EPA-910/9-75-016
JANUARY 1976

EVALUATION OF NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) NON-ATTAINMENT: METHODOLOGY AND EXAMPLE TOTAL SUSPENDED PARTICULATE ANALYSIS FOR SPOKANE COUNTY

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BOA No. 68-02-1378 TASK 16

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January 1976

ACKNOWLEDGMENT

The authors wish to express particular gratitude for the responsiveness and cooperation displayed by members of the Spokane County Air Pollution Control Authority. Without their assistance in providing comprehensive air quality and emissions data as well as related technical information, the "Total Suspended Particulate Analysis for Spokane County" would not have been possible.

We also wish to thank the Washington State Department of Ecology for their aid in providing air quality and available meteorological data.

EXECUTIVE SUMMARY

Environmental Protection Agency (EPA) has placed high priority during FY 1976 on identifying State Implementation Plan (SIP) control strategy deficiencies. In response to this, a methodology was developed to provide a framework within which an agency may work to evaluate control strategy deficiencies in light of National Ambient Air Quality Standards (NAAQS) non-attainment. The methodology, tailored to the evaluation of total suspended particulates (TSP) and sulfur dioxide (SO_2), was then applied to an analysis of the TSP non-attainment problem in Spokane County.

The approach first required completion of an air quality profile for the non-attainment area of concern. An air profile is a product representing the compilation and reduction of available ambient air quality, emission and relevant meteorological data. From this information and the findings from any previously conducted related studies, source-receptor relationships are to be defined. The development, implementation, and enforcement of the existing SIP control strategy may then be analyzed. Finally, the corrective actions necessary for attainment of NAAQS are to be delineated.

The method of assessing source-receptor relationships relies on the logical analysis of available data and information as opposed to emphasizing a mathematical modeling approach. This assessment is divided into (1) seasonal and annual analyses and (2) a day-by-day analysis of data. The long-term analysis may involve:

1. Correlating seasonal meteorological patterns with seasonal emission activity patterns.

2. Performing other statistical evaluations such as correlation analyses among sampling sites.

3. Evaluating the findings from previous modeling or filter analysis studies.

4. Evaluating the worth of modeling, and applying as needed and capabilities permit.

The day-by-day analysis may include activities such as:

1. Isolating days and monitoring sites where short-term standards were violated.

2. Determining what meteorological conditions could have accounted for the NAAQS violations.

3. Performing modeling to determine, under worst case conditions, what the impact of key sources may have been.

4. Performing microscopic analyses of selected filters to determine likely major contributing sources on violation days.

5. Performing statistical evaluations.

An evaluation of the State Implementation Plan (SIP) may include:

1. A review of the SIP for correctness of data input.

2. Comparison of regulation stringency with reasonably available control technology (RACT).

3. A review of the control strategy implementation and enforcement.

Corrective actions required for ensuring attainment may include:

1. Increased enforcement activity, and/or

2. Waiting for sources now on compliance schedules to come into compliance, and/or

3. Specific control strategy revisions for those aspects of control strategies found to be substantially inadequate.

The analysis of the TSP non-attainment problem in Spokane disclosed findings which include the following:

1. The geographical area of non-attainment for primary TSP NAAQS appears to extend in a band from the Spokane central downtown area east-northeasterly for approximately 3.5 miles (5.6 kilometers).

2. The two stations with the highest TSP concentrations are those located at Crown Zellerbach and the Aluminum Supply Company. Both are industrial areas. The highest annual geometric mean for CY 1974 in the Spokane area was 90 $\mu g/m^3$ at the Crown Zellerbach site. During FY 1975 which was the first 12 months of record at the Aluminum Supply Company monitoring site, a geometric mean of 119 $\mu g/m^3$ was recorded.

3. A strong pattern of high TSP concentrations during the relatively dry months of July through October is exhibited at all five sampling sites in the above described TSP non-attainment area.

4. Lower wind speeds are prevalent during the late summer and early fall months.

5. The largest single point source in Spokane County is Kaiser Mead, a primary aluminum reduction plant. Emissions are 1482 tons per year of particulates, based on the 1975 emissions inventory. The impact of these emissions on ambient air quality could not be made in this evaluation due to inadequate data. Kaiser Mead is located approximately 4 miles (6.4 km) north of the city center and the TSP non-attainment area.

6. Seasonal activities include agricultural harvest activities with associated increased grain handling operations and field burning, and gravel pit-crushing-screening-stockpiling operations. These activities are reported to be greatest during the summer and early fall months. Four different companies conduct gravel pit, crushing, screening, and stockpiling operations within a 0.5 mile (0.8 km) radius of the Aluminum Supply Company monitor. Combined emissions are estimated to be 111 tons per year plus 25 tons per year from a rotary asphalt dryer. Production is strongly dependent upon the seasonal demand for gravel and concrete.

7. As of 1974, it was estimated that 240 miles (384 km) of dirt roads in the City of Spokane contributed 1,000 tons of particulates annually. Within a radius of 0.5 mile (0.8 km) of the Crown Zellerbach and Aluminum Supply Company monitors, there are (as of January 1974) approximately 7.8 (12.5) and 2.4 (3.8) miles (km) of unpaved roads respectively. Calculated emissions show that these roads in the area of the Crown Zellerbach monitor contribute approximately 44 tons per year of particulates less than 10 microns in size. The 2.4 miles (3.8 km) of roads around the Aluminum Supply Company monitor were calculated to contribute 12 tons of less than 10 microns particulates annually. Emissions are likely to be concentrated during the dry part of the year.

8. The data shows a good correlation between dry periods and ambient TSP values. An analysis of 27 days with ambient TSP concentrations in excess of 150 $\mu g/m^3$ showed that 25 of the days were preceeded by rainless periods of three days to over one month.

9. No correlation between wind direction and TSP concentrations was noted. Such a correlation was attempted for the Aluminum Supply Company and Crown Zellerbach monitors for August through October 1974.

10. Droege and Clark[15] performed a special study in 1972 and 1973 to describe the TSP problem in Spokane County. Findings include:

a. Higher TSP concentrations are found on dry days as opposed to days with precipitation, regardless of the time of year.

b. TSP concentrations are higher during the summer than the winter.

c. High TSP concentrations are associated with strong winds and low humidity.

d. Considering the sampling months of May, August through September, November and January, the metals and organic composition were highest in November.

e. Only half as many filters were in the brown-green range (as opposed to gray) during the November/ January sampling periods compared to the May/ August - September sampling period.

11. The rollback calculations upon which the TSP control strategy was based were strongly deficient with respect to the correctness of data input. Maximum ambient TSP concentrations were much higher than shown by available data at the time of SIP development. Emission inventory figures were also seriously underestimated, due primarily to the omission of unpaved roads.

It was concluded that fugitive dust/fugitive industrial emissions are the likely major cause of TSP non-attainment in Spokane. The likely major contributors are (1) unpaved roads, (2) emissions from gravel pit, rock crushing, screening, and stockpiling operations, and (3) possibly natural wind blown dust.

Recommended corrective actions include:

1. Initiation of a program to control emissions from unpaved roads to the City of Spokane.

2. Reassess the magnitude of fugitive emissions from industrial operations in the geographical non-attainment area. Re-evaluate the compliance status of such sources.

3. Conduct a special monitoring study to determine the impact of emissions from gravel pit - crushing - screening - stockpiling operations on ambient air quality.

4. Determine RACT for gravel pit - rock crushing - screening - stockpiling operations. Compare existing emission controls with RACT for those operations conducted in the Spokane city area.

5. Consider revising the control strategy through the additions of specific fugitive emission regulations.

EVALUATION
OF
NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)
NON-ATTAINMENT: METHODOLOGY

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I. BACKGROUND

With the realization that a number of Air Quality Control Regions (AQCRs) would not be meeting National Ambient Air Quality Standards (NAAQS) by the Congressionally established attainment date of July 1975 the Environmental Protection Agency (EPA) is placing high priority during Fiscal Year (FY) 1976 on identifying State Implementation Plan (SIP) control strategy deficiencies. Where plans are found to be substantially inadequate to ensure attainment of NAAQS, EPA is to notify the States of the deficiencies and request corrective action. As required by EPA Headquarters, this notification is to appear in the Federal Register by July 1, 1976. A description and outline of this requirement appears in OAQPS Draft Guideline No. 1.2-011 entitled "Guidelines for Determining the Need for Plan Revisions to the Control Strategy Portion of the Approved State Implementation Plan."

In preparation for this activity, EPA Region X, during FY 1975, designated 20 counties (including two Alaska boroughs) as priority abatement areas (PAAs). PAAs were defined as counties (or Alaska boroughs) where attainment of primary NAAQS by July 1975 for one or more criteria pollutants was not expected. During the latter half of FY 1975 and first month of FY 1976, an air profile was completed for each PAA. An air profile is a product representing the compilation and reduction of all available ambient air quality, emission, and pertinent meteorological data. The primary purpose of a profile is to address the magnitude and geographical extent of the non-attainment problem as well as make a preliminary assessment, where possible, of the reasons for non-attainment of NAAQS. Thus, the profile is envisioned as being the foundation upon which the more specific non-attainment evaluation is to be built.

EPA Region X has worked closely with the states in outlining the tasks necessary to complete the non-attainment evaluations. The states agreed to complete the following in their FY 1976 work plans:

1. Make attainment - non-attainment determinations on all ambient data which has not been submitted to Region X.

2. Perform profile evaluations for all non-attainment areas. This includes updating, where necessary, existing profiles for PAAs and constructing profiles for any additional non-attainment areas.

3. Complete specific non-attainment evaluations for each non-attainment area except where non-attainment of standards is documented as being due solely to fugitive dust from natural or agricultural practices.

4. Recommend specific SIP control strategy revisions or more stringent enforcement policies where necessary to ensure attainment of NAAQS.

Figure 1 depicts the organization of those non-attainment evaluation activities as envisioned by EPA Region X. Note that the initiation of a non-attainment evaluation requires the completion of both attainment - non-attainment determination and profile tasks. EPA Region X has agreed to provide technical assistance to the states in carrying out these tasks.

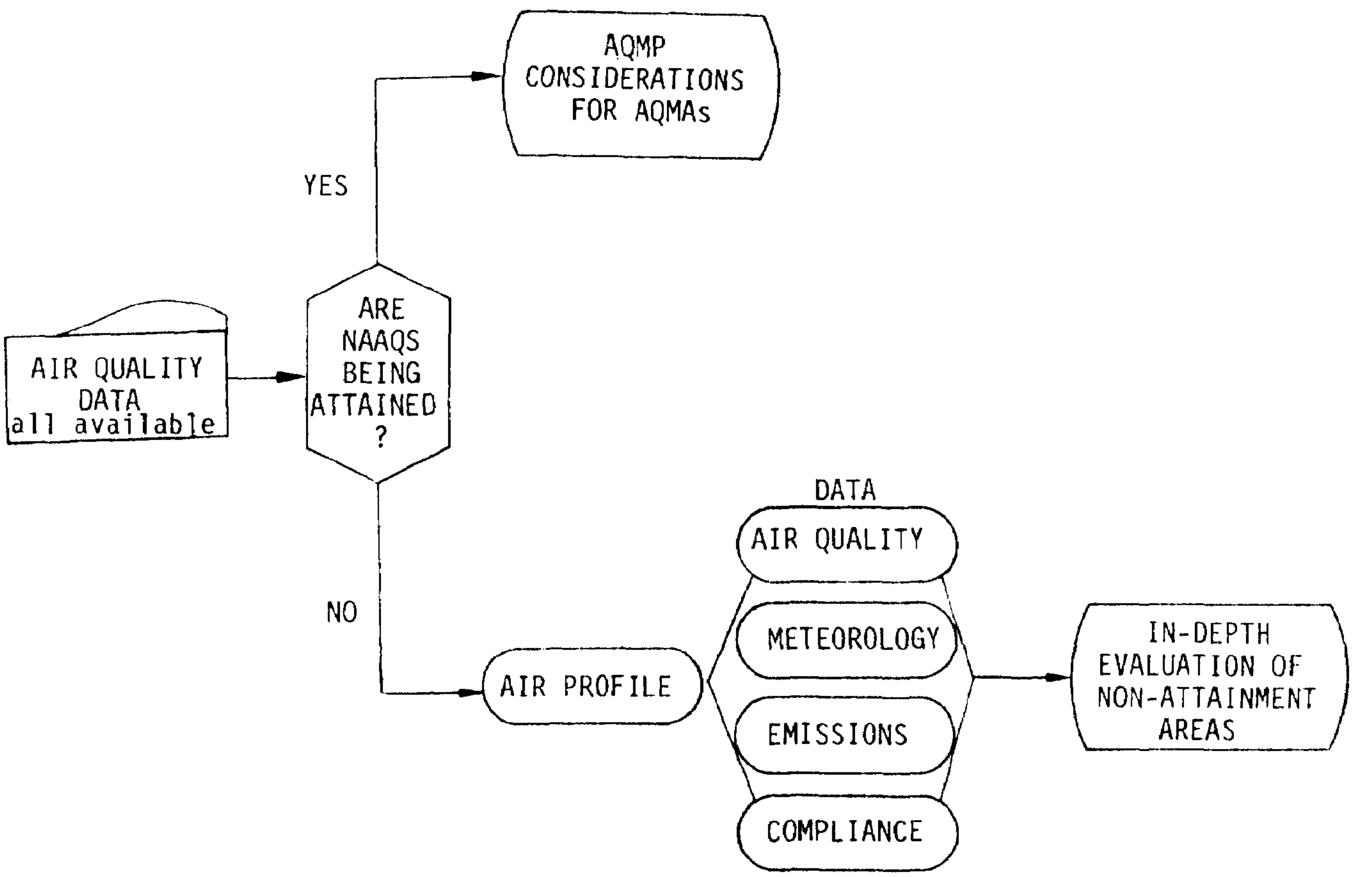


Figure 1. OVERALL NON-ATTAINMENT ANALYSIS

II. PURPOSE

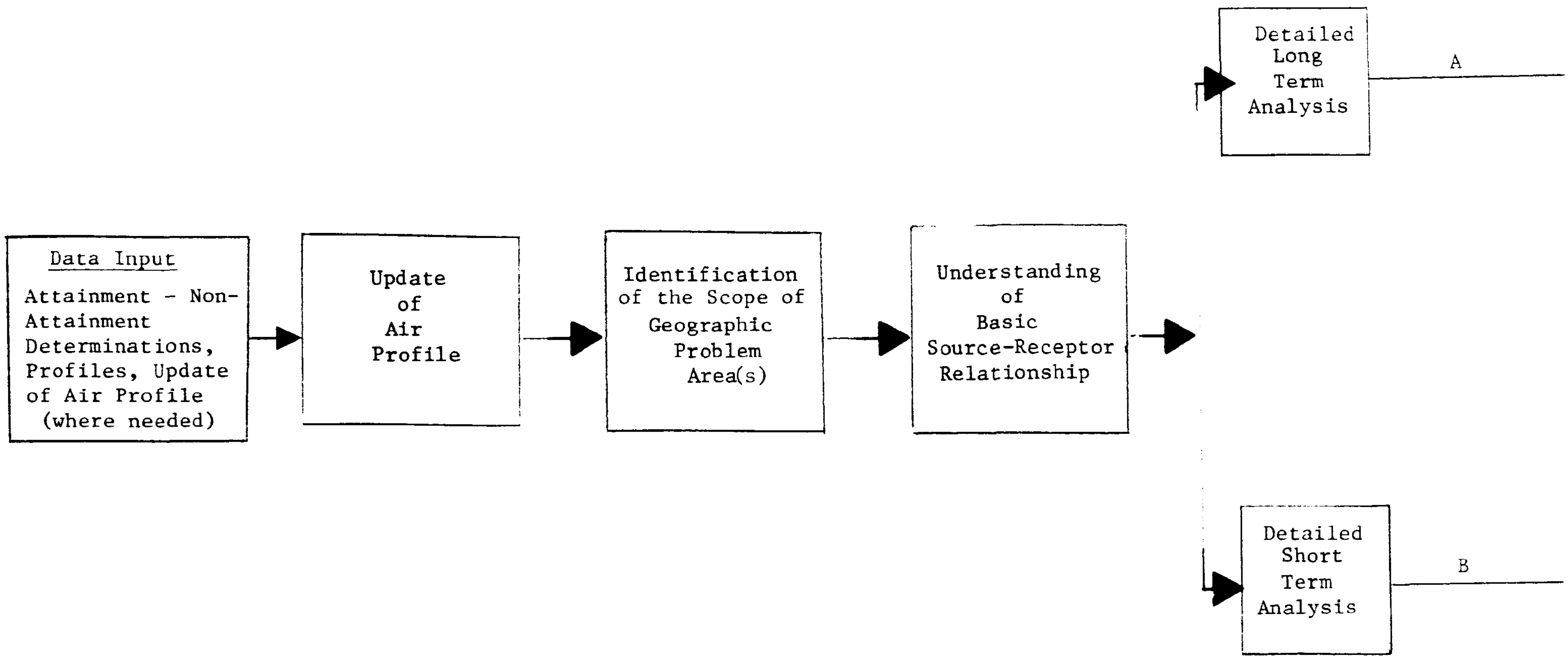
The purpose of this document is to describe a detailed methodology specific to Region X for the evaluation of the non-attainment of total suspended particulate (TSP) and sulfur dioxide (SO_2) NAAQS. It is felt, however, that the same general approach and many of the specific concepts presented in this document are applicable to carbon monoxide (CO), photochemical oxidants and nitrogen oxides (NO_x) as well.

