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Wednesday  
August 4, 1999

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**Part III**

**Environmental  
Protection Agency**

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40 CFR Part 58  
Air Quality Index Reporting; Final Rule

**ENVIRONMENTAL PROTECTION AGENCY****40 CFR Part 58**

[FRL-6409-7]

RIN 2060-AH92

**Air Quality Index Reporting**

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

**SUMMARY:** Today, EPA adopts revisions to the uniform air quality index used by States for daily air quality reporting to the general public in accordance with section 319 of the Clean Air Act (Act). These changes include the addition of the following elements: a new category described as "unhealthy for sensitive groups;" two new requirements, first, to report a pollutant-specific sensitive group statement when the index is above 100, and second, to use specific colors if the index is reported in a color format; new breakpoints for the ozone (O<sub>3</sub>) sub-index in terms of 8-hour average O<sub>3</sub> concentrations; a new sub-index for fine particulate matter (PM<sub>2.5</sub>); and conforming changes to the sub-indices for coarse particulate matter (PM<sub>10</sub>), carbon monoxide (CO), and sulfur dioxide (SO<sub>2</sub>). In addition, EPA is changing the name of the index from the Pollutant Standards Index (PSI) to the Air Quality Index (AQI). This document discusses the development of related informational materials on pollutant-specific health effects and sensitive groups and on precautionary actions that can be taken by individuals to reduce exposures of concern. This document also discusses the interrelationship between the uniform air quality index and other programs that provide air quality information and related health information to the general public, including State and local real-time air quality data mapping and community action programs.

**EFFECTIVE DATE:** October 4, 1999.

**ADDRESSES:** A docket containing information relating to EPA's revisions of the air quality index (Docket No. A-98-20) is available for public inspection in the Air and Radiation Docket and Information Center, U.S. Environmental Protection Agency, South Conference Center, Room M-1500, 401 M St., SW, Washington, DC 20460, telephone (202) 260-7548. The docket may be inspected between 8 a.m. and 5:30 p.m. on weekdays, and a reasonable fee may be charged for copying. For the availability of related information, see

**SUPPLEMENTARY INFORMATION.**

**FOR FURTHER INFORMATION CONTACT:** Terence Fitz-Simons, EPA (MD-14), Research Triangle Park, NC 27711, telephone (919) 541-0889, e-mail fitz-simons.terence@epa.gov. For health effects information, contact Susan Lyon Stone, EPA (MD-15), Research Triangle Park, NC 27711, telephone (919) 541-1146, e-mail stone.susan@epa.gov.

**SUPPLEMENTARY INFORMATION:** In compliance with President Clinton's June 1, 1998 Executive Memorandum on Plain Language in government writing, this package is written using plain language. Thus, the use of "we" or "us" in this package refers to EPA. The use of "you" refers to the reader and may include industry, State and local agencies, environmental groups and other interested individuals.

**Availability of Related Information**

Certain documents are available from the U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. Available documents include:

(1) The Review of the National Ambient Air Quality Standards for Ozone: Assessment of Scientific and Technical Information ("Staff Paper") (EPA-452/R-96-007, June 1996, NTIS #PB-96-203435, \$67.00 paper copy and \$21.50 microfiche). (Add a \$3.00 handling charge per order.)

(2) Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information ("Staff Paper") (EPA-452/R-96-013, July 1996, NTIS #PB-97-115406, \$47.00 paper copy and \$19.50 microfiche). (Add a \$3.00 handling charge per order.)

The guidance documents associated with this rulemaking are available from EPA's Office of Air Quality Planning and Standards in Research Triangle Park, NC. Requests for these publications can be mailed to: Terence Fitz-Simons, EPA (MD-14), Research Triangle Park, NC 27711. Your request may also be phoned in to Terence Fitz-Simons at 919-541-0889, or sent by e-mail to fitz-simons.terence@epa.gov.

(1) Guideline for Public Reporting of Daily Air Quality—Air Quality Index (AQI) (EPA-454/R-99-010).

(2) Guideline for Developing an Ozone Forecasting Program (EPA-454/R-99-009).

The following document is available from EPA's Office of Mobile Sources (OMS) in Ann Arbor, MI. Requests for this publication can be mailed to: Michael Ball, US EPA—National Vehicle and Fuel Emissions Laboratory (NVFEL), 2000 Traverwood Dr., Ann Arbor, MI 48103. Your request may also be phoned in to Michael Ball at 734-

214-4897, or sent by e-mail to ball.michael@epa.gov.

(1) Community Action Programs: Blueprint for Program Design (EPA 420-R-98-003).

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**I. Background****A. What Are the Legislative Requirements?**

Section 319 of the Act governs the establishment of a uniform air quality index for reporting of air quality. This section directs the Administrator to "promulgate regulations establishing an air quality monitoring system throughout the United States which utilizes uniform air quality monitoring criteria and methodology and measures such air quality according to a uniform air quality index" and "provides for daily analysis and reporting of air

quality based upon such uniform air quality index \* \* \*".

### B. What Is the History of the Air Quality Index?

In 1976, we established a nationally uniform AQI, called the Pollutant Standards Index (PSI), for use by State and local agencies on a voluntary basis (41 FR 37660). This uniform index was established in light of a study conducted by EPA and the President's Council on Environmental Quality (CEQ, 1976). This study found that the 55 urban areas in the U.S. and Canada reporting an index of air quality used 14 different indices, in conjunction with different cautionary messages, such that in essence 55 different indices were being used to report air quality. This diversity of indices sent a confusing message about air quality to the public. Based in part on this study, we developed an index to meet the needs of State and local agencies that has the following advantages: it sends a clear and consistent message to the public by providing nationally uniform information on air quality; it is keyed as appropriate to the national ambient air quality standards (NAAQS) and the significant harm level (SHL)<sup>1</sup> which have a scientific basis relating air quality and public health; it is simple and easily understood by the public; it provides a framework for reflecting changes to the NAAQS; and it can be forecasted to provide advance information on air quality.

The PSI, which is also commonly referred to by some State and local agencies as the AQI, includes sub-indices for O<sub>3</sub>, PM, CO, SO<sub>2</sub>, and nitrogen oxide (NO<sub>2</sub>), which relate ambient pollutant concentrations to index values on a scale from 0 through 500. This represents a very broad range of air quality, from pristine air to air pollution levels that present imminent and substantial endangerment to the public. The index has historically been normalized across pollutants by defining an index value of 100 as the numerical level of the short-term (i.e., averaging time of 24-hours or less) primary NAAQS for each pollutant and an index value of 500 as the SHL.<sup>2</sup> Such

index values serve to divide the index into categories, with each category being identified by a simple informative descriptor. The descriptors are intended to convey to the public information about how air quality within each category relates to public health, with increasing public health concerns being conveyed as the categories range to the upper end of the scale. Additional information about the general health effects associated with each category, and precautions that sensitive groups and the general public can take to avoid exposures of concern, has been made available through an informational booklet, updated as appropriate, that also presents and explains the PSI (EPA, 1994).

In 1979, we made changes to the AQI, in part to reflect revisions to the NAAQS for O<sub>3</sub>, and to establish requirements for AQI reporting (44 FR 27598). The requirement for State and local agencies to report the AQI appears in 40 CFR part 58.50, and the specific requirements (e.g., what to report, how to report, reporting frequency, calculations) are in appendix G to 40 CFR part 58.

### C. What Programs Are Related to the AQI?

Historically, State and local agencies have used primarily the AQI, or other AQIs, to provide general information to the public about air quality and its relationship to public health. In recent years, many States and local agencies, as well as EPA, have been developing new and innovative programs and initiatives to provide more information to the public, in a more timely way. These initiatives, including real-time data reporting through the Ozone Mapping Project and community action programs, can serve to provide useful, up-to-date, and timely information to the public about air pollution and its effects. Such information will help individuals take actions to avoid or reduce exposures of concern and can encourage the public to take actions that will reduce air pollution on days when levels are projected to be in air quality categories of concern to local communities. Thus, these programs are significantly

pollution, approaching the SHL, are in danger of being reached. Changes to this emergency episode program will be proposed in the near future.

Below an index value of 100, historically an intermediate value of 50 was defined either as the level of the annual standard if an annual standard has been established (for PM<sub>10</sub> and SO<sub>2</sub>), or as a concentration equal to one-half the value of the short-term standard used to define an index value of 100 (for O<sub>3</sub> and CO). Coarse or inhalable particulate matter, PM<sub>10</sub>, refers to particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers.

broadening the ways in which State and local agencies can meet the nationally uniform AQI reporting requirements, and are contributing to State and local efforts to provide community health protection and to attain or maintain compliance with the NAAQS. We and State and local agencies recognize that these programs are interrelated with AQI reporting and with the information on the effects of air pollution on public health that is generated through the periodic review, and revision when appropriate, of the NAAQS.

The most recent revisions to the O<sub>3</sub> and PM NAAQS, the Ozone Mapping Project, and community action programs are discussed briefly below. In light of the interrelationships among these programs, we have developed today's revisions to the uniform AQI with the goal of creating a revised AQI that can effectively serve as a nationally uniform link across these programs. In so doing, we intend to support and encourage State and local participation in real-time data reporting initiatives and the development and implementation of community action programs that serve public education and health protection goals.

### 1. Ozone and Particulate Matter NAAQS Revisions

On July 18, 1997, we revised the primary NAAQS for O<sub>3</sub> and PM based on a thorough review of the scientific evidence linking exposures to ambient concentrations of these pollutants to adverse health effects at levels allowed by the previous NAAQS. In particular, we replaced the 1-hour O<sub>3</sub> NAAQS with an 8-hour O<sub>3</sub> NAAQS and supplemented the PM NAAQS with 24-hour and annual standards for fine particulate matter (measured as PM<sub>2.5</sub><sup>3</sup>). These decisions were challenged in the U.S. Court of Appeals for the District of Columbia Circuit, and on May 14, 1999, the Court remanded them to the Agency for further consideration, principally in light of constitutional concerns regarding section 109 of the Act as interpreted by EPA. *American Trucking Associations v. EPA*, Nos. 97-1440, 97-1441 (D.C. Cir. May 14, 1999). On June 28, 1999, the U.S. Department of Justice on behalf of EPA filed a petition for rehearing seeking review of the Court's decision by the entire Court of Appeals. The EPA is continuing to assess what further legal or administrative proceedings may be appropriate in response to the Court's decision, as well

<sup>1</sup> Significant harm levels are those ambient concentrations of air pollutants that present an imminent and substantial endangerment to public health or welfare, or to the environment, as established in 40 CFR 51.151.

<sup>2</sup> Intermediate index values of 200, 300, and 400 were defined and are the basis for the Alert, Warning, and Emergency episode levels included in 40 CFR part 51, appendix L, as part of the Prevention of Air Pollution Emergency Episodes program. This program requires specified areas to have contingency plans in place and to implement these plans during episodes when high levels of air

<sup>3</sup> PM<sub>2.5</sub> refers to particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.

as its relevance to other rulemakings such as this one.

With respect to the present rulemaking, we have concluded that it is appropriate to proceed with final action on the proposed AQI revisions. As indicated previously, section 319 of the Act requires the Agency to establish a uniform air quality index, and this requirement is independent of the statutory provisions governing establishment and revision of the NAAQS. Moreover, there is no statutory requirement that the AQI be linked to the NAAQS, although EPA has used NAAQS levels in the past as reference points for the establishment of specific breakpoints within sub-indices. Nothing in the Court's opinion alters the conclusions EPA reached in revising the air quality criteria for PM and O<sub>3</sub> under section 108 of the Act, or in the NAAQS rulemakings, concerning the occurrence of specific health effects at varying concentrations of PM and O<sub>3</sub> in the air. Regardless of the outcome of the remand as to the NAAQS themselves, we believe the scientific record and conclusions underlying them are more than sufficient as a basis for decisions on the levels at which the public should be notified about health risks associated with daily air quality.<sup>4</sup>

We do not regard this notification function as involving the constitutional concerns raised in the Court's opinion. The AQI has no bearing on pollution control requirements for specific sources; nor does it serve to implement the NAAQS involved in the litigation. Rather, it provides information on air quality and health that will help individual citizens take prudent, self-protective actions to avoid or reduce exposures of concern and to avoid contributing to air pollution on days when unhealthy air quality is projected.

<sup>4</sup>Under section 319, the levels that are appropriate for this purpose do not necessarily depend on the NAAQS levels that may be appropriate under section 109. Depending on how the Agency chose to set an ambient standard, for example, it might conclude that the standard does not need to preclude certain effects falling below the level of public health concern, and at the same time set the AQI in such a way as to assure that sensitive individuals who might experience those effects receive notification and advice on actions they might take to avoid them. Similarly, AQI values might be set that are higher than the standard would permit but that would require more serious health warnings. This is not to say, however, that the levels of the 1997 NAAQS are irrelevant to decisions on the AQI breakpoints. To the contrary, the levels of the 1997 NAAQS are useful surrogates for a series of scientific conclusions reached in the NAAQS rulemakings, based on the revised air quality criteria, regarding the nature, extent, and severity of health effects associated with varying concentrations of PM and O<sub>3</sub> in the air. Accordingly, later sections of this notice make reference as appropriate to relevant levels of the 1997 NAAQS.

In this regard, the AQI is essentially a way of conveying scientific/medical advice to the public in an easily understood form.

As indicated below, there was broad support in public comments for modifying and expanding the use of the AQI to take into account the expanded understanding of air quality-health relationships that resulted from EPA's review of the latest scientific information on the effects of PM and O<sub>3</sub>. Other proposed revisions were designed to enhance the effectiveness of the AQI generally. The function the AQI serves of conveying to the public information on daily air quality and associated health risks is clearly important, and the season of higher pollution levels is imminent. For all the above reasons, we see no reason to delay final action on the proposed revisions of the AQI. The remainder of this section discusses aspects of the O<sub>3</sub> and PM NAAQS rulemakings as they relate to today's action.

