AQS Basics

What Data are in AQS?

Ambient Air Monitoring
#101

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Common Data Reported to AQS

Much of the data submitted to the AQS are required by regulations. National Ambient Air Quality Standards (NAAQS) exist for the following six 'criteria' pollutants: particulate matter (PM), ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and lead (Pb). There are two types of NAAQS: The goal of the 'primary' NAAQS is to protect public health; 'secondary' standards protect against welfare effects (e.g., damage to crops, ecosystems, decreased visibility). EPA oversees extensive national networks for each of the criteria pollutants. Because, the ozone and particulate matter pollution problems are nationally the most pervasive and affect the most people, special enhanced monitoring is conducted for those pollutants. The Photochemical Assessment Monitoring Station (PAMS) program collects information on ozone precursors and the Speciation program collects information on the components of particulate matter. Concentration levels, quality assurance information, and related metadata from the criteria pollutant and supporting networks comprise a significant percentage of the data reported to AQS. Although the national monitoring focus has traditionally been on the criteria pollutants, there has been a recent push to enhance the monitoring and data reporting of Hazardous Air Pollutants (HAPs); an expanding toxic pilot monitoring initiative was begun in early 2000. All of the networks noted above are described briefly below. Several additional large air monitoring programs (e.g., CASTNET, IMPROVE) also exist but are not included here since their data are not currently reported to AQS. It is anticipated that data from these other networks may also be stored in AIRS at some future date.

- Note: In general, any requirements listed below apply only to <u>EPA-funded monitoring stations.</u>

1. Carbon Monoxide (CO) Network

A. Pollutant Nature, Sources, and Health Effects:

- CO is a colorless odorless, poisonous gas formed when carbon in fuels is not burned completely. It is the product of motor vehicle exhaust, which contributes about 60 percent of all CO emissions nationwide. In cities, as much as 95 percent of all CO emissions emanate from automobile exhaust. These emissions can result in high concentrations of CO, particularly in areas with heavy traffic congestion. Other sources of CO emissions include industrial processes, non-transportation fuel combustion, and natural sources such as wildfires. Peak CO concentrations typically occur during the colder winter months of the year when CO automotive "cold start" emissions are greater and nighttime inversion conditions are more frequent.

- CO enters the bloodstream and reduces oxygen delivery to the body's organs and tissues. The health threat from CO is most serious for those who suffer from cardiovascular disease. At higher levels of exposure, healthy individuals are also affected. Visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks are all associated with exposure to elevated CO levels.

B. NAAQS

- There are two primary NAAQS for ambient CO: The 1-hour standard is 35 ppm, and the 8-hour standard is 9 ppm. These concentrations are not to be exceeded more than once per year. There currently are no secondary standards for CO.

C. Network Status:

- As of March 2002, there were 563 'active' CO monitors (at 560 sites) in AQS.
- As of 2000, only 6 sites exceeded any CO NAAQS (all the 8-hr standard). With decreasing problems, the network is shrinking and the monitoring focus is shifting to representative urban and rural areas (for model evaluation, linkage to health studies, source apportionment, and background & transport evaluation purpose). Collection with other air monitors (e.g., NO_x, O_3, SO_2, PM) is helpful for source attribution and emission inventory evaluation. Enhanced monitor sensitivity is necessary for the new role.
- Typical concentrations: 90% of the reported hourly data fall in the range 0.0 to 2.0 ppm with a median of .5 ppm.

D. Raw Data Reporting:

- Parameter: 42101
- Units: CO data are reported as concentrations, in parts per million (ppm, AQS Units code = 007), with one decimal place.
- Duration: CO data measurements are taken hourly and loaded to AQS as such (AQS Duration Code = 1). AQS keeps the hourly data ans also converts it to 8-hr running averages, using the end hour to identify the segment (AQS Duration Code = Z).

E. Additional Data Reporting Requirements Per Site:

- 'Accuracy' checks: SLT's are required to perform and submit at least one accuracy audit every year for the following 4 concentration ranges: 3-8; 15-20; 35-45; and 80-90 ppm. Data are submitted via accuracy transactions.
- 'Precision' checks: SLT's are required to perform a one-point precision check at least once every 2 weeks (with the challenge gas concentration in the range 8-10 ppm). Results are reported via precision transactions.

2. Sulfur Dioxide (SO2) Network

A. Pollutant Nature, Sources, and Effects:

- Sulfur dioxide belongs to the family of sulfur oxide gases. These gases are formed when fuel containing sulfur (mainly coal and oil) is burned and during metal smelting and other industrial processes. Most SO_2 monitoring stations are located in urban areas. The highest monitored concentrations of SO_2 are recorded in the vicinity of large industrial facilities. Fuel combustion, largely from coal-fired power plants, accounts for most of the total SO_2 emissions.