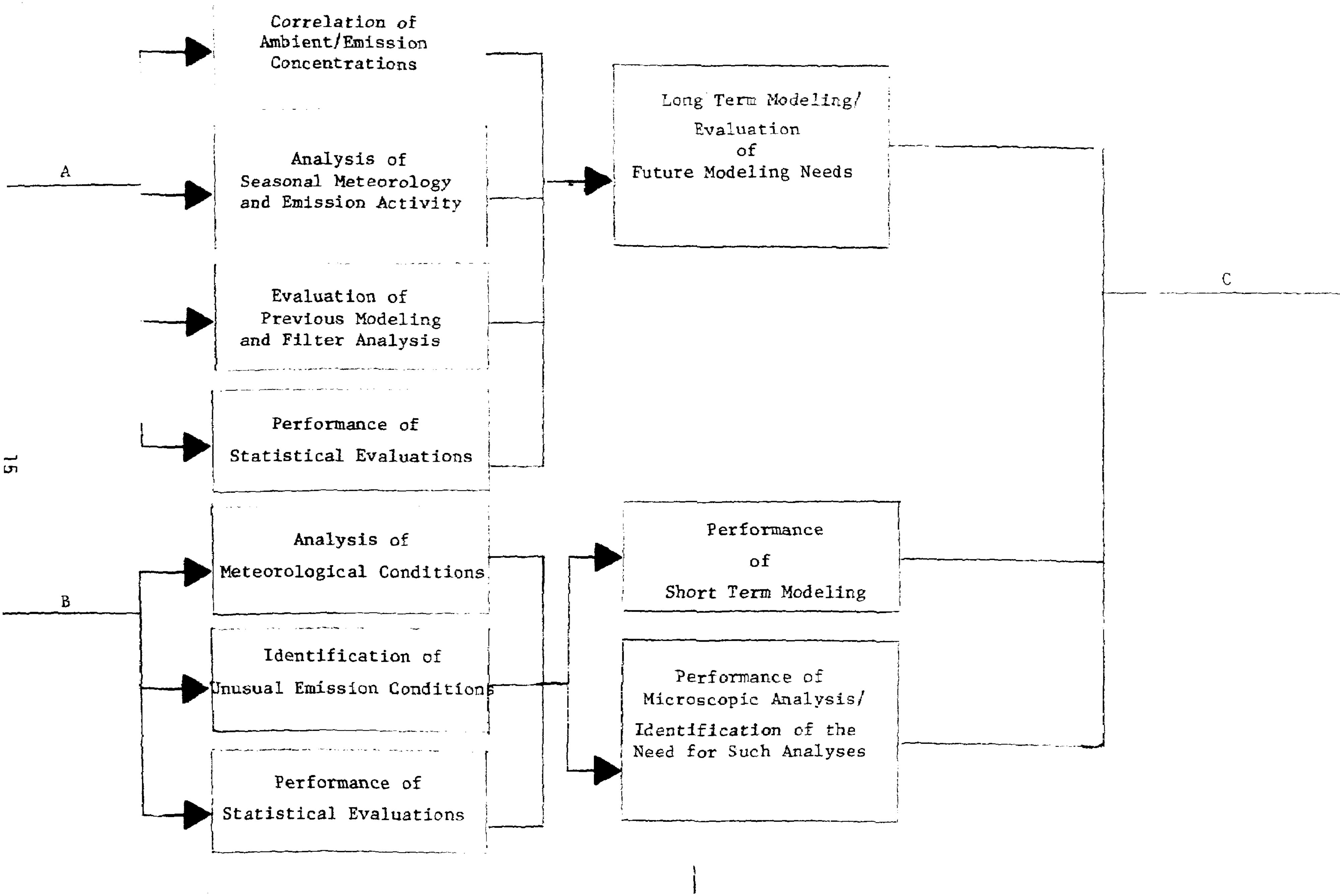
This methodology is intended for use by EPA Region X, State and local agency personnel as a guideline for identifying source-receptor relationships and evaluating existing SIP control strategies and control strategy enforcement. The methodology presented here is not intended to be a step-by-step procedure which must be strictly adhered to, but is more a recommended framework or guideline within which an agency may work to answer those questions necessary to evaluate NAAQS non-attainment problems. Due to the unique nature of individual non-attainment situations, it is recognized that no single method will meet the specific needs of all non-attainment areas. Each evaluation must be approached on a case-by-case basis. Thus, it is expected that considerable ingenuity will be required in performing non-attainment evaluations. The methodology presented here is intended to be used with latitude and flexibility limited only by the requirement that SIP deficiencies and the reasons for NAAQS non-attainment be documented and corrective actions leading to attainment of NAAQS be proposed.

III. APPROACH OVERVIEW

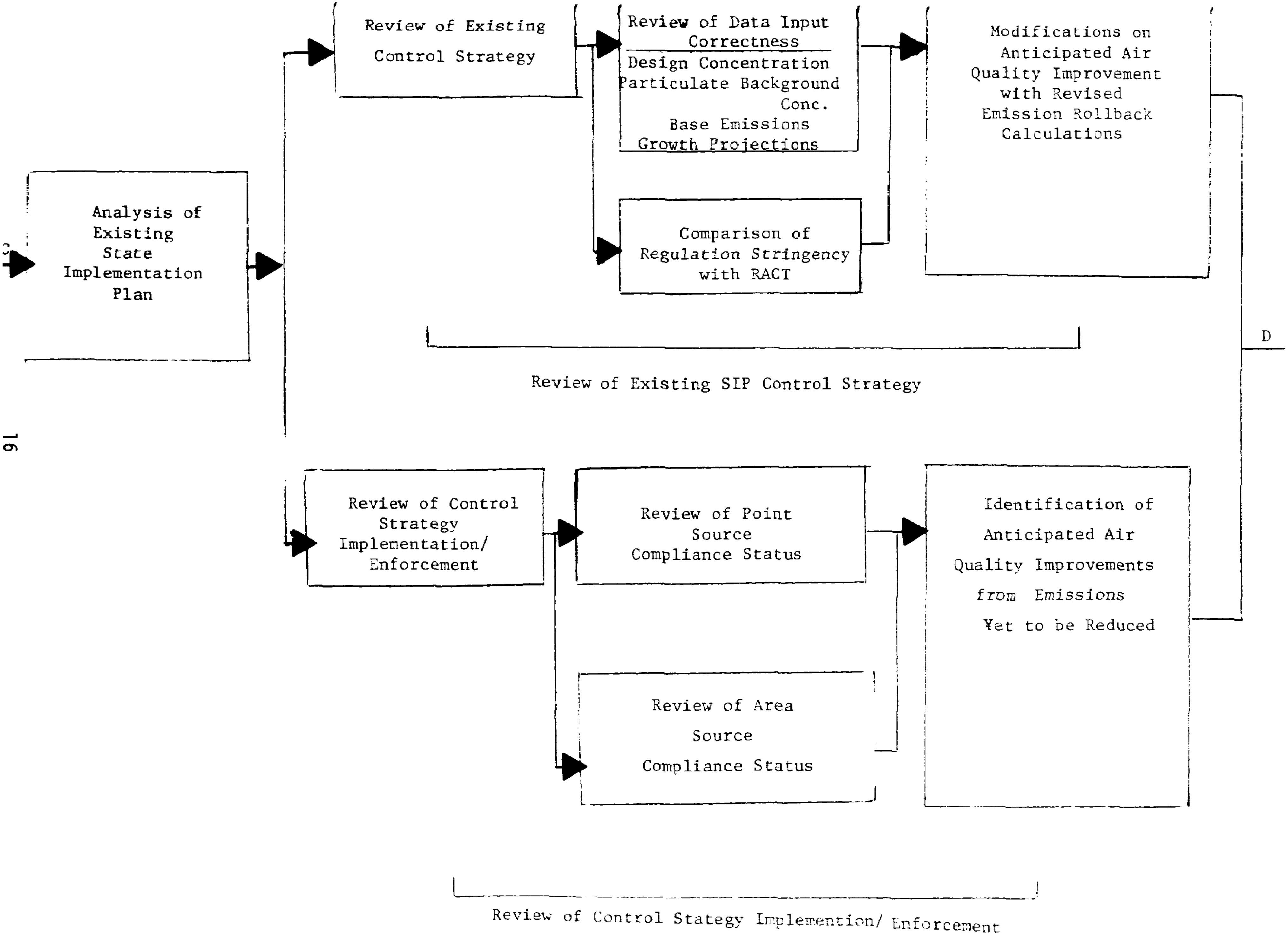
The proposed methodology for evaluation of the non-attainment of NAAQS involves identifying the extent of non-attainment and then determining the causes of that non-attainment. This procedure can be divided into three evaluation steps - 1) update and strengthen the existing air profile as necessary, 2) identify source-receptor relationships, and 3) analyze the implementation and enforcement of the existing SIP control strategy. Particular non-attainment causes are to be documented and quantified. A brief discussion of possible corrective actions in response to the non-attainment findings is to be made.

Figure 2 shows the flow diagram for the evalution methodology.


Data Input
Attainment - Non-Attainment Determinations, Profiles, Update of Air Profile (where needed)
Update of Air Profile
Identification of the Scope of Geographic Problem Area(s)
Understanding of Basic Source-Receptor Relationship
Detailed Long Term Analysis
A
Detailed Short Term Analysis
B



Assessment of Source-Receptor Relationships


Analysis of Existing State Implementation Plan
Review of Existing Control Strategy
Review of Data Input Correctness
Design Concentration
Particulate Background Conc.
Base Emissions
Growth Projections
Comparison of Regulation Stringency with RACT
Modifications on Anticipated Air Quality Improvement with Revised Emission Rollback Calculations
Review of Existing SIP Control Strategy
D
Review of Control Strategy Implementation/ Enforcement
Review of Point Source Compliance Status
Review of Area Source Compliance Status
Identification of Anticipated Air Quality Improvements from Emissions Yet to be Reduced
Review of Control Stategy Implemention/ Enforcement

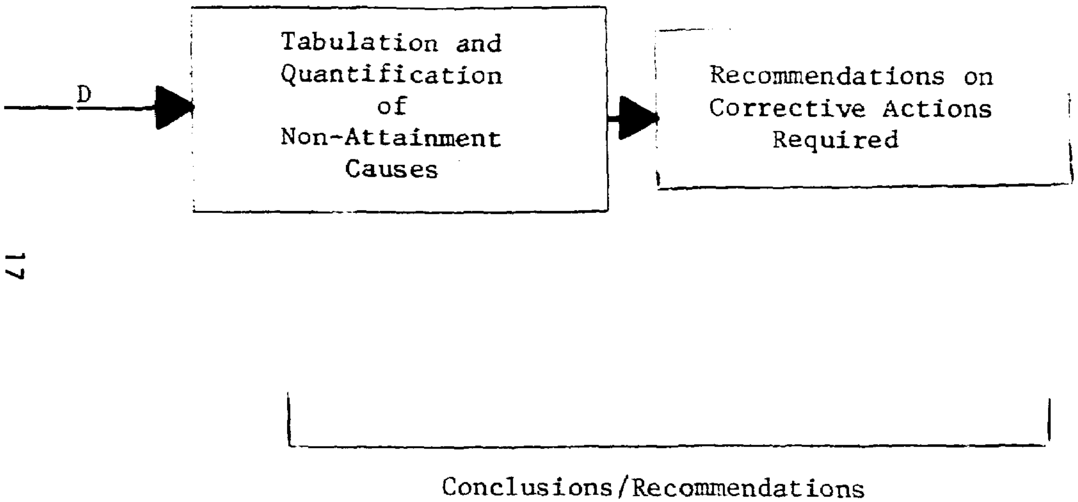


Figure 2. FLOW DIAGRAM FOR EVALUATION METHODOLOGY

IV. DETAILED APPROACH

A. UPDATE OF AIR PROFILE

Evaluation of a present ambient air quality problem must first include an identification and characterization of that problem. This is the purpose of air profiles, required for all non-attainment areas and completed for the 20 PAAs. These reports provide an analysis of ambient air quality trends, point and area source emission data, meteorology and summarized findings from any modeling and/or hi vol filter analysis studies already completed. The most recent air quality, emissions, meteorological and other pertinent data should be added, when available and when needed to update and strengthen earlier profiles.

Of special interest in the profile is a discussion of the representativeness at each monitoring site - i.e., what is being sampled at each site; what sources are influencing the site? A detailed description of each site should be made. Specific characteristics may include surrounding terrain, land use and sources. One purpose of determining the representativeness of monitoring sites is to prevent the misinterpretation of data from a site that may be strongly biased by a single local source.

B. ASSESSMENT OF SOURCE-RECEPTOR RELATIONSHIPS

1. Narrowing the Geographical Scope of Non-attainment Problem Areas - The initial transitional step from the air profiles is the discussion of geographic areas where NAAQS are not being attained. This discussion should address whether the non-attainment problem is localized or relatively widespread. The point and area sources that are located within these areas should be identified. Identification of major point and area sources outside the non-attainment areas that may be affecting monitoring stations within the problem

areas should also be made. Maps may be utilized to show the monitoring sites and the pertinent emission sources.

2. <u>Understanding of Basic Source-Receptor Relationship</u> - The non-attainment evaluation should be based upon the basic source-receptor relationship described by the following fundamental model:

$$X = \frac{Q}{\pi \sigma_y \sigma_z U} \exp\left[-\frac{1}{2}\left(\frac{H}{\sigma_z}\right)^2\right]$$

Where = Ambient Air Quality Concentration

Q = Emission Rate

σ_y = *Standard Deviation of Plume Concentration Distribution* in the Horizontal Cross-Wind Direction

σ_z = Standard Deviation of Plume Concentration Distribution in the Vertical

U = Wind Speed

H = Effective Emission Height

The equation was taken from "Workbook of Atmosphere Dispersion Estimates", D. Bruce Turner, U.S. Public Service Publication No. 999-AP-26, 1969. It should be noted that this equation applies only to continuous point sources, but that the principles involved are applicable to any source.

The formula identifies the pertinent emission and meteorological factors and their effects on ambient air quality concentration. The direct proportionality between emission rate and ambient concentration, and the inverse proportionality between wind speed and ambient concentration can be seen in this formula.

If mathematical modeling is utilized in assessing the source-receptor relationships, the above equation or a modified version should be used. If a modeling approach is not utilized, the formula is still of significant value in logically directing an assessment of source-receptor relationships in non-attainment areas.

Non-attainment evaluations should be addressed to long term (annual and seasonal) and 24 hour time frames since these generally represent the averaging periods for both particulate matter and sulfur dioxide NAAQS. For sulfur oxides, an additional discussion on the 3-hour secondary standard should be included.

