AQS Formulas for calculating

Raw Data Summaries

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Table of Contents

1. Terms

Average	Arithmetic mean
Exceedance	A sample value measurement that is above the level of the applicable standard.
Hourly Sample	A sample whose sample duration, or interval, is one (1) hour.
MDL	Minimum detectable limit, or the lowest concentration that can be detected by a sampling instrument and method.
Monitoring Season (Defined)	The consecutive sub-annual period, defined by state, county, or site, during which ozone monitoring is required for NAMS and SLAMS monitors, as listed in the ambient monitoring rule (40CFR58, Appendix D.)
Monitoring Season (Effective)	The defined monitoring season for a NAMS or SLAMS monitor extended to include the earliest and latest exceedances occurring outside that defined season.
Valid Daily Maximum	The maximum value recorded, or computed, on a day that meets daily summary criteria.
Active Day	A day occurring within a valid sample period.
Scheduled Day	A day where sampling is required for a monitor, as determined by the applicable required collection frequency and the NAMS schedule.
Scheduled Stratum	A period of time starting from a Scheduled Day up to, but not including the immediately succeeding Scheduled Day.
Valued Stratum	A Scheduled Stratum during at least one observation was record.
Scheduled Sample	A sample recorded on a Scheduled Day.
Make-Up Sample	A sample recorded as a replacement for a missing Scheduled Sample.

2. Standard Unit Conversion (RAW_DATA)

The value reported for a raw data sample is converted to a value in the standard unit for the parameter, i.e., standard sample value. Each from-to unit combination has a record in the UNIT_CONVERSIONS table, which specify the values to be used in the following formula:

$$v = s + (l * r * m^i * c^j)$$

where:

v = the value in standard units (STD_SAMPLE_VALUE);
s = the scalar factor (SCALAR_FACTOR);
l = the linear factor (LINEAR_FACTOR);
r = the sample value in reported units (REPORTED_SAMPLE_VALUE);
m = the molecular weight of the parameter (MOLECULAR_WEIGHT);
i = indication of whether molecular weight applies, e.g., 0 means "No", 1 means "Yes" (MOLECULAR_WGT_IND);
c = the carbon count of the parameter (CARBON_CNT);
j = indication of whether carbon count applies, e.g., 0 means "No", 1 means "Yes" (CARBON_CNT_IND).

For standard sample values less than the applicable minimum detectable limit (MDL), (and where the parameter is not 88101), that standard sample value is superceded by a value equal to ½ the applicable MDL. When such a substitution occurs, a "½ MDL substitution" flag is set on the raw data record itself

For any sample, the applicable MDL generally is that which is assigned to the method by the EPA. This EPA-assigned, i.e., federal, MDL, may be superceded by an alternative MDL. An alternate MDL is specified by the submitting agency as part of a raw data transaction. This alternative MDL is stored with the corresponding monitor protocol, and is converted to the standard unit, using the above formula, for comparison to the corresponding standard sample value.

Standard sample values greater than, or equal to, the applicable MDL, and all ozone (44201) standard sample values, regardless of relation to the applicable MDL, are subject to rescaling. The scaling factor is assigned to the method by the EPA, and is called the summary scale. Rescaling is either rounding or truncation of the converted value to the number of decimal places specified in the summary scale. Each parameter has a conversion indicator field, which specifies whether truncation or rounding applies. (Rounding is the default.)

3. Summaries

3.1 Common Items (NAAQS_AVERAGES, DAILY_SUMMARIES, QUARTERLY_SUMMARIES, ANNUAL_SUMMARIES)

3.1.1 Monitor (MO_MO_ID)

The air monitoring station whose data is summarized. A sequentially assigned number that serves as a surrogate for the AIRS monitor ID (state-county-site-parameter-POC).

3.1.2 Date/Time (NAAQS_AVG_DATETIME)

The date and hour identifying a NAAQS average. For ozone (44201) 8-hour running averages (3.2.1 O3 8-Hour Running Average), it is the first hour in the period; for carbon monoxide (42101) 8-hour running averages (3.3.1 CO 8-Hour Running Average) , and all block averages (3.4.1 SO2 3-Hour Block Average, 3.4.2 SO2 24-Hour Block Average, 3.5.1 PM10 24-Hour Block Average, 3.6.1 PM2.5 24-Hour Block Average), it is the last hour in the period.

3.1.3 Date (DAILY_COLL_DATE)

The date identifying a daily summary.

3.1.4 Year (ANNUAL_SUMMARY_YEAR, QTR_YEAR)

The year identifying a quarterly or annual summary.

3.1.5 Quarter (QTR_NUM)

The quarter number (1-4) identifying a quarterly summary.

3.1.6 Sample Duration (SD_DURATION_CODE)

A code identifying the length of time required to obtain the sample begin summarized, or, for NAAQS averages, the length of the interval.

3.1.7 Exceptional Data Type (EDT_EDT_ID)

A numeric identifier that represents the event-data condition being summarized. The meaning of the identifiers are, as follows:

ID	Description
0	No events
1	Events excluded
2	Events included
3	Exceptional events excluded
4	Natural events excluded
5	Events with concurrence excluded
6	Exceptional events with concurrence excluded

ID	Description
7	Natural events with concurrence excluded

The event qualifiers and types are, as follows:

Code	Description	Type
A	High Winds	Natural Event
B	Stratospheric Ozone Intrusion	Natural Event
C	Volcanic Eruptions	Natural Event
D	Sandblasting	Exceptional Event
E	Forest Fire	Natural Event
F	Structural Fire	Exceptional Event
G	High Pollen Count	Natural Event
H	Chemical Spills & Indust. Accidents	Exceptional Event
I	Unusual Traffic Congestion	Exceptional Event
J	Construction/Demolition	Exceptional Event
K	Agricultural Tilling	Exceptional Event
L	Highway Construction	Exceptional Event
M	Rerouting Of Traffic	Exceptional Event
N	Sanding/Salting Of Streets	Exceptional Event
O	Infrequent Large Gatherings	Exceptional Event
P	Roofing Operations	Exceptional Event
Q	Prescribed Burning	Exceptional Event
R	Clean Up After A Major Disaster	Exceptional Event
S	Seismic Activity	Natural Event
U	Sahara Dust	Natural Event

3.2 Ozone

3.2.1 8-Hour Running Average (NAAQS_AVERAGES)

3.2.1.1 Arithmetic Mean (NAAQS_ARITH_MEAN)

Where there are between 6 and 8 hourly samples in an 8-hour period, (i.e. at least 75% of the required data is present):

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = arithmetic mean,
s = sample value,
n = number of samples.

Where there are less than 6 samples in an 8-hour period, (i.e. at least 75% of the required data is not present):

$$u = \frac{\left(\sum_{j=1}^{n} s_j + \left((8 - n) * h\right) \right)}{8}$$

where:

u= arithmetic mean,
s = 1-hour sample value,
h = ½ MDL substitution,
n = number of 1-hour sample values,

and *u* exceeds the standard.

3.2.2 Daily Summarization of Hourly Data (DAILY_SUMMARIES)

3.2.2.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.2.2.2 Number of Observations).

3.2.2.2 Number of Observations (DAILY_OBS_CNT)

The number of samples occurring within the 24-hour period.

3.2.2.3 Observation Percentage (DAILY_OBS_PCT)

$$p = \left(n \Big/ 24 \right) * 100$$

where:

p = observation percentage,
n = number of samples (3.2.2.2 Number of Observations).

3.2.2.4 Summary Criteria Indication (DAILY_CRITERIA_IND)

Minimum summary criteria are met when there were either at least nine samples from 9:01 AM LST to 9:00 PM LST, (i.e., at least 75% of possible hourly samples were measured), or at least one exceedance.

3.2.2.5 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The maximum sample for a day.

3.2.2.6 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour of the day for which the Maximum Value (3.2.2.5 Maximum Value) was recorded.

3.2.2.7 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.2.2.5 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.2.2.8 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of samples within the 24-hour period that exceeded the primary standard.

3.2.2.9 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of samples within the 24-hour period that exceeded the secondary standard.

3.2.3 Quarterly Summarization of Hourly Data (QUARTERLY_SUMMARIES)

3.2.3.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.2.3.2 Number of Observations).

3.2.3.2 Number of Observations (QTR_OBS_CNT)

The number of samples that occurred within the quarter, regardless of monitoring season.

3.2.3.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n \Big/ (q * 24) \right) * 100$$

where:

p = observation percentage,

n = number of samples that occurred within the quarter, regardless of monitoring season (3.2.3.2 Number of Observations),
q = number of active days in the quarter, regardless of monitoring season.

3.2.3.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met when the quarterly observation percentage, (3.2.3.3 Observation Percentage), is greater than, or equal to, 75%.

3.2.4 Annual Summarization of Hourly Data (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.2.4.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} d_j \Big/ v$$

where:

u = mean,
d = valid daily maximum occurring in effective monitoring season (3.2.2.5 Maximum Value, 3.2.2.4 Summary Criteria Indication),
v = valid days (3.2.4.12 Number of Valid Days).

3.2.4.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(v * \sum_{j=1}^{v} d_j^{\,2}\right) - \left(\sum_{j=1}^{v} d_j\right)^2\right)}{\left(v * (v-1)\right)}}$$

where:

σ = standard deviation,
d = valid daily maximum occurring in effective monitoring season (3.2.2.5 Maximum Value, 3.2.2.4 Summary Criteria Indication),
v = valid days (3.2.4.12 Number of Valid Days),

and $v > 1$.

If the number of valid days (3.2.4.12 Number of Valid Days) is exactly 1, then the standard deviation is assigned a value of 0.

3.2.4.3 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that were recorded for the year, regardless of monitoring season.

3.2.4.4 Observation Percentage (ANNUAL_OBS_PCT)

$$p = \left(v / r\right) * 100$$

where:

p = percentage,
v = valid days (3.2.4.12 Number of Valid Days),
r = required days (3.2.4.13 Number of Required Days).

3.2.4.5 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met when the annual observation percentage, (3.2.4.4 Observation Percentage), is greater than or equal to 75%.

3.2.4.6 Maximum Values (MAX_SAMPLE_VALUE)

The ten highest valid daily maximums (3.2.2.5 Maximum Value, 3.2.2.4 Summary Criteria Indication) for the year, regardless of monitoring season.

3.2.4.7 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.2.4.6 Maximum Values), relative to other Maximum Values, in descending value order.

3.2.4.8 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.2.4.6 Maximum Values) was recorded.

3.2.4.9 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of days in the year when the daily maximum (3.2.2.5 Maximum Value) exceeded the primary standard.

3.2.4.10 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of days in the year when the daily maximum (3.2.2.5 Maximum Value) exceeded the secondary standard.

