AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

Institute, Menlo Park, CA. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA–450/3–77–018. June 1977, revised December 1977.

11. Ball, R.J. and G.E. Anderson. Optimum Site Exposure Criteria for SO_2 Monitoring. The Center for the Environment and Man, Inc., Hartford, CT. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA–450/3–77–013. April 1977.

12. Ludwig, F.L. and J.H.S. Kealoha. Selecting Sites for Carbon Monoxide Monitoring. Stanford Research Institute, Menlo Park, CA. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA–450/3–75–077. September 1975.

13. Ludwig, F.L. and E. Shelar. Site Selection for the Monitoring of Photochemical Air Pollutants. Stanford Research Institute, Menlo Park, CA. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA–450/3–78–013. April 1978.

14. Lead Analysis for Kansas City and Cincinnati, PEDCo Environmental, Inc., Cincinnati, OH. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 66–02–2515, June 1977.

15. Barltrap, D. and C.D. Strelow. Westway Nursery Testing Project. Report to the Greater London Council. August 1976.

16. Daines, R. H., H. Moto, and D. M. Chilko. Atmospheric Lead: Its Relationship to Traffic Volume and Proximity to Highways. Environ. Sci. and Technol., 4:318, 1970.

17. Johnson, D. E., *et al.* Epidemiologic Study of the Effects of Automobile Traffic on Blood Lead Levels, Southwest Research Institute, Houston, TX. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA–600/1–78–055, August 1978.

18. Air Quality Criteria for Lead. Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC EPA–600/8–83–028 aF–dF, 1986, and supplements EPA–600/8–89/049F, August 1990. (NTIS document numbers PB87–142378 and PB91–138420.)

19. Lyman, D. R. The Atmospheric Diffusion of Carbon Monoxide and Lead from an Expressway, Ph.D. Dissertation, University of Cincinnati, Cincinnati, OH. 1972.

20. Wechter, S.G. Preparation of Stable Pollutant Gas Standards Using Treated Aluminum Cylinders. ASTM STP. 598:40–54, 1976.

21. Wohlers, H.C., H. Newstein and D. Daunis. Carbon Monoxide and Sulfur Dioxide Adsorption On and Description From Glass, Plastic and Metal Tubings. J. Air Poll. Con. Assoc. 17:753, 1976.

22. Elfers, L.A. Field Operating Guide for Automated Air Monitoring Equipment. U.S. NTIS. p. 202, 249, 1971.

23. Hughes, E.E. Development of Standard Reference Material for Air Quality Measurement. ISA Transactions, 14:281–291, 1975.

24. Altshuller, A.D. and A.G. Wartburg. The Interaction of Ozone with Plastic and Metallic Materials in a Dynamic Flow System. Intern. Jour. Air and Water Poll., 4:70–78, 1961.

25. Code of Federal Regulations. Title 40 part 53.22, July 1976.

26. Butcher, S.S. and R.E. Ruff. Effect of Inlet Residence Time on Analysis of Atmospheric Nitrogen Oxides and Ozone, Anal. Chem., 43:1890, 1971.

27. Slowik, A.A. and E.B. Sansone. Diffusion Losses of Sulfur Dioxide in Sampling Manifolds. J. Air. Poll. Con. Assoc., 24:245, 1974.

28. Yamada, V.M. and R.J. Charlson. Proper Sizing of the Sampling Inlet Line for a Continuous Air Monitoring Station. Environ. Sci. and Technol., 3:483, 1969.

29. Koch, R.C. and H.E. Rector. Optimum Network Design and Site Exposure Criteria for Particulate Matter, GEOMET Technologies, Inc., Rockville, MD. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 68–02–3584. EPA 450/4–87–009. May 1987.

30. Burton, R.M. and J.C. Suggs. Philadelphia Roadway Study. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, N.C. EPA–600/4–84–070 September 1984.

31. Technical Assistance Document For Sampling and Analysis of Ozone Precursors. Atmospheric Research and Exposure Assessment Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. EPA 600/8–91–215. October 1991.

32. Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV. Meteorological Measurements. Atmospheric Research and Exposure Assessment Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. EPA 600/4–90–0003. August 1989.

33. On-Site Meteorological Program Guidance for Regulatory Modeling Applications. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. EPA 450/4–87–013. June 1987F.

[71 FR 61323, Oct. 17, 2006]

APPENDIX F TO PART 58 [RESERVED]

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. What Monitors Should I Use To Get the Pollutant Concentrations for Calculating 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_3), particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2). 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 [1]
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"	Maroon.[1]

[1] 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.
$PM_{2.5}$	People with respiratory or heart disease, the elderly and children are the groups most at risk.
PM_{10}	People with respiratory disease are the group most at risk.
CO	People with heart disease are the group most at risk.
SO_2	People with asthma are the group most at risk.
NO_2	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_3 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. A different approach is taken for NO_2, for which no short-term standard has been established. 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_{10} and $PM_{2.5}$ are to be considered separately. The pollutant responsible for the highest index value (the reported AQI) is called the ''critical'' pollutant.

10. What Monitors Should I Use To Get the Pollutant Concentrations for Calculating the AQI?

You must use concentration data from population-oriented State/Local Air Monitoring Station (SLAMS) or parts of the SLAMS required by 40 CFR 58.10 for each pollutant except PM. For PM, calculate and report the AQI on days for which you have measured air quality data (e.g., from continuous $PM_{2.5}$ monitors required in Appendix D to this part). You may use PM measurements from monitors that are not reference or equivalent methods (for example, continuous PM_{10} or $PM_{2.5}$ monitors). Detailed guidance for relating non-approved measurements to approved methods by statistical linear regression is referenced in section 13 below.