As a result of the reviews of the scientific information upon which the 1997 NAAQS for O<sub>3</sub> and PM are based, an expanded understanding emerged as to the nature of the relationships between exposure to ambient concentrations of these pollutants and the health effects likely to be experienced, especially near the level of the NAAQS. We and the Clean Air Scientific Advisory Committee (CASAC)<sup>5</sup> recognized that for these pollutants there may be no thresholds below which health effects are not likely to occur, but rather a continuum of effects potentially extending down to background levels. As ambient concentrations increase, the proportion of individuals likely to experience effects and the seriousness of the health effects increase. Thus, the 1997 standards were not considered risk free. While the standards were intended to protect public health with an adequate margin of safety, in accordance with section 109(b) of the Act, including the health of sensitive groups, exposures to ambient concentrations just below the numerical level of the standards may result in exposures of concern for the most sensitive individuals. Conversely, exposures to ambient concentrations just above the numerical level of the standards are not likely to result in exposures of concern for most healthy people. This expanded understanding is reflected in the forms of the new standards, which allow for multiple

<sup>5</sup>CASAC is a scientific advisory committee established under the Act to review the scientific criteria and standards and to advise the Administrator on revision of the NAAQS, as appropriate.

days above the numerical level of the standards.

These understandings were also reflected in CASAC's advice to the Administrator during the O<sub>3</sub> NAAQS review, urging expansion of the public health advisory system (i.e., a uniform AQI) and communication to the public of the apparent nonthreshold nature of the health effects. More specifically, a number of CASAC panel members recommended "that an expanded air pollution warning system be initiated so that sensitive individuals can take appropriate 'exposure avoidance' behavior" (Wolff, 1995). Consistent with this advice, in the preamble to the proposed revisions to the O<sub>3</sub> NAAQS (61 FR 65733-65734), the Administrator requested comment on the usefulness of providing specific health effects information when ambient concentrations are around the numerical level of the standard, the appropriateness of using the AQI to convey such information to the public, the possible addition of two new AQI categories (one just above and one just below the numerical level of the standard) and associated descriptors and levels, as well as related health effects and cautionary statements.

Broad support for modifying the AQI was received in public comments on this aspect of the O<sub>3</sub> NAAQS proposal, as discussed in the final rule establishing revisions to the O<sub>3</sub> NAAQS (62 FR 38873-38874). Commenters overwhelmingly endorsed expanding the use of the AQI for various reasons, although many expressed concern with the possible category descriptors suggested in the proposal (i.e., "moderately good" and "moderately unhealthful"). Many commenters felt that an expanded AQI could help particularly sensitive people take action to minimize their exposures, and that the AQI could be combined with community action programs to reduce ambient concentrations when the numerical level of the standard was forecasted to be exceeded. Some commenters endorsed increasing the specificity of health and cautionary statements related to the AQI categories. Commenters from State and local agencies encouraged us to develop any approaches to revising the AQI in consultation with them, specifically in the areas of sharing real-time monitoring data, risk communication with the public, and coordination of a national program.

## 2. Real-time Data Reporting Initiative (Ozone Mapping Project)

The Ozone Mapping Project is part of EPA's Environmental Monitoring for

Public Access and Community Tracking (EMPACT) initiative—a new approach to providing timely environmental information to communities. It is a cooperative effort of the EPA, State and local air pollution control agencies, and regional organizations including the Mid-Atlantic Regional Air Management Association (MARAMA), the Northeast States for Coordinated Air Use Management (NESCAUM), the northeast Ozone Transport Commission (OTC), the Lake Michigan Air Directors Consortium (LADCO), SouthEast States Air Resource Managers (SESARM), and Central States Air Resource Agencies (CenSARA). During the summer of 1998, EPA's Office of Air Quality Planning and Standards assumed coordination of the project.

The Ozone Map provides simple and timely information about ground-level O<sub>3</sub>. During the 1998 O<sub>3</sub> season it was available on EPA's AIRNOW web site (<http://www.epa.gov/airnow>) and on some local television and news reports. It is an animated contour map that shows concentrations of O<sub>3</sub>, in categories ranging from good to moderate to varying degrees of unhealthy, based on AQI values, as they develop across the eastern United States. In 1998, the map was created from real-time, hourly O<sub>3</sub> data provided by a network of more than 400 air monitoring stations from South Carolina to Wisconsin and Maine. When accessed on a computer, cautionary statements for each category could be displayed by running a cursor over the legend. Also available on the AIRNOW web site were still maps of maximum values and forecasted values, and archived animated maps. In 1999, the ozone mapping coverage is being expanded to include 31 States and over 1500 monitors across the eastern and central U.S., and California. In addition, TV weather service providers are planning to carry the Ozone Map and forecasts as part of their traditional weather packages for local TV stations.

Along with the Ozone Map, the AIRNOW web site contains information about O<sub>3</sub> health effects in the "Health Facts" section, and emission reduction activities in the "What You Can Do" section. It also provides links to real-time data, and community action program web sites, that are maintained by State and local agencies around the country. The goals of the web site are to: (1) Provide real-time air pollution data in an understandable, visual format, (2) provide information about the public health and environmental effects of air pollution, and (3) provide the public with information about ways in which

they can protect their health and actions they can take to reduce pollution.

### 3. Community Action Programs

The implementation of community action programs (also referred to as voluntary action programs or episodic emission control programs) is becoming increasingly popular across the country as an innovative approach used to reduce emissions of O<sub>3</sub> precursors, CO, and PM. Motivation for implementation of this type of program often stems from local government and business concerns about the NAAQS attainment status of the area and the restrictions, additional controls, and costs associated with being classified as a nonattainment area. Many areas are also motivated by public health concerns and believe that increasing the amount of air quality information available to sensitive populations raises awareness and results in significant health benefits. Specific goals which are usually associated with community action programs include: (1) Educate the public and enhance protection of public health; (2) attain or maintain NAAQS attainment status and the associated economic benefits; (3) meet specific emission reduction targets; and (4) manage/reduce traffic congestion.

Community action programs are usually voluntary and generally provide multiple steps that the public, business, and industry can take to reduce emissions when higher levels of air pollution are forecast to occur, including in particular transportation-related measures such as trip reduction, postponement of certain activities such as vehicle refueling, and maintenance of cars. The programs emphasize educating the public about the impact of individual activities on local air quality and the basics of air pollution. The educational component of these programs also helps to create a strong link between environmental goals and associated public health benefits.

Most of these programs are based on the categories of the AQI and make use of the AQI descriptors and related health effects and cautionary statements on action days. By linking action days to the AQI, local control programs hope to alter individual behavior to reduce emissions and to reduce exposures to the population. In addition to reduced pollutant exposure of the general population due to improved air quality, there are other health benefits directly associated with community action programs that can be enhanced by linkage to the AQI. Different population groups are more sensitive to the harmful effects of the different air pollutants included in the AQI, and the revisions

to the AQI being adopted today, together with related informational materials, will significantly improve the effectiveness of communications with these groups. Public education, or programs directly targeting these groups, may provide the most significant benefits of a community action program. Forecasting days with elevated pollution levels, and then communicating effectively about air quality and associated health effects, may help these groups selectively limit their outdoor activities and, therefore, limit their potential for exposures of concern.

We are committed to providing States and local agencies with support in their efforts to meet air quality standards, to inform the public about air quality, and to educate the public about the impacts of air pollution. The revisions to the AQI being adopted today have as a goal the creation of a revised AQI that can effectively serve as a nationally uniform link across the range of programs (e.g., real-time data reporting initiatives, community action programs) that have these functions.

In support of community action programs, we have developed informational materials related to the AQI, including the health effects and cautionary statements associated with each category and more detailed health effects information (see section II.D.), available on the AIRNOW web site, that State and local agencies may use to enhance their community action programs. Focusing on transportation measures that are often a major component of community action programs, EPA's OMS has developed a report entitled, "Community Action Programs: Blueprint for Program Design." This document describes the major steps needed to put together a successful episodic control program and provides criteria that State and local agencies can use to examine and evaluate their own programs. The report is available from OMS (see Availability of Related Information).

## II. Rationale for Final Revisions

In developing the revisions to the AQI that are being adopted today, we sought extensive input from State and local agencies and from the public. We sponsored a workshop with State and local agencies, participated in numerous meetings, prepared and made available a staff draft revision to the AQI sub-index for O<sub>3</sub> for use during the 1998 O<sub>3</sub> season, and conducted several focus groups across the nation to obtain public input on the effectiveness of draft revisions to the AQI and related O<sub>3</sub> maps and informational materials. A

detailed history of the process leading to the proposal and the rationale for the proposed revisions are described more fully in the December 9, 1998 proposal notice (63 FR 67818-67834). The subsections below contain a description of the revisions we proposed, a discussion of the significant comments we received and our responses to them, and a summary of the AQI we are adopting today.

A. What Revisions Did We Propose?

The primary consideration that shaped the proposed revisions was the importance of providing nationally uniform health information associated with daily ambient levels of the air pollutants included in the index, consistent with the requirement of section 319 of the Act for an index to achieve national uniformity in daily air quality reporting. More specifically, the proposed changes to the AQI sub-indices for O<sub>3</sub> and PM reflected the 1997 revisions to the O<sub>3</sub> and PM NAAQS. The proposed general changes to the structure of the AQI were based on the expanded understanding that emerged during the O<sub>3</sub> and PM reviews as to the nature of the relationships between exposure to ambient concentrations of these pollutants and the health effects likely to be experienced, consideration of the implications of changes for the other pollutants, and broad input from State and local agencies and the public. The proposed general changes to the AQI, together with related informational materials, were intended to expand the use of the AQI to provide more pollutant-specific health information, especially when ambient concentrations are close to the level of the primary NAAQS.

1. What Were the Proposed General Changes?

a. *Categories and related descriptors, index values and colors.* The AQI currently incorporates the pollutants O<sub>3</sub>, PM, CO, SO<sub>2</sub>, and NO<sub>2</sub>. Index values range from 0 to 500<sup>6</sup>, and the index is segmented into five categories named by descriptor words that were chosen to characterize the relationship between daily air quality and public health. To reflect better the current understanding of the health effects associated with exposure to these air pollutants, we proposed to revise the AQI categories and descriptors, and to associate specific colors with the categories as shown below in Table 1.

TABLE 1.—PROPOSED CATEGORY INDEX VALUES, DESCRIPTORS, AND COLORS

Index values	Descriptor	Color
0–50	Good	Green
51–100	Moderate	Yellow
101–150	Unhealthy for sensitive groups.	Orange
151–200	Unhealthy	Red
201–300	Very unhealthy	Purple
301–500	Hazardous	Maroon

These proposed changes reflected the addition of a new category above an AQI of 100, created by dividing the current “unhealthy” category into two categories.

When air quality is in the “unhealthy for sensitive groups” range, people that are in the sensitive group, whether the sensitivity is due to medical conditions, exposure conditions, or inherent sensitivity, may experience exposures of concern. However, exposures to ambient concentrations in this range are not likely to result in exposures of concern for most healthy people. The descriptor “unhealthy for sensitive groups” was chosen to convey this message clearly. Participants in focus groups (SAIC 1998) clearly understood that “sensitive groups” does not refer to the general public, indicating that this descriptor effectively communicates the intended health message. This category would include a caution that while perhaps of interest to all citizens, would be of particular interest to individuals and families of individuals who are members of sensitive groups.

As air quality moves into the “unhealthy” range, exposures are associated with an increase in the number of individuals who could potentially experience effects and includes a greater proportion of members of the general public. Based on input received in the development of the proposal, the descriptor “unhealthy” appropriately characterizes air quality in this range.

In addition to an increasing number of exposures of concern, when air quality moves into the “unhealthy” range and above, individuals who were affected at lower levels, typically members of sensitive groups, are likely to experience more serious health effects than members of the general public. To reflect this understanding, it is appropriate to convey two messages in the cautionary statements for both the “unhealthy” and “very unhealthy” categories. One message is directed to members of sensitive groups, and the other is directed to the general public. The use of a distinct cautionary message

for members of sensitive groups is entirely consistent with an original goal that the index be based on the relationships between pollutant concentrations and adverse health effects within various groups, e.g., aggravation of disease in people with respiratory disease and incidence of respiratory effects in healthy people. Guidance on pollutant-specific cautionary statements related to the categories of the AQI is discussed below in section II.D.

Consistent with the overarching goal of national uniformity in the reporting of air quality, we proposed that the specific colors listed in Table 1 be associated with each category. While the AQI can be reported without the use of colors (through text and numbers alone), when the index is reported using colors, we proposed to require that only these specified colors be used. Three examples of AQI reports that use color are the color bars that appear in many newspapers, the color scales on State and local agency web sites, and the color contours of the Ozone Map. We participated in many discussions with State and local agencies and associations regarding which specific colors should be associated with the AQI categories, particularly above an index value of 100. These discussions typically were in the context of either the Ozone Mapping Project or community action programs. It was clear that the color associated with a category can be part of the health effects and cautionary message being conveyed. Were various State and local agencies to use different colors to represent the same category, and thus the same level of air quality, it could well send a confusing message about air quality and associated health effects to the public.

As an alternative to requiring the use of specified colors, we solicited comment on the option of recommending, rather than requiring, the use of these colors when reporting agencies choose to report the AQI in color format. In soliciting comment on this alternative, we sought to allow communities maximum flexibility in AQI reporting, while still preserving a nationally uniform AQI. We, therefore, requested that commenters addressing this issue discuss how this more flexible approach would satisfy the statutory language requiring a nationally uniform AQI if different colors may be used across the nation to represent the same range of air quality.

b. *Reporting requirements.* We proposed to change 40 CFR part 58.50 to require reporting of the AQI in all

<sup>6</sup>For NO<sub>2</sub>, the index ranges from 200 to 500, since there is no short-term NAAQS for this pollutant.

Metropolitan Statistical Areas (MSAs)<sup>7</sup> with a population over 350,000, instead of all urbanized areas with a population over 200,000. This change was proposed for consistency with the other monitoring regulations in part 58, which are or will be based on MSAs. This proposed change would not, however, have a significant impact on who is required to report, since virtually the same number of cities would be covered under the proposed reporting requirement as are covered under the existing requirement.