3.2.4.11 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

The number of days in the year when the daily maximum (3.2.2.5 Maximum Value) exceeded the alert level.

3.2.4.12 Number of Valid Days (VALID_DAY_CNT)

The number of days within the effective monitoring season when minimum daily criteria were met (3.2.2.4 Summary Criteria Indication).

3.2.4.13 Number of Required Days (REQ_MONITORING_CNT)

The number of active days within the effective monitoring season.

3.2.4.14 Number of Missing Days Assumed Less Than the Standard (MISSING_DAYS_ASSUMED_LT_STD)

The number of invalid or missing days in the effective monitoring season whose daily maximums are assumed to be less than or equal to the standard. A missing day is assumed to be less than the standard when either of the following conditions exists:

- The daily maximums on the days immediately preceding, and immediately succeeding, the missing day were less than, or equal to, 75% of the standard.
- The number of valid samples for the day was less than 18, and the sum of the following is greater than, or equal, to 18, i.e., 75% of the possible values:

  - Number of valid samples;
  - Number of null samples that were both flagged as not likely to exceed the standard, and for which the Regional Office has indicated concurrence;
  - Number of omitted samples that were flagged with event qualifiers, and for which the Regional Office has indicated concurrence.

3.2.4.15 Estimated Number of Days Greater Than the Standard (EST_DAYS_GT_STD)

The number of days expected to be greater than the standard:

$$e = d + \left(\left(d/v\right) * \left(r - v - a\right)\right)$$

where

e = expected days greater than the standard,
r = required days (3.2.4.13 Number of Required Days)
v = valid days (3.2.4.12 Number of Valid Days),
a = days assumed less than the standard (3.2.4.14 Number of Missing Days Assumed Less Than the Standard) ,
d = the actual number of daily maximums greater than the standard (3.2.4.9 Number of Primary Standard Exceedances)

The estimate exceedance is rounded to 1 decimal place.

3.2.4.16 Minimum Value (MIN_SAMPLE_VALUE)

The lowest valid daily maximum (3.2.2.5 Maximum Value, 3.2.2.4 Summary Criteria Indication) that occurred in the year, regardless of monitoring season.

3.2.4.17 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified hourly samples that occurred within the year, regardless of monitoring season.

3.2.4.18 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null hourly samples that occurred within the year, regardless of monitoring season.

3.2.4.19 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of hourly samples that occurred within the year, regardless of monitoring season, whose standard values were less than the applicable MDL.

3.2.4.20 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the hourly samples within the year, regardless of monitoring season..

3.2.4.21 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The daily maximum (3.2.2.5 Maximum Value) at a system-defined percentile (3.2.4.22 Percentile) where there are *k* daily maximums less than or equal to it, where *k* is the calculated rank for the percentile with the daily maximums ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

k = percentile rank
p = percentile (3.2.4.22 Percentile),
n = number of daily maximums.

3.2.4.22 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.2.4.21 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.2.4.23 Protocols (MP_MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year, regardless of monitoring season.3.2.4.21 Percentile Value

3.2.5 Daily Summarization of 8-Hour Averages (DAILY_SUMMARIES)

3.2.5.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 8-hour running average (3.2.1.1 Arithmetic Mean),
n = number of valid 8-hour averages (3.2.5.2 Number of Observations).

3.2.5.2 Number of Observations (DAILY_OBS_CNT)

The number of valid 8-hour averages (3.2.1.1 Arithmetic Mean) computed for the 24-hour period.

3.2.5.3 Observation Percentage (DAILY_OBS_PCT)

$$p = \left(n \Big/ 24 \right) * 100$$

where:

p = observation percentage,
n = number of valid 8-hour averages (3.2.5.2 Number of Observations).

3.2.5.4 Summary Criteria Indication (DAILY_CRITERIA_IND)

Minimum summary criteria are met where either of the following conditions exists:

- there are at least 18 valid 8-hour averages for the 24-hour period (3.2.5.3 Observation Percentage);
- the Maximum Value (3.2.5.5 Maximum Value) is greater than the standard (3.2.5.8 Number of Primary Exceedances >= 1).

3.2.5.5 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The maximum valid 8-hour average (3.2.1.1 Arithmetic Mean) for the 24-hour period.

3.2.5.6 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The identifying hour of the Maximum Value (3.2.5.5 Maximum Value).

3.2.5.7 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.2.5.5 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.2.5.8 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of valid 8-hour averages (3.2.1.1 Arithmetic Mean) that exceed the primary standard.

3.2.5.9 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of valid 8-hour averages (3.2.1.1 Arithmetic Mean) that exceed the secondary standard.

3.2.6 Quarterly Summarization of 8-Hour Averages (QUARTERLY_SUMMARIES)

3.2.6.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 8-hour average (3.2.1.1 Arithmetic Mean),
n = number of valid 8-hour averages (3.2.6.2 Number of Observations).

3.2.6.2 Number of Observations (QTR_OBS_CNT)

The number of valid 8-hour averages (3.2.1.1 Arithmetic Mean) that were computed for the quarter, regardless of monitoring season.

3.2.6.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n \Big/ (q * 24) \right) * 100$$

where:

p = observation percentage,
n = number of valid 8-hour averages (3.2.6.2 Number of Observations) that were computed for the quarter, regardless of monitoring season.,
q = number of active days in the quarter, regardless of monitoring season.

3.2.6.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met when the quarterly observation percentage, (3.2.6.3 Observation Percentage), is greater than or equal to 75%.

3.2.7 Annual Summarization of 8-Hour Averages (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES)

3.2.7.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{v} d_j \Big/ v$$

where:

u = mean,
d = valid daily maximum 8-hour average occurring within the effective monitoring season (3.2.5.4 Summary Criteria Indication, 3.2.5.5 Maximum Value),
v = number of valid days in the effective monitoring season (3.2.7.11 Number of Valid Days).

3.2.7.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(v * \sum_{j=1}^{v} d_j^{\,2}\right) - \left(\sum_{j=1}^{v} d_j\right)^2\right)}{\left(v * (v-1)\right)}}$$

where:

σ = standard deviation,
d = valid daily maximum 8-hour average occurring within the effective monitoring season (3.2.5.4 Summary Criteria Indication, 3.2.5.5 Maximum Value),
v = number of valid days in the effective monitoring season (3.2.7.11 Number of Valid Days),

and $v > 1$.

If the number of valid days (3.2.4.12 Number of Valid Days) is exactly 1, then the standard deviation is assigned a value of 0.

3.2.7.3 Number of Observations (ANNUAL_OBS_CNT)

The number of valid 8-hour averages (3.2.1.1 Arithmetic Mean) that were computed for the entire year, regardless of monitoring season.

3.2.7.4 Observation Percentage (ANNUAL_OBS_PCT)

$$p = \left(v \Big/ r\right) * 100$$

where:

p = percentage,
v = number of valid days in the effective monitoring season (3.2.7.11 Number of Valid Days),
r = number of days in effective monitoring season (3.2.7.12 Number of Required Days).

3.2.7.5 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met when the percentage derived from the following formula is greater than or equal to 75%:

$$p = \left((v + a) / r \right) * 100$$

where:

p = percentage,
v = number of valid days in the effective monitoring season (3.2.7.11 Number of Valid Days),
a = number of missing days assumed to be less than the standard (3.2.7.13 Number of Missing Days Assumed to be Less Than the Standard),
r = number of active days in effective monitoring season (3.2.7.12 Number of Required Days).

3.2.7.6 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest valid daily maximum 8-hour averages (3.2.5.4 Summary Criteria Indication, 3.2.5.5 Maximum Value) for the year, regardless of monitoring season.

3.2.7.7 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.2.7.6 Maximum Value), relative to other Maximum Values, in descending value order.

3.2.7.8 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.2.7.6 Maximum Value) was recorded.

3.2.7.9 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of days in the effective monitoring season where the valid daily maximum (3.2.5.5 Maximum Value) exceeds the primary standard.

3.2.7.10 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of days in the effective monitoring season where the valid daily maximum (3.2.5.5 Maximum Value) exceeds the secondary standard.

3.2.7.11 Number of Valid Days (VALID_DAY_CNT)

The number of valid days (3.2.5.4 Summary Criteria Indication) within the effective monitoring season.

3.2.7.12 Number of Required Days (REQ_MONITORING_CNT)

The number of active days within the effective monitoring season.

3.2.7.13 Number of Missing Days Assumed Less Than the Standard (MISSING_DAYS_ASSUMED_LT_STD)

The number of invalid or missing days in the effective monitoring season whose daily maximums are assumed to be less than or equal to the standard. A missing day is assumed to be less than the standard for the following condition:

- The number of valid 8-hour arithmetic averages (3.2.1.1 Arithmetic Mean) for the day was less than 18, and the sum of the following is greater than, or equal, to 18, i.e., 75% of the possible values:

  - Number of valid 8-hour arithmetic averages (3.2.1.1 Arithmetic Mean);
  - Number of missing 8-hour arithmetic averages that would be valid if excluded samples (null or event-qualified) were included, where those excluded samples have concurrence from the Regional Office.

3.2.7.14 Minimum Value (MIN_SAMPLE_VALUE)

The lowest valid 8-hour arithmetic average (3.2.1.1 Arithmetic Mean) that was computed for the year, regardless of monitoring season.

3.2.7.15 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The daily maximum 8-hour average (3.2.5.4 Summary Criteria Indication) at a system-defined percentile (3.2.7.16 Percentile) where there are k daily maximums less than or equal to it, where k is the calculated rank for the percentile (3.2.7.16 Percentile). The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

k = percentile rank
p = percentile (3.2.7.16 Percentile),
n = number of daily maximums.

3.2.7.16 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.2.7.15 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.3 Carbon Monoxide

3.3.1 Running 8-Hour Averaging (NAAQS_AVERAGES)

3.3.1.1 Arithmetic Mean (NAAQS_ARITH_MEAN)

Where there are between 6 and 8 samples in an 8-hour period, (i.e. at least 75% of the required data is present):

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = arithmetic mean,
s = sample value,
n = number of sample values.

3.3.2 Daily Summarization of Hourly Data (DAILY_SUMMARIES)

3.3.2.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.3.2.2 Number of Observations).

3.3.2.2 Number of Observations (DAILY_OBS_CNT)

The number of samples that occurred within the 24-hour period.

3.3.2.3 Observation Percentage (DAILY_OBS_PCT)

$$p = \left(n \Big/ 24 \right) * 100$$

where:

p = observation percentage,
n = number of samples (3.3.2.2 Number of Observations).

3.3.2.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The maximum sample that occurred within the 24-hour period.

3.3.2.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour of the day for which the Maximum Value (3.3.2.4 Maximum Value) was recorded.

3.3.2.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the maximum value (3.3.2.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.3.2.7 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of samples that exceeded the primary standard.

