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DRAFT REGION V POLICY FOR UNUSUAL AMBIENT AIR QUALITY DATA

Issue 1: Should valid air quality data generated during an unusual event be entered into a State data handling system and subsequently entered into the National Air Data Bank?

Backgound: During the Fall of 1976 and Spring of 1977, Region V as well as other Regions experienced an area-wide dust storm which brought dramatically to our attention the need for a policy on unusual data (Attachment 1). "Unusual" data may be defined as data which is valid, but not necessarily suitable for attainment analysis purposes (40 CFR 51.12). In the Spring of 1977, Region IV drafted a data policy and sent it out to its eight States for comments. The policy requested that only data suitable for attainment analysis be submitted for inclusion into the National EPA data bank (NADB). The data not submitted to NADB was to be submitted once a year to EPA with an explanation of why it was not suitable for attainment analysis. Since NADB data were (and are) used most of the time as the starting point for most attainment analyses, Region IV wanted the data to "stand alone" for EPA Headquarters, Congressional, and public use; i.e., the data user would not have to call the Region or State for an explanation of which data they could use. Region IV staff would thoroughly review this unusual data, submitted once a year, to see if it should be excluded. Moreover, the Region felt it was impossible to analyze the data and recalculate geometric means in a reasonable amount of time when called upon to do an analysis or trends. Generally, it would also be difficult to continue to maintain a log of the unusual data.

In 1979, Region IV felt their States were excluding too much data. After soliciting State's comments, they revised the unusual data submission policy. All data were and are to be submitted to SAROAD. States are to identify all data they wish to be excluded from attainment analysis. However, since the Region still wished to recalculate, means, number of short term standard exceedances, they requested that a flagging system be devised by NADB so that such recalculation could be accomplished. The NADB chose to implement a user-oriented comments file to document problems or events of general nature, i.e., all ozone data collected in California during 1977 to 1979 is 20% high. Individual data values could not be flagged and, therefore, excluded from statistical analysis.

During the Spring, NADB staff visited each Region to discuss the new data base management system, Air Information Retrieval System (AIRS). During a recent brief poll of the Regions, concensus was that EPA needed access to all valid data but that the new AIRS should be able to flag unusual data and optionally exclude this data from summary. A proposal for implementing such flagging technique has been sent to NADB for consideration in AIRS (Attachment 2). NADB expects that the air quality portion of AIRS will be available for direct input and retrieval on a pilot basis by the end of the Fiscal Year 1984.

In the interim, Region V proposes to its reporting agencies a draft policy similar to the Region IV policy. An issue paper on this topic is also expected from the Standing Air Monitoring Work Group (SAMWG) during FY 1984.

REGION V DRAFT POLICY FOR SUBMITTAL OF UNUSUAL AMBIENT AIR QUALITY DATA

This policy supersedes any previous guidance issued by Region V concerning data deletion and invalidation. It does not revise any guidance on data to be excluded from control strategy or attainment/maintenance analyses.

Reporting Requirements for Ambient Air Quality Data

The Ambient Air Quality Monitoring, Data Reporting, and Surveillance Provisions (40 CFR Part 58) require that specific quality assurance, methodology, and siting for NAMS and SLAMS be followed as of January 1, 1983. Further, 40 CFR 58.14 specifies that any ambient air quality monitoring stations other than a SLAMS or a Prevention of Significant Deterioration (PSD) station from which a State intends to use the data as part of a control strategy demonstration or as support for a plan revision must meet the same requirements as SLAMS after January 1, 1983. Methods, procedures and siting have been reviewed and agreed upon by EPA, State and, as appropriate, local agency representatives. All data is considered valid if the EPA reference or equivalent monitor is at an approved site and proper quality assurance procedures are used. The senior air pollution control officer in the State, or his/her designee, is required to certify that the data in the annual SLAMS summary report are accurate to the best of his/her knowledge. Therefore, EPA considers all designated NAMS and SLAMS data entered into the SAROAD system to be valid.

Principle Purposes of Collection and Uses of Air Monitoring Data

A summary of some uses of air monitoring data are listed as follows:

1. Judge attainment/non-attainment of NAAQS
2. Evaluate progress in achieving/maintaining NAAQS or State standards
3. Develop or revise SIP's to attain/maintain NAAQS
4. New Source Review and Prevention of Significant Deterioration
5. Develop or revise national control policies (e.g., New Source Performance Standards)
6. Model development and validation
7. Energy related issues
8. Support enforcement actions
9. Public information (e.g., air quality indices)
10. Health research/establish standards
11. Develop or revise local control strategy

12. Determine specific cause of pollution in an area

13. Determine nature of air pollution problem in an area

14. Document and analyze unusual meteorological events

For a number of the above monitoring data uses it may be desirable to understand and evaluate any unusual occurrence. For example, it may be true that the area in which the air monitoring site is located exceeds the NAAQS and that people may be exposed to those hazardous levels. However, the course of action necessary to correct the violation may be dependent upon the reason for the violation.

For calibrating a dispersion model, monitored geometric and arithmetic means should only reflect impacts from fugitive and point sources in the emission inventory and from representative background sources. Any inclusion of unusual data will result in an unexplained high intercept or an erroneous slope of the calibration curve.

The use of data in showing past trends and estimating future projections is a common practice. Trends are used to show what has happened over a general area and are not usually used for the purpose of demonstrating short-term problems or unusual occurrences. Quarterly or yearly averages are used to plot trends. As a result, outlying values and weighted quarters must be carefully considered.

Invalidation of Data

At a minimum, the State is required to edit, validate, and submit NAMS data to EPA within sixty days after the end of a calendar quarter. The State is required to edit, validate, certify and submit a summary of SLAMS data to EPA by July 1 after the preceding calendar year. This is ample time for any instrument malfunction to be identified.

The following is assumed of all air quality data reviewed in State or local agency reports and in SAROAD:

1. Data is of acceptable quality and reliability, i.e., proper and frequent calibration has been performed.

2. The site is properly located and free from any bias.

3. There are no transcription or keypunch errors in the data.

4. Common statistical analysis may be performed on the data.

5. The characteristics of the site have not changed, i.e., elevation of sampler and exposure.

It is only after these five assumptions are satisfied that the data will be further analyzed for determination of attainment and maintenance of NAAQS, NSR, PSD, and trends, dispersion modelling, and public dissemination.

Quality controls limits are generally used to determine whether an instrument is malfunctioning or beginning to malfunction. If the instrument has ceased to operate completely, of course, maintenance and a new calibration are required. If the instrument is "trending" toward a control limit, optimally the operator will provide necessary maintenance to cease the trending and recalibrate. In summary, control limits are a compromise between available resources and desired data quality. Use of control limits result in the initiation of specific corrective actions necessary to maintain desired data quality. The exceedance of control limits may indicate that:

- an instrument has malfunctioned,
- the control limits are too rigid, or
- the service frequency of the instrument is too lenient.

Data collected from a malfunctioning instrument is declared invalid only from the time the malfunction was identified back to the last satisfactory instrument check, i.e., precision check, audit, or calibration. These data are not to be entered into the SAROAD system. All other data is to be submitted and considered valid.

Invalidation of data which have already been entered into the SAROAD system will be handled by EPA on a case by case basis as necessary.

Data from a properly operating instrument are not to be invalidated because of any act of nature or man; the contribution to the atmospheric burden of fires, volcanoes, tornadoes, dust storms, construction, demolition, tec., affects the interpretation and use to be made of the data but does not render the data invalid. These data are valuable for future reference and are not to be invalidated.

Missing Data

Missing data refers to any data not entered into the SAROAD system. All periods of missing data are to be accounted for in a central record keeping system and are to be readily available for inspection. Ideally, these records are used by the agency to minimize the future loss of air quality data. Missing data includes but is not limited to, periods missed because of calibration, audits, precision checks, routine maintenance and malfunctions.

Data Flagging

EPA recommends that all "unusual" data and all data concentrations which approach or exceed the primary or secondary national ambient air quality standard be thoroughly and objectively investigated and documented. Calculations, and instrument performances should be verified. Local emission sources and meteorology should be investigated. Data generators should consider the value of investigating and documenting, all exceedances of the national ambient air quality standards (NAAQS), any other outstanding values, and/or the ten highest values at each site each year; microscopic analysis should be performed on hi-vol filters for the days with exceedances of the NAAQS. In this way, elevated valid data can be objectively evaluated and flagged for future interpretation.

It is incumbent on the data generator to flag "unusual" data; any limitations or restrictions on the data should be entered into the flag system (comments file). It is incumbent on the data generator to keep thorough and accurate records of the data investigation and the data flagged. The data generator should report to the EPA Regional Office so that the NADB comments file is updated to ensure the proper use of all data.

Currently, the flag system is independent of the SAROAD system and is maintained on State files. EPA is working towards consolidating these systems and estimates completion by the end of 1984.

