnd03/

U.S. EPA. 2003b. Air Quality Index: A guide to air quality and your health. EPA-454/K-03-002. http://www.epa.gov/airnow/aqibroch/AQI_2003_9-3.pdf (PDF) (10 pp, 905K)

U.S. EPA. 1999. Air quality index reporting, 40 CFR part 58. http://www.epa.gov/ttn/oarpg/t1/fr_notices/airqual.pdf (PDF) (21 pp, 108K)

Technical Documentation

Identification

1. Indicator Title

   Percent of Days with Air Quality Index Values Greater Than 100

2. ROE Question(s) This Indicator Helps to Answer

   This indicator helps answer the ROE question, "What are the trends in outdoor air quality and their effects on human health and the environment?"

3. Indicator Abstract

   This indicator presents trends in the percent of days from 1990 to 2009 in selected U.S. metropolitan areas with an Air Quality Index (AQI) value exceeding 100. This information provides insight on how the frequency of days where air pollutants pose a potential health concern has changed in recent decades.

4. Revision History

   May 2008: Original indicator posted
   December 2008: Indicator updated
   December 2009: Indicator updated
   December 2010: Indicator updated

Data Sources

5. Data Sources
   This indicator is based on summary air monitoring data from EPA's Air Quality System (AQS) from 1990 to 2009. The Air Quality Index used in this indicator is derived from measurements of five pollutants (particulate matter [PM], carbon monoxide [CO], nitrogen dioxide [NO_2], ozone [O_3], and sulfur dioxide [SO_2]).

6. Data Availability
   Summary data in this indicator were provided by EPA's Office of Air Quality Planning and Standards, based on AQI values computed from raw ambient air monitoring data for criteria pollutants reported in EPA's AQS (http://www.epa.gov/air/data/index.html and http://www.epa.gov/ttn/airs/airsaqs/index.htm). Spreadsheets with the processed AQI data for the 87 large metropolitan areas (see "Data Collection") in this indicator are available online (http://www.epa.gov/air/airtrends/factbook.html). This indicator aggregates the processed AQI data nationally and by EPA Region. Information about AirData and AQS can be found at http://www.epa.gov/air/data/info.html and http://www.epa.gov/air/data/aqsdb.html, respectively.

Methodology

7. Data Collection

This indicator is based on the percent of days during the year that recorded an AQI greater than 100 at one or more monitoring sites. The AQI is based on physical measurements of five pollutants in ambient air: ground-level ozone, particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2). This indicator reflects data that are collected at 1,275 monitors found in 87 large (500,000 people or more) Core-Based Statistical Areas (CBSAs) throughout the nation. The air quality data consist of daily (24-hour) measurements for PM_{10} and $PM_{2.5}$ and continuous (1-hour) measurements for CO, NO_2, ozone, and SO_2. The daily measurements for PM are taken from monitoring instruments that collect 24-hour measurements and typically operate on a systematic sampling schedule of once every 6 days, or 61 samples per year. In general, EPA has determined that these 61 daily samples adequately represent outdoor air quality throughout the year, although for calculation of this indicator, a special caveat applies due to the non-daily nature of PM measurements (see the response to "Indicator Derivation").

Thousands of monitoring sites report air quality data for one or more of the six criteria pollutants to EPA's Air Quality System (AQS). The data for this indicator come from State and Local Air Monitoring Stations (SLAMS), which are operated by state or local governments so they can develop ambient air monitoring networks tailored to their specific monitoring needs. The SLAMS network's focus is on providing data for assessing public health consequences of criteria pollutants. These sites are a key part of EPA's national network, particularly for urban area oriented ambient monitoring. Note that some data used in this indicator also come from special purpose monitors in addition to the SLAMS monitors. Sites must meet data quality requirements for inclusion in this indicator (see "Indicator Derivation"). A list of the metropolitan areas considered in the 2008 version of this indicator is posted to EPA's Web site (http://www.epa.gov/air/airtrends/aqi_info.html). The ambient monitoring network is not designed to represent populations, or specifically to target sensitive ecosystems or populations such as asthmatics, the elderly, or children. However, many of the sampled areas could be considered "sensitive" to air pollution to the extent that stressors contributing to poor air quality tend to be more prevalent in large urban areas.