3.3.2.8 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of samples that exceeded the secondary standard.

3.3.3 Quarterly Summarization of Hourly Data (QUARTERLY_SUMMARIES)

3.3.3.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.3.3.2 Number of Observations).

3.3.3.2 Number of Observations (QTR_OBS_CNT)

The number of samples that occurred within the quarter.

3.3.3.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n \Big/ (q * 24) \right) * 100$$

where:

p = observation percentage,
n = number of samples (3.3.3.2 Number of Observations),
q = number of active days in the quarter.

3.3.3.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met where the quarterly observation percentage, (3.3.3.3 Observation Percentage), is greater than, or equal to, 75%.

3.3.4 Annual Summarization of Hourly Data (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.3.4.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.3.4.3 Number of Observations).

3.3.4.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} s_j^{\,2}\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = hourly sample value,
n = number of samples (3.3.4.3 Number of Observations).

and $o > 1$.

If the number of samples (3.3.4.3 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.3.4.3 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that occurred within the calendar year.

3.3.4.4 Observation Percentage (ANNUAL_OBS_PCT)

$$p = \left(n / (a * 24) \right) * 100$$

where:

p = percentage,
n = number of samples (3.3.4.3 Number of Observations),
a = number of active days in the calendar year.

3.3.4.5 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met where the annual observation percentage, (3.3.4.4 Observation Percentage), is greater than, or equal to, 75%.

3.3.4.6 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest sample values for the year.

3.3.4.7 Maximum Level (MAX_LEVEL)

The numeric rank of the Maximum Value (3.3.4.6 Maximum Value), relative to other Maximum Values, in descending value order.

3.3.4.8 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which the Maximum Value (3.3.4.6 Maximum Value) was recorded.

3.3.4.9 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of samples in the year that exceeded the primary standard.

3.3.4.10 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of samples in the year that exceeded the secondary standard.

3.3.4.11 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample value that occurred in the year.

3.3.4.12 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified samples that occurred within the calendar year.

3.3.4.13 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the calendar year.

3.3.4.14 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the calendar year whose standard values were less than the applicable MDL.

3.3.4.15 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies that were used to collect and analyze the samples during the calendar year.

3.3.4.16 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The standard sample value at a system-defined percentile (3.3.4.17 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.3.4.17 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.3.4.17 Percentile),
k = calculated rank for percentile *p*,
n = number of observations (3.3.4.3 Number of Observations).

3.3.4.17 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.3.4.16 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.3.4.18 Protocols (MP_MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year.

3.3.5 Daily Summarization of 8-Hour Averages (DAILY_SUMMARIES)

3.3.5.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 8-hour arithmetic mean (3.3.1.1 Arithmetic Mean),
n = number of valid 8-hour averages (3.3.5.2 Number of Observations).

3.3.5.2 Number of Observations (DAILY_OBS_CNT)

The number of valid 8-hour averages (3.3.1.1 Arithmetic Mean) that were computed for the 24-hour period.

3.3.5.3 Observation Percentage (DAILY_OBS_PCT)

$$p = \left(n / 24 \right) * 100$$

where:

p = observation percentage,
n = number of valid 8-hour averages (3.3.5.2 Number of Observations).

3.3.5.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The maximum valid 8-hour average (3.3.1.1 Arithmetic Mean) for the 24-hour period, and the hour for which it was computed.

3.3.5.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour of the day for which the Maximum Value (3.3.5.4 Maximum Value) was computed.

3.3.5.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.3.5.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.3.5.7 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of valid 8-hour averages (3.3.1.1 Arithmetic Mean) for the 24-hour period that exceed the primary standard.

3.3.5.8 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of valid 8-hour averages (3.3.1.1 Arithmetic Mean) for the 24-hour period that exceed the secondary standard.

3.3.5.9 Number of Non-Overlapping Exceedances (NON_OVERLAPPING_AVG_GT_STD)

The number of primary exceedances (3.3.5.7 Number of Primary Exceedances) with 8 or more hours between any other exceedances.

3.3.6 Quarterly Summarization of 8-Hour Averages (QUARTERLY_SUMMARIES)

3.3.6.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 8-hour average (3.3.1.1 Arithmetic Mean),
n = number of valid 8-hour averages (3.3.6.2 Number of Observations).

3.3.6.2 Number of Observations (QTR_OBS_CNT)

The number of valid 8-hour averages (3.3.1.1 Arithmetic Mean) that were computed for the quarter.

3.3.6.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n / (q * 24) \right) * 100$$

where:

p = observation percentage,
n = number of valid 8-hour averages (3.3.6.2 Number of Observations),
q = number of active days in the quarter.

3.3.6.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met where the quarterly observation percentage, (3.3.6.3 Observation Percentage), is greater than, or equal to, 75%.

3.3.7 Annual Summarization of 8-Hour Averages (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES)

3.3.7.1 Number of Observations (ANNUAL_OBS_CNT)

The number of valid 8-hour averages (3.3.1.1 Arithmetic Mean) that were computed for the calendar year.

3.3.7.2 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met where the annual number of valid 8-hour averages, (3.3.7.1 Number of Observations), is greater than 0.

3.3.7.3 Actual Maximum Value (MAX_SAMPLE_VALUE)

The ten highest valid 8-hour averages (3.3.1.1 Arithmetic Mean) of the year, regardless of whether they overlap, and the dates and hours for which each was computed.

3.3.7.4 Non-Overlapping Maximum Value (MAX_SAMPLE_VALUE)

The two highest valid 8-hour averages (3.3.1.1 Arithmetic Mean) of the year where there is at least one other non-overlapping average that is greater than, or equal to, the second highest average, and the dates and hours for which each was computed. (Note: The first actual maximum (3.3.7.3 Actual Maximum Value) is always the first non-overlapping maximum.)

In the following example, the fourth actual maximum is the second non-overlapping maximum because, while it overlaps the first and second actual maximums, it does not overlap the third. Since the second actual overlaps the first, and the third overlaps both the first and second, neither one qualifies to be the second non-overlapping maximum.

Actual Rank	8-Hour Average (mg)	Date/Time	Does it overlap all of the higher values?
1	16	Dec. 8 10:01 AM – 6:00 PM	--
2	15	Dec. 8 9:01 AM – 5:00 PM	Yes
3	15	Dec. 8 11:01 AM – 7:00 PM	Yes
4	14	Dec. 8 3:01 AM – 11:00 AM	No
5	13	Nov. 20 10:01 AM – 6:00 PM	
6	13	Nov. 11 11:01 AM – 7:00 PM	
7	13	Feb. 9 9:01 AM – 5:00 PM	
8	12	Nov. 11 10:01 AM – 6:00 PM	
9	12	Oct. 29 10:01 AM – 6: 00 PM	

3.3.7.5 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.3.7.3 Actual Maximum Value, 3.3.7.4 Non-Overlapping Maximum Value), relative to other Maximum Values, in descending value order.

3.3.7.6 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.3.7.3 Actual Maximum Value, 3.3.7.4 Non-Overlapping Maximum Value) was recorded.

3.3.7.7 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of valid 8-hour averages (3.3.1.1 Arithmetic Mean) in the year that exceed the primary standard.

3.3.7.8 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of valid 8-hour averages (3.3.1.1 Arithmetic Mean) in the year that exceed the he secondary standard.

3.3.7.9 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

The number of days in the year where the maximum 8-hour average (3.3.5.4 Maximum Value) exceeds the alert level.

3.3.7.10 Number of Non-Overlapping Exceedances (NON_OVERLAPPING_AVG_GT_STD)

The number of primary exceedances (3.3.7.7 Number of Primary Exceedances) with 8 or more hours between any other exceedances.

3.3.7.11 Minimum Value (MIN_SAMPLE_VALUE)

The lowest valid 8-hour arithmetic mean (3.3.1.1 Arithmetic Mean) computed for the year.

3.3.7.12 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The valid 8-hour average (3.3.1.1 Arithmetic Mean) at a system-defined percentile (3.3.7.13 Percentile) where there are *k* valid 8-hour averages less than or equal to it, where *k* is the calculated rank for the percentile (3.3.7.13 Percentile) with the valid 8-hour averages ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.3.7.13 Percentile),
k = calculated rank for percentile *p*,
n = number of valid 8-hour averages (3.3.7.1 Number of Observations).

3.3.7.13 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.3.7.12 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.4 Sulfur Dioxide

3.4.1 Block 3-Hour Average (NAAQS_AVERAGES)

3.4.1.1 Arithmetic Mean (NAAQS_ARITH_MEAN)

When there are 3 hourly samples in a 3-hour block:

$$u = \sum_{j=1}^{3} s_j \Big/ 3$$

where:

u = arithmetic mean,
s = sample value.

When there less than 3 hourly samples in a 3-hour block:

$$u = \sum_{j=1}^{n} s_j \Big/ 3$$

where:

u= arithmetic mean,
s = 1-hour sample value,
n = number of 1-hour sample values,

and u exceeds the secondary standard.

3.4.2 Block 24-Hour Average (NAAQS_AVERAGES)

3.4.2.1 Arithmetic Mean (NAAQS_ARITH_MEAN)

When there are between 18 and 24 hourly samples in an 24-hour period, (i.e. at least 75% of the required data is present):

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = arithmetic mean,
s = sample value,
n = number of samples.

When there are less than 18 hourly samples in a 24-hour period:

$$u = \sum_{j=1}^{n} s_j \Big/ 24$$

where:

u= arithmetic mean,
s = sample value,
n = number of samples,

and *u* exceeds the primary standard.

3.4.3 Daily Summarization of Daily Data (DAILY_SUMMARIES)

3.4.3.1 Arithmetic Mean

$$u = s$$

where:

u = mean,
s = daily sample value.

3.4.3.2 Number of Observations

The number of daily sample values for the 24-hour period, i.e., 1.

3.4.3.3 Observation Percentage

$$p = (n / 1) * 100$$

where:

p = observation percentage,
n = number of daily samples (3.4.3.2 Number of Observations).

i.e., 100.

3.4.3.4 Maximum Value

The sample value for the 24-hour period.

3.4.3.5 Maximum Collection Hour

The hour at which the Maximum Value (3.4.3.4 Maximum Value) was started.

3.4.3.6 Daily Ranking Number

The rank of the daily sample values (3.4.3.4 Maximum Value) relative to all other daily sample values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.4.3.7 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of samples that exceeded the primary standard.

3.4.3.8 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of samples that exceeded the secondary standard.

3.4.4 Quarterly Summarization of Daily Data (QUARTERLY_SUMMARIES)

3.4.4.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.4.4.2 Number of Observations).

3.4.4.2 Number of Observations (QTR_OBS_CNT)

The number of samples that occurred within the quarter.