- High concentrations of SO_2 can result in temporary impairment for asthmatic children and adults who are active outdoors. Short-term exposures of asthmatic individuals to elevated SO_2 levels while at moderate exertion may result in breathing difficulties that may be accompanied by such symptoms as wheezing, chest tightness, or shortness of breath. Other effects that have been associated with longer-term exposures to high concentrations of SO_2, in conjunction with high levels of PM, including respiratory illness, alterations in the lungs' defenses, and aggravation of existing cardiovascular disease. The subgroups of the population that may be affected under these conditions include individuals with cardiovascular disease or chronic lung disease, as well as children and the elderly. Together, SO_2 and NO_x are the major precursors to acidic deposition (acid rain), which is associated with the acidification of soils, lakes, and streams, accelerated corrosion of buildings and monuments. Sulfur dioxide also is a major precursor to PM, which is a significant health concern as well as a main pollutant that impairs visibility.

B. NAAQS:

- There are two primary standards and one secondary standard for SO_2. The primary annual standard is an arithmetic mean of .03 ppm. The primary 24-hr standard is .14 ppm, not to be exceeded more than once a year. The secondary standard is a 3-hr level of .50 ppm, not to be exceeded more than once a year.

C. Network Status:

- As of march 2002, there were 603 active SO_2 monitors (at 595 sites) in AQS.

- Because exceedances of the NAAQs are isolated and point-source related, the national monitoring strategy is shifting its central focus in that direction. Due to the short-term health effects, shorter sampling durations are encouraged in hot spots. Monitoring is also being redirected to representative urban and rural areas (for model evaluation, linkage to health studies, source apportionment, and background & transport evaluation purposes). SO_2 data are important indicators related to accounting for success of major national emission strategics such as the Clear Skies Initiative (CSI). Enhanced monitor sensitivity is necessary for the new role.

- Typical concentrations 90% of the reported hourly data fall in the range of 0.000 to 0.017 ppm with a median of 0.002 ppm.

D. Raw Data Reporting:

- Parameter: 42401

- Units: SO_2 data are reported as concentrations, in parts per million (ppm, AQS Units code = 007), with three decimal places (0.001 ppm).

- Duration: SO_2 instruments run continuously. Measurements are typically reported to AQS as hourly averages (AQS Duration Code = 1). AQS keeps the hourly data and also converts it to 24-hr block averages (Duration Code = X) and 3-hr block averages (Duration Code = Y). [Note: SO_2 data can also be reported to AQS as hourly 5-minute maxima (Parameter Code = 42406, Duration Code = 1) or as individual 5-minute averages (Parameter Code = 42401, Duration Code = H)].

E. Additional Data Reporting Requirements Per Site:

- 'Accuracy' checks: SLT's are required to perform and submit at least one accuracy audit every year for the following 4 concentrations ranges: 0.03 – 0.08; 0.15 - 0.20; 0.35 – 0.45; and 0.80 – 0.90 ppm. Data are submitted via accuracy transactions.

- 'Precision' checks: SLT's are required to perform a one-point precision check at least once every 2 weeks (with the challenge gas concentration in the range 0.08 – 0.10 ppm). Results are reported via precision transactions.

3. Nitrogen Dioxide (NO_2) Network

A. Pollutant Nature, Sources, and Effects:

- Nitrogen dioxide (NO_2) is a reddish brown, highly reactive gas that is formed in the ambient air through the oxidation of nitric oxide (NO). Nitrogen oxides (NO_x), the term used to describe the sum of NO, NO_2 and other oxides of nitrogen, play a major role in the formation of ozone, particulate matter, haze and acid rain.

- The major sources of man-made NO_x, emissions are high-temperature combustion processes, such as those occurring in automobiles and power plants. Home heaters and gas stoves also produce substantial amounts of NO_2 in indoor settings.

- Short-term exposures (e.g., less than 3 hours) to low levels of nitrogen dioxide (NO_2) may lead to changes in airway responsiveness and lung function in individuals with pre-existing respiratory illnesses and increases in respiratory illnesses in children (5-12 years old). Long-term exposures to NO_2 may lead to increased susceptibility to respiratory infection and may cause permanent alterations in the lung. Nitrogen oxides react in the air to form ground-level ozone and fine particle pollution which are both associated with adverse health effects. Nitrogen oxides contribute to a wide range of environmental effects, including the formation of acid rain and potential changes in the composition and competition of some species of vegetation in wetland and terrestrial systems, visibility impairment, acidification of freshwater bodies, eutrophication (i.e.. excessive algae growth leading to a depletion of oxygen in the water) of estuarine and coastal waters (e.g., Chesapeake Bay), and increases in levels of toxins harmful to fish and other aquatic life.