To flag data, the data generator needs to submit the following information to the Environmental Monitoring Branch, Environmental Services Division, EPA Region V, Chicago, Illinois:

- SAROAD site number
- Pollutant
- Sample time(s) (year, month, day, hour)
- Sample concentration and units
- Explanation

Data may be flagged at any time, but should be flagged as soon as possible to minimize the potential for its misuse.

Consideration of Unusual Data

In addition to flagging unusual data in the NADB, the data generator should notify the Air Management Division, Environmental Protection Agency, Region V, Chicago, Illinois of the existence of this data. This may be accomplished by submitting a report containing the following:

- Information submitted to the flag system.
- Explanation for "unusual" data accompanied by some certification, such as a newspaper article or letter of the unusual circumstances.
- Meteorological data, maps, modelling results, etc., which support the influence of the unusual circumstances on the monitor.
- Microscopic analysis of hi-vol filters to determine source impact.

For industrial source pollution control malfunctions, the following information should also be submitted:

- Meteorological data, maps showing the impact on the monitor, and modeling demonstration.
- Summaries of past malfunctions or similar accidents for the previous two years from the involved source.
- Estimate of total actual emissions (type and amount).
- Enforcement actions to be taken.
- Procedures to minimize any future recurrence.

The Air Management Division may request additional background information.

Issue 2: TSP Sampling Schedule and Completeness Criteria
Should 10 samples per calendar quarter (i.e., 75% of samples collected on a six day schedule) instead of the EPA minimum of 5 be required to consider the annual geometric mean for a TSP site for comparison against the air quality standard?

Background: On April 19, 1983, Mr. Harry Williams, Director of the Indiana Air Pollution Control Division, sent a letter to Larry Purdue, USEPA, EMSL, to request that USEPA require site data completeness of 75%, based on a six-day sampling schedule, or 10 samples. The existing requirement of 5 samples per quarter was based on the old National Air Surveillance Network (NASN) biweekly sampling modified when EPA minimum recommended sampling schedule was increased to once every six days.

Mr. Williams stated in his letter that Indiana had thrown out data for many years and some of that data was not utilized for modelling purposes because it did not meet six day criteria for completeness, i.e., 10 samples. Indiana contended that if a site did not meet the six day schedule, EPA should not utilize the data. Indiana, therefore, recommended that USEPA make adjustment to 10 samples to take into account the more frequent sampling schedule.

Mr. Neil Frank, Office of Air Quality Planning and Standards, Monitoring and Reports Branch, responded to Mr. Williams letter, that the U.S. EPA Task Force Report on Air Quality Indicators "essentially acknowledged that an adjustment to the current EPA data completeness policy would be one way to handle the heavier, every 6-day sampling schedule". He pointed out that EPA Monitoring and Data Analysis Division has initiated a study to re-examine validity criteria for all criteria pollutants and is expected to publish recommendations for revisions to these criteria in the fall of 1983. With the use of every 6-day or more frequent TSP monitoring, the current NADB criteria is certainly minimal. However, reasonable estimates of the geometric mean for TSP can be obtained from a small number of samples. EPA does not suggest throwing out a data set merely because the number of observations is less than 40 per year. The completeness criteria is still EPA guidance, but sampling on a six schedule is mandated under 40 CFR 59.13 (b).

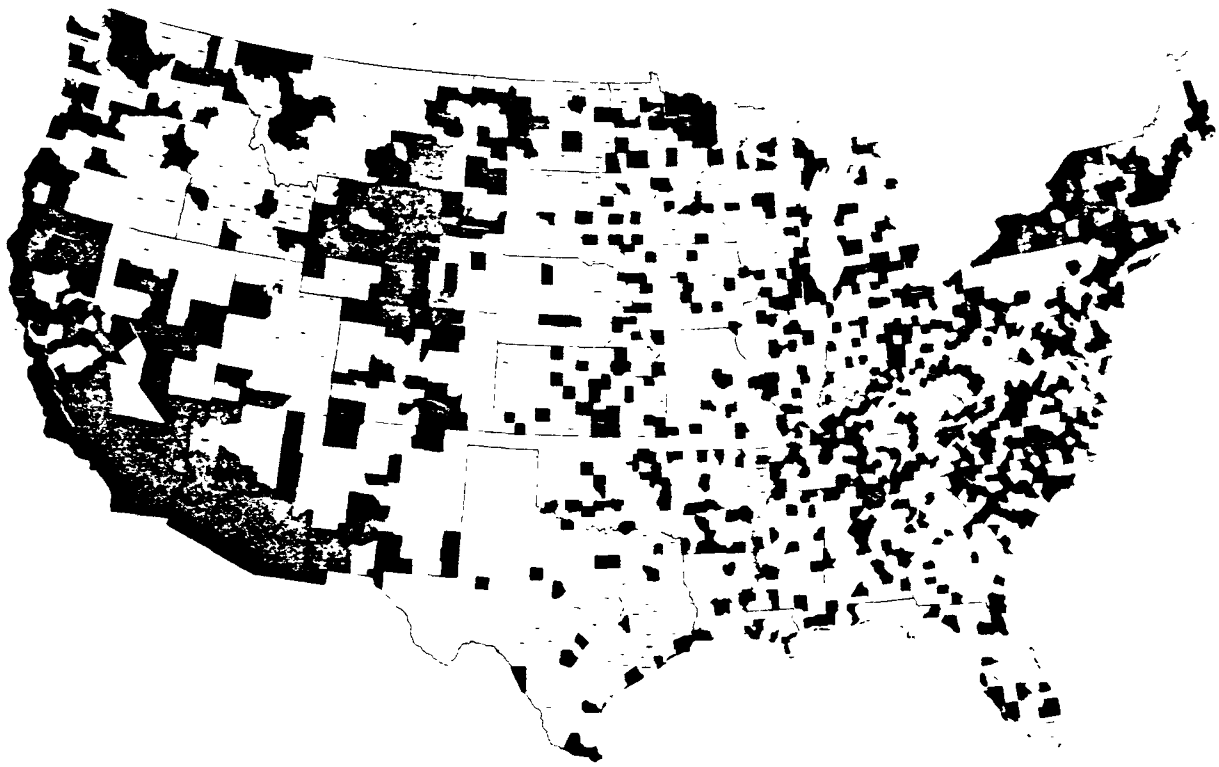
Mr. Williams contended in a reply to Neil Frank on June 13, 1983, that the present USEPA data completeness policy "allows anyone who reports data to the National Aerometric Data Bank (NADB) to manipulate the numbers in a way that best suits their purpose. For instance, if an industry shows non-attainment via a six-day, three day or daily sampling network, what would keep that industry from reporting only those numbers from a twelve-day schedule and still meet EPA's criteria for data completeness and possibly show attainment?

The answer is contained under Section 113(c)(2), "Federal Enforcement", of the Clean Air Act as amended August 1977: Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this Act or who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this Act, shall upon conviction, be punished by a fine of not more than $10,000 or by inprisonment for not more than six months, or by both.

ATTACHMENT 1

EPA-450/1-77-002
DECEMBER 1977

NATIONAL AIR QUALITY AND EMISSIONS TRENDS REPORT, 1976



U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

3. NATIONAL AND REGIONAL TRENDS IN CRITERIA POLLUTANTS

Trends in ambient levels of total suspended particulate, sulfur dioxide, carbon monoxide, oxidants, and nitrogen dioxide are reported in this section. Each of these criteria pollutants is discussed individually; the extent of the analysis varies according to the amount of available historical data. In contrast to Section 2, which dealt with specific urban areas, this section focuses upon national trends and trends over broad geographic regions. (Section 4 of this report presents maps illustrating the concentration ranges of several pollutants in various parts of the country.)

Considerable thought has been given to various ways to improve the nation's ambient air quality monitoring programs. The recent activities of the Standing Air Monitoring Work Group (SAMWG) have served as a focal point for new ideas. This work group, composed of representatives from EPA and State and local air monitoring agencies, has developed a comprehensive strategy document for ambient air quality monitoring.[1] Because many elements of the SAMWG strategy document will affect future trend analyses, some of these points are mentioned here so that interested readers will be made aware of anticipated improvements in the nation's air monitoring programs.

The most obvious change will be the designation of specific National Air Quality Stations (NAQTS) for the criteria pollutants. These NAQTS sites would primarily be determined by the population of the area. For total suspended particulate and sulfur dioxide, the allocation would be on the basis of population and pollutant concentration. Selected for the primary purpose of long-term trends analyses, these measuring stations will provide more consistent data bases from one year to the next and also ensure adequate geographical coverage. Obviously, these NAQTS sites would not be the only component of an air monitoring program. There are a variety of purposes for ambient monitoring programs, and, therefore, it will be necessary to supplement these NAQTS sites with other types of monitoring stations. Other items of note in the SAMWG strategy document relate to quality assurance, increased continuous monitoring, and adherence to standardized siting criteria, all of which will improve the ambient air quality data bases and thereby serve to improve subsequent trend analyses. Readers interested in the details of the SAMWG recommendations are referred to the strategy document.