Standard documentation is available to support these data. The Ambient Monitoring Technology Information Center (AMTIC) (http://www.epa.gov/ttn/amtic/) provides links to numerous resources that describe sampling and analytical methods. Specifically, ambient concentrations of these pollutants are measured using a set of standard methods, which are officially documented in: (1) 40 CFR 50—National ambient air quality standards (NAAQS) and reference methods for determining criteria air pollutant concentrations in the atmosphere; and (2) 40 CFR 53—Process for determining reference or equivalent methods for determining criteria air pollutant concentrations in the atmosphere. Physical methods for sampling and monitoring are specifically described in EPA's Air Quality Criteria documents for the NAAQS pollutants (http://www.epa.gov/ttn/naaqs/) and in EPA's most recent list of equivalent and reference monitoring methods for criteria pollutant monitoring, which are posted and periodically updated on the AMTIC Web site (http://www.epa.gov/ttn/amtic/criteria.html). In some cases, areas may use non-Federal Reference Method (FRM) monitors to report PM for the AQI (instead, these areas use continuous PM monitors). Before using these monitors, for the purpose of reporting PM values in the AQI, states must establish a linear relationship between concentrations from an FRM or equivalent method monitor and a non-FRM monitor.

The monitoring objectives for the SLAMS network are found in: (1) 40 CFR 58, Appendix D; (2) 40 CFR 58.2(c); and (3) EPA 454/R-98-004, Part I, Section 3.2. These documents are available through http://www.epa.gov/ttn/amtic/. This monitoring network conforms to uniform criteria for monitor siting, instrumentation, and quality assurance. In particular, see 40 CFR 58—Ambient air quality surveillance (monitoring) requirements. Other aspects of survey design are documented in EPA's Air Quality System (AQS, http://www.epa.gov/ttn/airs/airsaqs/, has links to data download functions) and EPA's National Air Monitoring

Strategy documents (see http://www.epa.gov/ttnamti1/monstratdoc.html). The measurement results used to generate the AQI data are widely believed to be scientifically valid, as supported by the fact that EPA's criteria pollutant monitoring program has undergone external, independent peer review. The most recent such review was as a part of U.S. EPA (2003).

8. Indicator Derivation

EPA compiles and processes outdoor air quality data to generate the AQI using consistent and well-documented statistical procedures, all of which comply with the recommendations of the Intra-Agency Task Force on Air Quality Indicators (U.S. EPA, 1981). Monitoring sites are classified into selected city groupings known as core-based statistical areas (CBSAs), which are defined by the Office of Management and Budget (OMB). CBSAs generally include one or more entire counties. CBSAs have been selected as the reporting unit for consistency with numerous other reporting systems. For this indicator, data are included only for CBSAs that have a population of 500,000 or more. Sites also must meet data quality requirements for inclusion (i.e., a certain minimum number of available data points). Information about data quality requirements can be found at http://www.epa.gov/air/airtrends/aqtrnd99/pdfs/AppendixB.pdf.

For each pollutant in the index, concentrations are "normalized" by converting them into index values between 0 and 500. Generally, an index value of 100 represents the level of the short-term, health-based standard for that pollutant. An index value of 500 is set at the significant harm level, which represents imminent and substantial endangerment to public health. The higher the index value, the greater the level of air pollution and health risk. The pollutant index values were then used to determine the overall AQI. This is a simple procedure where for any given day, the AQI index value will be equal to the highest individual index value from any of the five pollutants that make up the index. Statistical methods for transforming data from multiple monitors into a single index value for each CBSA are relatively straightforward. Information about the derivation of the AQI and the specific equations used to calculate the AQI can be found in U.S. EPA (1999). For more information about the AQI, see http://airnow.gov/index.cfm?action=static.aqi. For a table of AQI thresholds and the corresponding pollutant concentrations, see EPA's updated "Guidelines for the Reporting of Daily Air Quality—the Air Quality Index (AQI)," which is available online at http://www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf. (Note: The AQI values in the current version of the indicator are based on the NAAQS that were promulgated as of December 1, 2010. Thus, the NAAQS used in the current version of the indicator differ from those cited in some older documents referenced in this section.) This document also includes a formula for calculating AQI from known pollutant concentrations. It is important to note that $PM_{2.5}$ was added to the AQI in 1999, and thus for the years 1990 to 1998 the AQI is not based on ambient air concentrations of fine particulate matter. The most recent version of this indicator is based on the new 2010 1-hour NAAQS for SO_2 (75 ppb) and NO_2 (100 ppb) applied retroactively to the data. The previous releases of the indicator were based on the NAAQS for these pollutants that were available at the time.