Consistent with early input from State and local agencies, we proposed to change the rounding conventions used to calculate index values corresponding to pollutant concentrations at and above the numerical level of the NAAQS to be consistent with the rounding conventions used in defining the NAAQS for each pollutant. This would avoid situations where a health advisory could be issued that describes the air as unhealthy, when in fact the numerical level of the standard has not been exceeded.

The proposed rule retained the requirements to identify the area for which the AQI is being reported, the time period covered by the report, the "critical" pollutant for which the reported AQI value was derived, the AQI value, and the associated category descriptor. Recognizing that many agencies use a color format to report the AQI, the proposed rule added the requirement to report the associated category color if a color format is used. Because different sensitive groups are

at-risk from different pollutants, issuing advisories for all sensitive groups who may be affected at AQI values greater than 100 clearly improves public health protection. Therefore, the proposed rule encouraged, but did not require, that AQI reports include: appropriate health effects and cautionary statements, all AQI values greater than 100, the AQI for sub-divisions of the MSA (if there are important differences in air quality across sub-divisions of the MSA), possible causes for high index values, and the actual pollutant concentrations. These topics were also discussed in our draft "Guideline for Public Reporting of Daily Air Quality—Pollutant Standards Index (PSI)" that was made available on the AIRLINKS web site.

The proposed rule emphasized the importance of forecasting the AQI by specifying that forecasted values should be reported, when possible, but did not require that forecasted values be reported. Given the importance of the O<sub>3</sub> sub-index in a large number of MSAs, and the use of an 8-hour averaging time for calculating the O<sub>3</sub> sub-index value, forecasting the O<sub>3</sub> index value is now more beneficial than before. For a health advisory system to be effective, people need to be notified as early as possible to be able to avoid exposures of concern. Because the O<sub>3</sub> sub-index is based on 8-hour O<sub>3</sub> averages, forecasting O<sub>3</sub> concentrations clearly would have increased value in providing cautionary statements to the public. We recognized that many State and local air agencies are already issuing health advisories based on

forecasted O<sub>3</sub> concentrations. Since we have determined that forecasting would add much to the benefits of AQI reporting, we indicated that we would be making available guidance on starting a forecasting program (EPA 1999b) in an area or MSA where forecasting is not presently done. Included in the document is guidance on using hourly O<sub>3</sub> concentrations as predictors for 8-hour averages.

*c. Index name.* Many State and local agencies encouraged us to change the name of the PSI to the Air Quality Index, or AQI, since many agencies already use the name AQI when reporting the AQI value to the public. Most participants in the focus groups preferred the name AQI, commenting that it more clearly identified the index as relating to the quality of the air rather than to environmental pollution in general. Based on these considerations, we solicited comment on changing the index name from Pollutant Standards Index (PSI) to Air Quality Index (AQI).

2. What Were the Proposed Changes to the Sub-Indices?

To conform to the proposed general changes to the AQI discussed above, and to reflect the recent revisions to the O<sub>3</sub> and PM NAAQS, we proposed changes to the sub-indices for O<sub>3</sub>, PM, CO, and SO<sub>2</sub>; no conforming changes are necessary for the NO<sub>2</sub> sub-index. The proposed sub-indices are summarized below in Table 2, in terms of pollutant concentrations that correspond to breakpoints in the index, and are discussed in the following sections.

TABLE 2.—PROPOSED BREAKPOINTS FOR O<sub>3</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, CO, AND SO<sub>2</sub> SUB-INDICES

AQI value	O <sub>3</sub>		PM		CO, 8-hr (ppm)	SO <sub>2</sub> , 24-hr (ppm)
	8-hr (ppm)	1-hr (ppm)	PM <sub>2.5</sub> , 24-hr (µg/m <sup>3</sup> )	PM <sub>10</sub> , 24-hr (µg/m <sup>3</sup> )		
50	0.07	.....	15	50	4	0.03
100	0.08	0.12	65	150	9	0.14
150	0.10	0.16	* 100	250	12	0.22
200	0.12	0.20	* 150	350	15	0.30
300	0.40 (1-hr) ...	0.40	* 250	420	30	0.60
400	0.50 (1-hr) ...	0.50	* 350	500	40	0.80
500	0.60 (1-hr) ...	0.60	* 500	600	50	1.00

\* If a different SHL for PM<sub>2.5</sub> is promulgated, these numbers will be revised accordingly.

*a. Proposed ozone sub-index.* On July 18, 1997, we revised the O<sub>3</sub> primary NAAQS to replace the 1-hour standard with a new standard with an 8-hour average at a level of 0.08 ppm and a form based on the 3-year average of the annual fourth-highest daily maximum 8-

hour average O<sub>3</sub> concentrations measured at each monitor within an area (62 FR 38856–38896). These proposed revisions were based on findings from the most recent review of the NAAQS indicating that the new primary standard will provide increased

protection to the public, especially children active outdoors and other sensitive groups, against a wide range of O<sub>3</sub>-induced health effects, including decreased lung function; increased respiratory symptoms; hospital admissions and emergency room visits

<sup>7</sup> A complete list of MSAs and their boundaries can be found in the Statistical Abstract of the United States (1998).

for respiratory causes, among children and adults with pre-existing respiratory disease such as asthma; inflammation of the lung; and possible long-term damage to the lungs. In setting this standard, we recognized that there is no apparent threshold below which health effects do not occur, that the standard is not risk free, and, thus, that exposures of concern are possible below the numerical level of the standard for some extremely sensitive individuals.

We proposed to set an index value of 100 equal to the level of the 8-hour  $O_3$  standard. Recognizing the continuum of health effects, we considered the results of a quantitative risk assessment (Whitfield et al., 1996) in selecting 8-hour  $O_3$  concentrations to correspond to index values of 50, 150 and 200. Since no human health effects information was available for 8-hour average  $O_3$  concentrations at significantly higher levels, we proposed to retain the breakpoints at the upper end of the AQI scale (between the "very unhealthy" and "hazardous" categories and the SHL which corresponds to the top of the PSI scale of 500) in terms of the existing 1-hour average concentrations.

These proposed revisions reflect the new 8-hour  $O_3$  NAAQS and will in almost all areas result in a more precautionary index than the current 1-hour sub-index. However, we recognized that a very small number of areas in the U.S. have atypical air quality patterns, with very high 1-hour daily peak  $O_3$  concentrations relative to the associated 8-hour average concentrations. In such areas, the use of the current 1-hour sub-index may be more precautionary on a given day than the proposed 8-hour sub-index. To allow for the reporting of the more precautionary sub-index value, we proposed to retain the 1-hour sub-index at and above AQI values of 100 and to allow the reporting of the higher of the two  $O_3$  sub-index values. Thus, both the new 8-hour and the current 1-hour sub-indices, as shown in Table 2, were included in the proposed appendix G. Since for the large majority of areas the 8-hour sub-index will be more precautionary, we did not propose to require all areas to calculate both sub-index values. Rather, we proposed to allow areas the flexibility to calculate both sub-index values and, when both sub-index values are calculated, to require that the higher value be reported. We specifically solicited comment on this proposed approach.

*b. Proposed PM sub-index.* On July 18, 1997, we revised the PM NAAQS by adding a new set of standards for fine particles, or  $PM_{2.5}$ , set at levels of  $15 \mu\text{g}/\text{m}^3$  (annual) and  $65 \mu\text{g}/\text{m}^3$  (24-hour

average) (62 FR 38652–38760). These revisions were based on findings from the most recent review of the PM NAAQS that recently published studies have indicated that serious health effects were more closely associated with the levels of the smaller particle subset of  $PM_{10}$ . These health effects include premature mortality and increased hospital admissions and emergency room visits, primarily in the elderly and individuals with cardiopulmonary disease; increased respiratory symptoms and disease in children and individuals with cardiopulmonary disease; decreased lung function, particularly in children and individuals with asthma; and alterations in respiratory tract defense mechanisms. In addition,  $PM_{10}$  standards were retained at the same levels of  $50 \mu\text{g}/\text{m}^3$  (annual) and  $150 \mu\text{g}/\text{m}^3$  (24-hour average) to continue to provide protection against health effects associated with the coarse particle subset of  $PM_{10}$ , including aggravation of asthma and respiratory infections. To reflect these revisions to the PM NAAQS, we proposed to add a new sub-index for  $PM_{2.5}$ , and to make conforming changes to the sub-index for  $PM_{10}$ , consistent with the proposed general changes to the AQI. The proposed sub-indices are summarized in Table 2 and discussed below.

*Proposed new  $PM_{2.5}$  sub-index.* Consistent with the historical method of selecting breakpoints of the AQI, we proposed to set an index value of 100 at the level of the 24-hour  $PM_{2.5}$  NAAQS,  $65 \mu\text{g}/\text{m}^3$ , and an index value of 50 at the level of the annual NAAQS,  $15 \mu\text{g}/\text{m}^3$ . Also consistent with the basic structure of the AQI, the proposed upper bound index value of 500 corresponds to the SHL, established in section 51.16 of the CFR under the Prevention of Air Pollution Emergency Episodes program. The SHL is set at a level that represents an imminent and substantial endangerment to public health. When we propose revisions to the Prevention of Air Pollution Emergency Episodes program, the proposal will include a SHL for  $PM_{2.5}$ . In the interim, we proposed to establish a  $PM_{2.5}$  concentration of  $500 \mu\text{g}/\text{m}^3$  to be associated with a  $PM_{2.5}$  index value of 500.

For intermediate breakpoints in the AQI between values of 100 and 500,  $PM_{2.5}$  concentrations were proposed that generally reflect a linear relationship between increasing index values and increasing  $PM_{2.5}$  values. The available scientific evidence of health effects related to population exposures to  $PM_{2.5}$  concentrations between the 24-hour NAAQS level and the proposed

$PM_{2.5}$  concentration to be associated with a  $PM_{2.5}$  index value of 500 suggest a continuum of effects in this range, with increasing  $PM_{2.5}$  concentrations being associated with increasingly larger numbers of people likely experiencing serious health effects (62 FR 38675; Staff Paper, p. VII–27). The proposed generally linear relationship between AQI values and  $PM_{2.5}$  concentrations in this range, rounded to increments of  $50 \mu\text{g}/\text{m}^3$  to reflect the approximate nature of such a relationship, is consistent with this evidence.

*Proposed conforming changes to the  $PM_{10}$  sub-index.* Consistent with the retention of the levels of the  $PM_{10}$  NAAQS, we proposed to retain the  $PM_{10}$  sub-index generally and to add a new breakpoint at an index value of 150 to conform to the proposed additional AQI category. We proposed that this breakpoint be set at a  $PM_{10}$  24-hour average concentration of  $250 \mu\text{g}/\text{m}^3$ , the mid-point between the breakpoints associated with index values of 100 and 200. We believe that the  $PM_{10}$  sub-index, with this conforming change, remains appropriate for the public health protection purposes of the AQI.

*c. Proposed conforming changes to the CO and  $SO_2$  sub-indices.* Since the current AQI sub-indices reflect the current NAAQS for CO and  $SO_2$ , the only change we proposed for these sub-indices was to add a breakpoint to each sub-index at an index value of 150 to conform to the proposed additional AQI category. We proposed that these breakpoints be set at concentrations at the mid-points between the breakpoints associated with index values of 100 and 200, consistent with the approach described above for conforming changes to both the 1-hour  $O_3$  sub-index and the  $PM_{10}$  sub-index. These proposed breakpoints are summarized in Table 2 and will be reviewed in conjunction with the future reviews of the CO and  $SO_2$  NAAQS.

#### *B. What Were the Significant Comments and Our Responses?*

This section describes the significant comments we received on proposed revisions to the index and our general responses to them. More detailed comment summaries and responses are contained in a Response to Comments Document that is available in the docket (see ADDRESSES).

##### 1. Comments and Responses on General Changes

*a. Categories and related descriptors, index values and colors.* With regard to the proposed changes to the general structure of the index, we received comments that focused on two major



issues. The first major issue was whether to add a category above or below the standard, or both. In addition, related to that issue were comments about the proposed descriptor for the category we proposed to add above the level of the standard. The second major issue regarded the particular colors, listed in Table 1, we proposed to associate with each category.

With regard to the general structure of the index, most commenters supported our proposal to add a category above the level of the standard. However, commenters from environmental groups and several States suggested adding a category below the level of the standard to provide additional caution for members of sensitive groups, instead of, or in addition to one above. These commenters expressed the view that the proposed sub-indices, that added a category above the standard, did not sufficiently caution members of sensitive groups about health effects occurring below the level of the standard. Specifically, their comments were in reference only to potential health effects occurring below the 8-hour  $O_3$  and 24-hour  $PM_{2.5}$  standards. Regarding health effects below the  $PM_{2.5}$  standard, one State commenter took exception with the statement in the proposal that an additional category below the standard, while perhaps meaningful for  $O_3$ , would not be an appropriate distinction for the other pollutants in the index. This commenter noted that "such a distinction would be more imperative for other pollutants, especially for PM where the level of the 24-hour standard may be less protective of sensitive groups than the ozone standard." (Docket No. A-98-20, IV-D-19). Agreeing with the importance of cautioning sensitive groups below the level of the 24-hour  $PM_{2.5}$  standard, another commenter noted "We believe that adding a category below the level of the standard is of particular importance with respect to fine particles." (Docket No. A-98-20, IV-D-11). Regarding the  $O_3$  sub-index, some of the States and the environmental groups that endorsed adding a category below the level of the standard supported that position by noting that we and CASAC stated that extremely sensitive individuals may be affected down to background levels of  $O_3$ . One comment from an environmental group noted that:

The CASAC recognized that for  $O_3$  and fine particle pollution, "there are no discernible thresholds below which health effects are not likely to occur in the most sensitive individuals" as it was advising EPA to set new health standards. We agree with CASAC and support the idea of setting "an expanded

air pollution warning system (to) be initiated so that sensitive individuals can take appropriate exposure avoidance behavior," however EPA has misrepresented the health threat with the levels it has proposed. (Docket No. A-98-20, IV-D-17).