B. NAAQS:

- The level for both the primary and secondary NAAQS for NO_2 is an annual arithmetic average of 0.053 ppm, not to be exceeded.

C. Network Status:

- As of March 2002, there were 446 active NO_2 monitors (at 443 sites) in AQS.

- Currently there are few, if any sites (none as of the 2000 Trends Report) that exceed the NO_2 NAAQS. Accordingly, reductions in the numbers of urban sites where high levels once existed are occurring. NO_x reductions are still being sought to help reduce ozone pollution. Additional $NO_2/NO_x/NO$ monitoring sites in key locations will help characterize the expected reductions. $NO_2/NO_x/NO$ monitoring is required at PAMS sites. Like CO and SO_2, the $NO_2/NO_x/NO$ monitoring focus is shifting to representative urban and rural areas. Collocation with other air monitors (e.g., SO_2, O_3, CO, PM) is helpful for source attribution and emission inventory evaluation.

$NO_2/NO_x/NO$ data are also an important indicator of success for the CSI. Enhanced monitor sensitivity is necessary for the new roles.

- Typical concentrations: 90% of the reported NO_2 data fall in the range .001 to .041 ppm with a median of .011.

D. Raw Data Reporting:

- NO_2 concentration levels are generally derived by taking the difference between direct measurements of NO_x and NO.

- Parmeter: 42602 (NO_2), 42601 ( ), 42603 ( )

- Units: NO_2 instruments run continuously. Measurements are reported to AQS as hourly averages (AQS Duration Code = 1)

E. Additional Data Reporting Requirements Per Site:

- 'Accuracy' checks: SLT's are required to perform and submit at least one accuracy audit every year for the following 3 concentration ranges: 0.03 – 0.08; 0.15 – 0.20; and 0.35 – 0.45 ppm. Data are submitted via accuracy transactions.

- 'Precision' checks: SLT's are required to perform a one-point precision check at least once every 2 weeks (with the challenge gas concentration in the range 0.08 – 0.10 ppm). Results are reported via precision transaction.

4. Ozone (O_3) Network

A. Pollutant Nature, Sources, and Effects:

- Ground-level ozone (the primary constituent of smog) is not emitted directly into the air but is formed by the reaction of VOCs and NO_x in the presence of heat and sunlight. Ground-level ozone forms readily in the atmosphere, usually during hot summer weather. VOCs are emitted from a variety of sources, including motor vehicles, chemical plants, refineries, factories, consumer and commercial products, and other industrial sources. Nitrogen oxides are emitted from motor vehicles, power plants, and other sources of combustion. Changing weather patterns contribute to yearly differences in ozone concentrations from region to region. Ozone and the precursor pollutants that form ozone also can be transported into an area from pollution sources found hundreds of miles upwind.

- Short-term (1-3 hours) and prolonged (6-8 hours) exposures to ambient ozone have been linked to a number of health effects of concern. For example, increased hospital admissions and emergency room visits for respiratory problems have been associated with ambient ozone exposures. Exposures to ozone can make people more susceptible to respiratory infection, result in lung inflammation, and aggravate pre-existing respiratory diseases such as asthma. Other health effects attributed to ozone exposures include significant decreases in lung function and increased respiratory symptoms such as chest pain and cough. These effects generally occur while individuals are actively exercising, working or playing outdoors. Children, active outdoors during the summer when ozone levels are at their highest, are most at risk of experiencing such effects. Other at-risk groups include adults who are active outdoors (e.g., some outdoor workers and individuals with pre-existing respiratory disease such as asthma and chronic lung disease. In addition, longer-term exposures

to moderate levels of ozone present the possibility of irreversible changes in the lung structure which could lead to premature aging of the lungs and worsen chronic respiratory illnesses.

- Ozone also affects vegetation and ecosystems, leading to reductions in agricultural and commercial forest yields, reduced growth and survivability of tree seedlings, and increased plant susceptibility to disease, pests, and other environmental stresses (e.g., harsh weather). In long-lived species, these effects may become evident only after several years or even decades, thus having the potential for long-term effects on forest ecosystems. Ground-level ozone damage of the foliage of trees and other plants also can decrease the aesthetic value of ornamental species as well as the natural beauty of our national parks and recreation areas.

B. NAAQS:

- There are two ozone standards, one for 1-hr averages and the other for 8-hr averages. The 1-hr NAAQS is a maximum daily 1-hr average of .12 ppm; this standard is met when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 is equal to or less than one. The 8-hr standard is a 4^{th} maximum daily 8-hr average of 0.08 ppm; this standard is met when the 3-year average of the 4^{th} max daily 8-hr average is below that level. The secondary standards for O_3 are the same as the primary standards.

C. Network Status:

- As of March 2002, there were 1193 'active' O_3 monitors (at 1188 sites) in AQS.