3.1 TRENDS IN TOTAL SUSPENDED PARTICULATE

The general long-term improvement in ambient air quality with respect to total suspended particulate (TSP) has been discussed in previous reports.[2-6] During the 1970's, there has been nationwide improvement in TSP concentrations, but many areas experienced increases between 1975 and 1976. This section discusses national and regional TSP trends during the 1970-1976 time period with particular attention given to comparisons between 1975 and 1976.

The data used in these analyses were obtained from EPA's National Aerometric Data Bank. The vast majority of the data were collected by State and local agencies through their air monitoring programs and then submitted to EPA. All sites having four consecutive quarters of data from 1970-1973 and also from 1974 through 1976 were included in these analyses. This selection criterion was used to ensure balanced seasonality and a comparable data base from the beginning to the end of the time period. Sufficient data to satisfy this selection criterion were available from 2,350 sites. Although a site would need only a minimum of 2 years of data to qualify for selection, 70 percent of these 2,350 sites had at least 4 complete years of data during the 1970-1976 time period.

As in last year's Trends Report,[6] a modified version of the graphical technique known as a box-plot[7] is used to display trends. This plotting technique depicts several characteristics of the data simultaneously. Figure 3-1 is a sample illustration of the plotting conventions used for the box-plots in

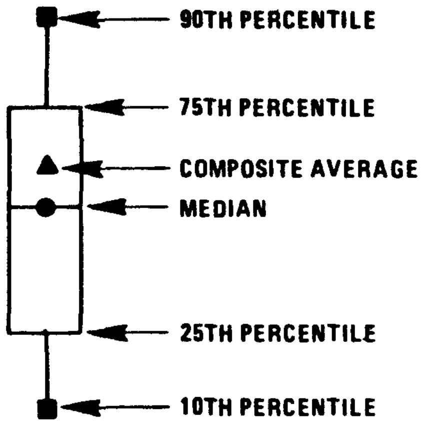


Figure 3-1. Sample illustration of plotting conventions for box plots.

this report. For each year, various percentiles and the composite averages are indicated so that the general trend in the average levels may be seen as well as the trends for the higher and lower concentration ranges.

3.1.1 Long-Term TSP Trends: 1970-1976

During the 1970's, there has been general improvement nationally in ambient TSP concentrations. Figure 3-2 shows a box-plot presentation of trends in geometric mean TSP levels during the 1970-1976 time period for the 2,350 sites used in this analysis. This plot is consistent with results discussed in previous reports.[2-6] The general pattern shows stability for the lower concentration sites and more pronounced improvement for the higher concentration ranges. The median and composite average also indicate fairly consistent improvement through 1975. During this time period, the overall rate of improvement was slightly less than 4 percent per year, with more marked improvement in the Northeast and Great Lakes regions. Figure 3-3 displays trends in peak values at these same sites and shows a similar pattern during this time period. It should be noted that sampling frequencies at many of these sites were increased during this time period. While increasing sampling frequencies would not alter trends in annual means, it could be expected to result in an artificial increase on the order of 2 to 3 percent per year for the peak values during this time period. Even with this contribution, however, the general pattern in Figure 3-3 shows improvement through 1975. Also apparent in both graphs is the trend reversal in 1976, which is discussed in more detail in the following section dealing with short-term changes. Knowledge of geographical differences in long-term TSP trends provides background information that is useful in considering the short-term changes.

Figure 3-4 displays 1970-1976 trends for each EPA Region and provides a convenient presentation of trends by geographical area. Although all areas had improved TSP levels in the 1970-1976 time period, trends in the western areas of the country were generally less pronounced. In many cases, this geographical variation is attributable to a difference in the nature of TSP problems from one area to another. In some locations, wind-blown dust is an important component of TSP levels and is more difficult to control than emissions from traditional sources.

As would be expected from these graphs, improvement was fairly consistent from 1970 to 1976, with 72 percent of the sites having decreases in ambient TSP levels. Because air pollution control strategies are designed to reduce levels at locations exceeding the National Ambient Air Quality Standards, more pronounced improvement would be expected for the sites with higher concentrations. For those sites with 1970-1973 averages above the annual primary standard, 81 percent showed improvement. For sites in this category, improvements outnumbered increases by at least a 2 to 1 margin in all

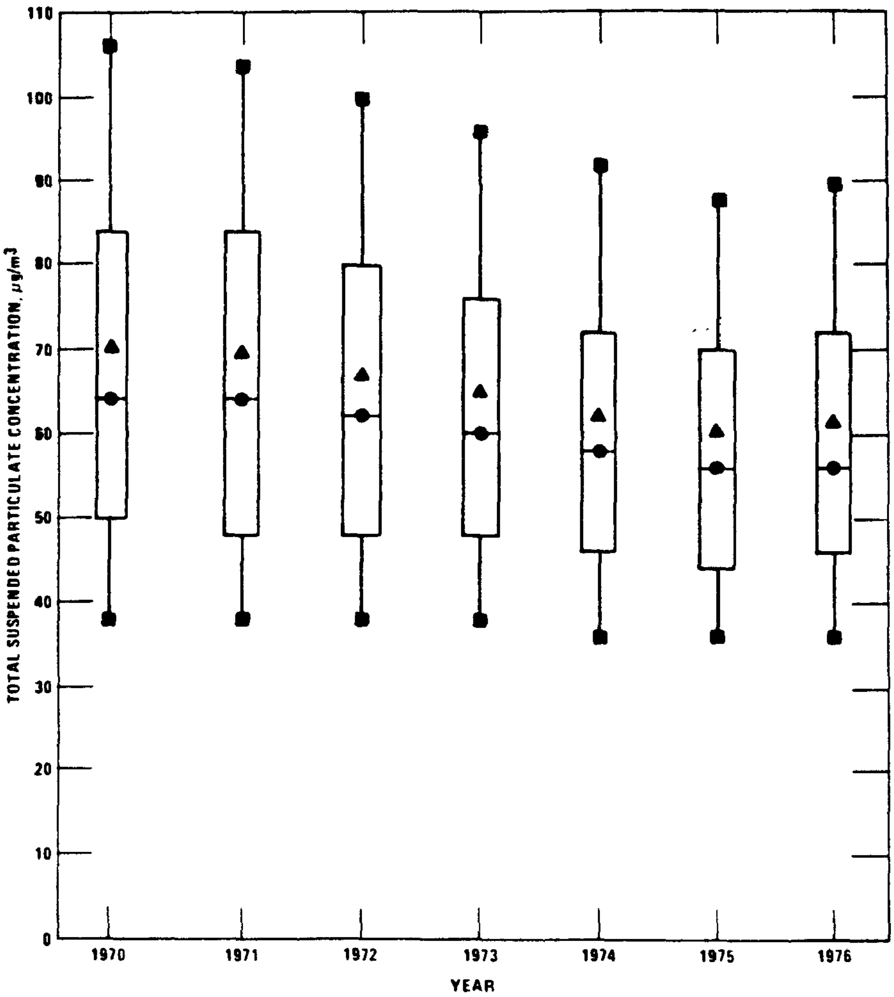


Figure 3-2. Trends of annual mean total suspended particulate concentrations from 1970 to 1976 at 2,350 sampling sites.

regions of the country. Using nonparametric regression, 27 percent of these higher concentration sites show statistically significant improvement while only 1 percent of these sites had statistically significant increases.

3.1.2 Short-Term TSP Trends: 1975-1976

In many areas of the country, the general downward trend in TSP levels in the early 1970's was followed by a reversal in 1976. This was apparent in Figure 3-2 and 3-3 for the nation, but is more obvious in some of the regional graphs in Figure 3-4. Based upon changes between comparable quarters in 1975 and 1976 for these TSP trend sites, 53 percent of those comparisons showed increases. Over half the States had more increases than decreases between 1975 and 1976. The Southeast, Midwest, and West generally recorded increases.