A State commenter that supported adding a category below the level of the standard observed that adding such a category would be consistent with EPA's conclusion "that exposures to ambient concentrations just below the numerical level of the standard may result in exposures of concern for the most sensitive individuals." (Docket No. A-98-20, IV-D-19).

We understand and agree with the issues related to communication of risk below the levels of the 24-hour  $PM_{2.5}$  and 8-hour  $O_3$  standards. For the  $PM_{2.5}$  sub-index, we have addressed concerns about health effects below the level of the 24-hour  $PM_{2.5}$  standard by revising the  $PM_{2.5}$  sub-index so sensitive groups are cautioned below the 24-hour  $PM_{2.5}$  standard. Based on review of the suggested revisions to the  $PM_{2.5}$  sub-index that we received in comments, we believe this approach fully addresses their concerns. The revision is discussed in section II.B.2 below.

For better communication of health risk below the 8-hour  $O_3$  standard, we have addressed the issues raised by commenters by revising the  $O_3$  sub-index. We have expanded the "moderate" range of the 8-hour  $O_3$  sub-index to make it more precautionary. When air quality is in the "moderate" range of the 8-hour  $O_3$  sub-index, we have provided health effects and cautionary statements, available in our AQI Reporting Guidance document (EPA, 1999a) (discussed in section II.D), that may be used by State and local agencies to caution unusually sensitive individuals below the level of the 8-hour  $O_3$  standard. This revision is discussed in section II.B.2 below.

We do not believe it is necessary or appropriate to change the general structure of the index by adding a new category below the level of the standard to caution extremely sensitive individuals. Based on the concerns of State and local agencies that the addition of two new categories would unduly complicate the index, we are adding just one new category to maintain the degree of simplicity strongly supported by State and local agencies, none of whom advocated the addition of two new categories. As described in section II.A.1 above, we believe that adding a category above the level of the standard makes a distinction that is useful for members of sensitive groups without alarming the general

public. As noted by one State commenter:

We are satisfied and support the proposed category index values, descriptors and colors. [We] believe that the Air Quality Index \* \* \* has been a very effective communication tool during the ozone season. It has been our experience that a category above the standard provides the proper communication to the affected populations without alarming or desensitizing others. (Docket No. A-98-20, IV-G-04).

Further, given the changes we have made to the  $PM_{2.5}$  sub-index, and the expanded "moderate" range and the cautionary statements we have made available in guidance for use below the level of the 8-hour  $O_3$  standard, we do not believe a category below the level of the standard to caution members of sensitive groups would be an appropriate distinction for any of the pollutants included in the index. We believe that the approach we have adopted retains the simplicity of the index while allowing for more detailed cautionary information to be made available to the public when appropriate.

With regard to the descriptor "unhealthy for sensitive groups," some commenters expressed the view that this descriptor is misleading because it encompasses a large segment of the population. In addition, they argued, the public will not know that for certain pollutants healthy people, especially healthy children, are members of sensitive groups. Noting that it is prudent policy to assume that most risk communication regarding air quality impacts will be limited to the general descriptors, some of these commenters requested that if we continue to distinguish sensitive groups from the general population, that the descriptor be changed from "unhealthy for sensitive groups" to "unhealthy for children and other sensitive groups," so that the public would receive a clear message that children are members of a sensitive group that may be at increased risk from exposure to ozone. (Docket No. A-98-20, IV-D-2, IV-D-4 and IV-D-11). We agree with the view of these commenters, based on the responses of participants in the focus groups, that the public will not know that healthy people, including healthy children, may be at risk when air quality is in the "unhealthy for sensitive groups" range. The suggested descriptor, however, is only appropriate for pollutants for which children are a sensitive group. Since the sensitive groups differ from one pollutant to another, and children are only part of the sensitive group for  $O_3$ ,  $PM_{2.5}$  and  $NO_2$ , this descriptor is not appropriate for the other pollutants. For

example, the descriptor "unhealthy for children and other sensitive groups" would not be appropriate for use in the CO sub-index, where people with heart disease are the group most at-risk. Use of this descriptor when CO levels are above an index value of 100 could lead to confusion about the health effects associated with high levels of CO. Therefore, we do not believe it would be useful or prudent to adopt the descriptor "unhealthy for children and other sensitive groups." To increase public awareness that healthy children are members of the sensitive group for O<sub>3</sub>, we are adding the requirement that when the AQI value is above 100, reporting agencies include in their published report a statement describing the sensitive group for that particular pollutant. The reporting requirement for pollutant-specific statements describing sensitive groups is discussed below in section II.C.1.b on reporting requirements, and listed in appendix G. We believe that the requirement for agencies to report the pollutant-specific statements identifying the groups at risk, when air quality is above an index value of 100, will more effectively communicate the risk associated with specific air pollutants, and thereby better help members of the public reduce personal exposure. To the extent possible with AQI reporting, this requirement will also ensure that the public is informed that children are part of the sensitive group for O<sub>3</sub>. This requirement will not only improve protection for healthy children, but also healthy adults, the elderly, and people with heart and lung disease. We believe that another good way to address this lack of awareness is to educate the public, and the media and health care professionals that inform the public, about the health effects message associated with the category "unhealthy for sensitive groups." To help accomplish the goal of educating the public, we will be expanding the development of education and outreach materials and activities as described in section II.D below.

With regard to the colors listed in Table 1, we received comments concerning both the particular colors associated with the different categories and whether specific colors should be required or recommended. The majority of commenters, including most State and local agencies commenting, supported our proposed color scheme. Many of those (commenters that did support it), had used the same or a similar color scheme associated with either community action programs or ozone maps. Commenters that had used

the same or a similar color scheme noted that it effectively and appropriately portrayed the full range of local air quality values. On the other hand, some environmental groups and several States commented that the color red should be used for the category just above standard, instead of the color orange that we proposed. Primarily, these commenters expressed the view that the color orange would not send a sufficiently strong message that the standard has been exceeded. In the proposal we indicated that because the color red sends a strong cautionary message, it is most appropriately used when effects are likely to occur in the general population, and when more serious effects are likely in members of sensitive groups. Many of these commenters noted that since up to 30 percent of the population could be considered to be in the sensitive group for O<sub>3</sub>, when the standard is exceeded the general public should be alerted. These commenters expressed the view that it is appropriate to use the color red just above the level of the standard both to alert the public of potential health risks and to encourage emission reduction actions. An environmental group commented:

While individuals that are sensitive to poor air quality may look at the daily listing in the newspaper or call a message recorded by the state or local air agency, we know from experience that air quality does not receive broad public attention until it is predicted or reaches the level of "code red." At that point, the television and radio media announces that people should restrict outdoor activity and take steps to not add more pollution to the air by carpooling, using less electricity, or using mass transit. (Docket No. A-98-20, IV-D-17).

Another commenter from a State agency noted:

Considering that the definition of sensitive individuals for ozone includes healthy active children and outdoor workers, a clear unambiguous message needs to be sent to the public so that they can respond accordingly. For parents of active children, a message which states that air quality is unhealthy, and displays it using the color red, sends a clear message—even though it may carry with it the risk that individuals not in the sensitive population might also take exposure avoidance measures. Issuing a message that air quality is unhealthy for sensitive individuals and displays it with a code orange runs the risk of having sensitive individuals, or those guiding sensitive individuals (i.e., doctors and parents) not prescribe any avoidance action because of the ambiguity of the message. (Docket No. A-98-20, IV-G-19).

Additionally, these commenters suggested that the color orange be used for the category they wanted us to add

below the level of the standard, as described above.

In considering these comments, we recognize that the NAAQS are set to protect public health with an adequate margin of safety, including the health of sensitive groups. When the standards are met, public health is protected. Exposures to ambient concentrations just above the numerical level of the standards are not likely to result in exposures of concern for most healthy people. This is especially true for the 8-hour O<sub>3</sub> standard, which has a concentration-based form designed to offer more protection from higher concentrations than from multiple smaller exceedances of the standard. The form of the 8-hour O<sub>3</sub> standard allows for multiple days above the level of the standard, provided the 3-year average of the fourth-highest maximum concentrations does not exceed the level of the standard. This means that public health is protected, even when there are multiple days each year when ambient O<sub>3</sub> concentrations are above the level of the standard, as long as the standard is met. Therefore, it is inappropriate on any given day to express a high level of concern when air quality just exceeds the level of the standard. Besides sending an inaccurate health effects message by using the color red with the category "unhealthy for sensitive groups," another concern is the potential loss of credibility that could result from repeatedly sending a signal disproportionate to the expected incidence of noticeable symptoms. If this were to happen, the AQI could lose the power to influence people's behavior to protect their health. One commenter from a State agency expressed this concern:

One of our key concerns \* \* \* is that the general public will become ambivalent if we forecasted 20, 30, or more Code Red days over the course of an ozone season. Under this scenario, people may not take adequate precautions to protect themselves when an actual unhealthy level is reached. (Docket No. A-98-20, IV-G-05).

A commenter from another State agency expressed a similar view:

It is important to make sure that this general message is not jeopardized by treating the new 85 ppb, 8-hour standard as the bright line between healthy and unhealthy. The Code Red message will not be considered credible if it is issued between 40 to 60 times a summer in our area. Last year there were 54 days \* \* \* where the 8-hour standard was exceeded. (Docket No. A-98-20, IV-G-13).

From the comments we have received and from our focus group research, we believe that the color red sends too strong a message for use in the

“unhealthy for sensitive groups category.” Additionally, based on the comments of State and local agencies that have used the same or a similar color scheme, we believe that the color orange sends an appropriate health message and yet a strong message that the standard has been exceeded. One State commenter noted that their environmental agency:

has been using a green/yellow/orange/red communication system since 1993. The media has used the red, orange and yellow air quality codes to convey a “the air is not clean” message. In general, the media has used Code Red to convey a message that air pollution is or will be at a near emergency level. Code Orange has connoted “very dirty.” Code Yellow has, in general, been used to characterize air pollution as not too bad—but still not clean. (Docket No. A-98-20, IV-G-13).

Another State commenter noted:

We disagree, however, with \* \* \* [the] assertion that the “Code Orange” message in the PSI does not adequately protect public health. Our experience \* \* \* has been that the health message can be effectively delivered for Code Orange levels. We have received much feedback from the general public about our ozone action day program, and the resounding message has been: Thank you for this program. I can now plan my day to avoid exposure to high levels of ozone. (Docket No. A-98-20, IV-G-05).

In addition, ozone mapping projects have successfully represented air quality using the full AQI color scheme. In the Ozone Mapping Project, described in section I.C.2, the proposed AQI color scheme was used successfully during the 1998 O<sub>3</sub> season. Participating State and local agencies and regional organizations have selected the same color scheme for use in the 1999 O<sub>3</sub> season. Having used the proposed color scheme in their local O<sub>3</sub> map, one metropolitan air agency noted that “EPA’s proposed color scheme communicates clearly in a logical progression which in our experience is already understood by the public and the media.” (Docket No. A-98-20, IV-G-11).

Because we believe the proposed color scheme effectively and appropriately communicates the health effects message that was the basis for setting the O<sub>3</sub> and PM standards, we have adopted the color scheme as proposed. However, we strongly agree with the views expressed by commenters that it is important for the health effects message associated with the category “unhealthy for sensitive groups” to be effectively communicated to the public, health care providers and the media. It is very important that members of sensitive groups, which for

some pollutants includes healthy children and adults, be alerted to potential health risks and that the general public be motivated to take emissions reductions measures when air quality is above the level of the standard. In response to the concerns expressed by these commenters, we are planning to significantly step up the development of education and outreach materials and increase activities to get this message out, as discussed in section II.D below.

Only two commenters recommended against requiring specific colors. The first commenter did so on the grounds that requiring specific colors would be unenforceable, and may lead to frustration and conflict. While applauding our goal of establishing a consistent message, and agreeing that it is good to have as much national consistency as possible, this commenter noted that efforts to legislate aesthetics are uncomfortable, unwieldy and ultimately unnecessary. (Docket No. A-98-20, IV-D-11). The second commenter noted that some States may elect to use Code Red for ozone action programs at levels other than what is being proposed and the regulation should not preclude them from doing that. (Docket No. A-98-20, IV-D-19). On the other hand, there was very strong support in the comments for us to require that agencies that use color, use specific colors in AQI reporting. All of the other commenters that addressed this issue, including a commenter from an environmental organization, supported requiring specific colors for all State/local agencies using a color format. The commenter from an environmental group noted:

EPA states that revisions to the PSI have as a goal the creation of a nationally uniform link across a range of programs. We urge that this uniformity be achieved through the use of a national public health warning system that is clear to the public. To this end, we do support the EPA requiring that when colors are used by a state in its PSI, that the same color system incorporated in the PSI, and not variants, be utilized by such state. (Docket No. A-98-20, IV-D-21).

One of the many State commenters agreeing with us that such a requirement was necessary for national uniformity, noted that “Specific colors \* \* \* associated with each category should be required for national uniformity and ease of understanding. Anything less would defeat the purpose of a national index for comparing air quality in different locales.” (Docket No. A-98-20, IV-D-07). Another State commenter made the point that “Consistency of message is important, especially if the regional nature of many

air pollution problems is to be communicated effectively.” (Docket No. A-98-20, IV-D-01).

In response to the first commenter’s objections, we do not believe that requiring specific colors presents any particular enforceability problems. This requirement is one of many contained in the 40 CFR part 58 Ambient Air Quality Surveillance requirements and would be enforceable in the same manner and to the same extent as any other requirement of this section. As such, we believe there is no difference in enforceability between this and a requirement for the use of particular descriptors or air quality index values. We expect to work with EPA Regional Offices to ensure that they monitor State implementation of the revised AQI and work with the States to encourage compliance.