3.4.4.3 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met where the number of observations, (3.4.4.2 Number of Observations), is greater than, or equal to, 12.

3.4.5 Annual Summarization of Daily Data (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.4.5.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,

n = number of samples (3.4.5.3 Number of Observations) .

3.4.5.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} s_j^{\,2}\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
n = number of samples (3.4.5.3 Number of Observations),
s = sample value,

and $n > 1$.

If the number of samples (3.4.5.3 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.4.5.3 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that occurred within the year.

3.4.5.4 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met when each of the four quarters in the year have met criteria (3.4.4.3 Summary Criteria Indication).

3.4.5.5 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest samples for the year.

3.4.5.6 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.4.5.5 Maximum Value), relative to other Maximum Values, in descending value order.

3.4.5.7 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.4.5.5 Maximum Value) was recorded.

3.4.5.8 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample for the year.

3.4.5.9 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL)

The number of samples in the year that exceeded the primary standard.

3.4.5.10 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

The number of samples in the year that exceeded the alert level.

3.4.5.11 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified, both natural and exceptional, samples that occurred within the year.

3.4.5.12 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the year.

3.4.5.13 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the year whose standard values are less than the applicable MDL.

3.4.5.14 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the samples during the year.

3.4.5.15 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The standard sample value at a system-defined percentile (3.4.5.16 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.4.5.16 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.4.5.16 Percentile),
k = calculated rank for percentile *p*,
n = number of observations (3.4.5.3 Number of Observations).

3.4.5.16 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.4.5.15 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.4.5.17 Protocols (MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year.

3.4.6 Daily Summarization of 3-Hour Block Averages (DAILY_SUMMARIES)

3.4.6.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 3-hour average (3.4.1.1 Arithmetic Mean),
n = number of valid 3-hour averages (3.4.6.2 Number of Observations).

3.4.6.2 Number of Observations (DAILY_OBS_CNT)

The number of valid 3-hour averages (3.4.1.1 Arithmetic Mean) that were computed for the 24-hour period.

3.4.6.3 Observation Percentage (DAILY_OBS_PCT)

$$p = \left(n / 8 \right) * 100$$

where:

p = observation percentage,
n = number of valid 3-hour averages (3.4.6.2 Number of Observations).

3.4.6.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The maximum valid 3-hour average (3.4.1.1 Arithmetic Mean) for the 24-hour period.

3.4.6.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour of the day for which the Maximum Value (3.4.6.4 Maximum Value) was computed.

3.4.6.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.4.6.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.4.6.7 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of valid 3-hour averages (3.4.1.1 Arithmetic Mean) that exceed the secondary standard.

3.4.7 Quarterly Summarization of 3-Hour Block Averages (QUARTERLY_SUMMARIES)

3.4.7.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 3-hour average (3.4.1.1 Arithmetic Mean),
n = number of valid 3-hour averages (3.4.7.2 Number of Observations).

3.4.7.2 Number of Observations (QTR_OBS_CNT)

The number of valid 3-hour averages (3.4.1.1 Arithmetic Mean) that were computed for the quarter.

3.4.7.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n \Big/ (q * 8) \right) * 100$$

where:

p = observation percentage,
n = number of valid 3-hour averages (3.4.7.2 Number of Observations),
q = number of active days in the quarter.

3.4.7.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met when the quarterly observation percentage, (3.4.7.3 Observation Percentage), is greater than, or equal to, 75%.

3.4.8 Annual Summarization of 3-Hour Block Averages (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES)

3.4.8.1 Number of Observations (ANNUAL_OBS_CNT)

The number of valid 3-hour averages (3.4.1.1 Arithmetic Mean) that were computed for the year.

3.4.8.2 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met when the annual number of valid 3-hour block averages, (3.4.8.1 Number of Observations), is greater than 0.

3.4.8.3 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest valid 3-hour averages (3.4.1.1 Arithmetic Mean) for the year.

3.4.8.4 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.4.8.3 Maximum Value), relative to other Maximum Values, in descending value order.

3.4.8.5 Maximum Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.4.8.3 Maximum Value) was computed.

3.4.8.6 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of valid 3-hour averages (3.4.1.1 Arithmetic Mean) that exceed the secondary standard.

3.4.8.7 Minimum Value (MIN_SAMPLE_VALUE)

The lowest valid 3-hour average (3.4.1.1 Arithmetic Mean) for the year.

3.4.8.8 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The valid 3-hour average (3.4.1.1 Arithmetic Mean) at a system-defined percentile (3.4.8.9 Percentile) where there are *k* valid 3-hour averages less than or equal to it, where *k* is the calculated rank for the percentile (3.4.8.9 Percentile) with the valid 3-hour averages ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.4.8.9 Percentile),
k = calculated rank for percentile *p*,
n = number of valid 3-hour averages (3.4.8.1 Number of Observations).

3.4.8.9 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.4.8.8 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.4.9 Daily Summarization of 24-Hour Block Averages (DAILY_SUMMARIES)

3.4.9.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = s$$

where:

u = mean,
s = valid 24-hour arithmetic mean (3.4.2.1 Arithmetic Mean).

3.4.9.2 Number of Observations (DAILY_OBS_CNT)

The number of valid 24-hour averages (3.4.2.1 Arithmetic Mean) computed for the 24-hour period, i.e., 1.

3.4.9.3 Observation Percentage (DAILY_OBS_PCT)

$$p = (n / 1) * 100$$

where:

p = observation percentage,
n = number of valid 24-hour averages (3.4.9.2 Number of Observations).

i.e., 100.

3.4.9.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The valid 24-hour average for the 24-hour period, (3.4.2.1 Arithmetic Mean).

3.4.9.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour of the day for which the Maximum Value (3.4.9.4 Maximum Value) was computed. (The value will always be 23, by rule.)

3.4.9.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.4.9.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.4.9.7 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of valid 24-hour averages (3.4.2.1 Arithmetic Mean) that exceeded the primary standard, i.e., 0 or 1.

3.4.10 Quarterly Summarization of 24-Hour Block Average (QUARTERLY_SUMMARIES)

3.4.10.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 24-hour average (3.4.2.1 Arithmetic Mean),
n = number of valid 24-hour averages (3.4.10.2 Number of Observations).

3.4.10.2 Number of Observations (QTR_OBS_CNT)

The number of valid 24-hour averages (3.4.2.1 Arithmetic Mean) that were computed for the quarter.

3.4.10.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n / q \right) * 100$$

where:

p = observation percentage,
n = number of valid 24-hour averages (3.4.10.2 Number of Observations),
q = number of active days in the quarter.

3.4.10.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met when the quarterly observation percentage, (3.4.10.3 Observation Percentage), is greater than, or equal to, 75%.

3.4.11 Annual Summarization of 24-Hour Block Averages (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES)

3.4.11.1 Number of Observations (ANNUAL_OBS_CNT)

The number of valid 24-hour block averages (3.4.2.1 Arithmetic Mean) computed for the year.

3.4.11.2 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met when the number of valid 24-hour block averages, (3.4.11.1 Number of Observations), is greater than 0.

3.4.11.3 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest valid 24-hour block averages (3.4.2.1 Arithmetic Mean) for the year, and the dates and hours for which each was computed.

3.4.11.4 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.4.11.3 Maximum Value), relative to other Maximum Values, in descending value order.

3.4.11.5 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.4.11.3 Maximum Value) was recorded.

3.4.11.6 Minimum Value (MIN_SAMPLE_VALUE)

The lowest 24-hour block average (3.4.2.1 Arithmetic Mean) for the year.

3.4.11.7 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL)

The number of valid 24-hour block averages (3.4.2.1 Arithmetic Mean) that exceed the primary standard.

3.4.11.8 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

The number of valid 24-hour block averages (3.4.2.1 Arithmetic Mean) that exceed the alert level.

3.4.11.9 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The valid 24-hour block average (3.4.2.1 Arithmetic Mean) at a system-defined percentile (3.4.11.10 Percentile) where there are *k* valid 24-hour block averages less than or equal to it, where *k* is the calculated rank for the percentile (3.4.11.10 Percentile) with the valid 24-hour block averages ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.4.11.10 Percentile),
k = calculated rank for percentile *p*,
n = number of valid 24-hour block averages (3.4.11.1 Number of Observations).

3.4.11.10 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.4.11.9 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.5 Nitrogen Dioxide

3.5.1 Daily Summarization of Daily Data (DAILY_SUMMARIES)

3.5.1.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = s$$

where:

u = mean,
s = daily sample value.

3.5.1.2 Number of Observations (DAILY_OBS_CNT)

The number of daily sample values for the 24-hour period, i.e., 1.

3.5.1.3 Observation Percentage (DAILY_OBS_PCT)

$$p = (n / 1) * 100$$

where:

p = observation percentage,
n = number of daily samples (3.5.1.2 Number of Observations).

i.e., 100.

3.5.1.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The sample value for the 24-hour period.

3.5.1.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour at which the Maximum Value (3.5.1.4 Maximum Value) was recorded.

3.5.1.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.5.1.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.5.2 Quarterly Summarization of Daily Data (QUARTERLY_SUMMARIES)

3.5.2.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.5.2.2 Number of Observations).

3.5.2.2 Number of Observations (QTR_OBS_CNT)

The number of samples that occurred within the quarter.

3.5.2.3 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met when the quarterly number of observations, (3.5.2.2 Number of Observations), is greater than, or equal to, 12.

3.5.3 Annual Summarization (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.5.3.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.5.3.3 Number of Observations).

3.5.3.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} {s_j}^2\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = daily sample value,
n = number of samples (3.5.3.3 Number of Observations).

and $n > 1$.

If the number of samples (3.5.3.3 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.5.3.3 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that occurred within the year.

3.5.3.4 Observation Percentage (ANNUAL_OBS_PCT)

Where the samples are hourly:

$$p = \left(n / (a * 24) \right) * 100$$

where:

p = percentage,
n = number of samples (3.5.3.3 Number of Observations),
a = number of active days in the calendar year.

Where the samples are daily, the field is not assigned a value.

3.5.3.5 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Where the samples are hourly, minimum summary criteria are met when the annual observation percentage, (3.5.3.4 Observation Percentage), is greater than, or equal to, 75%.

Where the samples are daily, minimum summary criteria are met when each of the four quarters in the year have met criteria (3.5.2.3 Summary Criteria Indication).

3.5.3.6 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest samples for the year.

3.5.3.7 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.5.3.5 Maximum Value), relative to other Maximum Values, in descending value order.

3.5.3.8 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.5.3.5 Maximum Value) was recorded.

3.5.3.9 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

If the annual arithmetic mean (3.5.3.1 Arithmetic Mean) exceeds the primary standard, then 1; otherwise, 0.