The widespread pattern of these increases suggests that some common factor was involved. Because no general increases in particulate emissions throughout these areas occurred in 1976 and there were

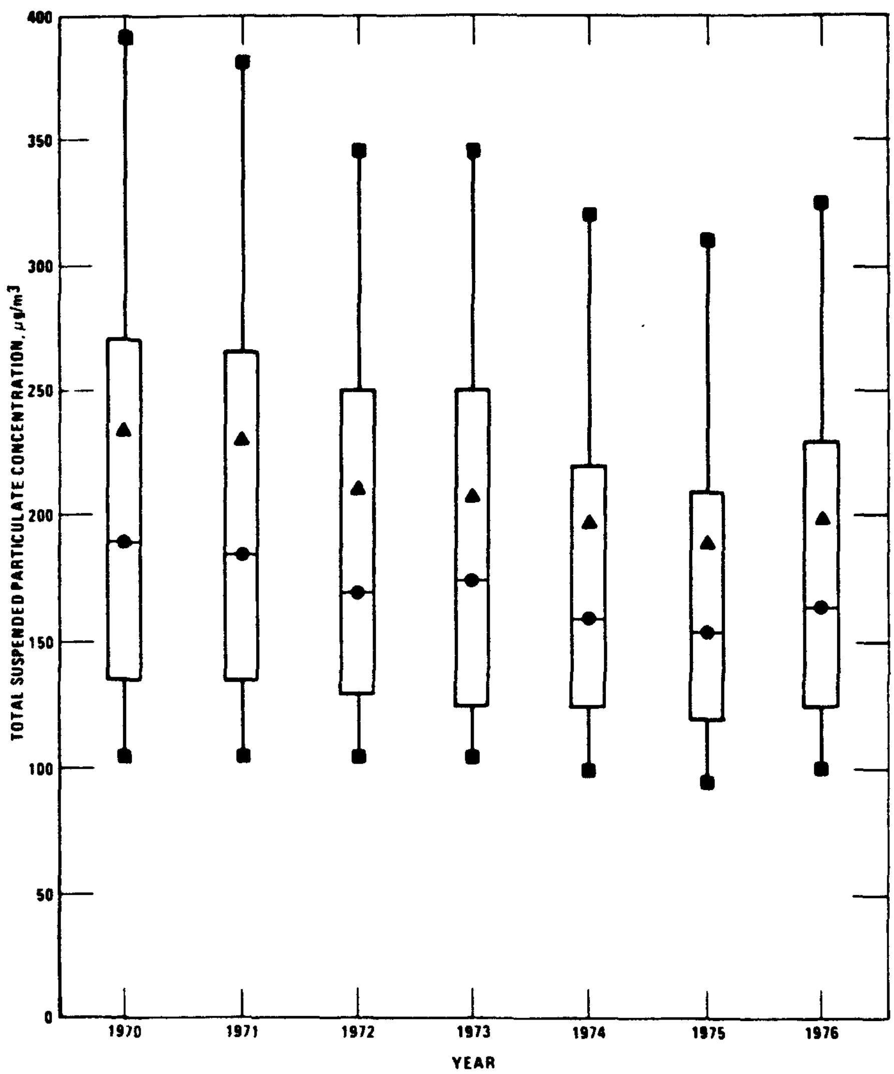


Figure 3-3. Trends of peak daily total suspended particulate concentrations from 1970 to 1976 at 2,350 sampling sites.

not widespread changes in sampling methodology, meteorological conditions would be the likely candidate for explaining these increases. In fact, many State agencies ranging from the Midwest to Washington and California have cited meteorology as the main reason for these TSP increases in 1976.[8-14] Large areas of the country experienced drought during 1976, and these extremely dry soil conditions increased the likelihood of wind-blown dust contributing to ambient TSP levels.

Figure 3-5 illustrates the geographical areas affected by drought in 1976. This map was constructed by integrating the Palmer Index* throughout 1976. The Palmer Index, a reasonable indicator of overall soil moisture conditions, reflects both rainfall and evapotranspiration. This map shows that dry soil conditions existed in those general areas that had TSP increases. Specific days that had high TSP concentrations may also be examined to see whether the dry conditions contributed to these values.

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* Obtained from the *Weekly Weather and Crop Bulletin, 1976.*

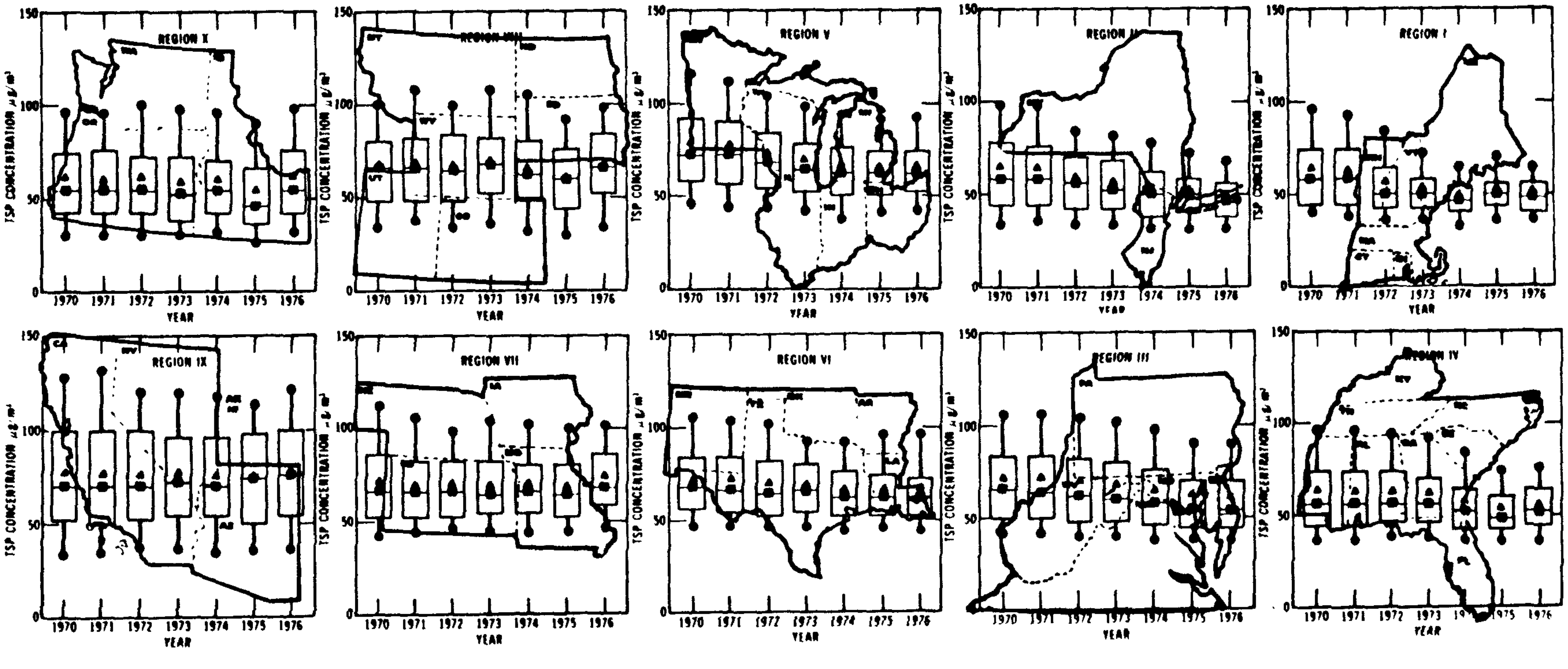

Figure 3-4. Regional trends of annual mean total suspended particulate concentrations, 1970 - 1976.