With regard to comments that our requirement would preclude States from using other color schemes and action levels in their voluntary programs, it is important to note that the AQI addresses the reporting of measured air quality and does not impose any requirements or limitations on community action programs based on air quality forecasts. We recognize that a nationally uniform color scheme for AQI reporting will, as a practical matter, complicate a State’s efforts to use other color schemes in action programs based on predicted air quality, but they remain free to do so under our regulations.

Because it is the fundamental goal of the AQI to provide nationally uniform information about daily air quality and the public health messages that are appropriately associated with various daily air quality levels, in a format that is timely and easily understood, we continue to believe that requiring specified colors when the AQI categories are reported in color format is both necessary and appropriate. Neither of the commenters opposing this requirement addressed how a more flexible approach of recommending specific colors, thereby allowing the use of different colors to represent the same range of air quality, would satisfy the statutory language requiring a nationally uniform air quality index. Therefore, we are adopting the requirement, as specified in appendix G below, that when State and local agencies report the AQI in a color format, that the specific colors listed in Table 1 be associated with each category.

*b. Reporting requirements.* We received significant comments on several issues related to the reporting requirements, including the population threshold and other aspects of the reporting requirements, the appropriate

method of monitoring and reporting the PM sub-indices, the effect of AQI changes relative to the SHL program, and the effective date of the final rule. Since we received no significant comments on our proposal to change the rounding conventions for calculating the index to make them consistent with the rounding conventions used in defining the NAAQS, we are adopting that revision as proposed. With regard to the population threshold, one commenter expressed the view that the change from requiring AQI reporting in urbanized areas with a population greater than 200,000, to requiring reporting in MSAs with populations greater than 350,000, would raise the threshold for the requirement and appear to mean that large segments of the U.S. population would not have access to AQI reporting. (Docket No. A-98-20, IV-D-03). We have adopted the requirement for AQI reporting in MSAs with populations greater than 350,000 to be consistent with the State/Local Air Monitoring Stations (SLAMS) monitoring regulations in 40 CFR part 58, since AQI reporting is based on information from SLAMS monitors that are located and reported within the context of MSAs. The use of MSAs also provides for more stable reporting areas since MSAs are usually defined by county boundaries that typically do not change, whereas the boundaries for urbanized areas are very irregular, may include parts of counties, and may change with each census. In selecting the MSA population threshold of 350,000, we tried to make the new reporting requirement equivalent to the old one. Under the new requirement, virtually the same number of cities will be required to report the AQI as were previously. Because urbanized areas and MSAs are not equivalent, we realize that some areas will be required to report the AQI that were not required to do so before this rulemaking, and vice versa. The regulation does not preclude any area from reporting the AQI, and we encourage State and local air agencies to report the AQI whenever possible so that people will be informed about local air quality.

Another commenter noted that some MSAs fall within the boundaries of more than one State, and requested that we identify which of the two or more reporting agencies would be responsible for reporting the AQI for the MSA. (Docket No. A-98-20, IV-G-15). We expect that decisions about AQI reporting in multi-State MSAs will be made by participating agencies in the same manner as decisions about activities to implement the standards

through the State Implementation Plans (SIPs). Guidance for air quality planning and implementation in MSAs that fall within the boundaries of more than one State generally calls for the participating State and local agencies to identify, in the SIPs for those States, who will be responsible for the preparation and submission of the required elements, including AQI reports. Where a local or regional planning organization has been designated to carry out such requirements, such an organization is the appropriate one to report the AQI. In any case, we encourage AQI reporting on the sub-MSA level, especially where the AQI differs within the MSA.

Another commenter urged us to expand the requirement for AQI reporting to areas with populations less than 350,000, if these areas are likely not to be in attainment for the 8-hour O<sub>3</sub> standard. To support this position, the commenter noted that O<sub>3</sub> can be transported long distances downwind from where it is generated, resulting in serious air quality problems in downwind rural and smaller urban areas. (Docket No. A-98-20, IV-G-27). We agree with this commenter that downwind areas may be significantly affected by transport of O<sub>3</sub> and precursors. In section 5 of appendix G, we encourage States to evaluate air quality in affected areas downwind of MSAs to identify the potential for significant transport-related air quality impacts and to expand their AQI reporting to address these situations. We have also changed the language in this section such that the affected area need not be contiguous to the reporting MSA.

On a related topic, one commenter noted an example in which a MSA with a population greater than 350,000, has not registered AQI values in excess of 50 (such that AQI reporting would be discretionary), although values above 100 are registered infrequently at a national monument within the larger air basin. (Docket No. A-98-20, IV-G-17). This commenter requested that we revise the reporting requirements to add an air quality consideration to the population threshold as a second component of AQI reporting. To address one part of this comment, we encourage State and local air agencies to report the AQI and issue forecasts for national parks or monuments whenever possible, since these are places people go to for activities that often involve prolonged or vigorous exertion, thereby increasing the risk from air pollution. We have worked with the National Park Service to develop appropriate guidance for visitors and staff to use when index values are expected to be above 100 for O<sub>3</sub>. To address the other part of this

comment, section 8 of appendix G describes exceptions under which AQI reporting becomes discretionary, either for one pollutant or the entire index, for areas with good air quality. Regarding these exceptions, a State commenter suggested that we require a minimum of 2 years at an AQI value lower than 50 before allowing agencies to "opt out" of reporting the AQI for a particular pollutant, so that for example, one unusually good O<sub>3</sub> season would not make it possible for an agency to avoid reporting high index values in subsequent O<sub>3</sub> seasons. (Docket No. A-98-20, IV-D-06). We believe that requiring 2 years of index values lower than 50 before allowing State and local agencies discretion in reporting, while appropriate in some situations, may be unnecessary in others. We agree with this commenter that it is appropriate to require reporting of higher index values, even if air quality has been good throughout the previous year. Therefore, we have revised section 8 of appendix G, such that when the criteria for an exemption are no longer met, the responsible agency is required to report the AQI. Another commenter expressed the view that we should strengthen the minimum notification requirements, so that when the AQI value exceeds 100, State and local agencies are required to report the index to all three media (print, radio and television) to help ensure that the public is informed that the standard has been exceeded. (A-98-20, IV-E-3) We agree that it is important to inform the public when the AQI is above 100, and therefore have strengthened the reporting provisions in section 6 of appendix G. In particular, when the AQI exceeds 100, reporting agencies should expand reporting to all major news media, and at a minimum, should include notification to the media with the largest market coverages for the area in question.

Looking at these reporting provisions more broadly, we believe that it would be very beneficial for reporting agencies to educate the media about alternative sources for this information, such as web sites and community action programs. Many State and local agencies have web sites that provide quick access to timely and accurate air quality and related information. For State and local agencies participating in the Ozone Mapping Project, the media could be directed to the AIRNOW web site as a source of information about O<sub>3</sub> air quality and associated health effects for yesterday, today and tomorrow. In addition, this web site provides in-depth information about O<sub>3</sub> health effects, sources of emissions and simple

measures people can take to improve air quality. Community action programs also provide timely and accurate information, and are often used to inform the public when air quality is predicted to be above an index value of 100. Tools and programs such as these can significantly improve the timeliness of AQI reporting and provide additional useful information. We believe that, in the near future, the AQI will be reported by the regional and national media in ways, such as the Ozone Map, that will not be limited to specific MSAs. This type of approach will help provide AQI reporting for areas that would otherwise not be covered, including, in some cases, rural and small urban areas and national parks.

Regarding reporting the PM sub-indices, one commenter requested that we clarify whether PM<sub>2.5</sub> and PM<sub>10</sub> should be treated as one pollutant (e.g., reported simply as PM) or two different pollutants (e.g., reported separately). (Docket No. A-98-20, IV-D-19). We expect State and local air agencies to report PM<sub>2.5</sub> and PM<sub>10</sub> separately, since there are two separate sub-indices with different sensitive groups, and different health effects and cautionary statements. In response to this comment, we have added clarifying language to section 9 in appendix G. In addition, many commenters noted that at the present time there is very little monitoring for PM (both PM<sub>2.5</sub> and PM<sub>10</sub>) that is suitable for use in daily AQI reports, and requested guidance for the use of non-reference methods for the purpose of AQI reporting. Since PM is often measured at intervals longer than every 24-hours, State and local agencies are encouraged to use monitoring data from continuous PM monitors for use in AQI reporting, whenever possible. As noted by commenters, due to the lack of appropriate monitoring information, at this time it may not be possible to report the AQI for PM in many locations. To assist State and local agencies in the use of non-reference methods, we have added language to section 10 of appendix G stating that non-reference methods may be used for the purpose of AQI reporting if it is possible to demonstrate a simple linear relationship between the non-reference and the reference methods.

Regarding the effect of changes to the AQI on the SHL program, we received two significant comments. One commenter noted that our proposed changes to the categories, to standardize them such that the upper bound falls on an even number, rounded to 50 (e.g., 200), and lower bound falls on an odd number (e.g., 201), resulted in the AQI breakpoint of 200 being the upper

bound of the "unhealthy" category, rather than the lower bound of the "very unhealthy" category, as it has been historically. Since the AQI breakpoint of 200 is also commonly used as the "Alert Level," or the first stage of an air pollution emergency episode in example guidance associated with the SHL program, this commenter requested that we leave the AQI value of 200 as the lower breakpoint of the "very unhealthy" category, so that emergency episodes would start when air quality is classified as "very unhealthy" and include appropriate-sounding health effects and cautionary statements. (Docket No. A-98-20, IV-D-22). We are adopting the breakpoints as proposed, because we believe that it is important to be consistent in the treatment of the category boundaries (e.g., 51 to 100, 101 to 150, 151 to 200, etc.). When we propose revisions to the requirements of the SHL program, we plan to change all references to the "Alert Level" so they will refer to air quality that exceeds the "Alert Level," rather than to air quality that reaches the "Alert Level." However, State and local agencies should not change their emergency episode plans at this point simply because we are adopting this consistent approach to setting AQI breakpoints. Eventually, some agencies may have to revise emergency episode plans because we have revised the AQI value of 200 for the 8-hour O<sub>3</sub> sub-index. But we do not expect States to make any revisions to their emergency episode plans until we promulgate the revised requirements. Finally, several commenters noted that in the proposal, we did not specify an effective date for the final revisions. Some of these commenters suggested that we extend the effective date, with suggestions ranging from 60 days to more than a year after publication. We are adopting an effective date of 60 days after publication. We believe that this will allow adequate time for State and local agencies to revise daily AQI reports. We recognize that it may take longer to revise related informational materials, such as printed documents, or related programs that agencies may want to revise. However, since this rulemaking applies only to the requirements for daily reporting of air quality, we believe an effective date of 60 days is adequate.

*c. Index name.* All commenters that expressed a view on the index name supported changing the name of the index from the Pollutant Standards Index (PSI) to the Air Quality Index (AQI), because this name clearly identifies the index as relating to the quality of the air. Accordingly, we are

changing the name of the index to the Air Quality Index, or AQI.

## 2. Comments and Responses on Changes to the Sub-Indices.

All of the comments we received on proposed changes to the sub-indices focused on the sub-indices that were added for O<sub>3</sub> (8-hour) and PM<sub>2.5</sub>. Since we did not receive specific comments on the conforming changes we proposed to the CO, SO<sub>2</sub> and PM<sub>10</sub> sub-indices, we are adopting these sub-indices as proposed.

*a. Ozone sub-index.* We received significant comments on two issues related to the O<sub>3</sub> sub-index. The first group of comments was in response to our request for comment on retaining the 1-hour O<sub>3</sub> sub-index in addition to the 8-hour O<sub>3</sub> sub-index. The second group of comments focused on the appropriateness of providing precautionary language below the level of the 8-hour O<sub>3</sub> standard. Regarding the 1-hour sub-index, almost all of the comments that addressed this issue supported retaining the 1-hour O<sub>3</sub> sub-index. However, one State commenter expressed the view that the proposal was unclear regarding how areas that have not attained the 1-hour O<sub>3</sub> standard are to use the new 8-hour O<sub>3</sub> sub-index. This commenter also noted that it might be confusing to report the AQI based on the 8-hour O<sub>3</sub> sub-index in an area where the 1-hour O<sub>3</sub> standard had not yet been attained. (Docket No. A-98-20, IV-D-07). We are requiring that all State and local agencies that report the AQI for O<sub>3</sub> calculate the 8-hour O<sub>3</sub> sub-index, even if the reporting area has not attained the 1-hour standard. In addition to calculating the 8-hour O<sub>3</sub> sub-index, which is required, the reporting agency may also calculate the 1-hour O<sub>3</sub> sub-index, but this is not required. However, if the reporting agency calculates both O<sub>3</sub> sub-index values, it is required to report the higher index value of the two. The AQI does not relate to attainment status; rather, it is a tool for reporting daily air quality and associated health information. We are retaining the 1-hour O<sub>3</sub> sub-index only because we recognize that there are a very small number of areas in the U.S. that have atypical air quality patterns, with very high 1-hour daily peak O<sub>3</sub> concentrations relative to 8-hour average concentrations. In such areas, an index value greater than 100 might be calculated using the 1-hour sub-index, even when the 8-hour sub-index might be below 100. For these areas, the use of the 1-hour sub-index is clearly more precautionary. Because our major interest is that appropriate precautionary messages be issued, we

are not retaining a complete 1-hour O<sub>3</sub> sub-index with "good" and "moderate" categories. Likewise, when ambient 8-hour O<sub>3</sub> concentrations are greater than 0.374 ppm, reporting agencies must calculate the index value using the 1-hour O<sub>3</sub> sub-index. This is because no human health effects information is available for higher 8-hour average O<sub>3</sub> concentrations to use as a basis for selecting 8-hour breakpoints and for developing appropriate health effects and cautionary statements. We believe that since State and local agencies are required to report the name of the pollutant responsible for an index value greater than 100, but not the associated averaging period, using the 8-hour O<sub>3</sub> sub-index should not be confusing in areas that have not yet attained the 1-hour O<sub>3</sub> standard.