3.5.3.10 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

If the annual arithmetic mean (3.5.3.1 Arithmetic Mean) exceeds the secondary standard, then 1; otherwise, 0.

3.5.3.11 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

If the annual arithmetic mean (3.5.3.1 Arithmetic Mean) exceeds the alert level, then 1; otherwise, 0.

3.5.3.12 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample value for the year.

3.5.3.13 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified, both natural and exceptional, samples that occurred within the calendar year.

3.5.3.14 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the calendar year.

3.5.3.15 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the calendar year whose standard values were less than the applicable MDL.

3.5.3.16 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the samples during the calendar year.

3.5.3.17 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The standard sample value at a system-defined percentile (3.5.3.18 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.5.3.18 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.5.3.18 Percentile),
k = calculated rank for percentile *p*,
n = number of observations (3.5.3.3 Number of Observations).

3.5.3.18 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.5.3.17 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.5.3.19 Protocols (MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year.

3.6 PM 10

3.6.1 24-Hour Block Average (NAAQS_AVERAGES)

3.6.1.1 Arithmetic Mean

Where there are between 18 and 24 hourly samples in an 24-hour period, (i.e. at least 75% of the required data is present):

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = arithmetic mean,
s = 1-hour sample value,
n = number of 1-hour sample values.

Where there are less than 18 hourly samples in a 24-hour period:

$$u = \sum_{j=1}^{n} s_j \Big/ 24$$

where:

u= arithmetic mean,
s = 1-hour sample value,
n = number of 1-hour sample values,

and *u*, when rounded to -1 places, (i.e., to the nearest 10), exceeds the primary standard.

3.6.2 Daily Summarization of Daily Data (DAILY_SUMMARIES)

3.6.2.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = s$$

where:

u = mean,
s = daily sample value.

3.6.2.2 Number of Observations (DAILY_OBS_CNT)

The number of daily sample values for the 24-hour period, i.e., 1.

3.6.2.3 Observation Percentage (DAILY_OBS_PCT)

$$p = (n / 1) * 100$$

where:

p = observation percentage,
n = number of daily samples (3.6.2.2 Number of Observations).

i.e., 100.

3.6.2.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The sample value for the 24-hour period.

3.6.2.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour at which the Maximum Value (3.6.2.4 Maximum Value) was recorded.

3.6.2.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.6.2.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.6.2.7 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of sample values for the 24-hour period that exceeded the primary standard, i.e., 0 or 1.

3.6.2.8 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of sample values for the 24-hour period that exceeded the secondary standard, i.e., 0 or 1.

3.6.3 Quarterly Summarization of Daily Data (QUARTERLY_SUMMARIES)

3.6.3.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.6.3.2 Number of Observations).

3.6.3.2 Number of Observations (QTR_OBS_CNT)

The number of samples that occurred within the quarter.

3.6.3.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(v / q \right) * 100$$

where:

p = observation percentage,
v = number of valued strata,
q = number of scheduled strata.

A valid stratum is one where the scheduled day occurs in the quarter and at least one observation occurs in the stratum.

Scheduled days are the number of days within the quarter that were scheduled for sampling, as determined by the EPA-defined calendar for the required collection frequency, and which also fall within the period of operation, as defined by sampling periods.

Seasonal and random frequencies are sub-divided in monthly required frequencies; otherwise, the required frequency applies to a defined period of time

The reference point for the EPA calendar is January 4, 1956. For example, in the year 2003, the every 6th day calendar would comprise: 1/3/2003, 1/9/2003, 1/15/2003, etc., and the every 3rd day calendar would comprise: 1/3/2003, 1/6/2003, 1/9/2003, 1/12/2003, etc. For a monitor doing seasonal sampling, with every 6th day sampling in April and every 3rd day sampling in May, both months in 2003, the schedule would be as follows: …, 4/15/03, 4/21/03, 4/27/03, 5/3/03, 5/6/03, 5/9/03, etc.

3.6.3.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met when the quarterly observation percentage, (3.6.3.3 Observation Percentage), is greater than, or equal to, 75%.

3.6.4 Annual Summarization of Daily Data (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.6.4.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.6.4.3 Number of Observations).

3.6.4.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} s_j^{\,2}\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = daily sample value,
n = number of samples (3.6.4.3 Number of Observations).

and $n > 1$.

If the number of samples (3.6.4.3 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.6.4.3 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that occurred within the year.

3.6.4.4 Observation Percentage (ANNUAL_OBS_PCT)

$$p = \left(v / r\right) * 100$$

where:

p = percentage,
v = number of valid days (3.6.4.12 Number of Valid Days),
m = number of scheduled (i.e., required), days(3.6.4.13 Number of Required Days).

3.6.4.5 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met when each of the four quarters in the year have met criteria (2.5.2.3 Summary Criteria Indication).

3.6.4.6 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest samples for the year.

3.6.4.7 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.6.4.6 Maximum Value), relative to other Maximum Values, in descending value order.

3.6.4.8 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.6.4.6 Maximum Value) was recorded.

3.6.4.9 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of samples in the year that exceeded the primary standard.

3.6.4.10 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of samples in the year that exceeded the secondary standard.

3.6.4.11 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

The number of samples in the year that exceeded the alert level.

3.6.4.12 Number of Valid Days (VALID_DAY_CNT)

The number of valued strata in the year. (A valued stratum is where at least one observation is made on, or after, a scheduled day, but before the next scheduled day.)

3.6.4.13 Number of Required Days (REQ_MONITORING_CNT)

Scheduled days are the number of days within the year that were scheduled for sampling, as determined by the EPA-defined calendar for the required collection frequency, and which also fall within the period of operation, as defined by sampling periods.

Seasonal and random frequencies are sub-divided in monthly required frequencies; otherwise, the required frequency applies to a defined period of time. A PM10 monitor must have a defined collection frequency for each active day, by rule.

The reference point for the EPA calendar is January 4, 1956. For example, in the year 2003, the every 6th day calendar would comprise: 1/3/2003, 1/9/2003, 1/15/2003, etc., and the every 3rd day calendar would comprise: 1/3/2003, 1/6/2003, 1/9/2003, 1/12/2003, etc. For a monitor doing seasonal sampling, with every 6th day sampling in April and every 3rd day sampling in May, both months in 2003, the schedule would be as follows: …, 4/15/03, 4/21/03, 4/27/03, 5/3/03, 5/6/03, 5/9/03, etc.

3.6.4.14 Estimated Number of Days Greater Than the Standard (EST_DAYS_GT_STD)

The estimated number of exceedances for the year:

$$e = \sum_{q=1}^{4} e_q$$

where:

e = estimated number of exceedances for the year,
e_q = the estimated number of exceedances for calendar quarter q,
q = the index for calendar quarter, q=1, 2, 3 or 4.

The estimate of the expected number of exceedances for a quarter is calculated using the following formula:

$$e = \left(\frac{a}{v}\right) * \sum_{j=1}^{v} \left(\frac{x_j}{n_j}\right)$$

where:

e = the estimated number of exceedances for calendar quarter q,
a = the number of days in calendar quarter q,
v = the number of valued strata in calendar quarter q,
x_j = the number of exceedances in stratum j,
n_j = the number of observations in stratum j.

The quarterly exceedance estimate is set to 1 for a calendar quarter in which the first observed exceedance has occurred if:

1. there was only one exceedance in the calendar quarter,
2. everyday sampling is subsequently initiated and maintained for 4 calendar quarters, in accordance with 40 CFR 58.13,
3. data capture of 75 percent is achieved during the required period of everyday sampling.

In addition, if the first exceedance is observed in a calendar quarter in which the monitor is already sampling every day, no adjustment for missing data will be made to the first exceedance if a 75 percent data capture rate was achieved in the quarter in which it was observed.

3.6.4.15 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample value for the year.

3.6.4.16 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified, both natural and exceptional, samples that occurred within the year.

3.6.4.17 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the year.

3.6.4.18 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the year whose standard values were less than the applicable MDL.

3.6.4.19 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the samples during the year.

3.6.4.20 Weighted Arithmetic Mean (WEIGHTED_ARITH_MEAN)

When the minimum collection frequency is neither seasonal, nor every day:

$$\frac{\sum_{k=1}^{q}\left(\frac{\sum_{j=1}^{s}\left(\frac{\sum_{i=1}^{n} v_i}{n}\right)_j}{s}\right)_k}{q}$$

where:

i = a sample value occurrence,
n = number of sample values in a stratum,
v_i = a sample value,
j = a valued stratum,
s = number of valued strata,
k = a quarter with valued strata,
q = number of quarters with valued strata.

When the minimum collection frequency is either seasonal, or every day:

$$\sum_{i=1}^{q} u_i \Big/ q$$

where:

i = quarter,
u_i = quarterly arithmetic mean (3.6.3.1 Arithmetic Mean),
q = number of active quarters.

3.6.4.21 Minimum Collection Frequency (CF_COLL_FREQ_CODE)

The minimum collection frequency report for the samples that occurred within the year.

3.6.4.22 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The standard sample value at a system-defined percentile (3.6.4.23 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.6.4.23 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.6.4.23 Percentile),
k = calculated rank for percentile *p*,
n = number of samples (3.6.4.3 Number of Observations).

3.6.4.23 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.6.4.22 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.6.4.24 Protocols (MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year.

3.6.5 Daily Summarization of 24-Hour Block Averages (DAILY_SUMMARIES)

3.6.5.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = s$$

where:

u = mean,
s = valid 24-hour arithmetic mean (3.6.1.1 Arithmetic Mean).

3.6.5.2 Number of Observations

The number of valid 24-hour averages (3.6.1.1 Arithmetic Mean) computed for the 24-hour period, i.e., 1.

3.6.5.3 Observation Percentage

$$p = (n / 1) * 100$$

where:

p = observation percentage,
n = number of valid 24-hour averages (3.6.5.2 Number of Observations).

i.e., 100.

3.6.5.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The valid 24-hour average (3.6.1.1 Arithmetic Mean) for the 24-hour period.

3.6.5.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour at which the Maximum Value (3.6.5.4 Maximum Value) was recorded, (which is 23 for 24-hour block averages, by rule).

3.6.5.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.6.5.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.6.5.7 Number of Primary Exceedances

The number of valid 24-hour averages (3.6.1.1 Arithmetic Mean) that exceeded the primary standard, i.e., 0 or 1.

3.6.5.8 Number of Secondary Exceedances

The number of valid 24-hour averages (3.6.1.1 Arithmetic Mean) that exceeded the secondary standard, i.e., 0 or 1.

3.6.6 Quarterly Summarization of 24-Hour Block Averages (QUARTERLY_SUMMARIES)

3.6.6.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 24-hour block average (3.6.1.1 Arithmetic Mean),
n = number of valid 24-hour block averages (3.6.6.2 Number of Observations).