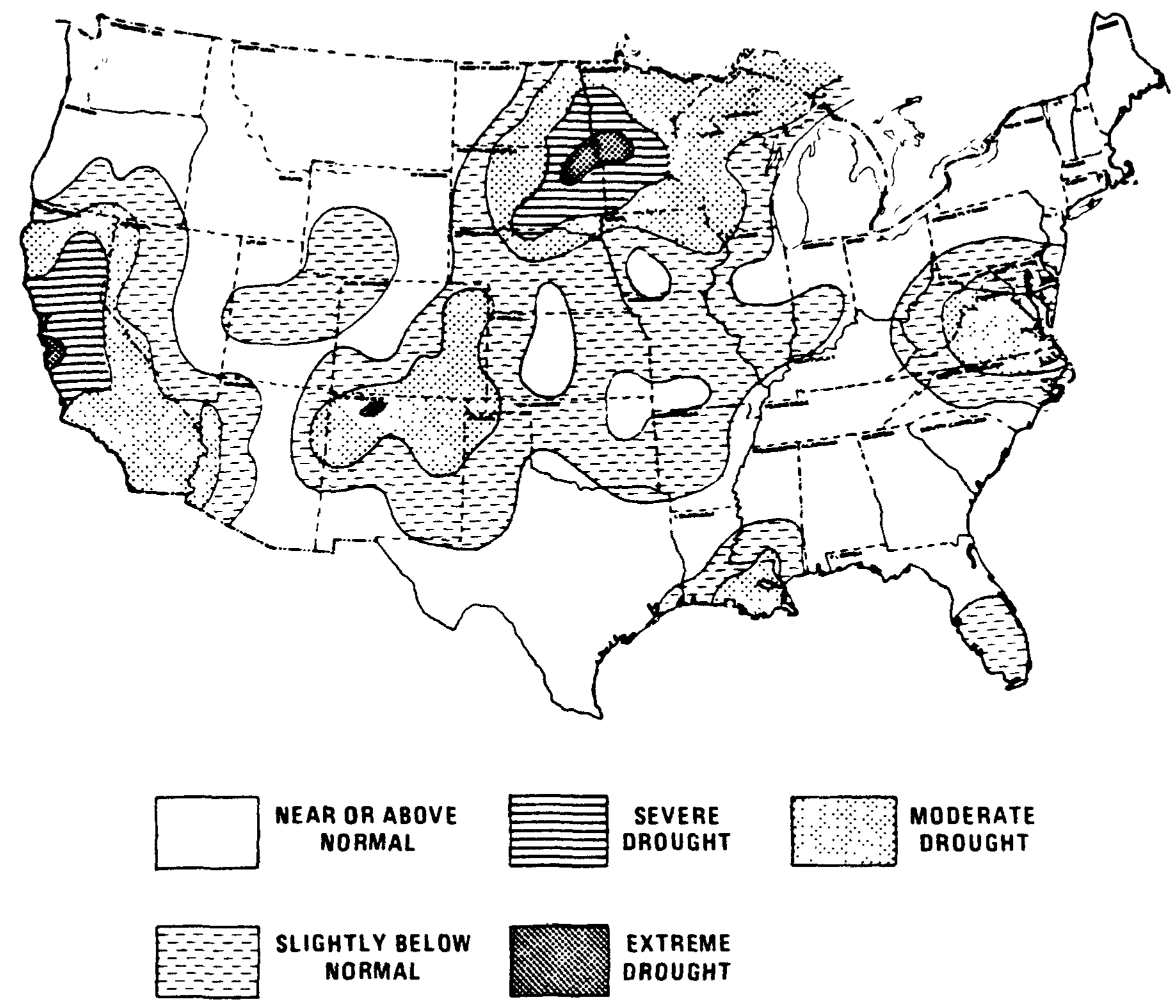

Figure 3-5. Index of drought from monthly Palmer Indices for period April - October 1976.

Such an analysis was done in the Midwest by EPA's Region V with the cooperation of the State agencies in Region V and also Iowa.[15] Figure 3-6 illustrates TSP isopleths in this area for October 15, 1976. Elevated TSP levels were recorded throughout this area. On this particular day, dry soil conditions and strong winds combined to increase the likelihood of wind-blown dust. These meteorological factors also coincided with fall harvesting, which increased the likelihood of wind-blown soil particles. This explanation of these high levels was also supported by microscopic examination of the high-volume filters for this day.[15]

An even more dramatic example of the impact of wind-blown dust over a broad geographic area occurred in February 1977 in the Southeast. Although this incident took place in 1977 rather than 1976, it illustrates the potential impact that dust storms can have. Extremely high TSP values were recorded on February 24, 1977, throughout this area, and an analysis was conducted by personnel of EPA's Region IV office with the cooperation of State and local air pollution agencies in the Southeast as well as the National Weather Service Forecast Office (NOAA) in Birmingham, Alabama.[16] Figure 3-7 shows TSP concentration isopleths in EPA Region IV for February 24, and is indicative of the

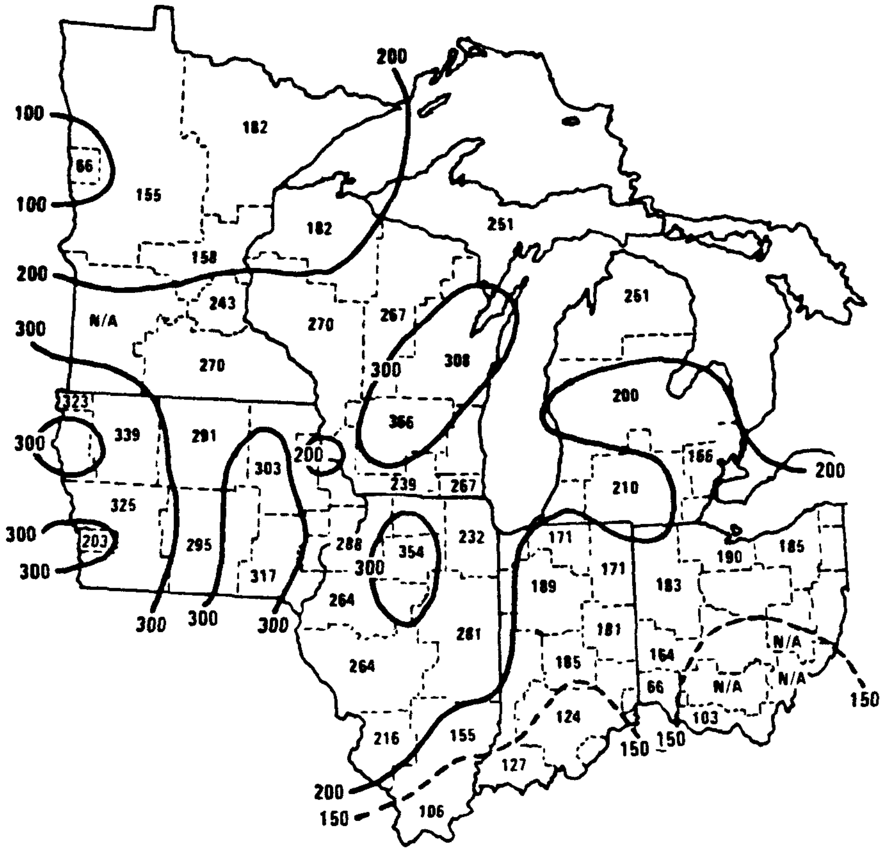

Figure 3-6. Isopleths of total suspended particulate concentrations ($\mu g/m^3$) in EPA Region V and Iowa for October 15, 1976.

extremely high values in this area for that day. The basic cause was wind erosion of the soil. Figure 3-8 graphically depicts a satellite view of the dust storm at successive points in time from February 23-25, 1977. Extremely dry soil conditions in the Central Plains and the development of a strong frontal system resulted in dust being stirred up and eventually transported east. Meteorological conditions that were likely to cause dust storms coincided with widespread cultivation for farming, and the end result was widespread transport of wind-blown dust throughout a broad geographical area. It should be noted that the concentration levels reported during this storm were extremely unusual for this area and represent historically high values that are not at all typical of the normal TSP ranges in the region.

In discussing the 1975-1976 increases, it should be noted that some areas continued to improve in 1976. For example, the continued progress in the New York area was presented in Section 2. Nationally, for those trend sites with complete 1975 and 1976 data, 54 percent of the sites above the primary standard in 1975 showed improvement in 1976. In general, the short-term 1975-1976 increases did not appreciably affect status with respect to the primary standards. For those sites located in highly populated areas (SMSA's), 5 percent went from above 75 $\mu g/m^3$ (the primary standard) to below, while another 5 percent crossed in the opposite direction for a net change of zero. For those sites located outside these populated areas, however, 8 percent crossed in the increasing direction while only 3 percent dropped below the standard so that there was a net increase. This seems consistent with the meteorological contribution to these increases in that the urbanized areas showed a lesser impact

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/2-78-052
December 1978

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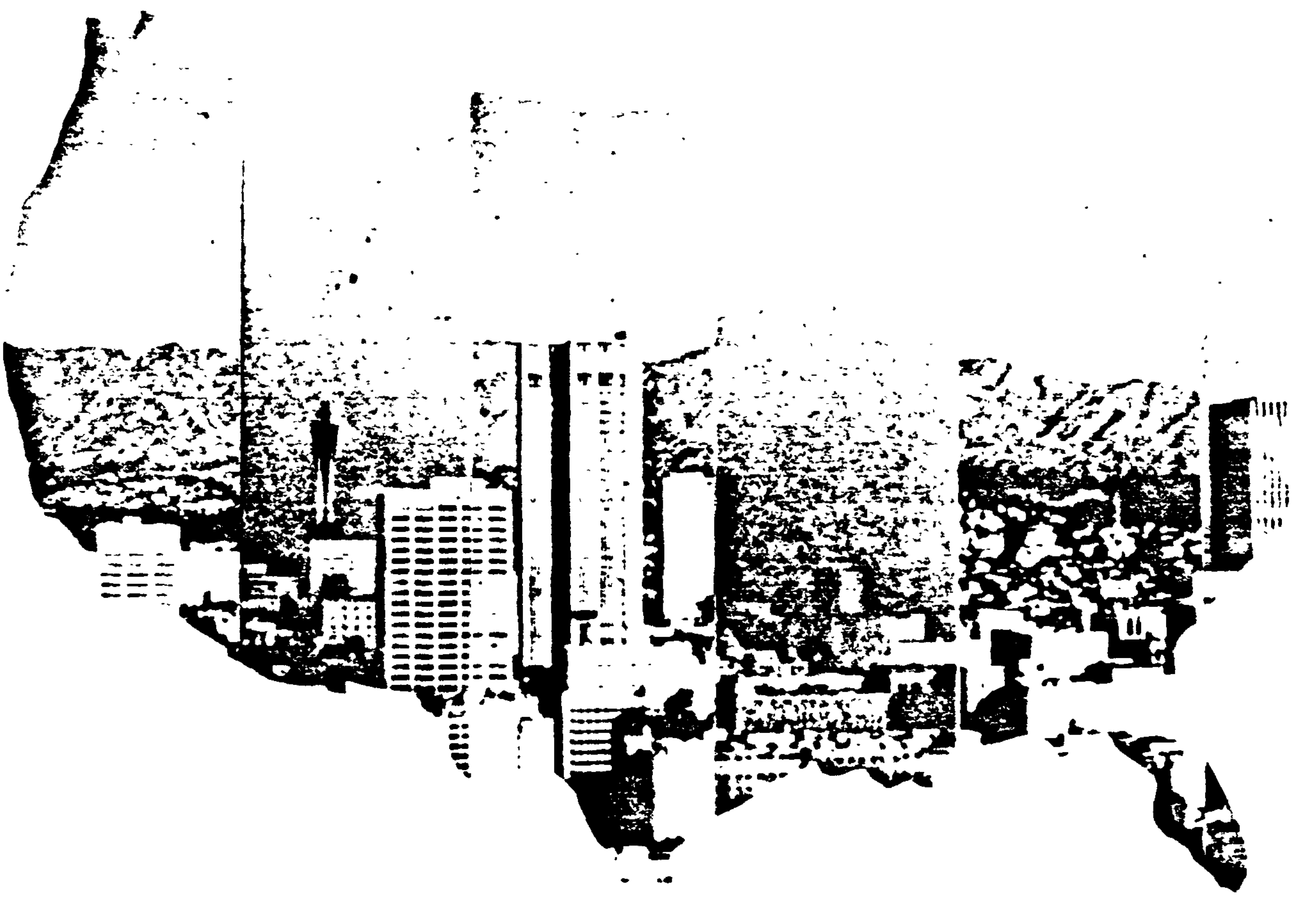
National Air Quality, Monitoring, and Emissions Trends Report, 1977