Regarding the issue of alerting sensitive individuals below the level of the 8-hour O<sub>3</sub> standard, some commenters not only suggested adding a category below the level of the standard, but also suggested reducing the lower bound of the "moderate" category. (Docket No. A-98-20, IV-D-11, IV-D-17, IV-D-19, IV-G-21). We are not adding a category below the level of the standard as discussed in section II.B.1. above. However, to be somewhat more precautionary, we have expanded the "moderate" range by reducing the lower bound of this category from 0.070 ppm to 0.065 ppm O<sub>3</sub>, 8-hour average. We believe that setting the breakpoint between the "good" and "moderate" categories at this lower level, is appropriate, based in part on risk estimates done in conjunction with the review of the O<sub>3</sub> NAAQS which suggested that risk to healthy people likely becomes negligible at this level (Whitfield et al., 1996). This change is also responsive to comments from State agencies that the proposed range of the "moderate" category was so narrow (spanning only 15 ppb O<sub>3</sub>, as compared to 20 ppb range used in the Ozone Map in 1998) that it would be more difficult to forecast accurately and also would provide too quick a transition from good to unhealthy. (Docket No. A-98-20, IV-D-10, IV-G-04). Conversely, an industry group and a State commenter took exception to issuing a "limited health notice" for O<sub>3</sub> that we proposed as the purpose of the "moderate" category. (Docket No. A-98-20, IV-D-12, IV-G-14). The State commenter objected to the use of the term "health notice" below the level of the standard because it implies that the standard is not protective of public health. In addition to stating that the "limited health

notice" associated with moderate air quality is inconsistent with the 8-hour O<sub>3</sub> standard because the standard is intended to protect public health, even the health of sensitive populations, with an adequate margin of safety, the industry commenter expressed the view that we should omit from our materials the health effects and cautionary statements suggesting that air quality meeting the level of the standard is a threat to health. We agree with the industry and State commenters that since the 8-hour O<sub>3</sub> standard is intended to protect public health, including the health of sensitive groups, with an adequate margin of safety, that the term "limited health notice" may be misleading. However, we continue to believe that it is appropriate to provide guidance with cautionary language for extremely sensitive individuals, not populations or groups, below the level of the standard. This approach is consistent with the advice of CASAC, and the way we discussed expanding the use of the AQI, specifically to caution extremely sensitive individuals below the level of the O<sub>3</sub> standard, in the O<sub>3</sub> proposal and final decision notices.

*b. PM<sub>2.5</sub> sub-index.* We received a number of comments regarding the PM<sub>2.5</sub> sub-index, almost all of them focusing on our proposal to set the index value of 100 at the level of the 24-hour standard (65 µg/m<sup>3</sup>). Some commenters recommended setting an index value of 100, or otherwise providing for cautionary messages, at concentrations lower than 65 µg/m<sup>3</sup>. One commenter, for example, stated that under the proposal "many areas of the country will likely violate the annual standard of 15 µg/m<sup>3</sup> without ever (or hardly ever) reaching a PSI of 100 or a category indicating some degree of unhealthfulness. This situation will result in an inconsistent and inappropriate message to the public, especially given the severe health effects associated with fine particles." (Docket No. A-98-20, IV-D-11).

In light of these comments, we have reexamined the basis for selecting PM<sub>2.5</sub> AQI breakpoints and agree that the sub-index as proposed would not adequately caution sensitive groups about potential risks associated with short-term exposures to PM<sub>2.5</sub>. This is essentially because the proposed PM<sub>2.5</sub> sub-index was developed using the Agency's historical approach to selecting index breakpoints, which on examination does not correspond well with the way the PM<sub>2.5</sub> standards were intended to function. The historical practice has been simply to set the AQI value of 100 at the level of the short-term standard

for a pollutant (in this case, the 24-hour PM<sub>2.5</sub> standard) and the AQI value of 50 at the level of the annual standard, if there is one, or at one-half the level of the short-term standard.<sup>8</sup> This method of structuring the index is appropriate for a "typical" suite of air-quality standards, which includes a short-term standard designed to protect against the health effects associated with short-term exposures and an annual standard designed to protect against health effects associated with long-term exposures. In such cases, the short-term standard in effect defines the level of health protection provided against short-term risks and thus is a useful benchmark against which to compare daily air-quality concentrations.

In the case of the PM<sub>2.5</sub> standards, however, EPA took a different approach to protecting against health risks associated with short-term exposures. For reasons discussed in the preamble to the final standards, the annual and 24-hour PM<sub>2.5</sub> standards were designed to work together for this purpose, and the intended level of protection against short-term risk is not defined by the 24-hour standard but by the combination of the two standards working in concert. Indeed, the annual PM<sub>2.5</sub> level of 15 µg/m<sup>3</sup> was intended to serve as the principal vehicle for protection against short-term PM<sub>2.5</sub> exposures (by reducing the entire distribution of PM<sub>2.5</sub> concentrations in an area), with the short-term standard serving essentially to provide supplemental protection in special situations.<sup>9</sup> Given the respective roles of the two standards, setting the AQI value of 100 at the level of the 24-hour standard would not reflect the short-term health risks associated with lower concentrations, which the annual standard was designed to address. Accordingly, we agree that it is appropriate to caution members of sensitive groups below the level of the 24-hour standard and believe this should be done in a way that reflects the intended roles of both standards in protecting against short-term risks.

It would also be inappropriate to compare daily air-quality concentrations directly with the level of the annual standard (by setting the AQI value of 100 at that level), because the annual standard represents an average of many daily concentrations rather than daily values per se. In the circumstances, we believe the guiding principle for PM<sub>2.5</sub> should be to set the AQI value of 100 in a way that, at least conceptually, reflects the general level of health protection against short-term risks

<sup>8</sup> See 63 FR 67819, 67829 (Dec. 9, 1998).

<sup>9</sup> See 62 FR 38669-71, 38676-77 (July 18, 1997).

provided by the annual and 24-hour standards in combination. This approach, although inexact, is consistent with the historical approach, in that the underlying logic of that approach, as applied to a typical suite of standards, is also to set the AQI value of 100 in a way that reflects the level of protection provided against short-term risks—that is, by setting it at the level of the short-term standard that provides the protection. In the case of  $PM_{2.5}$ , as indicated above, the level of the 24-hour standard ( $65 \mu\text{g}/\text{m}^3$ ) is too high to reflect the intended level of protection, and the level of the annual standard ( $15 \mu\text{g}/\text{m}^3$ ) is too low. Between the two values, the available health studies indicate a continuum of risks associated with increasing PM concentrations, although with significant uncertainties as to the extent of the risk associated with single peak exposures.<sup>10</sup> Consistent with EPA's general practice of setting AQI breakpoints in symmetrical fashion where health effects information does not suggest particular levels,<sup>11</sup> we concluded that it is appropriate to set the AQI value of 100 at the mid-point of the range between the annual and the 24-hour  $PM_{2.5}$  standards ( $40 \mu\text{g}/\text{m}^3$ ). Given that decision, we also concluded that it is appropriate to retain the level of the annual standard for an AQI value of 50, as proposed, and to set the AQI level of 150 at the level of the 24-hour standard.

To reiterate, the purpose of setting the AQI value of 100 somewhat below the level of the 24-hour standard was to reflect the dual role of the annual and 24-hour  $PM_{2.5}$  standards in protecting against short-term risks, and the aim was to select a breakpoint that would serve as a rough surrogate for the general level of protection provided by the two standards in combination. Given the nature of the standards and the available health information, a more exact approach was not possible. In this regard, setting the breakpoint at the mid-point of the range between the annual and 24-hour standards, as opposed to a level somewhat higher or lower within that range, simply reflected EPA's general practice of setting symmetrical breakpoints as indicated above, and does not imply any sort of health-effects threshold. In particular, it does not reflect a judgment about the extent of the risk associated with single peak concentrations of  $PM_{2.5}$ , as to which the available health information is inconclusive, or the level at which EPA might set a 24-hour standard if the annual standard did not

serve as the primary vehicle for protection against such concentrations. As with other AQI breakpoints, it also has no effect on the degree of control required of specific sources.

In short, EPA's decision to treat the annual standard as the principal vehicle for protecting against short-term  $PM_{2.5}$  concentrations, although judged to be the best approach based on the available health information, does present a different situation than that involved in previous AQI rulemakings. As discussed in the preamble to the final standards, the annual standard was intended to reduce all  $PM_{2.5}$  concentrations, including short-term peaks, in an area sufficiently to protect public health with an adequate margin of safety, aside from special situations which the 24-hour standard was designed to address. As one commenter suggested, however, it would be possible for an area to violate the annual standard without ever experiencing (or seldom experiencing) daily peaks that exceeded the level of the 24-hour standard. Moreover, it might be difficult, if not impossible, to predict in advance whether the annual standard will be attained in a given area. For these reasons, as well as the uncertainties in the available health information, it is inherently difficult to judge the significance of single peak concentrations when they occur. In view of the various uncertainties involved, particularly sensitive individuals may wish to avoid exposure to such concentrations, especially concentrations that approach the level of the 24-hour standard. To facilitate such choices, consistent with the purposes of the AQI and the advice of CASAC, we believe that cautioning members of sensitive groups in the range of  $40$  to  $65 \mu\text{g}/\text{m}^3$  is appropriate.

We did not receive any comments on the proposal to establish a concentration of  $500 \mu\text{g}/\text{m}^3$  to be associated with a  $PM_{2.5}$  index value of 500, or our method of selecting the intermediate breakpoints. Therefore, we are adopting  $500 \mu\text{g}/\text{m}^3$  as the upper bound of the index.<sup>12</sup> For intermediate breakpoints in the AQI between values of 150 and 500, we have adopted  $PM_{2.5}$  concentrations that generally reflect a linear relationship between increasing index values and increasing  $PM_{2.5}$  values. As discussed in the proposal, the generally linear relationship between AQI values and  $PM_{2.5}$  concentrations in this range, rounded to increments of  $50 \mu\text{g}/\text{m}^3$  to reflect the approximate nature of such a

relationship, is consistent with the health effects evidence that was the basis for the PM standards.

### C. What Are the Final Revisions?

The sub-sections below only summarize changes to the regulatory text. They do not describe all aspects of 40 CFR part 58.50 or appendix G.

#### 1. What Are the General Changes?

Based on the proposed structure of the AQI, the comments we received and our responses to them, as discussed above, we are adopting the following changes to the general structure and reporting requirements to the AQI.

*a. Categories and related descriptors, index values and colors.* We are adopting the index values, descriptors and associated colors listed in Table 1 above.

*b. Reporting requirements.* We are revising 40 CFR 58.50 to require reporting of the AQI in all MSAs with a population over 350,000. In appendix G, we are adopting rounding conventions to be used to calculate index values that are consistent with the rounding conventions used in defining the NAAQS for each pollutant.

The final rule retains the requirements to identify the area for which the AQI is being reported, the time period covered by the report, the "critical" pollutant for which the reported AQI value was derived, the AQI value, and the associated category descriptor. The final rule adds two requirements: (1) To report the associated category color if a color format is used and, (2) to report the pollutant-specific sensitive group for any reported index value greater than 100. The final rule encourages, but does not require, that AQI reports include: appropriate health effects and cautionary statements, all AQI values greater than 100, the AQI for sub-divisions of the MSA (if there are important differences in air quality across sub-divisions of the MSA), possible causes for high index values, and the actual pollutant concentrations.

In the case of rural or small urban areas that are significantly affected by pollutants transported from a MSA where the AQI is reported, the final rule recommends that the MSA report the AQI for the affected areas as well. In addition, when the AQI is greater than 100, reporting agencies should expand AQI reporting to include all major news media. The final rule continues to allow agencies to discontinue reporting for any pollutant, if index values for that pollutant have been below 50 for an entire season or a year. However, if in subsequent years pollutant levels rise

<sup>12</sup> As discussed in the proposal, should the final SHL for  $PM_{2.5}$ , when promulgated, be different from this concentration, we will revise this  $PM_{2.5}$  sub-index accordingly.

<sup>10</sup> See 62 FR 38670, 38677 (July 18, 1997).

<sup>11</sup> See 63 FR 67824, 67832 (Dec. 9, 1998).



such that index values for that pollutant would be above 50, then the final rule requires that AQI reporting for that pollutant resume. The final rule emphasizes the importance of forecasting the AQI by specifying that forecasted values should be reported, when possible, but does not require that forecasted values be reported.

*c. Index name.* We are adopting the name the Air Quality Index or AQI.  
 2. What Are the Changes to the Sub-Indices?  
 Based on the proposed sub-indices, the comments we received and our responses to them, as discussed above, we are adopting new sub-indices

corresponding to the 8-hour O<sub>3</sub> standard and the PM<sub>2.5</sub> standards, as well as conforming changes to the CO, 1-hour O<sub>3</sub>, PM<sub>10</sub>, and SO<sub>2</sub> sub-indices. The adopted breakpoints for the O<sub>3</sub> (8-hour and 1-hour) PM<sub>2.5</sub>, PM<sub>10</sub>, CO and SO<sub>2</sub> sub-indices are listed in Table 3.

TABLE 3.—BREAKPOINTS FOR O<sub>3</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, CO, AND SO<sub>2</sub> SUB-INDICES

AQI value	O <sub>3</sub>		PM		CO, 8-hr (ppm)	SO <sub>2</sub> , 24-hr (ppm)
	8-hr (ppm)	1-hr (ppm)	PM <sub>2.5</sub> , 24-hr (µg/m <sup>3</sup> )	PM <sub>10</sub> , 24-hr (µg/m <sup>3</sup> )		
50	0.06		15	50	4	0.03
100	0.08	0.12	40	150	9	0.14
150	0.10	0.16	65	250	12	0.22
200	0.12	0.20	* 150	350	15	0.30
300	0.40 (1-hr)	0.40	* 250	420	30	0.60
400	0.50 (1-hr)	0.50	* 350	500	40	0.80
500	0.60 (1-hr)	0.60	* 500	600	50	1.00

\* If a different SHL for PM<sub>2.5</sub> is promulgated, these numbers will be revised accordingly.