3. Long Term Analysis - A map may be prepared with air quality (annual) isopleths along with the location of significant point and area sources. Emission source strengths may be indicated in terms of point source emission rates and/or area densities. Significant source emission-ambient concentration correlations may be identified and discussed.

The air quality data should be analyzed for seasonal influence of meteorology and emission activity patterns. Correlations between air quality concentration and these seasonal meteorological and emission patterns should be made where possible. Specific items of interest are:

- Meteorological Patterns - wind speed, wind direction, vertical stability, temperature, precipitation, etc.
- Seasonal Emissions - industrial operations (grain terminals, rock and gravel dredging and crushing, etc.), agricultural activities (plowing, burning, etc.), open burning (residential, slash, etc.), and dirt roads.

Unusual meteorological patterns and their influence on ambient air quality should also be analyzed. The years being evaluated should be compared with normal values for various meteorological parameters based on historical record to ascertain the representativeness of these years.

Where possible, peak 24-hour values caused by unusual events should be identified. The effect of these concentrations on seasonal to annual averages can be measured by eliminating the peak values and recalculating.

Findings from previous modeling studies should be reviewed for information on source-receptor relationships. Information from previous filter analysis (color, microscopy, chemical analyses, etc.) studies should also be reviewed. Such information may provide insight on the origins and transport mechanisms of the suspended particulate material found on the filters.

Additional data tabulations and statistical evaluations may be beneficial. These may include, but are not limited to the following:

- Correlation of air quality trends among monitoring sites through a review of daily concentrations over an extended period. Such an examination may disclose to what extent non-attainment is due to a common emission problem.
- Tabulations and comparisons of weekend concentrations and week-day concentrations. The comparisons may be done for all days, or only days when the NAAQS were exceeded. They may provide insight into specific source category-receptor relationships through correlations between weekend - weekdays variations in emission activity and corresponding variations in ambient concentrations.

Finally, an evaluation of the worth of modeling to determine long term impact of sources on specific air monitors should be considered. If modeling is to be performed, it should be applied as needed and capabilities permit.

4. Short Term Analysis - First, for the previous one or more years those days when monitors recorded concentrations exceeding NAAQS for the pollutant of concern should be isolated. A tabulation of the number of times the NAAQS were exceeded at each site may be useful.

Meteorological conditions accounting for the NAAQS being exceeded should be identified where possible. Consideration with respect to wind speed and direction may include, but not necessarily be limited to:

- Average wind speed correlation with pollutant concentrations.
- Wind direction correlation with peak 24-hour concentrations.
- Wind direction versus frequency of concentration graphed for each monitoring site.
- Upwind pollutant concentrations to indicate relative location of major emission sources.
- Strong winds accounting for blowing dust.

Stability or inversion analysis may be conducted to identify the atmospheric structure's influence on air quality. The frequency and duration of inversions and stagnations may account for high air quality levels.

Temperature information may be reviewed. Unusually warm or cold weather may result in a change in fuel consumption which may have caused high ambient levels.

Precipitation records may also be reviewed to correlate rainfall (the lack of) with high 24-hour concentrations. Long periods of exceptionally dry weather may increase the particulate matter emissions from fugitive dust sources.

Unusual emission conditions which may have accounted for NAAQS being exceeded should be evaluated. Occurrence of the following activities should be checked since such events could result in short term high ambient concentrations:

- Point source startups, upsets, malfunctions and control equipment shutdown.
- Area source activities such as fires, demolition, construction etc.

Control agency records including citizen complaint files, and building department records may be sources of this information.

Additional data tabulations and statistical evaluations may be needed for the short term air quality data evaluation. These may include, but are not limited to the following.

- Frequency distribution of pollutant concentrations for each monitoring site for all days with high ambient concentrations of the pollutant of concern. By comparing the relative frequency and magnitude of short term NAAQS exceedences among sites, one may gain insight into which monitors are more strongly affected by local sources.
- General relationships among all sites for each day when one or more monitors indicate exceedences of NAAQS. The frequency and strength of repeated patterns may indicate the degree to which each site is affected by sources having local or area-wide effects.

The performance of short term modeling should be considered. The impact of one or more key sources on a given monitor under worst case conditions, can thus be determined. The peak 24-hour concentrations and appropriate meteorological conditions should be utilized. The results of this modeling may also permit an estimate of the likely or possible impact of other sources on the monitoring site.

The performance of microscopic analyses of selected high volume filters to determine likely major contributing sources on days that the NAAQS were exceeded should be considered. These analyses may be needed only if previous evaluations failed to adequately identify source-receptor relationships. If such analyses are identified as being needed, the specific scope of work, including those filters to be examined, should be described.

C. ANALYSIS OF EXISTING STATE IMPLEMENTATION PLANS

It is next necessary to consider an evaluation of the adequacy of the existing SIP in light of the understanding obtained on the source-receptor relationships in non-attainment areas. Specifically, the existing SIP control strategy and its implementation and enforcement should be reviewed to determine the need for strategy revisions and/or increased enforcement activity because of identified non-attainment causes. This aspect of the evaluation may thus blueprint future SIP activities in control strategy revision and/or enforcement necessary to resolve the non-attainment causes.

1. Review of Existing SIP Control Strategy - An inadequately designed control strategy may have directed control activities in an improper direction or with less stringency than necessary. Control strategy development aspects of interest are data inputs and enforcement mechanisms. Figure 3 depicts the control strategy development aspects.

Five major data inputs were needed to develop control strategies for SIPs: existing air quality, background particulate concentration, existing emissions inventory, growth factors and meteorological conditions.

The design concentration value (that used to calculate necessary emission rollback) utilized in the initial plan should be determined. The sampling site location of the design concentration value should be identified.

Background particulate concentrations are defined as that portion of the ambient particulate level derived from natural sources. The background concentration utilized should be reviewed to determine if the original background concentration is reasonable or if it should be adjusted.

The base emissions inventory should be checked to see if all source categories were included and properly quantified. In some areas, the collection of smaller point sources (less than 100 tons per year but not included in area sources) represents a significant amount of pollution which is not recorded in inventories. This situation should be reviewed by checking point source files and

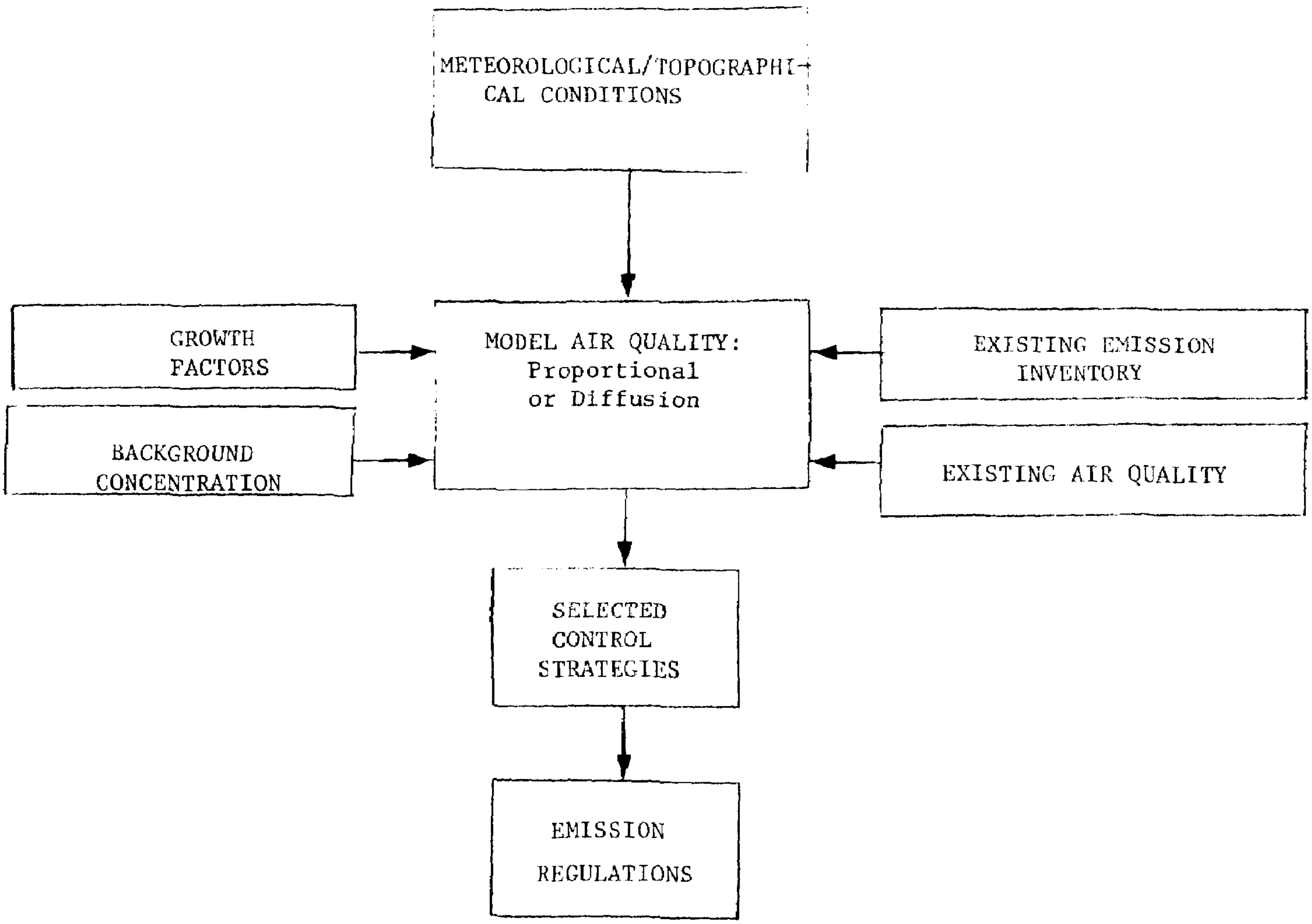


Figure 3. DEVELOPMENTAL ASPECTS OF A CONTROL STRATEGY

methods of area source inventory techniques. In addition, source categories such as fugitive emissions (fugitive industrial emissions and fugitive dust from dirt roads) and agricultural burning may not have been included in the initial inventory. If updated emission information or emission factors (from references such as the most recent AP-42) are available, these should be used.

Growth projections applied to base emissions for control strategy purposes should be obtained. Actual growth data since strategy development should be obtained for comparison. Information on various growth elements - population, industrial, fuel consumption, transportation activities, etc. may provide checks on the projected growth trends utilized.

Another major area of concern related to control strategy development deals with the applicable control regulations for the selected strategy. The type, specificity and strength of the regulations should be defined. The scope of coverage of individual regulations should be assessed and a determination of the effect of broader coverage on emission reductions may be considered. The strength of regulations should be determined; the term strength being defined by how much emission reduction is required versus what is achievable with reasonably available control technology (RACT), as defined in the September 14, 1973 Federal Register. The possible effects of more stringent regulations on emission reductions, up to RACT, should be determined as needed.

After consideration of the above elements in the existing SIP, all appropriate data base changes should be made. The proportional rollback calculations should be redone to determine the revised projected effect on air quality. Each significant incremental change in the initial SIP should be related to its resultant change in projected air quality. This will, in effect, result in the development of more realistic air quality improvement projections through the implementation and enforcement of the existing SIP control strategy.

Consideration may also be given to performing an elementary rollback calculation for the specific geographic area(s) where NAAQS are being exceeded. By selecting data from a monitoring site "representative" of this area for the design concentration value, geographically limiting the emission inventory, and assuming or determining a background pollutant concentration (concentration of pollutant in the air mass entering the geographical area of concern), one could apply the rollback modeling technique to each definable geographical area where NAAQS are being exceeded. Thus, a more realistic projection may be made on required emission reductions to meet NAAQS in each area of concern.

2. Review of Control Strategy Implementation/Enforcement - A primary measurement of control strategy implementation is the compliance status of sources. The total number type and emission size of point sources should be identified. Those subject to control regulations should be reviewed for compliance status. Compliance status categories include: 1) in compliance; 2) out of compliance on a schedule; and 3) out of compliance not on a schedule. Sources on compliance schedules should be checked to identify the adequacy of progress being made on these schedules. A tabulation of those point source categories which are in compliance, soon to be coming into compliance, and those not likely to be coming into compliance should be made. Special precautions should be taken in evaluating source compliance information obtained solely from the Compliance Data System (CDS). For example, a source may be considered in compliance, but may experience periodic or frequent upsets, malfunctions, or short term violations. Such emissions may significantly impact ambient monitors.

For area sources, compliance status by source category should be determined. Compliance status should be estimated based on discussions with state and local agency personnel.

Emission reductions achieved by these point and area source compliance actions as well as those yet to be reduced should be determined. Those sources yet to achieve compliance may be presented on a map. Anticipated air quality improvement resulting from emission reductions when all sources come into compliance should be determined. These determinations will more clearly reflect the amount of impending emission reductions and the geographical distribution of the subject sources.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Findings on the major reasons for non-attainment of the NAAQS should be discussed. These findings will be drawn from the assessment of source-receptor relationships. A ranking on relative importance should be assigned to the identified reasons. Quantification of these reasons should also be made.

If sufficient source-receptor relationships cannot be established with the available data and time frame then recommended further studies should be defined. These may deal principally with modeling and/or microscopic analyses of hi vol fiters. Each recommended study should be specific with respect to objectives and detailed scope of work.

Recommendations of needed corrective actions to achieve attainment of NAAQS should be listed. These should be expressed in terms of an inadequate control strategy development or insufficient control strategy implementation/enforcement - i.e., control strategy revision and/or increased enforcement activity. Likely categories of recommendations may deal with the following:

- <u>CONTROL STRATEGY REVISION</u>
  - More restrictive emission limitations for specific areas
  - Stricter point source emission limitations up to RACT
  - Industrial fugitive emission control
  - The need for road and parking lot dust control and paving
  - The need for limitations on agricultural operations
  - The need for street cleaning requirements
  - Prohibition of residential open burning

- IMPLEMENTATION/ENFORCEMENT ACTIVITY

  - Awaiting compliance for sources on compliance schedules/ enforcement orders
  - Increased enforcement activity to achieve compliance on sources not on compliance schedules/enforcement orders
  - More active compliance assurance program to ensure that those sources considered in compliance are in fact operating in compliance with applicable emission limitations.

APPENDIX A

AVAILABLE DATA SOURCES

1. Assessment of Source-Receptor Relationships - The following data sources and types of information should be available:

a. Air profile
- air quality data
- emissions inventory
- meteorological data

b. SAROAD
- air quality data
- station description

c. Quarterly air quality reports
- air quality data

d. NEDS
- emissions inventory

e. Semi annual progress reports
- emission inventory

f. Other local, state, federal, etc. reports
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EVALUATION

OF

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

NON-ATTAINMENT:

EXAMPLE TOTAL SUSPENDED PARTICULATE ANALYSIS

FOR

SPOKANE COUNTY

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I. INTRODUCTION

In January, 1972, the Washington State Department of Ecology submitted A Plan for the Implementation, Maintenance and Enforcement of National Ambient Air Quality Standards in the State of Washington to the Environmental Protection Agency. The plan included a control strategy and regulatory provisions to attain the National Ambient Air Quality Standards (NAAQS) for suspended particulates in the Washington portion of the Eastern Washington - Northern Idaho Interstate Air Quality Control Region (AQCR) by July, 1975.

Recent air quality data indicates that the AQCR, more specifically Spokane County, will not achieve the NAAQS for suspended particulates by the defined attainment date. An assessment was undertaken to determine the reasons for non-attainment so that corrective action to achieve the standards can be taken.

This report describes the evaluation first by identifying and characterizing the present air quality problem in terms of ambient air quality trends, point and area source emission data, and meteorology. This updates and strengthens the existing air profile. The non-attainment problem is discussed with respect to the source-receptor relationships. Specific factors are identified as likely reasons for non-attainment. These likely non-attainment reasons are then discussed with respect to inadequacies in the design of the initial control strategy and the possibility of insufficient implementation of the adopted plan. Finally, corrective actions necessary to achieve the NAAQS for suspended particulates are addressed.

II. DESCRIPTION OF THE SPOKANE COUNTY PRIORITY ABATEMENT AREA

A. GEOGRAPHY

The Spokane County Priority Abatement Area is one of the eight Washington counties in the Eastern Washington-Northern Idaho Interstate AQCR. The County's total land area is 32,848 acres (133 sq. km). The County's general location is shown in Figure 1. (All figures and tables can be found in the back of the report).