This analysis covers 87 CBSAs. Each CBSA is weighted equally in the analysis. This indicator is not assumed to represent the entire United States, and no attempt was made to portray data beyond the temporal bounds of the data set. Two steps were taken to calculate the national trend lines (Exhibit 1). First, for each year, the total number of days with AQI above 100 in each of the 87 CBSAs was summed to get a national total. Then, the national total was divided by the total number of days in the annual sample (365 x 87, or 31,755 days) to obtain the percentage of days with AQI above 100 in a year. The indicator also presents the 3-year average of the percentage of days with AQI above 100 for 1990-1992 and 2007-2009; these 3-year values are simply the arithmetic mean of the individual year's values for percentage of days with AQI greater than 100.

The AQI for PM is a special case because day counts are derived slightly differently than for the other pollutants in this indicator. AQI levels for PM are best estimated from daily PM monitors, and therefore, the nation's air programs are installing more continuous PM monitors. However, some areas use EPA's FRM, which involve non-daily sampling schedules for PM that can affect the observed day counts. To address this, EPA is evaluating methods for adjusting the counts for PM days with an AQI over 100. This indicator uses the easiest method for evaluating AQI values based on PM alone: The indicator simply presents the percent of days on which ambient monitoring occurred that AQI was greater than 100. Because PM is not sampled daily in some areas, the data presented in this indicator may understate the actual number of days on which AQI values were greater than 100 due to PM concentrations.

9. Quality Assurance and Quality Control

AQI information is presented for air quality data that meet EPA's data quality requirements. The quality assurance/quality control (QA/QC) of the national air monitoring program has several major components: (1) the Data Quality Objective (DQO) process; (2) reference and equivalent methods program; (3) EPA's National Performance Audit Program (NPAP); (4) system audits; and (5) network reviews (http://www.epa.gov/ttn/amtic/netamap.html). Further information on QA/QC procedures is available from other EPA publications (e.g., http://www.epa.gov/ttn/amtic/qaqcrein.html) and through EPA's Quality Assurance Handbook (EPA-454/R-98-004 Section 15).

To ensure quality data, the SLAMS are also required to meet the following QA/QC criteria: (1) each site must meet network design and site criteria; (2) each site must provide adequate QA assessment, control, and corrective action functions according to minimum program requirements; (3) all sampling methods and equipment must meet EPA reference or equivalent requirements; (4) acceptable data validation and record keeping procedures must be followed; and (5) data from SLAMS must be summarized and reported annually to EPA. Finally, there are system audits that regularly review the overall air quality data collection activity for any needed changes or corrections. There is a Quality Assurance Project Plan (QAPP) from each state or local agency operating a SLAMS monitor meeting the EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5. The QA plans for specific sites are publicly available by request to the reporting agency or the corresponding EPA Regional Office; some of these may also be accessed online (see: http://www.epa.gov/ttn/amtic/plans.html). The plans are audited at least once every 3 years as required in 40 CFR 58, Appendix A, Section 2.5.

Analysis

10. Reference Points

The AQI has reference points built into its derivation. For each pollutant, concentrations are normalized by converting them into index values between 0 and 500. Generally, an index value of 100 represents the level of the short-term, health-based standard for that pollutant. An index value of 500 is set at the significant harm level, which represents imminent and substantial endangerment to public health. Overall, EPA has divided the AQI scale into six general categories that correspond to different levels of health concern:

1. "Good" (0-50): Air quality is considered satisfactory, and air pollution poses little or no risk.
2. "Moderate" (51-100): Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of individuals. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.
3. "Unhealthy for Sensitive Groups" (101-150): Some groups of people may be particularly sensitive to the harmful effects of certain air pollutants. This means they are likely to be affected at lower levels than people in the general public. For example, people with respiratory disease are at greater risk from exposure to ozone, while people with respiratory disease or heart disease are at greater risk from exposure to PM. When the AQI is in this range, members of sensitive groups may experience health effects, but the general public is not likely to be affected.

4. “Unhealthy” (151–200): Everyone may begin to experience health effects. Members of sensitive groups may experience more serious health effects.
5. “Very Unhealthy” (201–300): Air quality in this range triggers a health alert, meaning everyone may experience more serious health effects.
6. “Hazardous” (over 300): Air quality in this range triggers health warnings of emergency conditions. The entire population is more likely to be affected.

For a table of AQI thresholds and the corresponding pollutant concentrations, see EPA’s updated “Guidelines for the Reporting of Daily Air Quality—the Air Quality Index (AQI)” at http://www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf. AQI thresholds are linked to EPA’s NAAQS standards, which are based on well-documented scientific knowledge (e.g., toxicological parameters). (Note: The AQI values in the current version of the indicator are based on the NAAQS that were promulgated as of December 1, 2010. Thus, the NAAQS used in the current version of the indicator differ from those cited in some older documents referenced in this section.)