- Because peak levels of ozone generally occur during hot summer months and levels are typically much lower in winter, some areas of the country are only required to monitor during prescribed 'ozone seasons'.

- Typical concentrations: 90% of the reported data fall in the range .002 to .064 ppm with a median of .028.

D. Raw Data Reporting:

- Parameter: 44201

- Units: O_3 data are reported as concentrations, typically either in parts per million (AQS Units code = 007) or parts per billion (AQS Units Code = 008). The preferred reporting units are ppm with 3 decimal places.

- Duration: O_3 instruments run continuously; hourly average concentrations are reported to AQS (AQS Duration Code = 1). AQS keeps the hourly data and also converts it to 8-hr running averages, using the begin hour to identify the segment (AQS Duration Code = W).

E. Additional Data Reporting Requirements Per Site:

- 'Accuracy' checks: SLT's are required to perform and submit at least one accuracy audit every year for the following 4 concentrations ranges"0.03 – 0.08; 0.15 – 0.20; 0.35 – 0.45; and 0.80 – 0.90 ppm. Data are submitted via accuracy transactions.

- 'Precision' checks: SLT's are required to perform a one-point precision check at least once every 2 weeks (with the challenge gas concentration in the range 0.08 – 0.10 ppm). Results are reported via precision transactions.

5. Lead (Pb) Network

A. Pollutant Definition, Sources, and Effects:

- Pb is a toxic element. Twenty-five years ago, automotive sources were the major contributor of lead emissions to the atmosphere. As a result of EPA's regulatory efforts to reduce the content of lead in gasoline, however, the contribution from the transportation sector, and particularly the automotive sector, has greatly declined. Though aviation fuels still contain relatively large amounts of lead, industrial processes (primarily metals processing) are the major source of lead emissions to the atmosphere today. The highest ambient air concentrations of lead are found in the vicinity of ferrous and nonferrous smelters, battery manufacturers, and other stationary sources of lead emissions.

- Exposure to lead occurs mainly through inhalation of air and ingestion of lead in food, water, soil, or dust. It accumulates in the blood, bones, and soft tissues. Lean can adversely affect the kidneys, liver, nervous system, and other organs. Excessive exposure to lead may cause neurological impairments such as seizures, mental retardation, and behavioral disorders. Even at low doses, lead exposure is associated with damage to the nervous system of fetuses and young children, resulting in learning deficits and lowered IQ. Recent studies also show that lead may be a factor in high blood pressure and subsequent heart disease. Lead can also be deposited on the leaves of plants, presenting a hazard to grazing animals.

B. NAAQS:

- The primary and secondary NAAQS for lead is a quarterly average concentration not to exceed 1.5 ug/m^3

C. Network Status:

- The large reductions in long-term lead emissions from transportation sources changed the nature of the lead problem in the U.S. Because industrial processes are now responsible for all violations of the NAAQS, the NAAQS monitoring strategy now focuses on emissions form those point sources. EPA revised the lead air monitoring regulations by publishing a new rule on January 20, 1999. The new rule only requires about a dozen mobile-related monitoring sites. However, while the number of mobile-related monitors has dropped dramatically, recent toxic monitoring initiatives have sprung new sites which monitor for Pb and other compounds.

- As of March 2002, there were 252 active TSP Pb monitors (at 230 sites) in AQS.

- Point source oriented monitors should be identified as such in AQS. Monitoring Objective (monitor_obj_type) should = 'SOURCE ORIENTED' and Dominant Source (dominant_source) should = 'POINT'.

- Typical concentrations: 90% of the reported daily data fall in the range 0.00 to 0.81 ug/m^3 with a median of .03. These statistics are for all sites, including those point-

source oriented. The data range is considerably lower for non-source oriented sites and can be much higher for source-oriented locations.

D. Raw Data Reporting

- Parameter: 12128
- Units: Pb data are reported as concentrations, in micrograms per cubic meter (ug/m^3) at 'standard conditions' (AQS Units code = 001), with two decimal places.
- Duration and Sample Frequency: Pb is measured off of Total Suspended Particulate (TSP) filters which collect for 24 hours (AQS Sample Duration = 7). The TSP filters are generally collected every 6^{th} day (AQS Sample Frequency = 6). SLT's can report the Pb portion of an individual filter to AQS with Raw Data (RD) transactions. However, because the Pb portion of the TSP matter on a individual filter is frequently very low (near instrument detection limits), SLT's have the opinion to combine filters (e.g., a month or quarter's worth) and report the aggregate Pb concentration to AQS in Composite Raw Data (RC) transaction. The applicable 'Number of Samples' (i.e., number of combined filters) also needs to be reported in the RC transactions.