Spokane County lies in the topographical area called the North Central Highlands. The area is on the upper plateau where the long gradual slope from the Columbia River meets the sharp rise of the Rocky Mountain Ranges. Physically, the area is characterized by steep cliffs, old cascades, swampy meadows, mesas and potholes--all remnants of former water courses.

The topography in the vicinity of the City of Spokane ranges from 1900 feet (570 m) along the Spokane River to about 3000 feet (900 m) in the nearby hills. Much of the urban area of Spokane lies within the Spokane River Valley at an elevation of about 2000 feet, (600 m) but the residential areas have spread to the crests of the plateaus on either side of the river with elevations up to 2,500 feet (750 m). Figure 2 is a topographic map of the Spokane area.

B. METEOROLOGY

The climate of Spokane is dominated by the mid-latitude belt of westerly winds. Pacific frontal systems pass the area fairly frequently during the winter months bringing precipitation usually in the form of snow. However, there are also numerous periods during the winter when a ridge of high pressure (both at the surface and aloft) will build over the area with associated stagnant air flow and subsidence inversions.

During the summer months the skies are typically clear or partly cloudy. With these conditions, there is a high probability that a surface-based temperature inversion will form at night, but an equally high probability that these inversions will be broken by solar heating during the daylight hours. It can be expected that a fumigation/inversion breakup condition would be a fairly regular occurrence in the summer months.

Annual precipitation totals in the area are generally less than 20 inches (51 cm). Approximately 70% of the total annual precipitation falls between the first of October and the end of March and about half of that falls as snow. The growing season usually extends over nearly 6 months from mid-April to mid-October.

C. DEMOGRAPHY

The County's 1975 population is 307,440 of which over 55 percent is concentrated in the City of Spokane.

D. INDUSTRY

While the largest single industrial employer in the Spokane area is primary aluminum reduction, the industrial activities within Spokane County include a wide variety of air pollution emission sources such as secondary smelting and refining of non-ferrous metal, sawing and planing mills, grain handling and milling, veneer and plywood production.

E. AGENCY JURISDICTION

The Spokane County Air Pollution Control Authority (SCAPCA) serves the County as the principal agency for engineering, enforcement and surveillance of air pollution control activities. The

Washington Department of Ecology (DOE) provides technical advice and consultation to the Local Agency. The State Agency, directed by the Washington Clean Air Act, has set ambient air standards and assumed jurisdiction for certain source categories on a statewide basis.

III. UPDATE OF AIR PROFILE

A. AIR QUALITY DATA

In 1974 and the first half of 1975, nine suspended particulate monitoring stations were operating in Spokane County. The location of the seven stations in the immediate Spokane area are shown in Figure 3. The two other stations, Turnbull Wildlife Refuge and Cheney City Hall, are located approximately 10 to 15 miles (16 to 24 km) southwest of downtown Spokane. Specific station descriptions relating sampler location, areal representativeness, and operating agency are included in Table 1.[1]

Air quality data from the nine monitoring stations are presented in Table 2 with annual geometric mean values for comparison with the primary and secondary NAAQS for suspended particulates.[2] Information for 1974 and the first half of 1975 is included. Although annual standards are based upon a calendar year (CY), data for Fiscal Year (FY) 1975 are presented to depict 12 month means from the most current data available. An isopleth map of the data is presented in Figure 4.[3]

In 1974, three of the sampling stations exceeded the primary standard on the basis of an annual geometric mean. The one site significantly exceeding the standard, Crown Zellerbach, is industrially oriented. The other two stations, Spokane City Hall (Local) and Gonzaga University, only slightly exceeded the standard. The same three sampling stations were the only sites exceeding the secondary standard guide on the basis of an annual geometric mean. A fourth monitor, located at the Aluminum Supply Company was in operation for only the last 7 months of CY 1974. During this period, the geometric mean was almost twice the primary annual standard.

Monthly geometric means for the five highest recording stations, Spokane City Hall (Local), Crown Zellerbach, Gonzaga

University, Spokane City Hall (Federal) and Aluminum Supply Company, are graphed in Figures 5 and 6.

Historical annual geometric mean data for the nine stations are tabulated in Table 3.[4] Periods of record range from 1970 to 1975.

This information is shown in graphic form in Figure 7. Considering the period 1972 through 1974, an improvement trend in air quality levels is apparent at all sampling sites except the Turnbull Wildlife Refuge background site which already meets the secondary standard. For the Spokane City Hall (Local) site, which is the station with the longest period of record, an overall improvement is observable from 1970 to 1974.

Historical monthly geometric mean data for the nine stations are shown in graphic form in Figure 8. Periods of record range from 1970 to 1975. It can be observed that the high concentrations generally occur in April and July through October. The lower concentrations are typically in November through March.

Table 4 shows the 1974 second highest 24 hour TSP concentration for each site as well as the number of times each site was found to exceed the value of the 24 standard for that year. Three of the stations exceeded the primary standard on the basis of the second highest 24-hour value. The three are Crown Zellerbach, Gonzaga University and Aluminum Supply Company. All but two of the nine sampling stations exceeded the secondary standard on the basis of the second highest 24-hour value. The two meeting the secondary standard were the Turnbull Wildlife Refuge and Millwood City Hall.

Table 4 also shows the total number of samples taken at each site in 1974. The percentage of occurrences in 1974 over the 24 hour value standard at Cheney City Hall and Rogers High School stations are 5 to 8% respectively. The five other stations, Spokane City Hall (Local), Crown Zellerbach, Gonzaga University

Spokane City Hall (Federal) and Aluminum Supply Company have a much higher proportion of occurrences over the secondary 24 hour value ranging from 10 to 45%.

Frequency distribution tabulations for 24-hours values observed during 1974 at the nine stations are presented in Figure 9.

Historical second highest 24-hour data for Spokane City Hall (Local) and Gonzaga University are shown in Figure 10.[5] Such data for the other stations were unavailable for this study.

All 24-hour concentrations recorded in 1974 and the first half of 1975 at the nine monitoring stations are plotted in Figure 11.

B. EMISSIONS DATA

The source category emissions inventory for the Spokane County area is presented in Table 5 and 6.[5,6,6A,6B] The most currently available emissions data are presented and used for discussions. It is important to note that due to inherent inaccuracies of emission inventories, all emissions data presented and discussed are considered best available and approximates only.

The largest single source category, dirt roads, contributes approximately 7,500 tons per year of particulate matter and accounts for over 50% of the County particulate emissions. Aluminum plants and transportation, the next most significant source categories, each contribute about 1,600 tons per year and account for a total 22% of the County particulate emissions. The aluminum plant category total is comprised of the two Kaiser facilities at Mead and Trentwood, and Hillyard Processing.

The emissions inventory has also been tabulated by an individual point and area source delineation in Table 6.[3] Area sources account for 84% of the total emissions while point sources account for 16%. Those point sources listed in Table 6 and located in or near the City of Spokane are shown in Figure 13.

C. METEOROLOGY

Meteorological data from two locations in Spokane County are available for 1974 and the first half of 1975.[7,8,9] The primary meteorological station is located at the Spokane International Airport, situated on the plateau 6 miles (9.6 km) west/southwest and some 400 feet (120 m) higher than the downtown business district. The Gonzaga University Air Sampling and Meteorological Station is discussed in Table 1.

Table 7 presents wind speed and direction on a monthly basis at the Spokane International Airport and Gonzaga University. It also includes mean monthly wind speeds and prevailing wind direction based on historical data at Spokane International Airport.

Note that various expressions of wind direction, and speed are included in Table 7. These include both average and resultant wind speeds and resultant and prevailing wind directions. The most useful expressions for air pollution considerations may be prevailing wind direction and average wind speed; resultant wind speed and resultant wind direction statistics were provided for general information, and should be used with caution as they may be misleading.

Table 7 reveals that monthly average wind speeds for 1974 at the Airport were consistently higher than respective historical monthly means for each of the first 9 months and for December. Only for October and November in 1974 were monthly average wind speeds less than respective historical monthly means. Average wind speeds are also shown to be consistently lower during 1974 at the Gonzaga site than at the Airport, often by as much as 50% or more.

The frequency of occurrence of adverse mixing conditions measured at Spokane International Airport is presented in Table 8.[10]

The information covers 1974 and has been summarized by months. For the purposes of this study "adverse mixing" is defined to occur when the mixing height is 2,500 feet (750 m) or less.

A summarized version of the full stability wind rose (STAR data-joint frequency distribution between stability, wind direction, and wind speed) on a seasonal and annual basis for the year 1974 for the Spokane Airport is presented in Table 9.[11] The data shows that stable conditions (Classes E and F) predominate throughout the year, while unstable conditions (Classes A and B) are relatively infrequent. Table 9 shows that during the September, October and November period Class F conditions occur almost 40% of the time. It can also be seen from the table that the lowest wind speeds occur in the fall period when the prevailing wind speed is in the 4-6 knots range, compared to an annually prevailing wind speed range of 7-10 knots.

The STAR data also shows that winds from the southwesterly quadrant predominate in all four seasons with a secondary small maximum from the northeast. During the fall period the bi-modal distribution is more pronounced, and considering a 16-point wind, rose winds from the northeasterly direction actually are most prevalent. During the fall and on an annual comparison, winds from the northeast tend to be higher than winds from the southwest.

One would expect stability conditions in the downtown area to be somewhat different from those encountered at the airport, since Spokane sits in a broad valley bounded by hills up to about 500 feet higher than the valley floor. Two factors could affect the stability conditions - night time drainage winds and the heat island effect. These two factors, however, would have an opposing affect on the atmospheric stability in downtown Spokane so that one may expect that the stability conditions measured at the Airport would be reasonably representative of the downtown area.

IV. ASSESSMENT OF SOURCE-RECEPTOR RELATIONSHIPS

A. IDENTIFICATION OF GEOGRAPHIC NON-ATTAINMENT AREAS

The air quality monitoring data previously discussed indicates that the geographical area exceeding the NAAQS extends from downtown in an east/northeasterly direction through the industrial corridor. This area is shown in Figure 12. Five sampling stations, Spokane City Hall (Local), Spokane City Hall (Federal), Crown Zellerbach, Gonzaga University, and Aluminum Supply Company are located in this area. In 1974, all of the five stations except Spokane City Hall (Federal) exceeded the value of the primary 24 hour standard.

These four stations generally exhibit the same annual trend, pointing to the conclusion that the same overall source receptor relationship likely affects all the four stations, but in varying degrees. The relative ranking of air quality measured at the four stations is as follows, starting with the worst - Aluminum Supply Company, Crown Zellerbach, Gonzaga University and Spokane City Hall (Local).

As indicated in Table 1, both Aluminum Supply Company and Crown Zellerbach are industrially oriented monitoring sites. Aluminum Supply Company has a number of point sources within one-half mile (0.8 km) of the sampling station. Crown Zellerbach also has several point sources within a mile (1.6 km) of the monitoring site. Both locations have surrounding dirt roads as a significant area source.

Gonzaga University is a commercially and industrially oriented monitoring site. A few point sources are located within a mile (1.6 km) of the station. Spokane City Hall (Local) is a commercially oriented station located in the downtown area.

Figure 13 shows the monitoring sites and pertinent emission sources.[12]

B. SEASONAL AND ANNUAL

The source-receptor relationship discussion that follows addresses both long-term (annual and seasonal) and short-term (daily) NAAQS. As mentioned before, four monitoring stations in the non-attainment area measured concentrations in excess of both the standards for annual geometric mean and second highest 24-hour value. Aluminum Supply Company and Crown Zellerbach monitors were the highest recording sites in both long-term and short-term respects.

Both the Aluminum Supply Company and Crown Zellerbach monitors appear to be surrounded by point sources, unpaved roads, and additional fugitive emission sources. This is shown in Figures 13 and 14. It appears that these two monitors may be significantly affected by emissions from all three categories of sources.

The air quality data was then analyzed for seasonal influence of meteorology and emission activity patterns. It was observed that in 1974, the highest concentrations occurred in the months of September and October. The "Historical Monthly Geometric Mean Data" shown in Figure 8 and discussed earlier indicates that the occurrence of peak TSP concentrations in September and October is also an annual pattern. A review of the wind speed data indicates that at Gonzaga University wind speeds were lower than the year's average during August through December of 1974 with the lowest occurring in October. At the Spokane International Airport wind speeds were lower than the year's average during June through December with the lowest occurring in October. Normal values for the Airport indicate below average winds occur in July through November. It appears that in general wind speeds in Spokane are lower in the latter part of the calendar year, thus possibly contributing to high TSP concentrations in the late summer and fall.

It is important to note that the occurrence of high TSP concentrations during the months of July through October (discussed in the Update of Air Profile) coincides with dry warmer weather.

This would direct one to suspect fugitive dust or other seasonal emissions as likely major contributors to the TSP non-attainment problem. A further evaluation of seasonal meteorological patterns is also warranted.

Table 8 shows the frequency of occurrence of adverse vertical mixing conditions (mixing depth less than 2,500 feet (750 m) feet). Adverse vertical mixing conditions occurred every morning of the year and the mixing depth remained below 2,500 feet (750 m) throughout most days in January, February, November and December. The afternoon mixing depth exceeded 2,500 feet (750 m) every day in August.

A plot of ambient particulate concentration against mixing depth showed no observable trends (Figure 15) which indicates that the mixing depth has little or no statistical correlation with the ambient particulate concentration in the Spokane area.

However, highest 24-hour average concentrations occurred in September and October which does correspond to the increased frequency of occurrence of low wind speeds and increased stability of the atmosphere. This is seen from the complete plots of ambient data (Figure 11) and stability wind rose information (Table 9).

Monthly air quality geometric mean data at Crown Zellerbach and Aluminum Supply Company was plotted versus monthly rainfall at the Spokane Airport in Figure 16. It can be observed that, in general, those months having less than an inch of precipitation had higher air quality values. The likely conclusion is that dirt roads, fugitive emissions and/or industrial operations requiring dry conditions are relatable factors for higher air quality values.

Seasonal emission activities in Spokane include industrial operations, agricultural activities, open burning and dirt roads.

Gravel pit operations with associated crushing, screening and stockpiling are thought to be a major industrial source of seasonal particulate emissions.[13] Within a radius of less than one mile (1.6 km) from the Aluminum Supply Company, monitor, gravel pits, crushing, screening and stockpiling operations are conducted by Acme Concrete, Ace Concrete, Inland Asphalt, and Central Premix. Combined emissions from these sources is 111 tons per year, plus an additional 25 tons per year from an asphalt rotary dryer. It is estimated that most of these emissions occur during the summer and early fall due to seasonal demand for the products and to the increased fugitive emissions during the drier part of the year. Blowing dust from gravel stockpiles during periods of strong winds has been observed to significantly decrease ambient air quality.[13] It is apparent then that these four sources are likely to strongly influence the TSP concentrations found at the Aluminum Supply Company monitoring site, particularly during the late summer and early fall as is shown in Figures 8 and 11.

Grain handling/processing activities are somewhat seasonal in their effect but are generally well controlled.[13]

Agricultural activities such as plowing/cultivation and field burning may have some impact. The nearest field burning areas are approximately 15 miles (24 km) east and 30 miles (48 km) southeast of downtown Spokane.[13] Burning occurs primarily in August and September and as indicated in the September 1975, SCAPCA monthly report, burning on bad ventilation days can cause smoke and reduced visibility in the Spokane downtown area.[14] SCAPCA reported that total acres (sq. km) burned within the county totalled approximately 22,800 (92.2) in 1974 and 16,700 (67.6) in 1975.

SCAPCA conducted a special air monitoring study in Fairfield, located approximately 23 miles (37 km) southeast of Spokane, during the 1974 harvest season.[14] The objective of the study was to quantify the local impact of agricultural operations.[14] Grain elevators and processing facilities are located both upwind and downwind from the monitoring station. In addition, area sources would likely have contributed significantly to the suspended particulate problem. These area sources include the burning of turf grass and cereal grain stubble fields, agricultural field plowing, and wind blown dust from fields in fallow. Sampling data was accumulated for 10 days during the period from August 14, 1974 to September 18, 1974. The highest concentration recorded was 181 $\mu g/m^3$. Only one other violation of the 150 $\mu g/m^3$ secondary standard occurred. Thus, it would appear unlikely that these agricultural activities would have a significant impact on the violations of primary NAAQS in Spokane.