3.6.6.2 Number of Observations (QTR_OBS_CNT)

The number of valid 24-hour block averages (3.6.1.1 Arithmetic Mean) computed for the quarter.

3.6.6.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n \Big/ q \right) * 100$$

where:

p = observation percentage,
n = number of valid 24-hour block averages (3.6.6.2 Number of Observations),
q = number of active days in the quarter.

3.6.6.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met where the quarterly observation percentage, (3.6.6.3 Observation Percentage), is greater than, or equal to, 75%.

3.6.7 Annual Summarization of 24-Hour Block Averages (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES)

3.6.7.1 Number of Observations (ANNUAL_OBS_CNT)

The number of valid 24-hour block averages (3.6.1.1 Arithmetic Mean) computed for the year.

3.6.7.2 Observation Percentage (ANNUAL_OBS_PCT)

$$p = \left(v / r \right) * 100$$

where:

p = observation percentage,
v = number of valid days (3.6.7.10 Number of Valid Days),
r = number of required days (3.6.7.11 Number of Required Days).

3.6.7.3 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met when each of the four quarters in the year have met criteria (3.6.6.4 Summary Criteria Indication).

3.6.7.4 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest valid 24-hour block averages (3.6.1.1 Arithmetic Mean) for the year.

3.6.7.5 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.6.7.4 Maximum Value), relative to other Maximum Values, in descending value order.

3.6.7.6 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.6.7.4 Maximum Value) was recorded.

3.6.7.7 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of valid 24-hour block averages (3.6.1.1 Arithmetic Mean) in the year that exceed the primary standard.

3.6.7.8 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of valid 24-hour block averages (3.6.1.1 Arithmetic Mean) in the year that exceed the secondary standard.

3.6.7.9 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

The number of valid 24-hour block averages (3.6.1.1 Arithmetic Mean) in the year that exceed the alert level.

3.6.7.10 Number of Valid Days (VALID_DAY_CNT)

The number of valid 24-hour block averages (3.6.1.1 Arithmetic Mean) within the year. (Same as 3.6.7.1 Number of Observations.)

3.6.7.11 Number of Required Days (REQ_MONITORING_CNT)

The number of active days in the year.

3.6.7.12 Estimated Number of Days Greater Than the Standard (EST_DAYS_GT_STD)

The estimated number of exceedances for the year:

$$e = \sum_{q=1}^{4} e_q$$

where:

e = estimated number of exceedances for the year,
e_q = the estimated number of exceedances for calendar quarter q,
q = the index for calendar quarter, q=1, 2, 3 or 4.

The estimate of the expected number of exceedances for a quarter is calculated using the following formula:

$$e = v * \left(\frac{a}{n}\right)$$

where:

e = the estimated number of exceedances for calendar quarter q,
v = the observed number of exceedances for calendar quarter q,
a = the number of days in calendar quarter q,
n = the number of observations (3.6.6.2 Number of Observations) in calendar quarter q.

The quarterly exceedance estimate is set to 1 for a calendar quarter in which the first observed exceedance has occurred if:

1. there was only one exceedance in the calendar quarter,

2. everyday sampling is subsequently initiated and maintained for 4 calendar quarters in accordance with 40 CFR 58.13,
3. data capture of 75 percent is achieved during the required period of everyday sampling.

In addition, if the first exceedance is observed in a calendar quarter in which the monitor is already sampling every day, no adjustment for missing data will be made to the first exceedance if a 75 percent data capture rate was achieved in the quarter in which it was observed.

3.6.7.13 Minimum Value (MIN_SAMPLE_VALUE)

The lowest valid 24-hour block average (3.6.1.1 Arithmetic Mean) computed for the year.

3.6.7.14 Weighted Arithmetic Mean (WEIGHTED_ARITH_MEAN)

$$\sum_{i=1}^{q} u_i \Big/ q$$

where:

i = quarter,
u_i = quarterly arithmetic mean (3.6.6.1 Arithmetic Mean),
q = number of active quarters.

3.6.7.15 Minimum Collection Frequency (CF_COLL_FREQ_CODE)

The minimum reported collection frequency for the daily samples during the year. (Always '1' for 24-hour block averages.)

3.6.7.16 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The valid 24-hour block average (3.6.1.1 Arithmetic Mean) at a system-defined percentile (3.6.7.17 Percentile) where there are *k* valid 24-hour block averages less than or equal to it, where *k* is the calculated rank for the percentile (3.6.7.17 Percentile) with the valid 24-hour block averages ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.6.7.17 Percentile),
k = calculated rank for percentile *p*,
n = number of valid 24-hour block averages (3.6.7.1 Number of Observations).

3.6.7.17 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.6.7.16 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.7 PM 2.5

3.7.1 Block 24-Hour Average (NAAQS_AVERAGES)

3.7.1.1 Arithmetic Mean (NAAQS_ARITH_MEAN)

Where there are between 18 and 24 hourly samples in an 24-hour period, (i.e. at least 75% of the required data is present):

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = arithmetic mean,
s = 1-hour sample value,
n = number of 1-hour sample values.

Where there are less than 18 hourly samples in a 24-hour period:

$$u = \sum_{j=1}^{n} s_j \Big/ 24$$

where:

u= arithmetic mean,
s = 1-hour sample value,
n = number of 1-hour sample values,

and u, when rounded to zero places, i.e., to the nearest integer, exceeds the primary standard.

3.7.2 Daily Summarization of Daily Data (DAILY_SUMMARIES)

3.7.2.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = s$$

where:

u = mean,
s = daily sample value.

3.7.2.2 Number of Observations (DAILY_OBS_CNT)

The number of daily sample values for the 24-hour period, i.e., 1.

3.7.2.3 Observation Percentage (DAILY_OBS_PCT)

$$p = (n / 1) * 100$$

where:

p = observation percentage,
n = number of daily samples (3.7.2.2 Number of Observations).

i.e., 100.

3.7.2.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The sample value for the 24-hour period.

3.7.2.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour at which the Maximum Value (3.7.2.4 Maximum Value) was recorded.

3.7.2.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.7.2.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.7.2.7 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of sample values for the 24-hour period that exceeded the primary standard, i.e., 0 or 1.

3.7.2.8 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of sample values for the 24-hour period that exceeded the secondary standard, i.e., 0 or 1.

3.7.3 Quarterly Summarization of Daily Data (QUARTERLY_SUMMARIES)

3.7.3.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.7.3.2 Number of Observations).

3.7.3.2 Number of Observations (QTR_OBS_CNT)

The number of samples that occurred within the quarter.

3.7.3.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(v / r \right) * 100$$

where:

p = observation percentage,
v = number of valid days,
r = number of scheduled days.

Valid days are equal to the sum of valued, scheduled sampling days, plus make-ups for missing scheduled days. A make-up day is a sample recorded in the same stratum as, or exactly seven days after, a missing scheduled sample. In both conditions, the make-up sample must occur within the same quarter as the missed sample. A maximum of five make-up samples are allowed per quarter.

Scheduled days are the number of days within the quarter that were scheduled for sampling, as determined by the EPA-defined calendar for the required collection frequency, and which also fall within a period of operation, as defined in sampling periods.

Seasonal and random frequencies are sub-divided in monthly required frequencies; otherwise, the required frequency applies to a defined period of time. A PM2.5 monitor must have a defined collection frequency for each active day, by rule.

The reference point for the EPA calendar is January 4, 1956. For example, in the year 2003, the every 6th day calendar would comprise: 1/3/2003, 1/9/2003, 1/15/2003, etc., and the every 3rd day calendar would comprise: 1/3/2003, 1/6/2003, 1/9/2003, 1/12/2003, etc. For a monitor doing seasonal sampling, with every 6th day sampling in April and every 3rd day sampling in May, the scheduled days for 2003 would be as follows: …, 4/15/03, 4/21/03, 4/27/03, 5/3/03, 5/6/03, 5/9/03, etc.

3.7.3.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met where the quarterly observation percentage, (3.7.3.3 Observation Percentage), is greater than, or equal to, 75%.

3.7.4 Annual Summarization of Daily Data (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.7.4.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.7.4.3 Number of Observations).

3.7.4.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} {s_j}^2\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = sample value,
n = number of samples (3.7.4.3 Number of Observations).

and $n > 1$.

If the number of samples (3.7.4.3 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.7.4.3 Number of Observations (ANNUAL_OBS_CNT)

The sum of scheduled, replacement (make-up), and non-scheduled samples that occurred within the year.

3.7.4.4 Observation Percentage (ANNUAL_OBS_PCT)

$$p = \left(v \Big/ r\right) * 100$$

where:

p = observation percentage,
v = number of valid days (3.7.4.12 Number of Valid Days),

r = number of required monitoring days (3.7.4.13 Number of Required Days).

3.7.4.5 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met where each of the four quarters in the year have met criteria (3.7.3.4 Summary Criteria Indication).

3.7.4.6 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest samples for the year.

3.7.4.7 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.7.4.6 Maximum Value), relative to other Maximum Values, in descending value order.

3.7.4.8 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.7.4.6 Maximum Value) was recorded.

3.7.4.9 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of samples in the year that exceeded the primary standard.

3.7.4.10 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of samples in the year that exceeded the secondary standard.

3.7.4.11 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

The number of days in the year where the Daily Maximum Value (3.7.2.4 Maximum Value) exceeded the alert level.

3.7.4.12 Number of Valid Days (VALID_DAY_CNT)

Valid days are equal to the sum of valued, scheduled sampling days, plus make-ups for missing scheduled days. A make-up day is a sample recorded in the same stratum as, or exactly seven days after, a missing scheduled sample. In both conditions, the make-up sample must occur within the same quarter as the missed sample. A maximum of five make-up samples are allowed per quarter. (References: EPA-454/R-99-008 Guideline on Data Handling Conventions for the PM NAAQS; Memorandum: February 3, 1999 Use of Make-Up Samples to Replace Scheduled PM Samples)

3.7.4.13 Number of Required Days (REQ_MONITORING_CNT)

Scheduled days are the number of days within the year that were scheduled for sampling, as determined by the EPA-defined calendar for the required collection frequency, and which also fall within a period of operation, as defined in sampling periods.

Seasonal and random frequencies are sub-divided in monthly required frequencies; otherwise, the required frequency applies to a defined period of time. A PM2.5 monitor must have a defined collection frequency for each active day, by rule.

The reference point for the EPA calendar is January 4, 1956. For example, in the year 2003, the every 6th day calendar would comprise: 1/3/2003, 1/9/2003, 1/15/2003, etc., and the every 3rd day calendar would comprise: 1/3/2003, 1/6/2003, 1/9/2003, 1/12/2003, etc. For a monitor doing seasonal sampling, with every 6th day sampling in March and every 3rd day sampling in April, the scheduled days for 2003 would be as follows: …, 3/16/03, 3/22/03, 3/28/03, 4/3/03, 4/6/03, 4/9/03, etc.