E. Additional Data Reporting Requirements Per Site:

- Accuracy & Bias checks: Two types of accuracy checks should be reported to AQS for Pb. SLT's are required to perform and submit at least one flow rate audit every year for each TSP sampler where Pb is measured (25% of the RO network should be audited per quarter). Also, analytical accuracy checks are required each quarter for the RO's lab. These later checks must encompass at least 3 audit samples in each of the following 2 ranges: 100-300 and 600-1000 ug Pb / glass fiber filter strip (AQS Unit Code = 77).
- Precision checks: Duplicate collocated Pb sampling and reporting are required; if the RO runs 1-5 Pb-TSP sites, at least 1 needs to be collected, if 6-20 sites are run, at least 2 must be collocated, and if more than 20 sites are operated, at least 3 should have collocation. The collocated monitors also run every 6^{th} day. Paired Pb measurements are submitted via precision transactions.

6. Particulate Matter Networks

A. Pollutant Nature, Sources, and Effects:

- Particulate matter (PM) is the general term used for a mixture of solid particles and liquid droplets found in the air. The chemical composition and physical properties of these particles vary widely. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or haze. Particles whose aerodynamic diameter is less than or equal to 2.5 micrometers, or $PM_{2.5}$ are known as "fine" particles. Those larger than 2.5 micrometers but less than or equal to 10 micrometers are known as "course" particles. PM_{10} refers to all particles less than or equal to 10 micrometers in diameter.
- When breathed, particulate matter can accumulate in the respiratory system and are associated with numerous health effects. Exposure to coarse particles is primarily associated with the aggravation of respiratory conditions, such as asthma. Fine particles are most closely associated with such healt effects as increased hospital

admissions and emergency room visits for heart and lung disease, increased respiratory disease and symptoms such as asthma, decreased lung function, and even premature death. Sensitive groups that appear to be at greatest risk to such effects include the elderly, children, and individuals with cardiopulmonary disease such as asthma. In addition to health problems, PM is the major cause of reduced visibility in many parts of the United States. Airborne particles also can impact vegetation and ecosystems and can cause damage to paints and building materials.

- PM can be emitted directly or form secondarily in the atmosphere. 'Primary' particles, such as dust from roads or elemental carbon (soot) from wood combustion, are emitted directly into the atmosphere. 'Secondary' particles are formed in the atmosphere from primary gaseous emissions. Examples include sulfate, formed from SO_2 emissions from power plants and industrial facilities; and nitrates, formed from NO_x emissions from power plants, automobiles and other types of weather. Generally, fine PM is composed mostly of secondary particles, and coarse PM is composed largely of primary particles.

B. Network:

- EPA currently operates several networks related to PM_{10} and $PM_{2.5}$. In the near future, PM_{10} NAAQS monitoring is expected to decline and a new network (and new NAAQS) will be instituted for PMcourse.

6(a). PM_{10} Network

A. Pollutant

- PM_{10} refers to all particles less than or equal to 10 micrometers in diameter.

B. NAAQS:

- There are 2 primary standards for PM_{10}. The annual standard is an arithmetic mean of 50 ug/m^3 averaged over 3 years. The 24-hour or "short-term" standard is 150 ug/m^3, not to be exceeded more than once per year on average over 3 years. The secondary standards for PM_{10} are the same as the primary standards.

C. Network Status:

- As of March 2002 AQS, there were approximately 1,370 active monitors at 1,216 sites.

- PM_{10} Federal reference and equivalent methods (FRM & FEM) include filter-based samplers and automated (continuous) systems. Hence, the national network consists of a combination of these 2 sampler types. Approximately 85% of the network uses filter-based samplers.

- Typical concentrations: 90% of the reported hourly data fall in the range 4.5 to 63.7 ug/m^3 with a median of 19.5. 90% of the 24-hour data fall in the range 7.0 to 58.0 ug/m^3 with a median of 21.0.

D. Raw Data Reporting:

- Parameter: 81102
- Units: PM_{10} data are reported as concentrations, in micrograms per cubic meter (ug/m^3) at standard conditions (AQS Units code – 001) to one decimal place.
- Duration: 24-hours (AQS Duration code = 7) for the filter-based samplers and hourly (AQS Duration Code = 1) for the continuous samplers.
- Sample Frequency: Most of the filter-based samplers (~ 87%) operate on an every 6th day (Sample Frequency Code = 6). Some monitors (~ 8%) sample every day (Sample Frequency Code = 1) and some (5%), operate every 3rd day (Sample Frequency Code = 3).

E. Additional Data Reporting Requirements Per Site:

- "Accuracy" checks:
  - Manual Methods (24-hour): States/Locals/Tribes (SLT's) are required to perform and submit at least one accuracy flow rate audit every year for every sampler (25% of an RO's network should be audited per quarter). Data are submitted via accuracy transactions.
  - Automated Method (continuous): A one point flow rate check is to be made every 2 weeks. Results of the check are to be reported in AQS accuracy transactions.
- 'Precision' checks:
  - Manual Methods: Duplicate collocated sampling and reporting is required; if the RO runs 1-5 PM_{10} sites, at least 1 needs to be collocated, if 6-20 sites are run, at least 2 must be collocated, and if more that 20 sites are operated, at least 3 should have collocation. The collocated monitors typically run every 6th day. Paired PM_{10} measurements are submitted via precision transactions.