Residential open burning should not be a significant emission source in the non-attainment area since the City of Spokane is designated as a "no-burn" area.

Emissions from dirt roads would be expected to occur primarily during the dry summer and early fall months. The location of these dirt roads are generally indicated in Figure 14.[12] Approximately 240 miles (384 km) of dirt roads were located in the City of Spokane as of 1973.[6] This accounts for approximately 1,000 tons per year of particulate emissions which, again, are produced primarily in the summer and early fall months.[6] As can be seen from Figure 14, Crown Zellerbach monitor is located in the center of one of the largest concentrations of unpaved roads in the area. Based upon an analysis of a Spokane City Engineering Department map (updated through January 1974) there are approximately 7.8 miles (12.5 km) of unpaved roads within a one-half-mile (0.8 km) radius of the Crown Zellerbach monitor. A similar county map shows approximately 2.4 miles (3.8 km) of unpaved roads within a one-half-mile (0.8 km) radius of the Aluminum Supply Company monitor. Based upon these figures as well as the following information provided by Jim Frank with the Spokane County Air Pollution Control Authority, (SCAPCA), annual TSP emissions from the unpaved roads within a one-half mile (0.8 km) radius of the Crown Zellerbach and Aluminum Supply Company monitors are approximately 44 tons per year and 12 tons per year, respectively:

(1) Number of vehicle trips per day, estimated jointly by SCAPCA, and the City and County planning agencies.

(a) Crown Zellerbach monitor area - 40

(b) Aluminum Supply monitor area - 35

(2) Estimated mean vehicle speed - 20 mph (32 km per hour)

(3) 2 lbs. of TSP ($<$ 10 microns) emitted per vehicle mile at 20 mph - based on work done by John Roberts with the Puget Sound Air Pollution Control Agency

(4) 140 potentially dusty days per year in Spokane based upon an evaluation of temperatures and rainfall records for 1973 and 1974.

With the emissions from these unpaved roads being concentrated during the dry summer and early fall months, it is evident that these emissions could substantially impact air quality, particularly in the area of the Crown Zellerbach monitor. Again, these emissions are likely to be greatest during that same time of year when highest TSP concentrations are encountered.

A special study was conducted by Droege and Clark of the Washington State Department of Ecology in 1972 and 1973.[15] The purpose was to determine the variation of particulate concentrations in various areas of Spokane County and the relationship with meteorological conditions, chemical and phsyical analyses of the collected material, and the season of the year. Sampling sites were selected at 7 different locations in and around the City of Spokane. A standard gravimetric determination of the suspended particulate loading was made for each sample. Additional analyses were run on each filter to determine the metal and organic content in the sample. An estimate was made of the color of the filter. Finally, a microscopic evaluation was made of each filter to determine in a qualitative way the basic physical characteristics of the particulate material.

A reasonably consistent pattern was found in the relative dirtiness of Spokane. The Gonzaga University, Spokane City Hall (Local) and Crown Zellerbach sites were generally dirtier than Rogers High School and the Spokane Airport. The meteorological conditions which may have produced high concentrations of particulate material were not easily defined.

However, an interesting correlation between TSP concentration and seasonality - meteorology was noted. During the first two sampling periods of May 1972 and mid-August through mid-September 1972, TSP concentrations for the 16 samples collected averaged 114 $\mu g/m^3$. During the four sampling days on which rain fell, the mean concentration was 54 $\mu g/m^3$. For the 12 dry days, the mean TSP concentration was 134 $\mu g/m^3$ or approximately 2 1/2 times as great. Little difference was noted in average wind speed between dry days and those with rain. The mean wind speeds were 6.5 (10.4) and 5.8 (9.3) mph (km per hour) respectively.

During the last two sampling periods of November 1972 and January 1973, the 18 samples collected averaged 60 $\mu g/m^3$ (compared to 114 $\mu g/m^3$ during the May/August-September sampling periods). The mean TSP concentrations for the five days on which rain fell was 43 $\mu g/m^3$; for the 13 dry days, the TSP concentration averaged 67 $\mu g/m^3$. Mean wind speeds for these two categories of sampling days were 4.8 mph (7.7 km per hour) and 4.4 mph (7.0 km per hour) respectively.

The strong pattern of higher (by a factor of almost 2) TSP concentrations during the May/August-September periods compared to the November/January periods and the sharp drop in TSP concentrations during days with rainfall, regardless of the time of year, suggest fugitive dust/fugitive emissions as the primary source of high TSP concentrations.

Droege and Clark determined that highest TSP concentrations were associated with both high winds and low relative humidity, further substantiating the fugitive dust/fugitive emissions theory.

The authors also were able to make two very noteworthy observations concerning the composition of collected TSP. It was found that the highest concentrations of aluminum, lead, and organic fraction occurred in November, the month with the lowest TSP concentration. Also, a major shift in filter color distribution was found to occur between the first two and last two sampling periods. During the November/January sampling periods, only half as many filters were observed to be in the brown-green range as during the May/August-September periods (31% vs 72%).

One could strongly conclude from the color and chemical composition analyses that, again, fugitive dust (usually brown in color)/fugitive emissions is the predominant source of TSP during the drier summer months, and that it contributes less to TSP loadings during the late fall and winter months when precipitation has increased. Correspondingly, with the decreased role of fugitive dust during the winter, the percent impact of non-ferrous metals from industrial emissions or automotive exhaust becomes greater. The increase in combustion products (organic fraction) would also be expected during the colder months due to increased heating.

C. DAY-BY-DAY

As mentioned previously, four monitoring stations exceeded the secondary standard for the second highest 24-hour concentration. These were Aluminum Supply Company, Crown Zellerbach, Gonzaga University and Spokane City Hall (Local). A tabulation of the number of times the NAAQS was exceeded at each site is made in Table 4.

An analysis of 27 days on which the 24-hour ambient standard (150 $\mu g/m^3$) was exceeded, showed that for 25 of these occasions the day in question was preceded by dry spells ranging in duration from 3 days to over one month. On one of the two remaining days a trace of rain was recorded at the Airport and this day was preceded by a 15-day dry spell, but it is not known if any rain fell in the central Spokane area. On the remaining day a thunderstorm was reported at the Airport and it should be pointed out that in eastern Washington thunderstorms are often preceded by blowing dust caused by the associated strong, gusty winds. However, it is not known whether a thunderstorm occurred in the central Spokane area. This analysis shows that occurrences of high particulate concentrations are associated with spells of dry weather.

Wind conditions accounting for the NAAQS being exceeded were analyzed. At Aluminum Supply Company and Crown Zellerbach, a correlation was attempted between average wind speed and pollutant concentration for August-October, 1974. This is shown in Figure 17. It indicates that high TSP concentrations occur with both low and high wind speeds.

At both Aluminum Supply Company and Crown Zellerbach, a correlation was attempted between mean wind direction and pollutant concentration for August-October, 1974. This is also shown in Figure 17. No significant correlation was found indicating measured TSP concentrations at each monitor were not being strongly affected by a single point source.

Unusual emission conditions accounting for the exceeding of the NAAQS were evaluated. Control equipment breakdown and citizen complaint logs were reviewed.[13A] Occurrence of unusual fires, demolition, and construction activities were noted by the SCAPCA Control Officer.[13] Based upon an evaluation of the limited data available, positive correlations between these activities and high TSP concentrations were dismissed. Residential open burn areas do not include Spokane City, and thus emission from such sources are not likely to be a local influence.

Additional data tabulations and statistical evaluations were made for the short-term air quality data. Geometric means for weekday and weekend samples at Aluminum Supply Company and Crown Zellerbach are shown in Table 10. The means were calculated from 20 weekday and 9 weekend Aluminum Supply Company samples, and from 44 weekday and 14 weekend Crown Zellerbach samples. The weekday and weekend values were generally comparable. The weekday mean was approximately 10 percent lower than the weekend mean at the Crown Zellerbach site, but about 10 percent higher at the Aluminum Supply Company site. These findings suggest that the TSP problem is not significantly affected by weekend-weekday variations in industrial activity.

General relationships for the highest individual TSP concentration days were reviewed to identify and evaluate the reasons for these occurrences. Table 11 presents the pertinent data for eight days in 1974 - April 17, August 27, September 8, September 20, September 26, October 14 and October 20. Air quality data for the five higher measuring stations were reviewed.

The ranking of highest TSP concentrations at the stations corresponds with the ranking of annual geometric means - Aluminum Supply Company being the highest, and Spokane City Hall (Local) and Spokane City Hall (Federal) being in the lower group.

The high TSP values occurred with both higher than average wind speeds (3 days) and lower than average speeds (5 days). Note, however, that on the day with highest TSP concentration, winds were strong and blowing dust with limited visibility was noted at the Spokane Airport. Wind direction did not seem to be directly *correlated to high concentrations of TSP. Limited mixing* height did not seem to be a requirement for the high concentration days since only one day had both limited mixing height in the morning and afternoon.

A modeling study was conducted for two days in which elevated ambient concentrations were recorded. These days were November 19, 1974, for the Aluminum Supply Company station and September 26, 1974, for the Crown Zellerbach station. The data available consisted of morning and afternoon soundings taken at the Airport, wind speed and direction at the Gonzaga University station, and emissions data from a NEDS listing. Procedures given in *Turner's Workbook were followed to determine one-hour averaged* concentrations.[16] Twenty-four hour averaged values were then obtained by dividing the one-hour average by four according to the procedures given in the Federal Register (Vol. 36, No. 158, August 14, 1971.)[17]

Emissions from Spokane Seed Company, a significant point source located near the Aluminum Supply Company monitor, were modeled to determine likely maximum impact on TSP concentrations at this monitoring site. Spokane Seed is located approximately 0.3 miles (0.5 km) southeast of the monitoring station. Based on the 1973 inventory, emissions were 106 tons per year from the dump pit, and 6 tons per year from the secondary screening operations. These emission figures were used as opposed to the presently indicated emissions of 34 tons per year for the source because: (1) according to SCAPCA, a baghouse, the major air pollution control device for the facility, was installed in 1971, (2) the day selected for modeling was in 1974, and (3) according to SCAPCA, no additional control equipment was installed until 1975. Meteorological conditions on November 19, 1974, the day selected for modeling, were a wind speed of 7.3 mph (11.7 km per hour) from the direction of the source to the monitor and an atmospheric stability class of E.

A TSP concentration of 152 $\mu g/m^3$ at the Aluminum Supply Company monitor was recorded for this day. This specific day was selected because of the meteorological conditions and relatively high TSP concentration.

Using the value of 112 tons per year and the appropriate meteorological conditions, it is estimated that Spokane Seed could have contributed a maximum of about 880 $\mu g/m^3$ over a one-hour time period at the sampler (220 $\mu g/m^3$ over a 24-hour period). This indicates that Spokane Seed may have had a significant impact on the 24-hour averaged values recorded at the Aluminum Supply monitor (152 $\mu g/m^3$ on November 19, 1974). It is important to note, however, that with emissions reduced from 112 tons per year to 34 tons per year, the potential impact of emissions from this source on air quality has been reduced correspondingly.

A similar modeling study was performed on the impact of emissions from Long Lake Lumber on the Crown Zellerbach monitor. The source is located approximately 0.9 mile (1.5 km) east north-east of the monitor. Particulate emissions of 396 tons per year, as provided in the 1973 emissions inventory, were used for the modeling calculations. The day for which modeling was performed is September 26, 1974. This date, according to SCAPCA, preceeds by one month or less the installation of a baghouse on the facility's hog fuel boiler. This modification resulted in a decrease of total plant emissions from 396 to 106 tons per year. Meteorological conditions on September 26, 1974, were a wind speed of 16 mph (26 km per hour) from the direction of the source to the monitor and an atmospheric stability class of D. A TSP concentration of 323 $\mu g/m^3$ was recorded for this day at the Crown Zellerbach monitor. Although September 26 was selected for modeling due to wind direction and high TSP concentrations, it is important to note that strong winds were prevalent, and as indicated in Table 11, blowind dust noted at the Airport.

The modeling analysis indicated that Long Lake Lumber could contribute a one-hour averaged concentration of up to 112 $\mu g/m^3$. (28 $\mu g/m^3$ over a 24-hour period), which would thus be a reasonably significant contribution to the 24-hour avearged value of 323 $\mu g/m^3$. However, as stated above, data for 1975 indicate that Long Lake Lumber's emissions have been reduced to 106 tons per year. Since the ambient concentration is directly proportional to the emissions strength, this facility's impact on concentrations measured at the Crown Zellerbach station is now likely to be minor.

V. ANALYSIS OF EXISTING STATE IMPLEMENTATION PLAN

An evaluation of the adequacy of the existing SIP in light of the understanding obtained on the source-receptor relationships was performed. Specifically, the existing SIP control strategy, its development, and its implementation/enforcement were reviewed for deficiencies or inadequacies. It was felt that the findings from such a review may aid in identifying the need for strategy revisions and or increased enforcement activity.

A. REVIEW OF EXISTING SIP CONTROL STRATEGY

1. Maximum Concentration Value

Air quality data from the Spokane City Hall (Local) site were utilized in the development of the original state implementation plan and its control strategy.[18] The pertinent 1970 data for this station are presented in Table 12. This was the only operating station in 1970 at the time of plan development.

As discussed in the previous section, a number of sampling stations have begun operation since 1970. Information from Table 3 shows that the Spokane City Hall (Local) was not the maximum concentration site in the AQCR. The Aluminum Supply Company, Crown Zellerbach and Gonzaga University sampling stations have recorded higher concentrations between 1971 and 1974. Since the Aluminum Supply Company station operated only part of 1974, the Crown Zellerbach station 1972 information was used to obtain the revised rollback calculations shown in Table 13. The revised rollback calculations more correctly reflect the required emission reductions necessary to meet the suspended particulate standards. For attainment of the primary standard a 28 percent reduction is required in addition to that identified in the SIP, for attainment of the secondary guide an additional 18 percent reduction is needed. These figures are based only upon revising the TSP concentration upon which rollback calculations are based.

2. Particulate Background Value

The particulate background value of 30 $\mu g/m^3$ was used in the initial control strategy development. Sampling at a background station, Turnbull Wildlife Refuge, since 1971 has indicated annual geometric means no higher than 22 $\mu g/m^3$. This indicates a slight overestimation of the background concentration and subsequently a small overestimation of the magnitude of TSP reduction required through implementation of the control strategy.

3. Base Emissions Data

A comparison of the base emissions inventory used in the initial control strategy development and the 1973 inventory is presented in Table 14. A significant source category, dirt roads, was not included in the initial inventory. In 1973, this category accounted for 7,500 tons per year, which was 47 percent of that year's total. Additional emissions differences of much smaller significance are also shown in Table 14. The sum of these changes reflect 7,490 tons per year in addition to the base inventory, increasing the total by 87 percent.

Revised rollback calculations based on only the 1973 inventory changes described above, while holding other control strategy development elements constant, result in the computations presented in Table 15. Thus for achievement of the primary standard, this exercise would indicate that an additional 1,723 tons/year of particulate matter emissions must be eliminated. Removal of an additional 3,671 tons/year of emissions would similarly be required for achievement of the secondary guide.

4. Growth Projections

Growth projections utilized in control strategy development are presented in Table 16 along with actual growth information.[19,20] From the limited data available, actual population and industrial growth in the City of Spokane appeared to be in line with the projected growth. The remainder of the County, however, experienced a more substantial population growth.

5. Regulation Stringency

SCAPCA and DOE regulations comprising the adopted control strategy are compared with those considered as reasonably available control technology in Table 17.[21,22,23] The effect of the SCAPCA regulations appears to be more stringent for particulate emissions from incineration and fuel combustion than reasonably available control technology. Maximum industrial process and visible emission limitations are comparable. With respect to fugitive dust controls, the SCAPCA guidelines are comparable except for the notable lack of limitations on public unpaved roads. These guidelines, since not part of the SIP, may also be weak from an enforceability standpoint. A review of regulations governing fugitive industrial emissions for compatability with RACT was not made due to time limitations.