3. NATIONAL AND REGIONAL TRENDS IN CRITERIA POLLUTANTS

Trends in ambient levels of total suspended particulate (TSP), sulfur dioxide (SO_2), carbon monoxide (NO_2), oxidants/ozone (O_3), and nitrogen dioxide (NO_2) are reported in this section. Each of these criteria pollutants is discussed individually; the extent of the analysis varies according to the amount of available historical data. The major emphasis is upon national trends and trends over broad geographical regions. As in previous reports,[1,6] California is emphasized in the subsections dealing with the automotive-related pollutants -CO, O_3, and NO_2 - because of extensive historical monitoring of these pollutants.

3.1 TRENDS IN TOTAL SUSPENDED PARTICULATE

Total Suspended Particulate (TSP) levels throughout the nation have improved during the 1970's These trends have been discussed in previous reports.[1-6] This section examines long-term TSP trends from 1972 through 1977 and the short-term changes from 1976 to 1977. The general trend shows long-term improvement with a gradual leveling off in the past few years.

Data for describing these trends were obtained from EPA's National Aerometric Data Bank, which stores air quality data submitted by State and local agencies and by federal monitoring programs To ensure seasonal balance, trend sites were selected only if they had four consecutive quarters of TSP data in both the 1972-74 and the 1975-77 time periods. Accordingly, 2,707 sites that met this selection criterion were included in the analysis. Over 70% of these sites had at least 4 years of data and over 90% had at least 3 years.

Throughout this section, as in previous reports,[5,6] trends are depicted using a modified box-plot[7] to display simultaneously several features of the data Figure 3-1 illustrates the use of this technique in presenting the composite average, the median, and selected percentiles corresponding to the lower and higher concentration levels.

3.1.1 Long-Term TSP Trends: 1972-77

Figure 3-2 is a box-plot presentation of national trends in geometric mean TSP levels from 1972 to 1977. During this period, the nationwide average decreased by 8%, an improvement of almost 2% per year. While all parameters show improvement, the decrease in TSP levels is most pronounced in the 90th percentile values of the box-plots.

Figure 3-3 summarizes TSP trends for each of the 10 EPA Regions. The overall trend in improvement from 1972 through 1975 was followed by a reversal in some regions in 1976; this reversal is discussed in more detail in the following section on short-term changes.

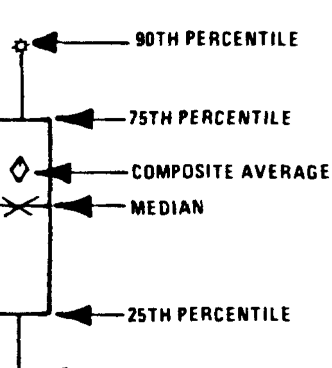


Figure 3-1. Sample illustration of plotting conventions for box plots.

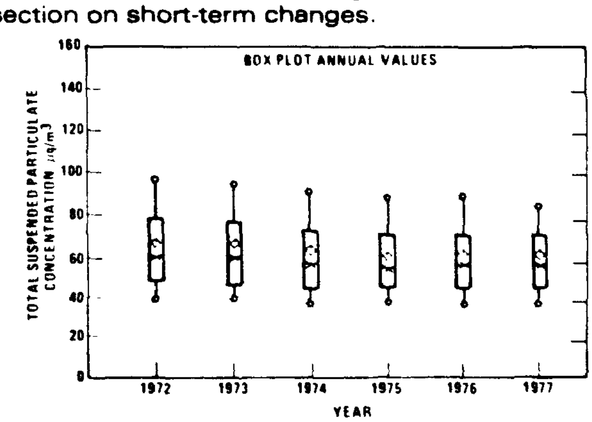


Figure 3-2. Nationwide trends in annual mean total suspended particulate concentrations from 1972 to 1977 at 2,707 sampling sites.

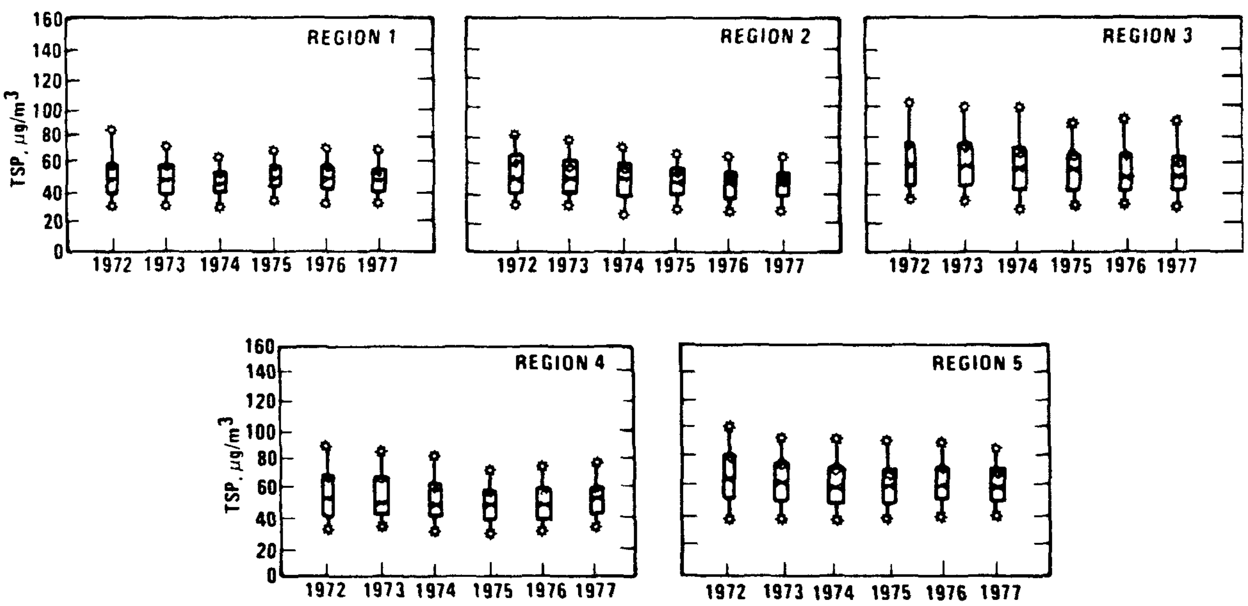
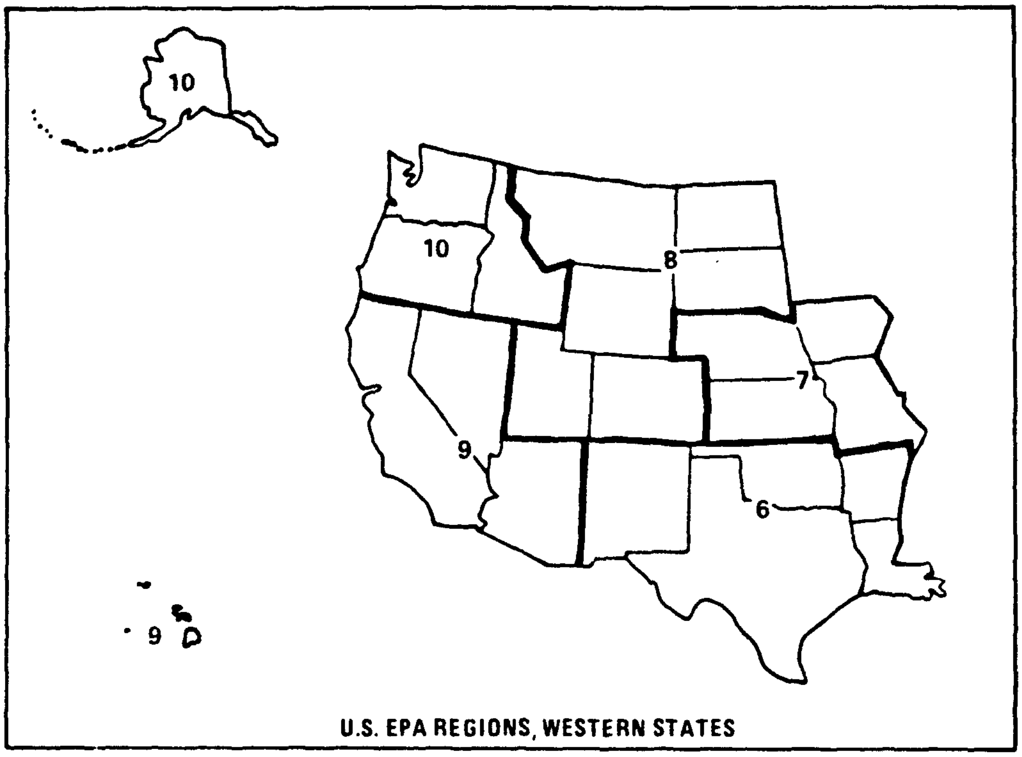