6(b). $PM_{2.5}$ (Fine Particle) Federal Reference Method (FRM) Network:

A. Pollutant

- Particles whose aerodynamic diameter is less than or equal to 2.5 micrometers, or $PM_{2.5}$, are known as fine particles or fine particulate matter.

B. NAAQS:

- There are 2 primary standards for $PM_{2.5}$. The Annual Standard is met when the 3-year average of the annual mean concentration is ≤ 15.0 ug/m^3. The 24-hour or "Daily" Standard is met when the 3-year average of the annual 98th percentile value is ≤ 65 ug/m^3. [Note: SLT's are permitted to use a Spatial Average (for the annual standard only) for a set of sites in lieu of the statistics for each individual site, if the site set is designated in advance.] The secondary standards for $PM_{2.5}$ are the same as the primary standards.

C. Network Requirements and Status:

- As of March 2002 AQS, there were 1,371 active monitors at 1,144 sites.
- The overall number of sites/monitors is expected to decline in the near future as 1) the number of continuous monitors increase (see #8), and 2) sufficient collected data indicate there exists no pollution problem in a particular area and/or an area is over-monitored.
- Typical concentrations: 90% of the reported 24-hour or daily data fall in the range 3.6 to 29.9 ug/m^3 with a median of 11.3.

D. Raw Data Reporting:

- Parameter: 88101
- Units: $PM_{2.5}$ data are reported as concentrations, in micrograms per cubic meter (ug/m^3) at local conditions (AQS Units code = 105) to one decimal place.
- Duration: 24-hours (AQS Duration Code = 7).
- Sample Frequency: Sites generally operate on one of 3 schedules: Every day sampling (Sample Frequency Code = 1); every 3rd day (Sample Frequency Code = 3); or every 6th day (Sample Frequency Code = 6).

E. Additional Data Reporting Requirements Per Site:

- 'Accuracy' checks: States/Locals/Tribes (SLT's) are required to perform and submit at least one accuracy flow rate audit every quarter for each operating site. Data are submitted via accuracy transactions.
- 'Precision' checks: 25% of the sites for a Reporting Organization (RO) are required to submit collocated $PM_{2.5}$ data at a frequency of every 6 days. RO's can submit the collocated information using raw data transactions (under a separate POC) or via precision transactions.
- 'L-1' or 'Field Data': For each $PM_{2.5}$ concentration reported to AQS, SLT's are also required to submit 9 corresponding 'field' measurements. These are: Sample Flow Rate Coefficient of Variation (CV) which is the standard deviation divided by the mean in percent (AQS Parameter Code = 68101), Sample Volume for the sample period in cubic meters of air (68102), Ambient Minimum Temperature in degrees Celsius (68103), Ambient Maximum Temperature in degrees Celsius (68104), Ambient Average Temperature in degrees Celsius (68105), Sample Minimum Barometric Pressure in mm Hg (68106), Sample Maximum Barometric Pressure in mm Hg (68107), Sample Average Barometric Pressure in mm Hg (68108), and Elapsed Time for the sample period in minutes (68109).
- Reported raw data should be appropriately qualified. In addition to applicable 'Exceptional Event' flags, there are also numerous quality assurance flags specifically created for $PM_{2.5}$. These are: W (Flow Rate Average out of Spec.); X (Filter Temperature Difference out of Spec.); T (Multiple $PM_{2.5}$ Validity Flags); O (Elapsed Sample Time out of Spec.); 1 (Deviation from a CFR/Critical Criteria); 2 (Operational, Deviations); 3 (Field Issue); 4 (Lab Issue); 5 (Outlier); and 6 (QAPP Issue).

6(c). $PM_{2.5}$ Continuous Program:

A. Pollutant Definition:

- Same as noted above.

B. Network Requirements and Status:

- $PM_{2.5}$ continuous monitoring is required in U.S. metropolitan areas with population greater than 1 million (~ 50 areas). Additional monitoring (especially for the purpose of 'public reporting') is encouraged and often funded. For instance, Air Quality Index (AQI) reporting is required in metropolitan statistical areas (MSAs) with a population over 350,000.

- As of Spring 2002, there are no $PM_{2.5}$ continuous monitors designated as Federal Equivalent Methods. Since timely AQI reporting requires the use of continuous monitors, PM continuous methods that are not designated as "equivalent" may be used if these monitors can be related to the FRM by statistical linear regression. In some cases, continuous monitors and/or accompanying data loggers can be programmed to 'adjust' data so that it correlates more closely to FRM.