6. Summary

It is apparent that the combined effect is of having inadequate ambient TSP and incomplete particulate emission data at the time of SIP development resulted in a serious underestimation of the control strategy requirements. Maximum TSP concentration in the AQCR was probably at least 30 percent higher than that used for rollback calculations. Emissions, due largely to the exclusion of unpaved roads in the original inventory, were close to 40 percent greater than that indicated in the SIP rollback. Further, an apparent absence of any control program for emissions from public unpaved roads may have resulted in a signficant control strategy shortcoming.

B. REVIEW OF CONTROL STRATEGY IMPLEMENTATION/ENFORCEMENT

1. Point Source Compliance Status

The total number of particulate emitting point sources located in and near the City of Spokane (as shown in Figures 13 and 14) and their compliance status are shown in Table 18.[24] As of November 28, 1975, twenty-two of the twenty-seven identified point sources were classified by the Compliance Data System (CDS) as in compliance with applicable regulations.

Four of the five sources not in compliance are scheduled to be in compliance by July 1976. The remaining source, Washington Water Power (gas/oil boiler) is thought to be out of compliance for only about 30 minutes per day during soot blowing and only when oil is being burned. The status of this source is presently being negotiated. Spokane Seed is the only source of the other four that is presently not meeting its schedule. The remaining three sources are Boyd Conlee, Inland Empire Pea Growers, and Inland Foundry.

The present emission size and geographical distribution of the five sources yet to come into compliance would indicate that little improvement in TSP concentrations would likely follow attainment of compliance.

As shown in Table 19, four of the five sources are presently less than 25 tons per year each and Washington Public Power, the largest of the sources, is rated at only 59 tons per year. Inland Empire Pea Growers and Spokane Seed are both located within 0.3 mile (0.5 km) of the Aluminum Supply Company monitor but have combined particulate emissions of only 43 tons per year. Boyd Conlee is about 0.3 mile east of the Gonzaga monitor, but is only a 30 ton per year source. The location of Inland Foundry and Washington Water Power, the remaining two sources, can be seen in Figure 13.

2. Area Source Compliance Status

The preliminary Air Profile indicates the paving of dirt roads was expected to reduce 6% (964 tons per year) of the total 1973 emissions by 1975. The control of particulate emissions from dirt roads is not included as a part of the present control strategy. However, the paving and use of oil pallative on dirt roads are being encouraged as voluntary dust suppression measures. It should be remembered that emissions from dirt roads are estimated to total 7,500 tons per year in 1973.

The restrictions on burning of turf grass fields became effective with the 1974 harvest.[6] In 1973, total acreage (sq.km) burned was 28,077 (114) while in 1975, acreage (sq.km) burned was about 17,000 (69). The emission reduction achieved from 1973 to 1975 was 166 tons per year. Emissions in 1973 from grass field burning were 421 tons per year and in 1975 were 255 tons.

Further information on area source compliance status was not available for this study.

VI. SUMMARY

The following summary presents those significant findings which contribute to a description of the reasons for TSP standards non-attainment in Spokane County:

1. The geographical area of non-attainment for primary TSP NAAQS appears to extend in a band from the Spokane central downtown area east-northeasterly for approximately 3.5 miles (5.6 km). The most recent available ambient data indicates that four monitors within this area are exceeding the 24-hour and or annual primary TSP standards.

2. The two stations with the highest TSP concentrations are those located at Crown Zellerbach and the Aluminum Supply Company. Both are in an industrial area. The highest annual geometric mean for Calendar Year (CY) 1974 in the Spokane area was 90 $\mu g/m^3$ at the Crown Zellerbach site. During Fiscal Year (FY) 1975, the first 12 months of record at the Aluminum Supply Company monitoring site, a geometric mean of 119 $\mu g/m^3$ was recorded.

3. A strong pattern of high TSP concentrations during the relatively dry months of July through October is exhibited on all five sampling sites in the above described TSP non-attainment area.

4. Lower wind speeds are prevalent during the late summer and early fall months.

5. The largest single point source in Spokane County is Kaiser Mead, a primary aluminum reduction plant. Emissions are 1482 tons per year of particulates, based on the 1975 emissions inventory. The impact of these emissions on ambient air quality could not be made in this evaluation due to inadequate data. Kaiser Mead is located approximately 4 miles (6.4 km) north of the city center and the TSP non-attainment area described above. Prevailing

winds would carry emissions from this facility away from Spokane during most of the year except the winter months when TSP concentrations have been noted to be lowest.

6. Seasonal activities include agricultural harvest activities with associated increased grain handling operations and field burning, and gravel pit-crushing-screening-stockpiling operations. These activities are reported to be greatest during the summer and early fall months. Some or all of the seven grain handling facilities in the Spokane City area experience increased activity during this time of year. Estimated emissions from grass field burning (no closer than 15-30 miles (24-48 km) from the City of Spokane) have been reduced from 421 tons in 1973 to 225 tons in 1975. Four different companies conduct gravel pit, crushing, screening, and stockpiling operations with a 0.5 mile (0.8 km) radius of the monitor located at the Aluminum Supply Company. Combined emissions are estimated to be 111 tons per year plus 25 tons per year from a rotary asphalt dryer. Production is strongly dependent upon the seasonal demand for gravel and concrete.

7. As of 1974, it was estimated that 240 miles (384 km) of dirt roads in the City of Spokane contributed 1,000 tons of particulates annually. Within a radius of 0.5 mile (0.8 km) of the Crown Zellerbach and Aluminum Supply Company monitors, there are (as of January 1974) approximately 7.8 (12.5) and 2.4 (3.8) miles (km) of unpaved roads respectively. Calculated emissions show that these roads in the area of the Crown Zellerbach monitor contribute approximately 44 tons per year of particulates less than 10 microns in size. The 2.4 miles (3.8 km) of roads around the Aluminum Supply Company monitor were calculated to contribute 12 tons of less than 10 micron particulates annually. Emissions are likely to be concentrated during the dry part of the year.

8. The data shows a good correlation between dry periods and ambient TSP values. An analysis of 27 days with ambient TSP

concentrations in excess of 150 $\mu g/m^3$ showed that 25 of the days were preceeded by rainless periods of three days to over one month.

9. No correlation between wind direction and TSP concentrations was noted. Such a correlation was attempted for the Aluminum Supply Company and Crown Zellerbach monitors for August through October 1974.

10. No significant weekend-weekday variation in TSP concentrations were found.

11. Data from a maximum TSP concentration site was not available when the SIP rollback calculations were being performed. The maximum concentration site value used for the original control strategy rollback was approximately 37 percent lower than the annual value recorded two years later at the Crown Zellerbach site during its first year of operation.

12. The original emissions inventory upon which rollback calculations were based was approximately 43 percent lower than a more comprehensive inventory completed in 1973, due largely to the omission of the contribution from unpaved roads in the SIP inventory.

13. No regulations in the control strategy govern the emissions from, or the paving of, unpaved roads. It was not determined in this study if RACT is being applied to fugitive industrial emissions such as grain handling facilities and rock crushing, screening, and stockpiling operations. All remaining aspects of the control strategy appear consistent with, or are more stringent than RACT.

14. Twenty-two of the twenty-seven listed particulate emitting point sources located in the Spokane City area are in compliance. Four of the five remaining sources are scheduled to be in compliance by July 1976 or before. The remaining source has only periodically exceeded emission limits and its compliance status is presently being negotiated. All five of these sources are located in an area

with a radius of 2 miles (3.6 km). Four of the five sources are located within the previously described TSP non-attainment area. The total particulate emissions from all five sources that are out of compliance is only 145 tons per year.

15. Droege and Clark[15] performed a special study in 1972 and 1973 to describe the TSP problem in Spokane County. Their findings are consistent with those of this study and include:

a. Higher TSP concentrations are found on dry days as opposed to days with precipitation, regardless of the time of year.

b. TSP concentrations are higher during the summer than the winter.

c. High TSP concentrations are associated with strong winds and low humidity.

d. Considering the sampling months of May, August through September, November and January, the metals and organic composition were highest in November.

e. Only half as many filters were in the brown-green range (as opposed to gray) during the November/ January sampling periods compared to the May/August - September sampling period.

VII. CONCLUSIONS

Fugitive dust/fugitive industrial emissions are the likely major causes of TSP non-attainment in Spokane. The likely major contributors are (1) unpaved roads, (2) emissions from gravel pit, rock crushing, screening, and stockpiling operations, and (3) possibly natural wind blown dust. All monitoring sites in the non-attainment area exhibit the same general trend of high TSP concentrations during the summer and early fall months. No apparent correlation between wind direction and TSP concentration was noted. These two findings would imply an area fugitive dust source.

The two monitors with highest TSP concentration, Aluminum Supply Company and Crown Zellerbach are centrally located in major fugitive dust-fugitive emission areas. The Aluminum Supply Company monitor is surrounded by nine sources within a radius of .8 miles (1.3 km), all of which would be associated with fugitive emissions. The sources include three feed-grain operations, four gravel pit-crushing-screening-stockpiling (plus one asphalt) operations (136 tons per year), one sand blasting operation (5 tons per year), and one automobile fragmentor (15 tons per year). Total <u>inventoried</u> emissions from these operations are 205 tons per year. It should be noted, however, that fugitive industrial emissions are not easily quantified and estimations may be subject to considerable error. In addition, calculated emissions from the 2.4 miles (3.8 km) of unpaved roads located within a 0.5 mile (0.8 km) radius of the monitor are 12 tons per year. Most all of these emissions are seasonally oriented, tending to be concentrated in the dry summer and early fall months. This corresponds to the observed annual pattern of high TSP from July through October.

The Crown Zellerbach monitor is located in the center of one of the largest concentrations of unpaved roads in the city. Within a 0.5 mile (0.8 km) radius alone, 7.8 miles (12.5 km) of unpaved roads were calculated to emit approximately 44 tons of particulates annually. In addition, five point sources located within one mile (1.6 km) west to northwest of the monitor emit a total of 188 tons of particulates annually. It is important to note that most of these emissions come from Long Lake Lumber (106 tons per year) and the Washington Water Power boiler (59 tons per year). Long Lake Lumber is considered in compliance with applicable emission limitations. Emissions from the Washington Water Power boiler (compliance status presently being negotiated) are seasonal, but are concentrated in the winter months when combustion of oil and associated soot blowing operations are more prevalent. Since high TSP values are recorded predominantly during the late summer and early fall, emissions from this boiler do not appear to be associated with the non-attainment problems. Long Lake Lumber emissions are likely to be relatively consistent throughout the year. Rough modeling calculations have shown that the maximum impact of emissions from this source on TSP concentrations at the Crown Zellerbach monitoring site are now likely to be minor. Emissions were reduced from 396 tons per year to 106 tons per year with the installation of a baghouse on the hog fuel boiler in October 1974. It is relevant to note that emissions release points for both Washington Water Power and Long Lake Lumber are elevated, with effective stack heights permitting much better particulate dispersion than the ground level emissions from dusty roads. Since (1) no correlation was noted between TSP concentration and wind direction when studied at this monitoring site during August through October 1974, (2) high TSP concentrations are found predominantly during the late summer and early fall, and (3) modeling has shown the maximum impact of emissions from Long Lake Lumber on the Crown Zellerbach site to be minimal, it appears likely that unpaved roads are strongly affecting the TSP concentrations at the Crown Zellerbach monitor.

The Gonzaga University and Spokane City Hall monitors may be influenced primarily by the numerous emission sources discussed above that are located near the Aluminum Supply Company and Crown Zellerbach monitors (Consult figures 13 and 14).

Periodically, during periods of strong wind, high TSP concentrations are likely to result from wind blown dust originating from natural sources, barren farm lands, dusty roads, stock piled materials (such as gravel), etc. April, one of the months noted as having high TSP concentration, is shown in Table 7 as also having the highest average monthly wind speed.

Agricultural field burning is not likely to be a significant contributor to high TSP in Spokane, particularly with the acreage reduction program being implemented. This is further substantiated by the following: (1) The nearest two field burning areas are 15 (24) and 30 (48) miles (km) from Spokane, (2) burning is normally conducted on days with meteorological conditions favorable for dispersion of emissions.

The rollback calculations upon which the particulate control strategy was based were strongly deficient with respect to data input. Ambient TSP concentrations have been shown to be at least 36 percent higher than the concentrations available during SIP development. Countywide emissions to be reduced have also been shown to be nearly 90 percent higher than emissions estimated in the rollback calculations.

VIII. RECOMMENDATIONS

1. Initiate a program to control emissions from unpaved roads in the City of Spokane. This may or may not entail a revision to the control strategy.

2. Reassess the magnitude of fugitive emissions from industrial operations in the geographical non-attainment area. Re-evaluate the compliance status of such sources.

3. Conduct a special monitoring study to determine the impact of emissions from gravel pit-crushing-screening-stockpiling operations on ambient air quality. A network of particulate sampling devices together with appropriate meteorological equipment should be located immediately downwind of these operations in the area of the Aluminum Supply Company. Sampling should be conducted during both operating and non-operating periods, and during wind conditions which are both favorable and unfavorable for measuring maximum impact of emissions from these sources.

4. Determine RACT for gravel pit-rock crushing-screening-stockpiling operations. Compare existing emission controls with RACT for those operations conducted in the Spokane city area.

5. Consideration may then be given to revising the control strategy through the addition of specific fugitive emission regulations.