3.7.4.14 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample value for the year.

3.7.4.15 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified, both natural and exceptional, samples that occurred within the year.

3.7.4.16 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the year.

3.7.4.17 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the year whose standard values were less than the applicable MDL. (By current rules, ½ MDL substitution is not performed for PM2.5 samples. Therefore, the value will always be 0.)

3.7.4.18 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the samples during the year.

3.7.4.19 Percentile Value (PERCENTILE_SAMPLE_VALUE)

For non-seasonal required collection frequencies, (i.e., where the required collection frequency code is not "S"), standard sample value at a system-defined percentile (3.7.4.20 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.7.4.20 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = TRUNCATE\left(\left(\sum_{q=1}^{4} Min(r_q, n_q)\right) * \left(p/100\right)\right) + 1 + \left(n - \left(\sum_{q=1}^{4} Min(r_q, n_q)\right)\right)$$

where:

- k = percentile rank
- r_q = number of required samples for the quarter (see definition at 3.7.3.3 Observation Percentage)
- n_q = number of actual samples for the quarter (3.7.3.2 Number of Observations),
- q = quarter,
- p = system defined percentile (3.7.4.20 Percentile),
- n = number of actual samples for the year (3.7.4.3 Number of Observations).

For seasonal required collection frequencies, (i.e., where the required collection frequency code is “S”), the minimum sample value that makes:

$$W(x) > \left({}^{p}/_{100} \right)$$

where:

$$W(x) = \left(\left({}^{d_h}/_{d_h + d_l} \right) * F_h(x) \right) + \left(\left({}^{d_l}/_{d_h + d_l} \right) * F_l(x) \right)$$

where:

d_h = number of calendar days in the high season,
d_l = number of calendar days in the low season,
p = system defined percentile (3.7.4.20 Percentile),
x = the measured concentration, and

$$F_a(x) = {}^{l_a}/_{n_a}$$

where:

a = high or low,
l_a = number of samples in season a that are <= x,
n_a = number of samples in season a.

The high season are those months where the monthly required frequency is that with minimum daily interval for the year; the low season is all others months.

(Reference: EPA-454/R-99-008 Guideline on Data Handling Conventions for the PM NAAQS)

3.7.4.20 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.7.4.19 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.7.4.21 Protocols (MP_ID)

The protocols used to collect, analyze, and report the monitor’s sample data for the year.

3.7.5 Daily Summarization of 24-Hour Block Averages (DAILY_SUMMARIES)

3.7.5.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = s$$

where:

u = mean,
s = valid 24-hour arithmetic mean (3.7.1.1 Arithmetic Mean).

3.7.5.2 Number of Observations (DAILY_OBS_CNT)

The number of valid 24-hour averages (3.7.1.1 Arithmetic Mean) computed for the 24-hour period, i.e., 1.

3.7.5.3 Observation Percentage (DAILY_OBS_PCT)

$$p = (n / 1) * 100$$

where:

p = observation percentage,
n = number of valid 24-hour averages (3.7.5.2 Number of Observations).

i.e., 100.

3.7.5.4 Maximum Value

The valid 24-hour average for the 24-hour period, (3.7.1.1 Arithmetic Mean).

3.7.5.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour for which the Maximum Value (3.7.5.4 Maximum Value) was computed, which is always 23, by definition.

3.7.5.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.7.5.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.7.5.7 Number of Primary Exceedances (VALUES_GT_PRI_LEVEL_DS)

The number of valid 24-hour averages (3.7.1.1 Arithmetic Mean) that exceeded the primary standard, i.e., 0 or 1.

3.7.5.8 Number of Secondary Exceedances (VALUES_GT_SEC_LEVEL_DS)

The number of valid 24-hour averages (3.7.1.1 Arithmetic Mean) that exceeded the secondary standard, i.e., 0 or 1.

3.7.6 Quarterly Summarization of 24-Hour Block Averages (QUARTERLY_SUMMARIES)

3.7.6.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = valid 24-hour block average (3.7.1.1 Arithmetic Mean),
n = number of valid 24-hour block averages (3.7.6.2 Number of Observations).

3.7.6.2 Number of Observations (QTR_OBS_CNT)

The number of valid 24-hour block averages (3.7.1.1 Arithmetic Mean) that were computed for the quarter.

3.7.6.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n \Big/ q \right) * 100$$

where:

p = observation percentage,
n = number of valid 24-hour block averages (3.7.6.2 Number of Observations),
q = number of active days in the quarter.

3.7.6.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met where the quarterly observation percentage, (3.7.6.3 Observation Percentage), is greater than, or equal to, 75%.

3.7.7 Annual Summarization of 24-Hour Block Averages (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES)

3.7.7.1 Number of Observations (ANNUAL_OBS_CNT)

The number of valid 24-hour block averages (3.7.1.1 Arithmetic Mean) that were computed for the year.

3.7.7.2 Observation Percentage (ANNUAL_OBS_PCT)

$$p = \left(v \Big/ r \right) * 100$$

where:

p = percentage,
v = number of valid days (3.7.7.10 Number of Valid Days),

r = number of required days (3.7.7.11 Number of Required Days).

3.7.7.3 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met where each of the four quarters in the year have met criteria (3.7.6.4 Summary Criteria Indication).

3.7.7.4 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest 24-hour block averages (3.7.1.1 Arithmetic Mean) for the year.

3.7.7.5 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.7.7.4 Maximum Value), relative to other Maximum Values, in descending value order.

3.7.7.6 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.7.7.4 Maximum Value) was recorded.

3.7.7.7 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of valid 24-hour block averages (3.7.1.1 Arithmetic Mean) in the year that exceed the primary standard.

3.7.7.8 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of valid 24-hour block averages (3.7.1.1 Arithmetic Mean) in the year that exceed the secondary standard.

3.7.7.9 Number of Alert Level Exceedances (DAYS_GT_ALERT_LEVEL)

The number of valid 24-hour block averages (3.7.1.1 Arithmetic Mean) in the year that exceed the alert level.

3.7.7.10 Number of Valid Days (VALID_DAY_CNT)

The number of valid 24-hour block averages (3.7.1.1 Arithmetic Mean) occurring during the year. The value will always be equal to the Number of Observations (3.7.7.1 Number of Observations).

3.7.7.11 Number of Required Days (REQ_MONITORING_CNT)

The number of active days within the year.

3.7.7.12 Minimum Value (MIN_SAMPLE_VALUE)

The lowest valid 24-hour block average (3.7.1.1 Arithmetic Mean) for the year.

3.7.7.13 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The valid 24-hour block average (3.7.1.1 Arithmetic Mean) at a system-defined percentile (3.7.7.14 Percentile) where there are *k* valid 24-hour block averages less than or equal to it,

where *k* is the calculated rank for the percentile (3.7.7.14 Percentile) with the valid 24-hour block averages ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.7.7.14 Percentile),
k = calculated rank for percentile *p*,
n = number of valid 24-hour block averages (3.7.7.1 Number of Observations).

3.7.7.14 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.7.4.19 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.8 TSP

3.8.1 Annual Summarization (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.8.1.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.8.1.5 Number of Observations).

3.8.1.2 Geometric Mean (ANNUAL_GEOM_MEAN)

$$u = \sum_{j=1}^{n} \log_{10} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.8.1.5 Number of Observations).

3.8.1.3 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} s_j^{\,2}\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = sample value,
n = number of samples (3.8.1.5 Number of Observations).

and $n > 1$.

If the number of samples (3.8.1.5 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.8.1.4 Geometric Standard Deviation (ANNUAL_GEOM_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} \log_{10} s_j^{\,2}\right) - \left(\sum_{j=1}^{n} \log_{10} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = sample value,
n = number of samples (3.8.1.5 Number of Observations).

and $n > 1$.

If the number of samples (3.8.1.5 Number of Observations) is exactly 1, or:

$$n * \sum_{j=1}^{n} \log_{10} s_j^{\,2} < \left(\sum_{j=1}^{n} \log_{10} s_j\right)^2$$

where:

s = sample value,
n = number of samples (3.8.1.5 Number of Observations),

then the standard deviation is assigned a value of 0.

3.8.1.5 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that occurred within the year.

3.8.1.6 Observation Percentage (ANNUAL_OBS_PCT)

Where the samples are hourly:

$$p = \left(n / (a * 24)\right) * 100$$

where:

p = percentage,
n = number of samples (3.8.1.5 Number of Observations),
a = number of active days in the calendar year.

Where the samples are daily, the field is not assigned a value.

3.8.1.7 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Where the samples are hourly, minimum summary criteria are met when the annual observation percentage, (3.8.1.6 Observation Percentage), is greater than, or equal to, 75%.

Where the samples are daily, minimum summary criteria are met when each of the four quarters in the year have met criteria (3.11.5.3 Summary Criteria Indication).

3.8.1.8 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest samples for the year.

3.8.1.9 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.8.1.8 Maximum Value), relative to other Maximum Values, in descending value order.

3.8.1.10 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.8.1.8 Maximum Value) was recorded.

3.8.1.11 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample for the year.

3.8.1.12 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified, both natural and exceptional, samples that occurred within the year.

3.8.1.13 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the year.

3.8.1.14 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the year whose standard values were less than the applicable MDL.

3.8.1.15 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the samples during the year.

3.8.1.16 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The standard sample value at a system-defined percentile (3.8.1.17 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.8.1.17 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.8.1.17 Percentile),
k = calculated rank for percentile p,
n = number of observations (3.8.1.5 Number of Observations).

3.8.1.17 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.8.1.16 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.8.1.18 Protocols (MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year.

3.9 Lead

3.9.1 Daily Summarization of Daily Data (DAILY_SUMMARIES)

3.9.1.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = s$$

where:

u = mean,
s = daily sample value.

3.9.1.2 Number of Observations (DAILY_OBS_CNT)

The number of daily sample values for the 24-hour period, i.e., 1.

3.9.1.3 Observation Percentage (DAILY_OBS_PCT)

$$p = (n / 1) * 100$$

where:

p = observation percentage,
n = number of daily samples (3.9.1.2 Number of Observations).

i.e., 100.

3.9.1.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The sample value for the 24-hour period.

3.9.1.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour at which the Maximum Value (3.9.1.4 Maximum Value) was recorded.

3.9.1.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.9.1.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.9.2 Quarterly Summarization (QUARTERLY_SUMMARIES)

3.9.2.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.9.2.2 Number of Observations).

3.9.2.2 Number of Observations (QTR_OBS_CNT)

The number of samples that occurred within the quarter.