11. Comparability Over Space and Time

For this indicator, data are limited to monitors in 87 large CBSAs (comprised of a total of 1,275 monitors) that each have a population of 500,000 or more. This urban focus is appropriate to the extent that urban areas are most likely to suffer from poor air quality and the associated health effects, based on population exposures. However, the indicator does not reflect CBSAs smaller than 500,000 or rural areas. In addition, air quality can vary across a single CBSA. In assigning a single number for each pollutant in each CBSA, the AQI does not reflect this potential variation.

Although year-to-year trends can be influenced by meteorological conditions, this record is sufficiently long that it can provide a good indication of general trends over time. However, EPA’s addition of $PM_{2.5}$ to the AQI in 1999, to which a considerable percentage of days with AQI values greater than 100 are attributed, limits the comparability of the long-term trends shown in the indicator.

All underlying measurements upon which this indicator is based were collected using highly accurate and price methods, typically federal reference or equivalent methods. Therefore, changes in or advances to measurement methodology likely do not affect the comparability of the measurements across CBSAs or between years.

12. Sources of Uncertainty

Uncertainty in the criteria pollutant monitoring data leads to uncertainty in this indicator's AQI trends. Sources of uncertainty in the criteria pollutant monitoring data include measurement uncertainty associated with the air sampling equipment and uncertainties associated with characterizing regional air quality trends using data from a limited number of monitoring sites. Measurement uncertainty is believed to be limited because the indicator is derived entirely from Federal Reference Method or equivalent method monitoring devices—methods that have been shown to be capable of measuring criteria pollutant air concentrations to a high degree of precision and accuracy. Further, the monitoring sites considered are required to meet strict quality assurance and quality control criteria to ensure the comparability of data from monitor to monitor. This is necessary because a primary objective for most of these monitors is to measure against the same air quality standards. A greater source of uncertainty arises from the spatial coverage of monitors. The statistics in this indicator are a composite of monitoring data collected from a discrete number of fixed monitoring sites, mostly found in higher populated areas as required by federal monitoring regulations. The depicted trends reflect air quality across those locations, and might not reflect conditions at unmonitored locations outside these more populated areas.

13. Sources of Variability

Air quality may vary across a single CBSA. In assigning a single value for each pollutant in each CBSA, the AQI does not reflect this potential variation. AQI extremes (i.e., AQI above 100) may be influenced by meteorological conditions, so some of the year-to-year variability in this indicator may in fact reflect meteorological variability.

14. Statistical/Trend Analysis

The indicator presents a time series of the percentage of time that AQI values exceeded 100 in selected metropolitan areas. No special statistical techniques or analyses were used to characterize the long-term trends and their statistical significance.

Limitations

15. Data Limitations

Limitations to this indicator include the following:

1. The AQI does not address hazardous air pollutants.
2. Air quality can vary across a single CBSA. In assigning a single number for each pollutant in each CBSA, the AQI does not reflect this potential variation.
3. The data for this indicator are limited to CBSAs comprising urban and suburban areas with populations greater than 500,000. Thus, this indicator does not reflect CBSAs smaller than 500,000 or rural areas.
4. The AQI does not show which pollutants are causing the days with an AQI of more than 100, or distinguish between days with AQI slightly above 100 and days with much higher AQI.
5. This composite AQI indicator does not show which specific CBSAs, or how many CBSAs, have problems—a specific number of days could reflect a few areas with persistent problems or many areas with occasional problems.
6. This indicator only covers the days on which ambient monitoring occurred. Because $PM_{2.5}$ is not sampled daily in some areas, the data presented in this indicator may understate the actual number of days on which AQI values were greater than 100 due to $PM_{2.5}$ concentrations. Although ozone is not sampled throughout the year, the percent of days with AQI greater than 100 is believed to be accurate because monitoring occurs throughout the summer, when ozone concentrations are typically highest.

References

U.S. EPA (United States Environmental Protection Agency). 2003. National air quality and emissions trends report, 2003 special studies edition. EPA/454/K-03/005. http://www.epa.gov/air/airtrends/aqtrnd03/.

U.S. EPA. 1999. Guidelines for the reporting of daily air quality—the air quality index (AQI). EPA/454/R-99/010. http://www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf (PDF) (31 pp, 557K).

U.S. EPA. 1981. Intra-Agency Task Force report on air quality indicators. EPA/450/4-81/015.