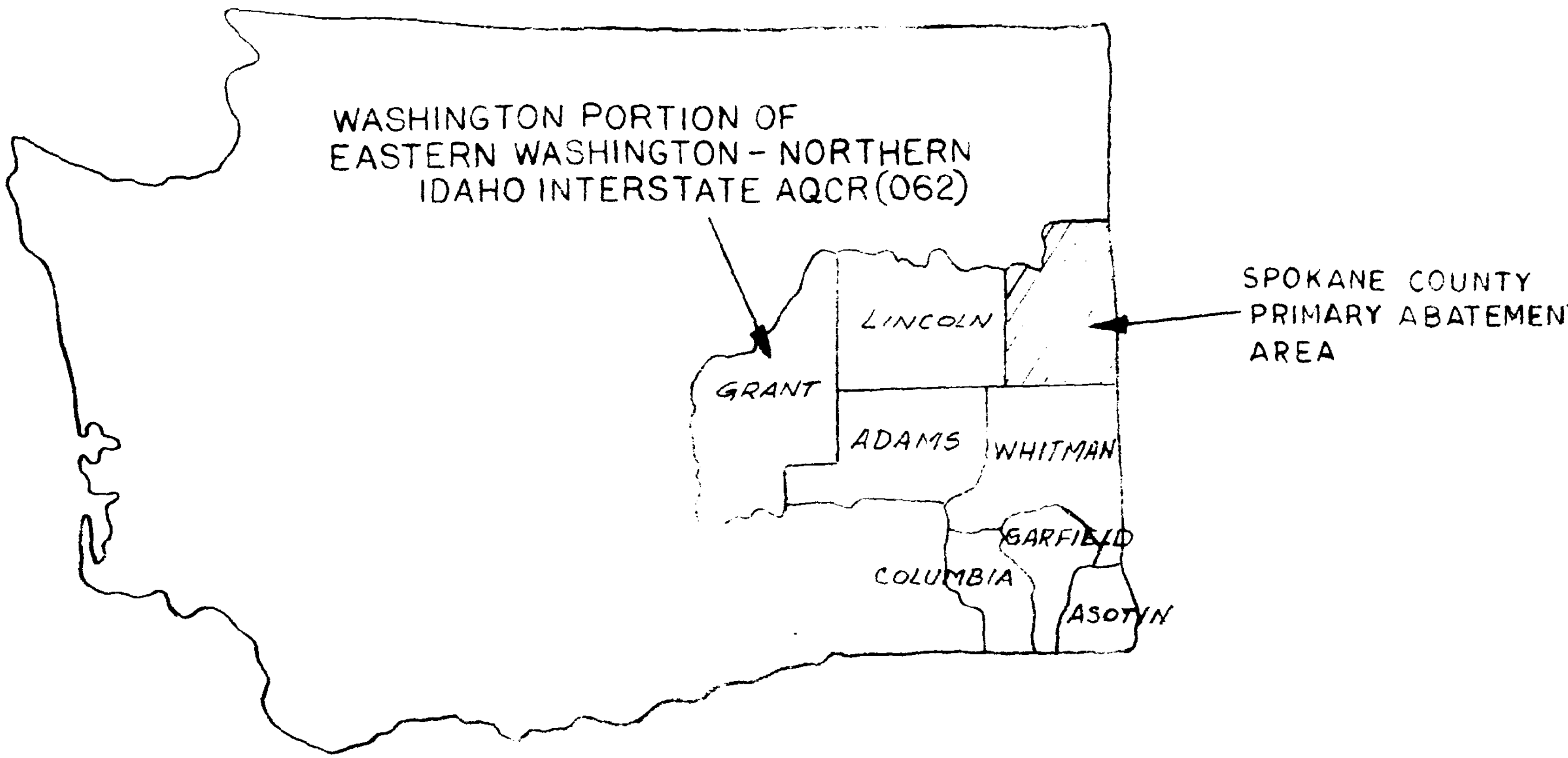


FIGURE 1. SPOKANE COUNTY PRIORITY ABATEMENT AREA LOCATIO

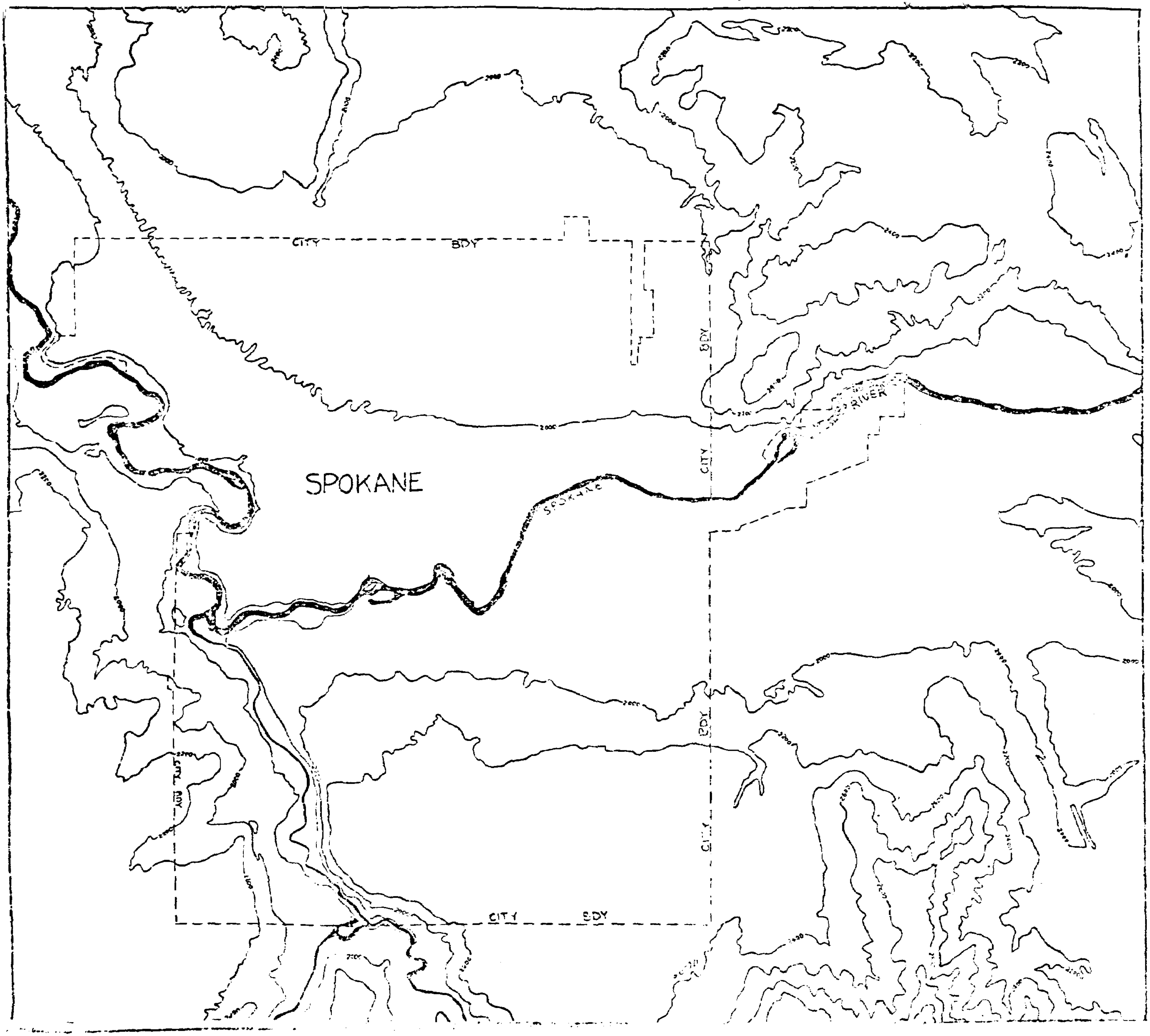


FIGURE 2. TOPOGRAPHIC MAP OF SPOKANE AREA

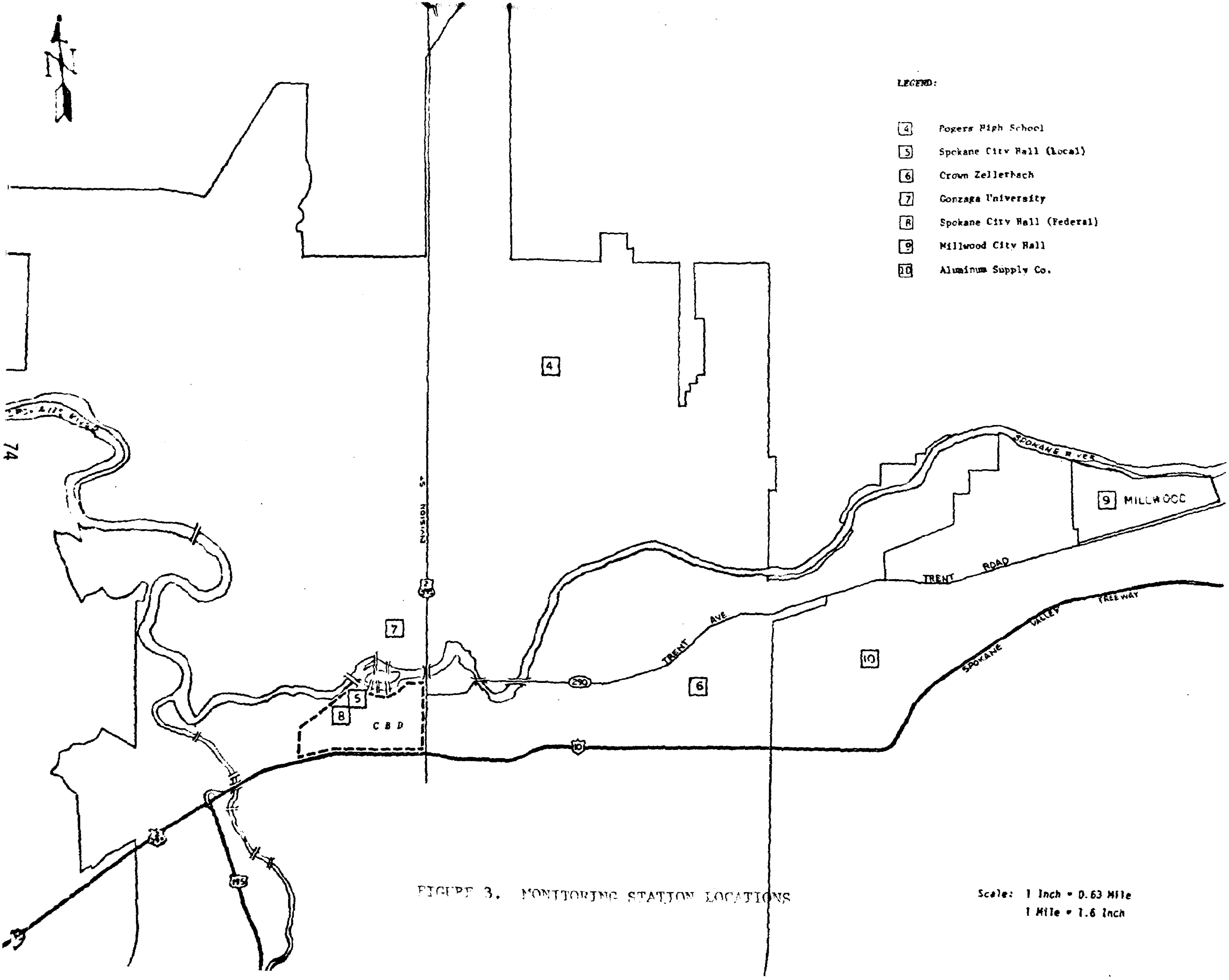


FIGURE 3. MONITORING STATION LOCATIONS

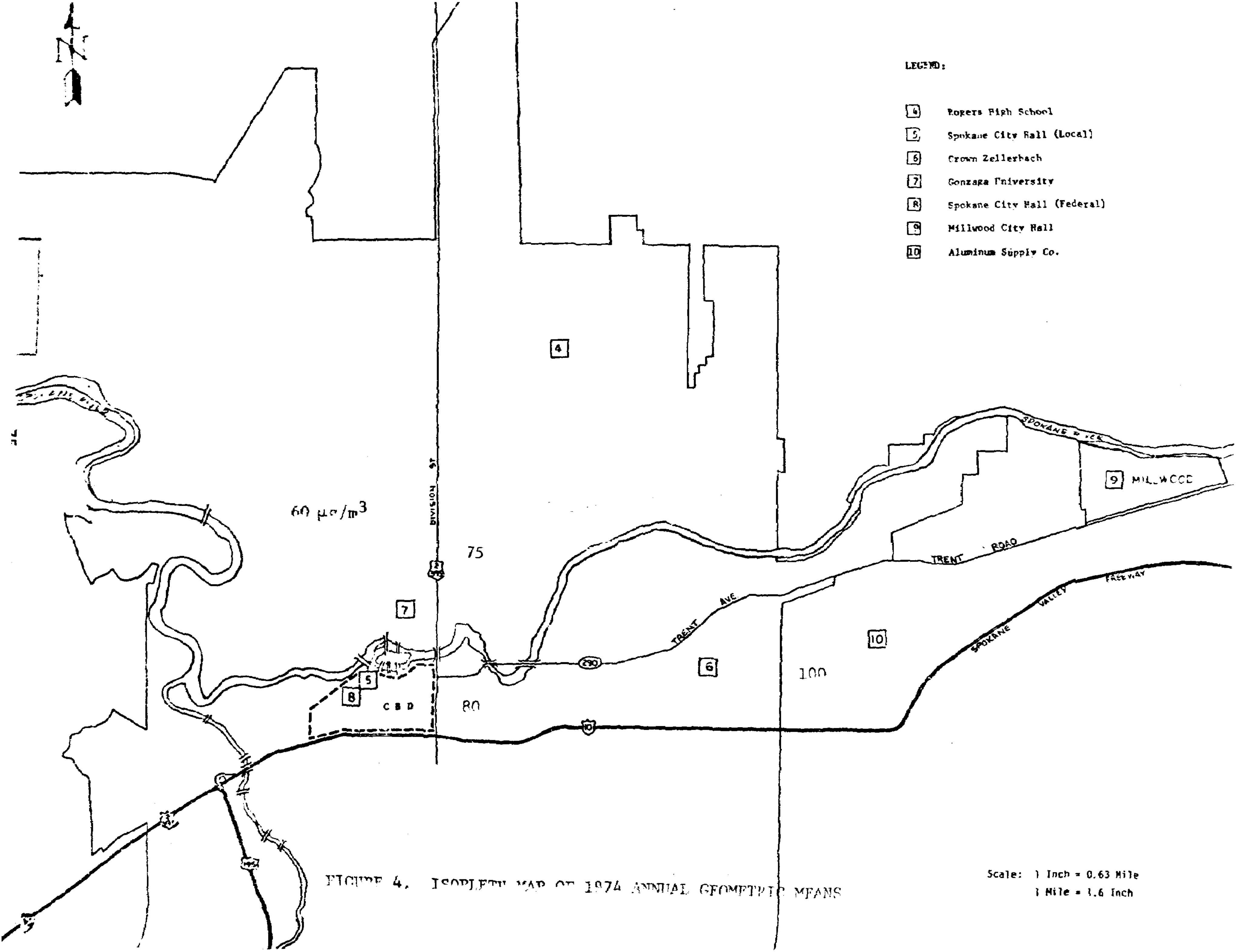


FIGURE 4. ISOPLETH MAP OF 1974 ANNUAL GEOMETRIC MEANS

Scale: 1 Inch = 0.63 Mile
1 Mile = 1.6 Inch