- As of March 2002 AQS, there were approximately 192 active monitors at 181 sites.

- The number of sites/monitors is expected to increase in the near future.

C. NAAQS:

- There are no hourly $PM_{2.5}$ NAAQS.

- Since there are no continuous reference or equivalent methods for fine particulate, continuous data cannot be used to show attainment/nonattainment of the $PM_{2.5}$ annual and daily NAAQS. There are limited provisions for site by site equivalency; however, no continuous monitoring sites have received this approval.

D. Raw Data Reporting:

- Parameter: 88101

- Units: $PM_{2.5}$ data are reported as concentrations, preferably in units of micrograms per cubic meter (ug/m^3) at local conditions (AQS Units code = 1)

- Duration: 1-hour (AQS Duration Code = 1)

- Typical concentrations: 90% of the reported data fall in the range 1.4 to 30.0 ug/m^3 with a median of 9.4.

E. Additional Data Reporting Requirements Per Site:

- If approved as an equivalent method for use in NAAQS decisions, a one point flow rate check is to be made every 2 weeks. Results of the check are to be reported in AQS accuracy transactions. Flows should be reported in units of liters / minute (AQS Units Code = 073).

6(d). $PM_{2.5}$ Speciation Program

A. Network Purpose and Status:

- A $PM_{2.5}$ chemical speciation program was initiated in 2000 to characterize the components of fine particulate matter. The resultant speciation database is expected to: help identify the sources of $PM_{2.5}$, assist with SIP development, verify the effects of control strategies, and eventually establish trends.

- A required National network of 54 sites was established with the primary goal of providing information on trends and changes in the $PM_{2.5}$ components. As of March 2002, all 54 sites were operating. To insure consistency, all sites operate comparable equipment (1 of 3 samplers) on the same schedule (every 3rd day).

- Up to 250 additional SLT sites were expected to complement the National network. The main purpose of these sites is to provide local characterization and assist with SIP development. As of March 2002, about 140 of these SLT non-Trend sites were operating. Although these sites can operate any av

B. Speciation Target Parameters:

- In the Trends network, almost 60 parameters are monitored/analyzed: $PM_{2.5}$ mass; sulfate; nitrate; 48 trace elements; 3 ions; and 4 carbon breaks. For QA purposes, 6 'field data' parameters (a subset of the 9 reported in the FRM program) are also reported to AQS with each set of daily data.

- To date, the SLT sites are basically monitoring/analyzing for the same target list as the Trends sites. This could change in the future.

- In general, the mass measurements taken at speciation sites can not be used for NAAQS purposes since they are not Federal Reference Methods. There are currently no NAAQS associated with any of the speciation components.

C. Raw Data Reporting:

- To date, all sample analyses and AQS reporting for the Trends network is handled by a contractor. The contractor is also handling most of the SLT processing.

- Units: All 'species' (and the mass) are reported as concentrations, in micrograms per cubic meter (ug/m^3) at local conditions (AQS Units code = 105.)

- Duration: For the filter-based samplers (which are the norm), all data are reported for 24-hour periods (AQS Duration Code = 7). Continuous methods have recently been developed for carbon, sulfate, and nitrate/ Measurements made with continuous carbon, sulfate, and nitrate samplers will be reported for 1-hr or 2-hr (carbon only) durations.

- Frequency: Trend sites operate on an every 3rd day schedule (AQS Sample Frequency = 3). SLT sites typically run on either the every 3rd day schedule or on an every 6th day schedule (AQS Sample Frequency = 6).

- Trend sites will eventually report raw data point-specific measurement uncertainties, once there is agreement on the approach.

7. Photochemical Assessment Monitoring Stations Network

A. Network Purpose and Status

- Due to the lack of attainment of the ozone NAAQS nationwide, the PAMS program was initiated (in 1994) to collect more extensive data on the pollutant and its precursors (VOC and NO_x). Data collected in the PAMS network are being used to make ozone attainment/nonattainment decisions (e.g., 'weight of evidence'), aid in tracking VOC and NO_x emission inventory reductions, evaluate photochemical model performance, prepare air quality trends, and better characterize the nature and extent of the ozone problem.

- A PAMS network is required in every 1-hr ozone nonattainment area classified as serious, severe, or extreme. Currently 24 areas are subject to PAMS; the 24 areas have a total population of over 85 million people. Because the flexibility of the PAMS regulations allow areas in close proximity to another to consolidate their monitoring operations, only 22 operating networks actually exist.