3.9.2.3 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met for the quarter when the number of observations (3.9.2.2 Number of Observations) is greater than, or equal to, a duration-specific threshold. Those thresholds are:

Duration	Threshold
Daily	12
Weekly; Composite Weekly	9
Monthly; Composite Monthly	2
Quarterly; Composite Quarterly; Composite Seasonal	1

3.9.3 Annual Summarization (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.9.3.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.9.3.5 Number of Observations).

3.9.3.2 Geometric Mean (ANNUAL_GEOM_MEAN)

$$u = \sum_{j=1}^{n} \log_{10} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.9.3.5 Number of Observations).

3.9.3.3 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} s_j^{\,2}\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = sample value,
n = number of samples (3.9.3.5 Number of Observations).

and $n > 1$.

If the number of samples (3.9.3.5 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.9.3.4 Geometric Standard Deviation (ANNUAL_GEOM_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} \log_{10} s_j^{\,2}\right) - \left(\sum_{j=1}^{n} \log_{10} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = sample value,
n = number of samples (3.9.3.5 Number of Observations).

and $n > 1$.

If the number of samples (3.9.3.5 Number of Observations) is exactly 1, or:

$$n * \sum_{j=1}^{n} \log_{10} s_j^{\,2} < \left(\sum_{j=1}^{n} \log_{10} s_j\right)^2$$

where:

s = sample value,
n = number of samples (3.9.3.5 Number of Observations),

then the standard deviation is assigned a value of 0.

3.9.3.5 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that occurred within the year.

3.9.3.6 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met where each of the four quarters in the year have met criteria (3.9.2.3 Summary Criteria Indication).

3.9.3.7 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest samples for the year.

3.9.3.8 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.9.3.7 Maximum Value), relative to other Maximum Values, in descending value order.

3.9.3.9 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which the Maximum Value (3.9.3.7 Maximum Value) was recorded.

3.9.3.10 Number of Primary Standard Exceedances (VALUES_GT_PRI_LEVEL)

The number of quarterly arithmetic means (3.9.2.1 Arithmetic Mean) that exceed the primary standard.

3.9.3.11 Number of Secondary Standard Exceedances (VALUES_GT_SEC_LEVEL)

The number of quarterly arithmetic means (3.9.2.1 Arithmetic Mean) that exceed the secondary standard.

3.9.3.12 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample for the year.

3.9.3.13 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified, both natural and exceptional, samples that occurred within the year.

3.9.3.14 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the year.

3.9.3.15 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the year whose standard values were less than the applicable MDL.

3.9.3.16 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the samples during the year.

3.9.3.17 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The standard sample value at a system-defined percentile (3.9.3.18 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.9.3.18 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.9.3.18 Percentile),
k = calculated rank for percentile *p*,
n = number of samples (3.9.3.5 Number of Observations).

3.9.3.18 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.9.3.17 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.9.3.19 Protocols (MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year.

3.10 Other Pollutants (< 24 Hours)

3.10.1 Daily Summarization (DAILY_SUMMARIES)

3.10.1.1 Arithmetic Mean (DAILY_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.10.1.2 Number of Observations).

3.10.1.2 Number of Observations (DAILY_OBS_CNT)

The number of samples that occurred within the 24-hour period.

3.10.1.3 Observation Percentage (DAILY_OBS_PCT)

$$p = \left(n \Big/ \left(24 \Big/ l \right) \right) * 100$$

where:

p = observation percentage,
n = number of samples (3.10.1.2 Number of Observations),
l = duration length (in hours).

3.10.1.4 Maximum Value (DAILY_MAX_SAMPLE_VALUE)

The maximum sample value for the 24-hour period.

3.10.1.5 Maximum Collection Hour (DAILY_MAX_COLL_HOUR)

The hour at which the Maximum Value (3.10.1.4 Maximum Value) was recorded.

3.10.1.6 Daily Ranking Number (DAILY_RANKING_NUM)

The rank of the Maximum Value (3.10.1.4 Maximum Value) relative to all other maximum values for the year, with 1 indicating the maximum value for the entire year. (Only computed for Exceptional Data Type values 0 and 2.)

3.10.2 Quarterly Summarization (QUARTERLY_SUMMARIES)

3.10.2.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
n = number of samples (3.10.2.2 Number of Observations),
s = sample value.

3.10.2.2 Number of Observations (QTR_OBS_CNT)

The number of samples that occurred within the quarter.

3.10.2.3 Observation Percentage (QTR_OBS_PCT)

$$p = \left(n \Big/ \left(q * 24 \Big/ l \right) \right) * 100$$

where:

p = observation percentage,
n = number of samples (3.10.2.2 Number of Observations),
l = duration length (in hours),
q = number of active days in the quarter.

3.10.2.4 Summary Criteria Indication (QTR_CRITERIA_IND)

Minimum summary criteria are met when the quarterly observation percentage, (3.10.2.3 Observation Percentage), is greater than, or equal to, 75%.

3.10.3 Annual Summarization (ANNUAL_SUMMARIES, SUMMARY_MAXIMUMS, SUMMARY_PERCENTILES, SUMMARY_PROTOCOLS)

3.10.3.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.10.3.3 Number of Observations).

3.10.3.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} {s_j}^2\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = sample value,
n = number of samples (3.10.3.3 Number of Observations).

and $n > 1$.

If the number of samples (3.10.3.3 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.10.3.3 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that occurred within the year.

3.10.3.4 Observation Percentage (ANNUAL_OBS_PCT)

$$p = \left(n \Big/ \left(a * 24 \Big/ l \right) \right) * 100$$

where:

p = observation percentage,
n = number of samples (3.10.3.3 Number of Observations),
l = duration length (in hours),
a = number of active days in the year.

3.10.3.5 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

Minimum summary criteria are met when the annual observation percentage, (3.10.3.4 Observation Percentage), is greater than, or equal to, 75%.

3.10.3.6 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest samples for the year.

3.10.3.7 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.10.3.6 Maximum Value), relative to other Maximum Values, in descending value order.

3.10.3.8 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.10.3.6 Maximum Value) was recorded.

3.10.3.9 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample for the year.

3.10.3.10 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified, either natural or exceptional, samples that occurred within the year.

3.10.3.11 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the year.

3.10.3.12 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the year whose standard values were less than the applicable MDL.

3.10.3.13 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the samples during the year.

3.10.3.14 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The standard sample value at a system-defined percentile (3.10.3.15 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.10.3.15 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.10.3.15 Percentile),
k = calculated rank for percentile p,
n = number of samples (3.10.3.3 Number of Observations).

3.10.3.15 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.10.3.14 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.10.3.16 Protocols (MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year.

3.11 Other Pollutants (>= 24 Hours)

3.11.1 Quarterly Summarization

3.11.1.1 Arithmetic Mean (QTR_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,
n = number of samples (3.11.1.2 Number of Observations).

3.11.1.2 Number of Observations

The number of samples that occurred within the quarter.

3.11.1.3 Summary Criteria Indication

Minimum summary criteria are met for the quarter when the number of observations (3.11.1.2 Number of Observations) is greater than, or equal to, a duration-specific threshold. Those thresholds are:

Duration	Threshold
Daily	12
Weekly; Composite Weekly	9
Monthly; Composite Monthly	2
Quarterly; Composite Quarterly; Composite Seasonal	1

3.11.2 Annual Summarization

3.11.2.1 Arithmetic Mean (ANNUAL_ARITH_MEAN)

$$u = \sum_{j=1}^{n} s_j \Big/ n$$

where:

u = mean,
s = sample value,

n = number of samples (3.11.2.3 Number of Observations).

3.11.2.2 Arithmetic Standard Deviation (ANNUAL_ARITH_STDDV)

$$\sigma = \sqrt{\frac{\left(\left(n * \sum_{j=1}^{n} s_j^{\,2}\right) - \left(\sum_{j=1}^{n} s_j\right)^2\right)}{\left(n * (n-1)\right)}}$$

where:

σ = standard deviation,
s = sample value,
n = number of samples (3.11.2.3 Number of Observations).

and $n > 1$.

If the number of samples (3.11.2.3 Number of Observations) is exactly 1, then the standard deviation is assigned a value of 0.

3.11.2.3 Number of Observations (ANNUAL_OBS_CNT)

The number of samples that occurred within the year.

3.11.2.4 Summary Criteria Indication (ANNUAL_CRITERIA_IND)

For daily, weekly, monthly, composite weekly, and composite monthly data, minimum summary criteria are met when each of the four quarters in the year have met criteria (3.11.1.3 Summary Criteria Indication).

For quarterly, composite quarterly, and composite seasonal data, criteria are met when the annual number of observations (3.11.2.3 Number of Observations) is greater than, or equal to, 3.

3.11.2.5 Maximum Value (MAX_SAMPLE_VALUE)

The ten highest samples for the year.

3.11.2.6 Maximum Level (MAX_LEVEL)

The numeric rank of a Maximum Value (3.11.2.5 Maximum Value), relative to other Maximum Values, in descending value order.

3.11.2.7 Maximum Collection Date/Time (MAX_COLL_DATETIME)

The date and time for which a Maximum Value (3.11.2.5 Maximum Value) was recorded.

3.11.2.8 Minimum Value (MIN_SAMPLE_VALUE)

The lowest sample for the year.

3.11.2.9 Number of Exceptional Samples (EXCEPTIONAL_DATA_CNT)

The number of event-qualified, either natural or exceptional, samples that occurred within the year.

3.11.2.10 Number of Null Samples (NULL_DATA_OBS_CNT)

The number of null samples that occurred within the year.

3.11.2.11 Number of ½ MDL Substitutions (OBS_CNT_LT_HALF_MDL)

The number of samples in the year whose standard values were less than the applicable MDL.

3.11.2.12 Number of Methods (SUMMARY_METHOD_CNT)

The number of distinct methodologies used to collect and analyze the samples during the year.

3.11.2.13 Percentile Value (PERCENTILE_SAMPLE_VALUE)

The standard sample value at a system-defined percentile (3.11.2.14 Percentile) where there are *k* standard sample values less than or equal to it, where *k* is the calculated rank for the percentile (3.11.2.14 Percentile) with the standard sample values ordered by ascending magnitude. The formula for determining the rank is:

$$k = n - TRUNCATE\left(n * \left(\frac{(100 - p)}{100} \right) \right)$$

where:

p = percentile (3.11.2.14 Percentile),
k = calculated rank for percentile *p*,
n = number of samples (3.11.2.3 Number of Observations).

3.11.2.14 Percentile (PERCENTILE_NUM)

An EPA-assigned percentile level for which a Percentile Value (3.11.2.13 Percentile Value) is determined. Those values are: 10, 25, 50, 75, 90, 95, 98, and 99.

3.11.2.15 Protocols (MP_ID)

The protocols used to collect, analyze, and report the monitor's sample data for the year.