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

These breakpoints							Equal these AQI's	
O_3 (ppm) 8-hour	O_3 (ppm) 1-hour [1]	$PM_{2.5}$ (μg/m³)	PM_{10} (μg/m³)	CO (ppm)	SO_2 (ppm)	NO_2 (ppm)	AQI	Category
0.000–0.059 ..	0.0–15.4	0–54	0.0–4.4	0.000–0.034	([3])	0–50	Good.	
0.060–0.075 ..	15.5–40.4	55–154	4.5–9.4	0.035–0.144	([3])	51–100	Moderate.	
0.076–0.095 ..	0.125–0.164	40.5–65.4	155–254	9.5–12.4	0.145–0.224	([3])	101–150	Unhealthy for Sensitive Groups.
0.096–0.115 ..	0.165–0.204	[4] 65.5–150.4	255–354	12.5–15.4	0.225–0.304	([3])	151–200	Unhealthy.
0.116–0.374 ..	0.205–0.404	[4] 150.5–250.4	355–424	15.5–30.4	0.305–0.604	0.65–1.24	201–300	Very Unhealthy.
([2])	0.405–0.504	[4] 250.5–350.4	425–504	30.5–40.4	0.605–0.804	1.25–1.64	301–400	
([2])	0.505–0.604	[4] 350.5–500.4	505–604	40.5–50.4	0.805–1.004	1.65–2.04	401–500	Hazardous.

[1] 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.

[2] 8-hour O_3 values do not define higher AQI values (≥ 301). AQI values of 301 or greater are calculated with 1-hour O_3 concentrations.

[3] NO_2 has no short-term NAAQS, and can generate an AQI only above the value of 200.

[4] If a different SHL for $PM_{2.5}$ 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_3 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_3.

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

Where:

I_p = the index value for pollutant$_p$

C_p = the truncated concentration of pollutant$_p$

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_{10} value of 210 μg/m³, a 1-hour O_3 value of 0.156 ppm, and an 8-hour O_3 value of 0.130 ppm, then do this:

a. Find the breakpoints for PM_{10} at 210 μg/m³ as 155 μg/m³ and 254 μg/m³, corresponding to index values 101 and 150;

b. Find the breakpoints for 1-hour O_3 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_3 at 0.130 ppm as 0.116 ppm and 0.374 ppm, corresponding to index values 201 and 300;

d. Apply Equation 1 for 210 μg/m³, PM_{10}:

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

e. Apply Equation 1 for 0.156 ppm, 1-hour O_3:

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

f. Apply Equation 1 for 0.130 ppm, 8-hour O_3:

$$\frac{300 - 201}{0.374 - 0.116}(0.130 - 0.116) + 201 = 206$$

g. Find the maximum, 206. This is the AQI. The minimal AQI report would read:

v. Today, the AQI for my city is 206 which is Very Unhealthy, due to ozone. Children and people with asthma are the groups most at risk.

13. What Additional Information Should I Know?

The EPA has developed a computer program to calculate the AQI for you. The program 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.airnow.gov*. Reference for relating non-approved PM measurements to approved methods (Eberly, S., T. Fitz-Simons, T. Hanley, L. Weinstock., T. Tamanini, G. Denniston, B. Lambeth, E. Michel, S. Bortnick. Data Quality Objectives (DQOs) For Relating Federal Reference Method (FRM) and Continuous $PM_{2.5}$ Measurements to Report an Air Quality Index (AQI). U.S. Environmental Protection Agency, research Triangle Park, NC. EPA–454/B–02–002, November 2002) can be found on the Ambient Monitoring Technology Information Center (AMTIC) Web site, *http://www.epa.gov/ttnamti1/*.

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PART 59—NATIONAL VOLATILE ORGANIC COMPOUND EMISSION STANDARDS FOR CONSUMER AND COMMERCIAL PRODUCTS

Sec.

Subpart A—General

59.1 Final determinations under section 183(e)(3)(C) of the Clean Air Act.

Subpart B—National Volatile Organic Compound Emission Standards for Automobile Refinish Coatings

59.100 Applicability and designation of regulated entity.
59.101 Definitions.
59.102 Standards.
59.103 Container labeling requirements.
59.104 Compliance provisions.
59.105 Reporting requirements.
59.106 Variance.
59.107 Addresses of EPA Regional offices.
59.108 State authority.
59.109 Circumvention.
59.110 Incorporations by reference.
59.111 Availability of information and confidentiality.

TABLE 1 TO SUBPART B—VOLATILE ORGANIC COMPOUND (VOC) CONTENT LIMITS FOR AUTOMOBILE REFINISH COATINGS

Subpart C—National Volatile Organic Compound Emission Standards for Consumer Products

59.201 Applicability and designation of regulated entity.
59.202 Definitions.
59.203 Standards for consumer products.
59.204 Innovative product provisions.
59.205 Labeling.
59.206 Variances.
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59.208 Charcoal lighter material testing protocol.
59.209 Recordkeeping and reporting requirements.
59.210 Addresses of EPA Regional Offices.
59.211 State authority.
59.212 Circumvention.
59.213 Incorporations by reference.