- Each PAMS network consists of 2-5 sites according to the areas' population. There are up to 4 different site 'types' in each network. Type 1 sites are situated upwind of the metropolitan area to measure ozone and precursors being transported into the area; these sites also are useful for background characterization. Type 2 sites are referred to as 'maximum precursor emissions impact sites'; they are located downwind of the central business district and operate on a more intensive schedule than other site Types. The Type 3 sites are located where the highest ozone concentrations are expected. The Type 4 PAMS sites are located downwind of the nonattainment area to assess the ozone and precursor levels exiting the area and possibly contributing to the ozone problem in other areas.

- Currently, there are 90 PAMS sites operating.

B. PAMS Target Parameters

- The data collected at the PAMS sites include measurements of O_3, NO_x, a target list of VOCs including several carbonyls, as well as surface and upper air meteorology. Most PAMS sites measure 54 target hydrocarbons on either a hourly or 3-hour basis during the 'PAMS season'. The 'PAMS season' typically runs June-August, but varies somewhat by area. The Type 2 sites also collect data on carbonyl compounds (formaldehyde, acetaldehyde). Included in the monitored VOC species are ten compounds classified as hazardous air pollutants (HAPs). All PAMS stations measure O_3, NO_x, and surface meteorological parameters on an hourly basis during the PAMS season. 24-hour VOC measurements are also required every 6^{th} day (year round for Type 2 sites; during the PAMS season for other site Types).

C. PAMS Data Reporting

- Ozone and NO_x are reported in ppm units. VOC totals and species should be reported in parts per billion carbon (ppbC, AQS Units Code 078). Three-hour VOC data are entered into AQS with a Duration Code of 'B'. 24-hour VOC measurements use a '7' Duration Code. Meteorological parameters (e.g., wind direction, wind speed, temperature) are reported in various units, but all at hourly intervals. Upper-air meteorological data are not reported to AQS.

- PAMS VOC and meteorological data must be reported within 6 months of the end of a quarter.

- Quality assurance requirements for PAMS are not yet well defined.

8. Toxics Pilot Network (and forthcoming National Network)

A. Network Purpose and Status

- The toxics pilot network consists of approximately 40 sites nationwide that have been funded with S103 grant funds to help assess the need, and location of a future national toxics ambient monitoring network. The network began in 2000 with 10 primary pilot cities. In 2001, 29 more smaller projects in 25 states were added. Data from the 10-city pilot project and preliminary data for the 2001 smaller projects will be analyzed in the winter of 2002, and will yield information on variability, average annual concentrations, and pollutants of national concern. This information will aid designers in building a national network. Even though all information needed to build a national network has not been collected, an initial, 10-city national network has been funded in fy2002, based on preliminary NATA results and also based on data analyzed from a 300-site data archive. This data archive includes sites built to address local questions on hot spot, or local source issues, and is not of consistent quality to base an entire network design on. Approximately 90 percent of the data in the archive presides in AIRS. Several of the 10-city pilot cities are also part of the 10-city initial national network.

B. NAAQS:

- There are currently no NAAQS for toxic air pollutants.

C. Network Status:

- As of March 2002, all 39 pilots sites were in operation (10 original pilot sites and 29 smaller fy2001 projects).

D. Target Parameters:

- The pilot sites have a target list of 18 compounds. For some of these compounds, the pilot collection organization has a choice in the 'form' of the compound to be measured. For example, for Pb, either the TSP, PM_{10}, or $PM_{2.5}$ form could be measured. Some of the 18 targets are measured off of particulate filters and other are measured with VOC sampling/analyses methods. Meteorological information (wind speed, wind direction, temperature, and pressure) is also collected at the sites (or at a representative site).

- The initial, 10 city national network discussed above will primarily monitor for benzene, acrolein, formaldehyde, and chromium compounds. More compounds will be added after data analysis is complete the spring of calendar year 2003.

E. Raw Data Reporting:

- Units: All pilot pollutant data are reported as concentrations, in micrograms per cubic meter (ug/m^3). TSP and PM_{10}-based measurements are reported at standard

temperature/pressure and $PM_{2.5}$ species are reported at local conditions. [The reporting of temperature and pressure facilitate subsequent conversions.]

- Duration: 24 hours (AQS duration Code = 7).

- Sample Frequency: Most of the filter-based samplers operate on every 6^{th} day (Sample Frequency Code = 6). The smaller pilot cities are on an every 12^{th} day (Sample Frequency Code = ?).

- All data are to be reported to AIRS 4 months after the end of the calendar quarter.

F. Additional Data Reporting Requirements Per Site:

- Various QA audits are being performed for the pilot sites, including round-robin laboratory analyses and flow rate checks. Duplicate collocated sampling and reporting (for the filter-based measurements) is required at all of the initial 10 pilot sites; collocated sampling at the 29 smaller fy2001 sites was not required due to funding issues. Pilot QA audit outputs are to be loaded to AQS. [Details are not provided since the procedure may change.]