Figure 3-3. Regional trends of annual mean total suspended particulate concentrations, 1972 - 1977.



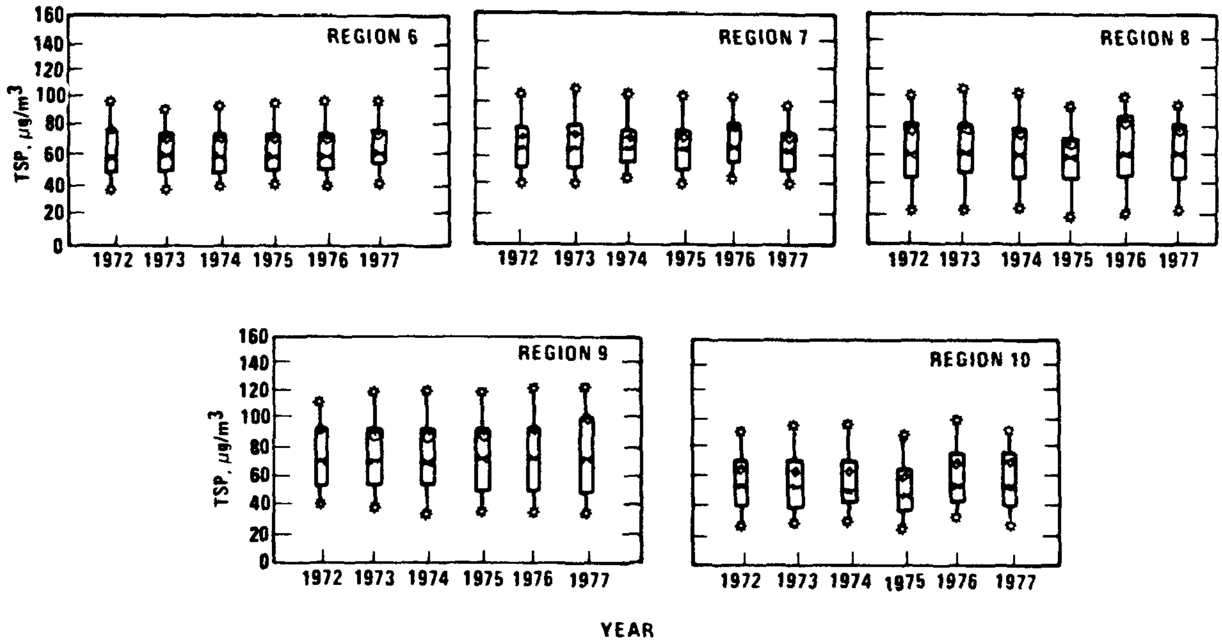


Figure 3-3 (continued). Regional trends of annual mean total suspended particulate concentrations, 1972 - 1977.

Despite the short-term reversal in 1976, 60% of the sites showed long-term improvement from 1972-1977. For those sites with TSP concentrations exceeding the annual standard, 77% showed long-term improvement. Approximately 25% of the sites reported their lowest annual values in 1977.

Although there has been a nationwide decrease in levels of total suspended particulate matter, there is evidence that levels of some types of particulates may be increasing. This is indicated by increasing trends in secondary particulates, such as sulfates[8] and deterioration of visibility in the Southwest and nonurban areas of the East.[9,10] The patterns are consistent with growth of emission sources outside of large metropolitan areas.

3.1.2 Short-Term TSP Changes: 1976-77

The short-term increase in TSP levels in 1976 was discussed in detail in last year's report.[6] Many areas experienced unusually dry weather in 1976; the resulting wind-blown dust may have contributed to elevated TSP levels. On February 24, 1977, the extremely dry soil conditions in the Central Plains and a strong frontal system resulted in dust being stirred up and transported east. The resulting high TSP levels measured throughout the Southeast were discussed previously.[6] Figure 3-4 shows peak value TSP levels in Region VI (Central Plains) by quarter from 1972 through 1977. The dramatic increase in the first quarter of 1977 is obvious from this graph. Monitoring sites throughout Texas, Oklahoma, and Arkansas reported high TSP levels during this February dust-storm. Several sites recorded daily values in excess of 1000 $\mu g/m^3$, a single value of this magnitude would increase the annual geometric mean at a site by 10%.

The short-term increases associated with unusually dry conditions had relatively little effect on the percentage of sites nationwide exceeding the TSP standard. In fact, those sites exceeding the annual mean standard continue to show improvement by a two to one margin.

3.2 TRENDS IN SULFUR DIOXIDE

Sulfur dioxide (SO_2) levels in urban areas throughout the Nation have gradually improved since 1970.[1-6] The 1972-1977 trends show dramatic initial improvement followed by fairly consistent continuing improvement. In most urban areas, this is consistent with the switch in emphasis from attainment of standards to maintenance of air quality; that is, the initial effort of reducing pollution to acceptable levels has been followed by efforts to maintain air quality at these lower levels.

Sites providing data for these analyses were selected from EPA's National Aerometric Data Bank. As with TSP, trend sites for the 1972-1977 time period were selected to ensure the historical completeness and seasonal balance of data. For SO_2, 1,233 sites had sufficient data to qualify as trend sites.

3.2.1 Long-Term SO_2 Trends: 1972-77

Figure 3-5 illustrates nationwide trends in annual mean sulfur dioxide levels from 1972 through 1977. The graph shows that sulfur dioxide levels continued to improve in the middle 1970's although the rate of improvement was much less pronounced than in 1970. From 1972 through 1977, the national average SO_2 level dropped 17%, an annual improvement rate of 4% per year. As would be expected, the majority of sites showed improvement during this period.

3.2.2 Short-Term SO_2 Changes: 1976-77

Short-term changes in sulfur dioxide levels between 1976 and 1977 were mixed, with no predominant trend. Most urban area SO_2 monitors reported levels well below the annual standard. High SO_2 levels are primarily associated with specific point sources.