These sub-indices are presented in more detail in appendix G to reflect the changes to the numerical rounding conventions for calculating index values.

*D. What Are the Related Informational Materials?*

The primary documents associated with the AQI and this rulemaking, are our guidance on AQI reporting, "Guideline for Public Reporting of Daily Air Quality—Air Quality Index (AQI)" (EPA 1999a), and our guidance on AQI forecasting, "Guideline for Developing an Ozone Forecasting Program" (EPA 1999b). These documents are available on AIRLINKS (<http://www.epa.gov/airlinks>). The AQI Reporting document contains information regarding the AQI requirements and recommendations, example AQI reports, and a list of MSAs required to report the AQI. It also includes pollutant-specific health effects and cautionary statements for use with the index, for O<sub>3</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, CO, and SO<sub>2</sub>. The AQI Forecasting document explains the steps necessary to start an air pollution forecasting program. Included in the document is guidance on using hourly O<sub>3</sub> concentrations as predictors for 8-hour averages.

Other related informational materials are also available. The brochure "The Pollutant Standards Index" (EPA 1994) contained general information about the health effects and air quality, and general precautions that sensitive groups and the general public can take to avoid exposures of concern. It is being revised to be consistent with the new name (i.e., the Air Quality Index

brochure), with final revisions to the AQI, and will identify sensitive groups in the health effects statements for each of the pollutants, and include the pollutant-specific health effects and cautionary statements discussed above. A colorful fact sheet, called the "Air Quality Guide," provides information about the AQI, O<sub>3</sub> health effects and the sources of ground-level O<sub>3</sub> is available on the AIRNOW web site. A revised booklet, "SMOG—Who Does It Hurt?," provides information for the general public about O<sub>3</sub> health effects and is based on scientific information gained in the recent review of the O<sub>3</sub> standard. "SMOG—Who Does It Hurt?" was designed to provide, in simple language, enough detail for individuals to understand who is at most risk from O<sub>3</sub> exposure and why, the nature of O<sub>3</sub> health effects, and a detailed explanation of how individuals can reduce the likelihood of exposure using common everyday activities as examples. We are also developing a shorter, summary pamphlet about O<sub>3</sub> health effects to complement the "SMOG—Who Does It Hurt?" booklet. We expect the AQI brochure, "SMOG—Who Does It Hurt?" and the shorter summary pamphlet about O<sub>3</sub> health effects to be available in paper format and on the AIRNOW web site early in the 1999 ozone season. In addition, we will translate the Air Quality Guide, the AQI brochure, "SMOG—Who Does It Hurt?," and the shorter summary pamphlet into Spanish. These materials will be available on a Spanish page on the AIRNOW web site.

There are other materials available on the AIRNOW web site that provide

general information about O<sub>3</sub>. Information about ground-level as contrasted to stratospheric O<sub>3</sub> may be found in EPA's publication "Ozone: Good Up High, Bad Nearby." The EPA's video, "Ozone Double Trouble" also provides information about ground-level and stratospheric O<sub>3</sub> and the health effects associated with exposure to ground-level O<sub>3</sub>, or smog.

In addition to the products discussed above, to address the concerns of commenters that when air quality is in the "unhealthy for sensitive groups" range the public will not understand that the standard has been exceeded or who is at risk, we are going to significantly increase education and outreach related to the AQI. At this point, we are still in the process of planning specific new products or activities, but have decided what general direction these efforts will take. First, we plan to increase our contacts with the news providers to better inform them about the importance of including accurate, timely and understandable information in their broadcasts and reporting, and to enlist them as full partners in the implementation of the AQI. Second, we plan to form new associations with health care providers to keep them informed about air pollution health effects, since these professionals are the most trusted source of health effects information. Third, we plan to increase direct outreach to the public through a variety of means, including materials tailored to school-age children, the Spanish-speaking community, and others. Finally, we plan to work with public health interest organizations to support



their efforts to provide more immediate and interactive education and outreach to all of these groups.

### III. Regulatory and Environmental Impact Analyses

#### A. Executive Order 12866: OMB Review of "Significant Actions"

Under Executive Order 12866, the Agency must determine whether a regulatory action is "significant" and, therefore, subject to Office of Management and Budget (OMB) review and the requirements of the Executive Order. The order defines "significant regulatory action" as one that may:

(1) Have an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another Agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations or recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order. The EPA has determined that the revisions to air quality index reporting in this final rule would not have an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities, and therefore did not prepare a regulatory impact assessment. The OMB has advised us this final decision should be construed as a "significant regulatory action" within the meaning of Executive Order 12866. Accordingly, this action was submitted to the OMB for review. Any changes made in response to OMB suggestions or recommendations will be documented in the public record and made available for public inspection at EPA's Air and Radiation Docket Information Center (Docket No. A-98-20).

#### B. Regulatory Flexibility Analysis/Small Business Regulatory Enforcement Fairness Act

Under the Regulatory Flexibility Act (RFA), 5 U.S.C. 601 *et seq.*, EPA must prepare a regulatory flexibility analysis assessing the impact of any proposed or final rule on small entities. Under 6

U.S.C. 605(b), this requirement may be waived if EPA certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small not-for-profit enterprises, and governmental entities with jurisdiction over populations less than 50,000 people.

Today's final decision to revise the AQI program modifies existing air quality reporting requirements for MSA's with populations over 350,000 people. Today's final decision will not establish any new regulatory requirements affecting small entities. On the basis of the above considerations, EPA certifies that today's final decision will not have a significant economic impact on a substantial number of small entities within the meaning of the RFA. Based on the same considerations, EPA also certifies that the new small-entity provisions in section 244 of the Small Business Regulatory Enforcement Fairness Act (SBREFA) do not apply.

#### C. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "Federal mandates" that may result in expenditures to State, local and tribal governments, in the aggregate, or to the private sector, of \$100 million or more in any 1 year. In addition, before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

The EPA has determined that today's final decision would not include a Federal mandate that may result in estimated costs of \$100 million in any 1 year to either State, local, or tribal governments, in the aggregate, or to the private sector. Accordingly, EPA has determined that the provisions of section 202 of the UMRA do not apply to this rulemaking. With regard to

section 203 of the UMRA, EPA has determined that this rule contains no regulatory requirements that might significantly or uniquely affect small governments. This rule requires reporting of the Air Quality Index only in MSAs with populations greater than 350,000, and therefore does not affect small governments.

#### D. Paperwork Reduction Act

Today's final decision does not establish any new information collection requirements beyond those which are currently required under the Ambient Air Quality Surveillance Regulations in 40 CFR part 58 (OMB #2060-0084, EPA ICR No. 0940.15). Therefore, the requirements of the Paperwork Reduction Act do not apply to today's action.

#### E. Executive Order 13045: Children's Health

Executive Order 13045, entitled "Protection of Children from Environmental Health Risks and Safety Risks" (62 FR 19885, April 23, 1997), requires Federal agencies to ensure that their policies, programs, activities, and standards identify and assess environmental health and safety risks that may disproportionately affect children. To respond to this order, agencies must explain why the regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the agency. In today's final decision, EPA identified children as one of the sensitive groups which may be at increased risk of experiencing the effects of concern following exposure to O<sub>3</sub>, PM<sub>2.5</sub> and NO<sub>2.5</sub>. The AQI categories, descriptors, and health effects and cautionary statements as proposed, for the first time reflect consideration of the increased health risk to children which may result from such exposures. Promulgation of the proposed AQI is one potentially effective alternative that was considered. However, based on comments that the public may not be aware that healthy, active children are included in the sensitive groups for O<sub>3</sub>, PM<sub>2.5</sub> and NO<sub>2</sub>, we have adopted the additional requirement that reporting agencies must include a pollutant-specific statement of the sensitive groups when an index value of 100 is exceeded. For example, when reporting an AQI value of 110 for ozone, the reporting agency must include a statement that children and people with asthma are the groups most at risk. Whenever the AQI value is above 100 for a pollutant, and children are one of the sensitive groups for that pollutant, the AQI report must include a statement

that children are at risk. Therefore, today's action does comply with the requirements of E.O. 13045.

*F. Executive Order 12848: Environmental Justice*

Executive Order 12848 requires that each Federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minorities and low-income populations in the United States.

The nature of today's action is to inform the general public, including minorities and low-income populations, about the nature of the air pollution in the areas in which they live. Today's action establishes a uniform tool for States to use to develop programs which will caution particularly sensitive people to minimize their exposures and educate the public about general health effects associated with exposure to different pollution levels. States may also use information established as part of the AQI to trigger programs designed to reduce emissions to avoid exceedances of the NAAQS. Therefore, today's action will help facilitate public participation, outreach, and communication in areas where environmental justice issues are present.

*G. Executive Order 12875: Enhancing Intergovernmental Partnerships*

Under Executive Order 12875, EPA may not issue a regulation that is not required by statute and that creates a mandate upon a State, local or tribal government, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by those governments, or we will consult with those governments. If EPA complies by consulting, Executive Order 12875 requires us to provide to OMB a description of the extent of our prior consultation with representatives of affected State, local and tribal governments, the nature of their concerns, copies of any written communications from the governments, and a statement supporting the need to issue the regulation. In addition, Executive Order 12875 requires us to develop an effective process permitting elected officials and other representatives of State, local and tribal governments "to provide meaningful and timely input in the development of regulatory proposals containing significant unfunded mandates."

Today's rule implements requirements set forth in section 319 of the Act and thus is required by statute.

This rule does not establish a wholly new requirement but rather modifies existing reporting requirements which State and local governments have been implementing for approximately 20 years. While these changes are significant in many ways, they are not expected to result in a significant increase in reporting burdens. Nonetheless, EPA engaged in extensive consultation with State and local governments in the development of the proposed and final rules, and this consultation is discussed and documented elsewhere in today's notice and in the notice of proposed rulemaking.

*H. Executive Order 13084: Consultation and Coordination With Indian Tribal Governments*

Under Executive Order 13084, EPA may not issue a regulation that is not required by statute, that significantly or uniquely affects the communities of Indian tribal governments, and that imposes substantial direct compliance costs on those communities, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the tribal governments, or EPA will consult with those governments. If EPA complies by consulting, Executive Order 13084 requires us to provide to OMB, in a separately identified section of the preamble to the rule, a description of the extent of our prior consultation with representatives of affected tribal governments, a summary of the nature of their concerns, and a statement supporting the need to issue the regulation. In addition, Executive Order 13084 requires us to develop an effective process permitting elected officials and other representatives of Indian tribal governments "to provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities."

Today's rule implements requirements specifically set forth by the Congress in section 319 of the Act without the exercise of any discretion by us. Accordingly, the requirements of section 3(b) of Executive Order 13084 do not apply to this rule.

This rule governs the reporting of air quality by States for MSAs and, in some cases, areas that are significantly affected by transport of pollutants from MSAs. In extensive public and intergovernmental coordination efforts during the development of the proposal, EPA received no information which would suggest that the rule will impose new requirements on Indian tribal governments nor will it significantly or

uniquely affect communities of Indian tribal governments. To the extent that air pollution from upwind MSAs significantly affects any lands within Indian country, this impact is not a result of, or affected by, today's rule and would be addressed under existing requirements governing the implementation of air quality standards.

*I. National Technology Transfer and Advancement Act*

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Public Law 104-113, section 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. The NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards. This action does not involve technical standards. Therefore, EPA did not consider the use of any voluntary consensus standards.

*J. Congressional Review Act*

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. The EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to the publication of the rule in the **Federal Register**. This rule is not a "major rule" as defined by 5 U.S.C. 804(2).

**IV. References**

- CEQ, (1976) A Recommended Air Pollution Index, report prepared by the Federal Interagency Task Force on Air Quality Indicators, Council on Environmental Quality, Environmental Protection Agency, and Department of Commerce.
- EPA, (1994) Measuring Air Quality: The Pollutant Standards Index, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards (MD-10), Research Triangle Park, NC, 27711, EPA 451/K-94-001.

EPA, (1999a) Guideline for Public Reporting of Daily Air Quality—Air Quality Index (AQI), U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 27711, EPA-454/R-99-010.

EPA, (1999b) Guideline for Developing an Ozone Forecasting Program, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 27711, EPA-454/R-99-009.

EPA, (1999c) The Air Quality Index, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 27711, in preparation.

Science Applications International Corporation, (1998) Report of Eight Focus Groups on the Ozone Map, the Pollutant Standards Sub-index for Ozone, and the Ozone Health Effects Booklet, Science Applications International Corporation, McLean, VA.

U.S. Department of Commerce, (1998) Statistical Abstract of the United States, U.S. Bureau of the Census.

Whitfield, R.G.; Biller, W.F.; Jusko, M.J.; Keisler, JM (1996) A probabilistic assessment of health risks associated with short-term exposure to tropospheric ozone. Report prepared for U.S. EPA, OAQPS, Argonne National Laboratory; Argonne, IL.

Wolff, G.T., (1995) Letter from Chairman of the Clean Air Scientific Advisory Committee to the EPA Administrator, dated November 30, 1995. EPA-SAB-CASAC-LTR-96-002.

**List of Subjects in 40 CFR Part 58**

Environmental protection, Air pollution control, Intergovernmental relations, Reporting and recordkeeping requirements.

Dated: July 23, 1999.

**Carol M. Browner,**  
Administrator.

Accordingly, 40 CFR part 58 is amended as follows:

**PART 58—AMBIENT AIR QUALITY SURVEILLANCE**

1. The authority citation for part 58 continues to read as follows:

**Authority:** 42 U.S.C. 7410, 7601(a), 7613, and 7619.

2. Section 58.50 is revised to read as follows:

**§ 58.50 Index reporting.**

(a) The State shall report to the general public through prominent notice an air quality index in accordance with the requirements of appendix G to this part.

(b) Reporting is required by all Metropolitan Statistical Areas with a population exceeding 350,000.

(c) The population of a Metropolitan Statistical Area for purposes of index reporting is the most recent decennial U.S. census population.

3. Appendix G to part 58 is revised to read as follows:

**Appendix G to Part 58—Uniform Air Quality Index (AQI) and Daily Reporting**

**General Requirements**

1. What is the AQI?
2. Why report the AQI?
3. Must I report the AQI?
4. What goes into my AQI report?
5. Is my AQI report for my MSA only?
6. How do I get my AQI report to the public?
7. How often must I report the AQI?
8. May I make exceptions to these reporting requirements?

**Calculation**

9. How does the AQI relate to air pollution levels?
10. Where do I get the pollutant concentrations to calculate the AQI?
11. Do I have to forecast the AQI?
12. How do I calculate the AQI?

**Background and Reference Materials**

13. What additional information should I know?

**General Requirements**

*1. What Is the AQI?*

The AQI is a tool that simplifies reporting air quality to the general public. The AQI incorporates into a single index concentrations of 5 criteria pollutants: ozone (O<sub>3</sub>), particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), and nitrogen dioxide (NO<sub>2</sub>). The scale of the index is divided into general categories that are associated with health messages.

*2. Why Report the AQI?*

The AQI offers various advantages:

- a. It is simple to create and understand.
- b. It conveys the health implications of air quality.
- c. It promotes uniform use throughout the country.

*3. Must I Report the AQI?*

You must report the AQI daily if yours is a metropolitan statistical area (MSA) with a population over 350,000.

*4. What Goes Into My AQI Report?*

- i. Your AQI report must contain the following:
  - a. The reporting area(s) (the MSA or subdivision of the MSA).
  - b. The reporting period (the day for which the AQI is reported).
  - c. The critical pollutant (the pollutant with the highest index value).
  - d. The AQI (the highest index value).
  - e. The category descriptor and index value associated with the AQI and, if you choose to report in a color format, the associated color. Use only the following descriptors and colors for the six AQI categories:

TABLE 1.—AQI CATEGORIES

For this AQI	Use this descriptor	And this color <sup>1</sup>
0 to 50 .....	“Good” .....	Green.
51 to 100 .....	“Moderate” .....	Yellow.
101 to 150 .....	“Unhealthy for Sensitive Groups”.	Orange.
151 to 200 .....	“Unhealthy” .....	Red.
201 to 300 .....	“Very Unhealthy”.	Purple.
301 and above	“Hazardous” ....	Ma- roon. <sup>1</sup>

<sup>1</sup> Specific colors can be found in the most recent reporting guidance (Guideline for Public Reporting of Daily Air Quality—Air Quality Index (AQI)).

f. The pollutant specific sensitive groups for any reported index value greater than 100. Use the following sensitive groups for each pollutant:

When this pollutant has an index value above 100 * * *	Report these sensitive groups * * *
Ozone .....	Children and people with asthma are the groups most at risk.
PM <sub>2.5</sub> .....	People with respiratory or heart disease, the elderly and children are the groups most at risk.
PM <sub>10</sub> .....	People with respiratory disease are the group most at risk.
CO .....	People with heart disease are the group most at risk.
SO <sub>2</sub> .....	People with asthma are the group most at risk.

When this pollutant has an index value above 100 \* \* \*

Report these sensitive groups \* \* \*

NO<sub>2</sub> ..... Children and people with respiratory disease are the groups most at risk.

- ii. When appropriate, your AQI report may also contain the following:
  - a. Appropriate health and cautionary statements.
  - b. The name and index value for other pollutants, particularly those with an index value greater than 100.
  - c. The index values for sub-areas of your MSA.
  - d. Causes for unusual AQI values.
  - e. Actual pollutant concentrations.

**5. Is My AQI Report for My MSA Only?**

Generally, your AQI report applies to your MSA only. However, if a significant air quality problem exists (AQI greater than 100) in areas significantly impacted by your MSA but not in it (for example, O<sub>3</sub> concentrations are often highest downwind and outside an urban area), you should identify these areas and report the AQI for these areas as well.

**6. How Do I Get My AQI Report to the Public?**

You must furnish the daily report to the appropriate news media (radio, television, and newspapers). You must make the daily report publicly available at one or more places of public access, or by any other means, including a recorded phone message, a public Internet site, or facsimile transmission. When the AQI value is greater than 100, it is particularly critical that the reporting to the various news media be as extensive as possible. At a minimum, it should include notification to the media with the largest market coverages for the area in question.

**7. How Often Must I Report the AQI?**

You must report the AQI at least 5 days per week. Exceptions to this requirement are in section 8 of this appendix.

**8. May I Make Exceptions to These Reporting Requirements?**

- i. If the index value for a particular pollutant remains below 50 for a season or year, then you may exclude the pollutant from your calculation of the AQI in section 12.

- ii. If all index values remain below 50 for a year, then you may report the AQI at your discretion. In subsequent years, if pollutant levels rise to where the AQI would be above 50, then the AQI must be reported as required in sections 3, 4, 6, and 7 of this appendix.

**Calculation**

**9. How Does the AQI Relate to Air Pollution Levels?**

For each pollutant, the AQI transforms ambient concentrations to a scale from 0 to 500. The AQI is keyed as appropriate to the national ambient air quality standards (NAAQS) for each pollutant. In most cases, the index value of 100 is associated with the numerical level of the short-term standard (i.e., averaging time of 24-hours or less) for each pollutant. Different approaches are taken for NO<sub>2</sub>, for which no short-term standard has been established, and for PM<sub>2.5</sub>, for which the annual standard is the principal vehicle for protecting against short-term concentrations. The index value of 50 is associated with the numerical level of the annual standard for a pollutant, if there is one, at one-half the level of the short-term standard for the pollutant, or at the level at which it is appropriate to begin to provide guidance on cautionary language. Higher categories of the index are based on increasingly serious health effects and increasing proportions of the population that are likely to be affected. The index is related to other air pollution concentrations through linear interpolation based on these levels. The AQI is equal to the highest of the numbers corresponding to each pollutant. For the purposes of reporting the AQI, the sub-indexes for PM<sub>10</sub> and PM<sub>2.5</sub> are to be considered separately. The pollutant responsible for the highest index value (the reported AQI) is called the "critical" pollutant.

**10. Where Do I Get the Pollutant Concentrations To Calculate the AQI?**

You must use concentration data from population-oriented State/Local Air

Monitoring Station (SLAMS) or parts of the SLAMS required under 40 CFR 58.20 for each pollutant except PM. For PM, you need only calculate and report the AQI on days for which you have measured air quality data (e.g., particulate monitors often report values only every sixth day). You may use particulate measurements from monitors that are not reference or equivalent methods (for example, continuous PM<sub>10</sub> or PM<sub>2.5</sub> monitors) if you can relate these measurements by statistical linear regression to reference or equivalent method measurements.

**11. Do I Have to Forecast the AQI?**

You should forecast the AQI to provide timely air quality information to the public, but this is not required. If you choose to forecast the AQI, then you may consider both long-term and short-term forecasts. You can forecast the AQI at least 24-hours in advance using the most accurate and reasonable procedures considering meteorology, topography, availability of data, and forecasting expertise. The document "Guideline for Developing an Ozone Forecasting Program" (the Forecasting Guidance) will help you start a forecasting program. You can also issue short-term forecasts by predicting 8-hour ozone values from 1-hour ozone values using methods suggested in the Reporting Guidance, "Guideline for Public Reporting of Daily Air Quality."

**12. How Do I Calculate the AQI?**

- i. The AQI is the highest value calculated for each pollutant as follows:
  - a. Identify the highest concentration among all of the monitors within each reporting area and truncate the pollutant concentration to one more than the significant digits used to express the level of the NAAQS for that pollutant. This is equivalent to the rounding conventions used in the NAAQS.
  - b. Using Table 2, find the two breakpoints that contain the concentration.
  - c. Using Equation 1, calculate the index.
  - d. Round the index to the nearest integer.

TABLE 2.—BREAKPOINTS FOR THE AQI

O <sub>3</sub> (ppm) 8-hour	O <sub>3</sub> (ppm) 1-hour <sup>1</sup>	These breakpoints				Equal these AQIs * * *		Category
		PM <sub>2.5</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	CO (ppm)	SO <sub>2</sub> (ppm)	NO <sub>2</sub> (ppm)	AQI	
0.000–0.064 .....	.....	0.0–15.4	0–54	0.0–4.4	0.000–0.034	( <sup>2</sup> )	0–50	Good.
0.065–0.084 .....	.....	15.5–40.4	55–154	4.5–9.4	0.035–0.144	( <sup>2</sup> )	51–100	Moderate.
0.085–0.104 .....	0.125–0.164	40.5–65.4	155–254	9.5–12.4	0.145–0.224	( <sup>2</sup> )	101–150	Unhealthy for sensitive groups.
0.105–0.124 .....	0.165–0.204	<sup>4</sup> 65.5–150.4	255–354	12.5–15.4	0.225–0.304	( <sup>2</sup> )	151–200	Unhealthy.
0.125–0.374 .....	0.205–0.404	<sup>4</sup> 150.5–250.4	355–424	15.5–30.4	0.305–0.604	0.65–1.24	201–300	Very unhealthy.
( <sup>3</sup> ) .....	0.405–0.504	<sup>4</sup> 250.5–350.4	425–504	30.5–40.4	0.605–0.804	1.25–1.64	301–400	
( <sup>3</sup> ) .....	0.505–0.604	<sup>4</sup> 350.5–500.4	505–604	40.5–50.4	0.805–1.004	1.65–2.04	401–500	Hazardous.

<sup>1</sup> Areas are generally required to report the AQI based on 8-hour ozone values. However, there are a small number of areas where an AQI based on 1-hour ozone values would be more precautionary. In these cases, in addition to calculating the 8-hour ozone index value, the 1-hour ozone index value may be calculated, and the maximum of the two values reported.

<sup>2</sup>NO<sub>2</sub> has no short-term NAAQS and can generate an AQI only above an AQI value of 200.

<sup>3</sup>8-hour O<sub>3</sub> values do not define higher AQI values (≥ 301). AQI values of 301 or higher are calculated with 1-hour O<sub>3</sub> concentrations.

<sup>4</sup>If a different SHL for PM<sub>2.5</sub> is promulgated, these numbers will change accordingly.

ii. If the concentration is equal to a breakpoint, then the index is equal to the corresponding index value in Table 2. However, Equation 1 can still be used. The results will be equal. If the concentration is

between two breakpoints, then calculate the index of that pollutant with Equation 1. You must also note that in some areas, the AQI based on 1-hour O<sub>3</sub> will be more precautionary than using 8-hour values (see

footnote 1 to Table 2). In these cases, you may use 1-hour values as well as 8-hour values to calculate index values and then use the maximum index value as the AQI for O<sub>3</sub>.

$$I_p = \frac{I_{Hi} - I_{Lo}}{BP_{Hi} - BP_{Lo}} (C_p - BP_{Lo}) + I_{Lo} \quad (\text{Equation 1})$$

Where:

$I_p$  = the index value for pollutant<sub>p</sub>

$C_p$  = the truncated concentration of pollutant<sub>p</sub>

$BP_{Hi}$  = the breakpoint that is greater than or equal to  $C_p$

$BP_{Lo}$  = the breakpoint that is less than or equal to  $C_p$

$I_{Hi}$  = the AQI value corresponding to  $BP_{Hi}$

$I_{Lo}$  = the AQI value corresponding to  $BP_{Lo}$ .

iii. If the concentration is larger than the highest breakpoint in Table 2 then you may use the last two breakpoints in Table 2 when you apply Equation 1.

#### Example

iv. Using Table 2 and Equation 1, calculate the index value for each of the pollutants measured and select the one that produces the highest index value for the AQI. For example, if you observe a PM<sub>10</sub> value of 210 µg/m<sup>3</sup>, a 1-hour O<sub>3</sub> value of 0.156 ppm, and an 8-hour O<sub>3</sub> value of 0.130 ppm, then do this:

a. Find the breakpoints for PM<sub>10</sub> at 210 µg/m<sup>3</sup> as 155 µg/m<sup>3</sup> and 254 µg/m<sup>3</sup>, corresponding to index values 101 and 150;

b. Find the breakpoints for 1-hour O<sub>3</sub> at 0.156 ppm as 0.125 ppm and 0.164 ppm, corresponding to index values 101 and 150;

c. Find the breakpoints for 8-hour O<sub>3</sub> at 0.130 ppm as 0.125 ppm and 0.374 ppm, corresponding to index values 201 and 300;

d. Apply Equation 1 for 210 µg/m<sup>3</sup>, PM<sub>10</sub>:

$$\frac{150 - 101}{254 - 155} (210 - 155) + 101 = 128.$$

e. Apply Equation 1 for 0.156 ppm, 1-hour O<sub>3</sub>:

$$\frac{150 - 101}{0.164 - 0.125} (0.156 - 0.125) + 101 = 140$$

f. Apply Equation 1 for 0.130 ppm, 8-hour O<sub>3</sub>:

$$\frac{300 - 201}{0.374 - 0.125} (0.130 - 0.125) + 201 = 203$$

g. Find the maximum, 203. This is the AQI. The minimal AQI report would read:

v. Today, the AQI for my city is 203 which is very unhealthy, due to ozone. Children and people with asthma are the groups most at risk.

#### Background and Reference Materials

##### 13. What Additional Information Should I Know?

The EPA has developed a computer program to calculate the AQI for you. The program works with Windows 95, it prompts for inputs, and it displays all the pertinent information for the AQI (the index value, color, category, sensitive group, health effects, and cautionary language). The EPA has also prepared a brochure on the AQI that explains the index in detail (The Air Quality Index), Reporting Guidance (Guideline for Public Reporting of Daily Air Quality) that provides associated health effects and cautionary statements, and Forecasting Guidance (Guideline for Developing an Ozone Forecasting Program) that explains the steps necessary to start an air pollution forecasting program. You can download the program and the guidance documents at [www.epa.gov/airnow](http://www.epa.gov/airnow).

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