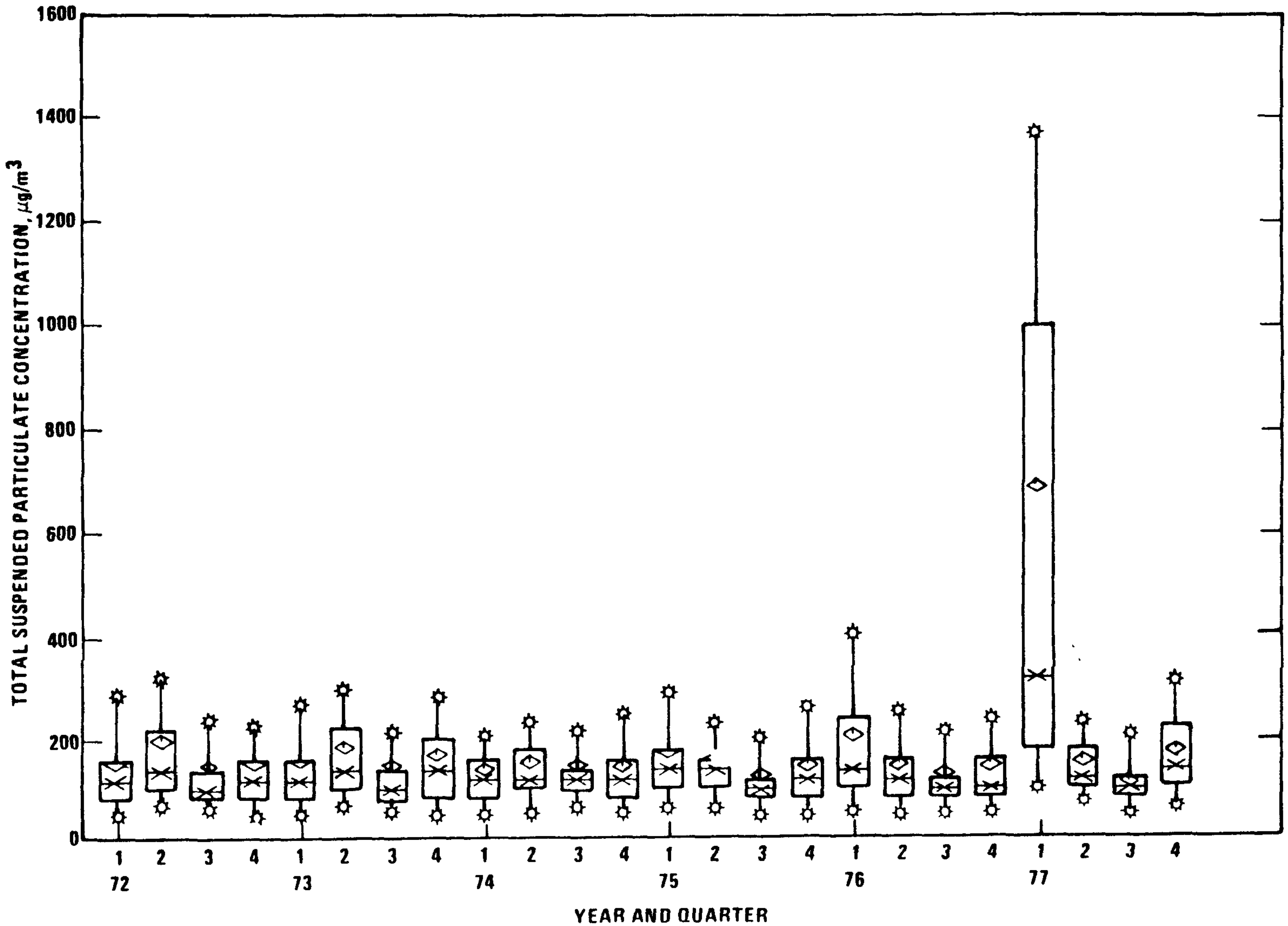


Figure 3-4. Quarterly total suspended particulate maximum values in Region VI from 1972 to 1977 illustrating the effect of the 1977 dust storm.

ATTACHMENT 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE SEP 2 1 1983

SUBJECT Suggested Method for Flagging Anomalous Data in the Future AIRS System

FROM: Stephen K. Goranson, Chief
Environmental Monitoring Branch

SKG

TO: John C. Bosch, Acting Chief
National Air Data Bank
MDAD, OAQPS (MD-14)

Our State agency and Regional Office participants appreciated your staffs' visit in May to discuss AIRS. We welcome your return at least annually to keep our staff and the States abreast of changes in the national air quality/emissions data base management systems as well as listening to our concerns.

One important discussion topic raised at the meeting was the ability to flag individual data points which were valid but which should be excluded for specific purposes such as attainment analysis. An example might be a single documented dust storm which affected most monitors over a large geographic area. AIRS will utilize ADABAS, a data base management system, offering the ability to select on a single or multiple parameter basis and then to perform statistical analysis of the selected data. The data base management system also allows tables and coordinated files, which could prove to be useful in tracking unusual data through the following scheme.

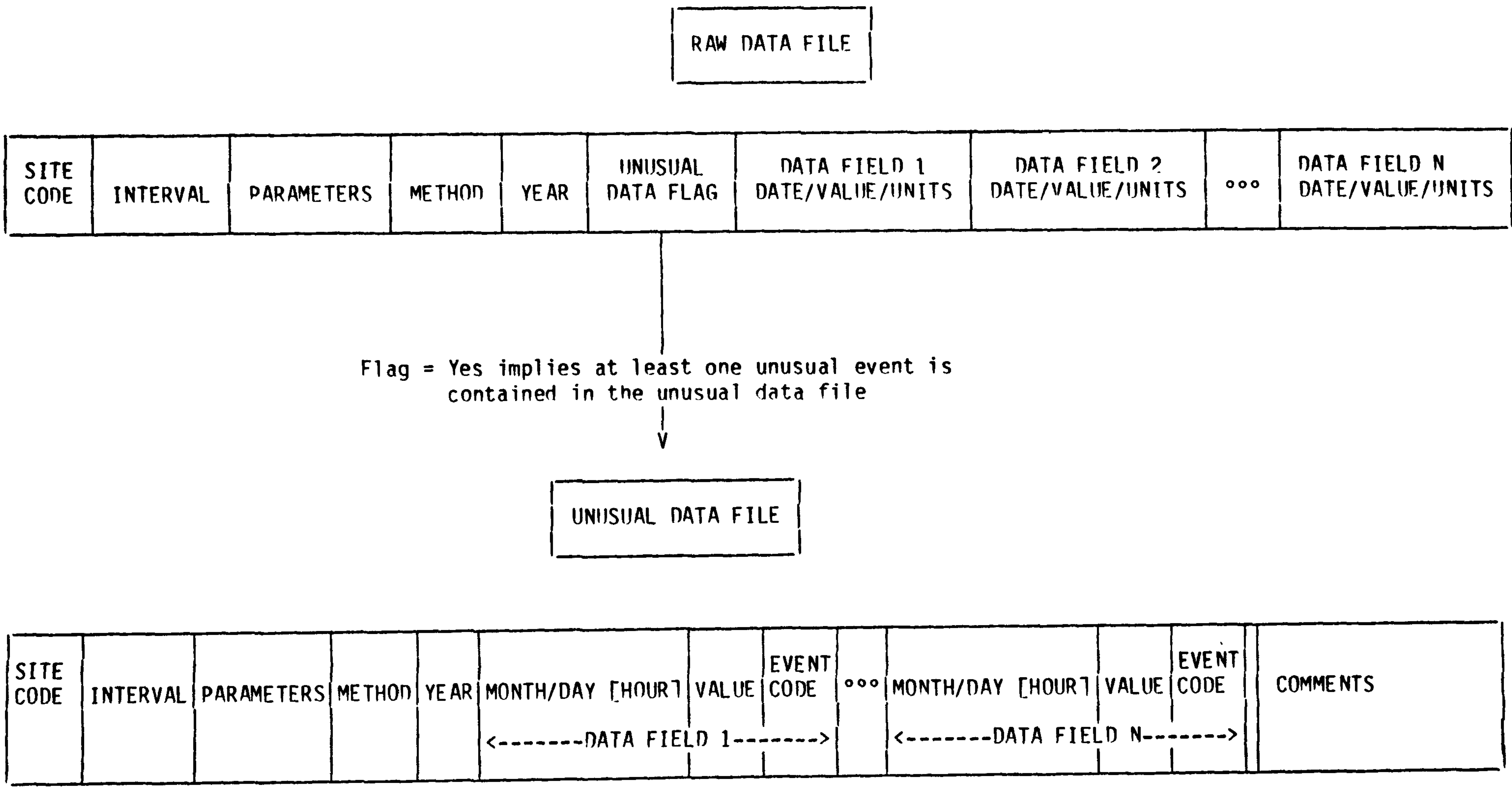
Obviously, maintaining a flag for each data value would be a tremendous overhead of disk space. However, if AIRS data records ard constructed on a SAROAD site/pollutant/year/data value(s) basis, as I believe the current system is for intermittent data, a one character flag could indicate whether the record contains at least one anomalous concentration value.

If the record indicates, for example, a flag $\neq 0$, then a coordinated file could be scanned to determine which value or values could be excluded from statistical analysis (e.g., arithmetic mean, maximums, etc.).

The coordinated file would consist of the site/parameter/year key and the associated date(s) and unusual value(s). A one character code could be assigned to the data value to indicate the type of event which occurred to exclude it from the statistical analysis. Since the expected number of these data would be small, the coordinated file could contain a free format comments field like the current NADB*AERO-MESSAGE file. If a summary file of statistics is also maintained, NADB has the choice to include or exclude such data upon update.

Depending on the structure of the raw data transaction record, the unusual data file could be updated either manually or automatically. A schematic of the flagging structure is attached.

As I am certain you have already been planning on such a request from the Regions, I hope this information may be useful to you. If your have further questions or suggestions, please contact me at 353-2306.


RAW DATA FILE
SITE CODE
INTERVAL
PARAMETERS
METHOD
YEAR
UNUSUAL DATA FLAG
DATA FIELD 1 DATE/VALUE/UNITS
DATA FIELD 2 DATE/VALUE/UNITS
°°°
DATA FIELD N DATE/VALUE/UNITS
Flag = Yes implies at least one unusual event is contained in the unusual data file
UNUSUAL DATA FILE
SITE CODE
INTERVAL
PARAMETERS
METHOD
YEAR
MONTH/DAY [HOUR]
VALUE
EVENT CODE
<-------DATA FIELD 1------->
°°°
MONTH/DAY [HOUR]
VALUE
EVENT CODE
<-------DATA FIELD N------->
COMMENTS