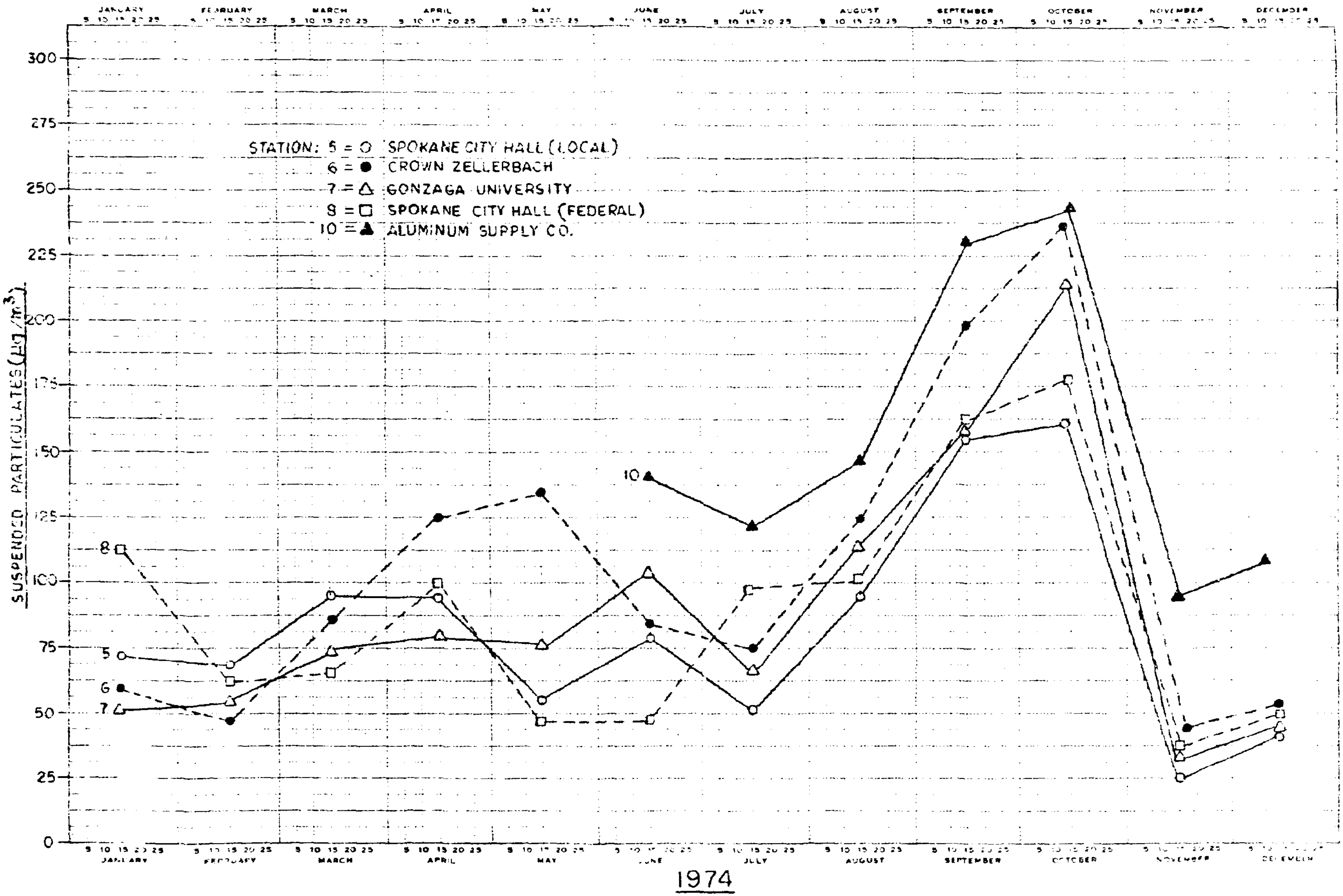


FIGURE 5. 1974 MONTHLY GEOMETRIC MEANS FOR STATIONS 5,6,7,8 & 10

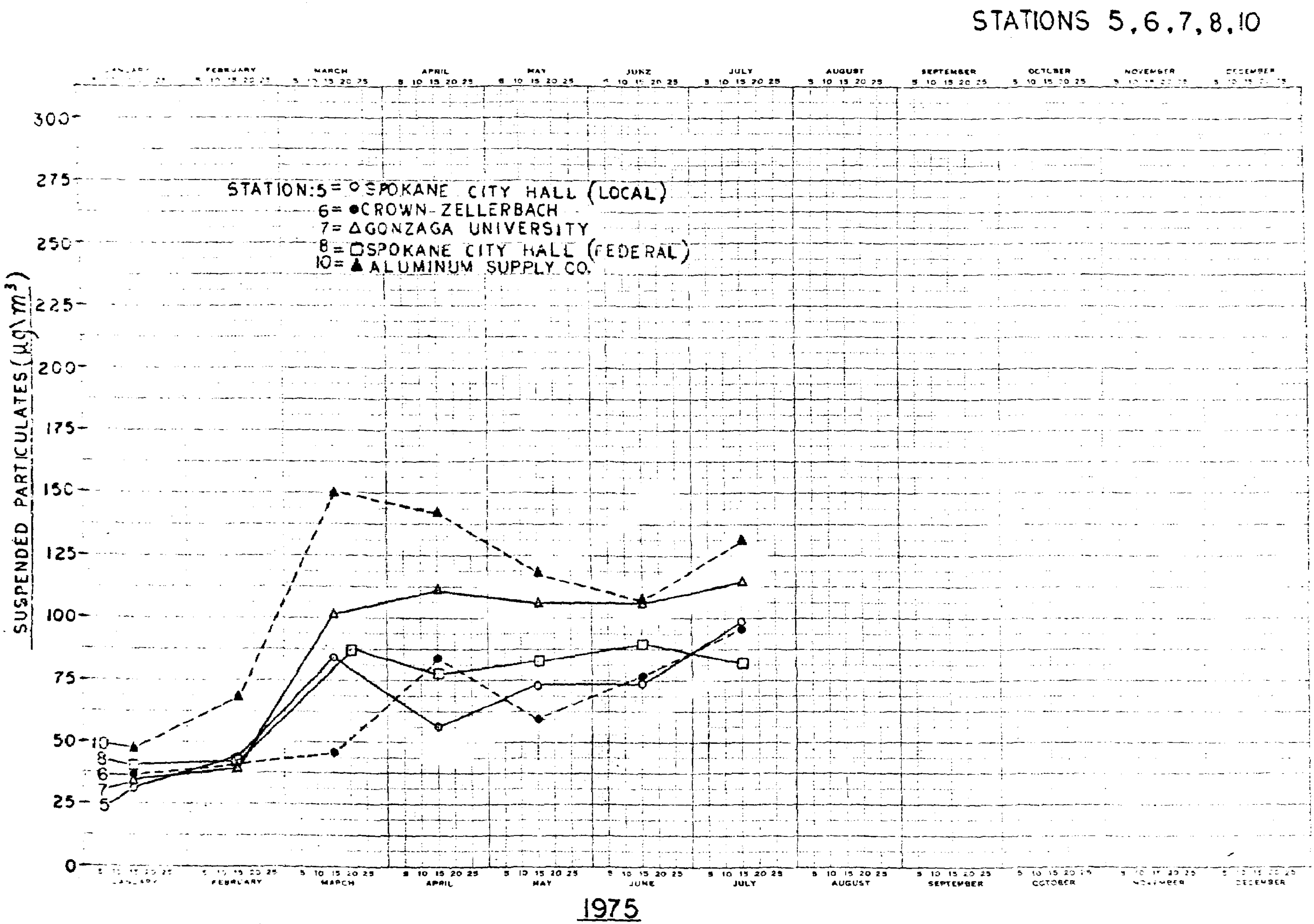


FIGURE 6. 1975 MONTHLY GEOMETRIC MEANS FOR STATIONS 5, 6, 7, 8 AND 10

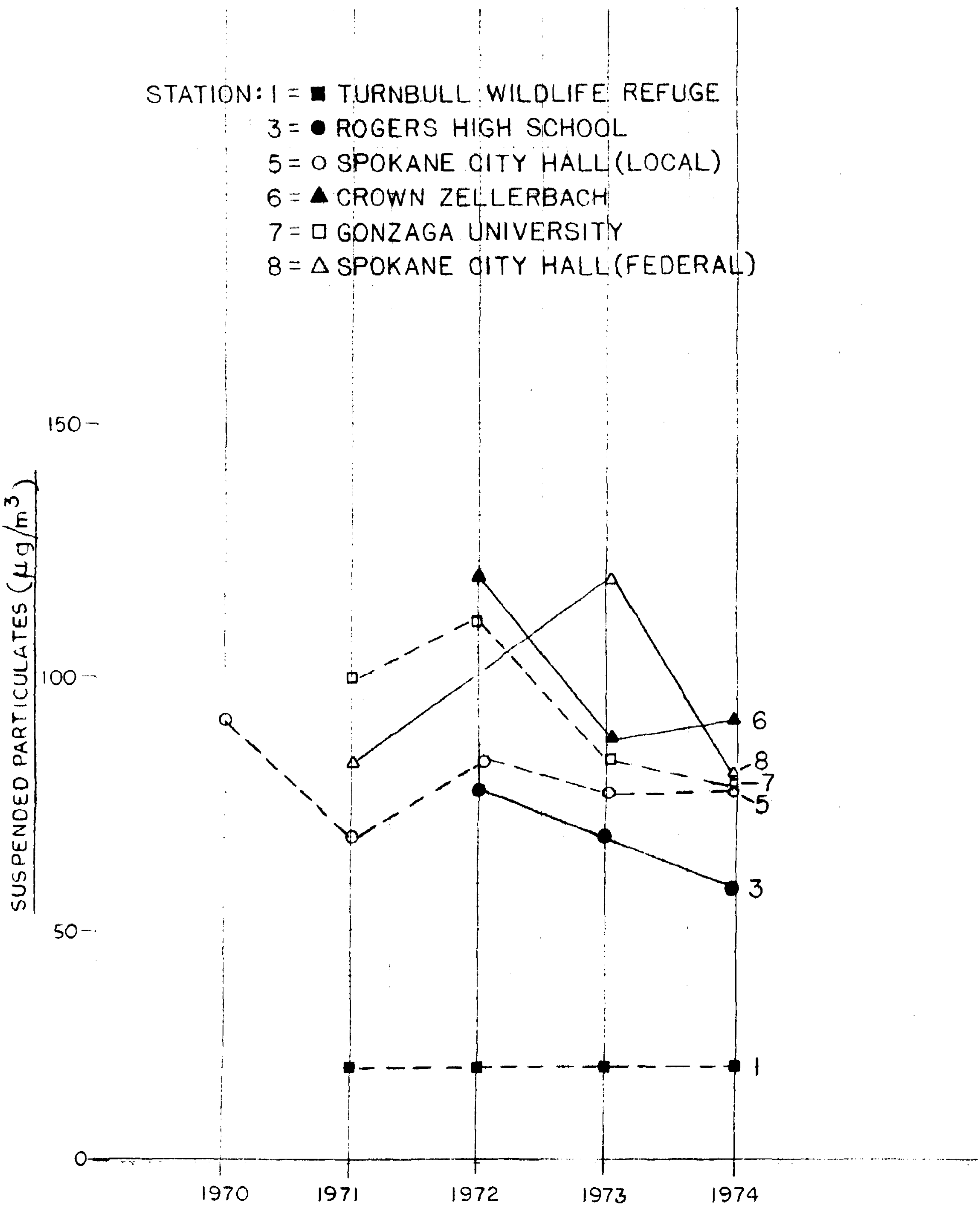


FIGURE 7. HISTORICAL ANNUAL GEOMETRIC MEAN DATA

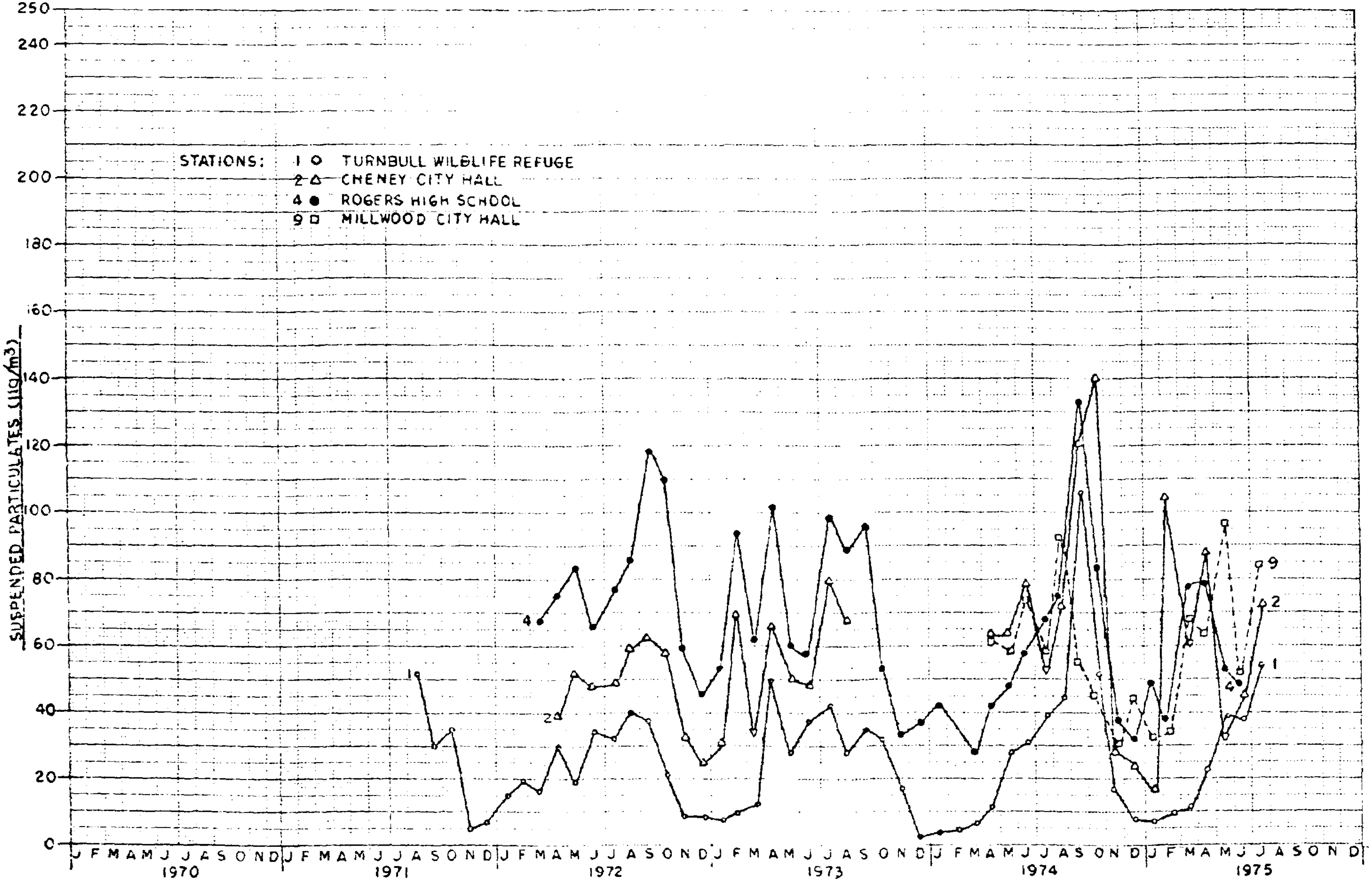
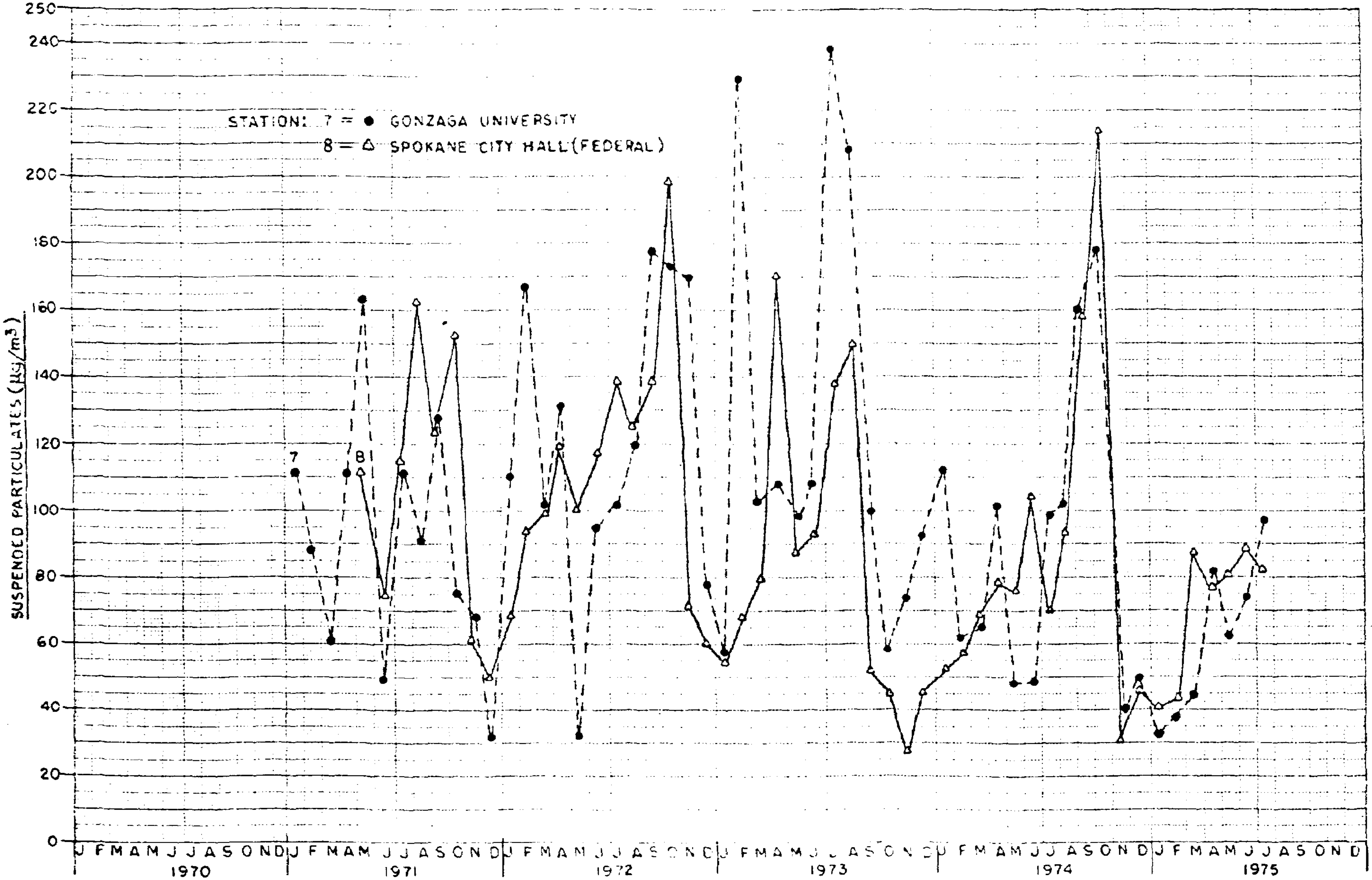
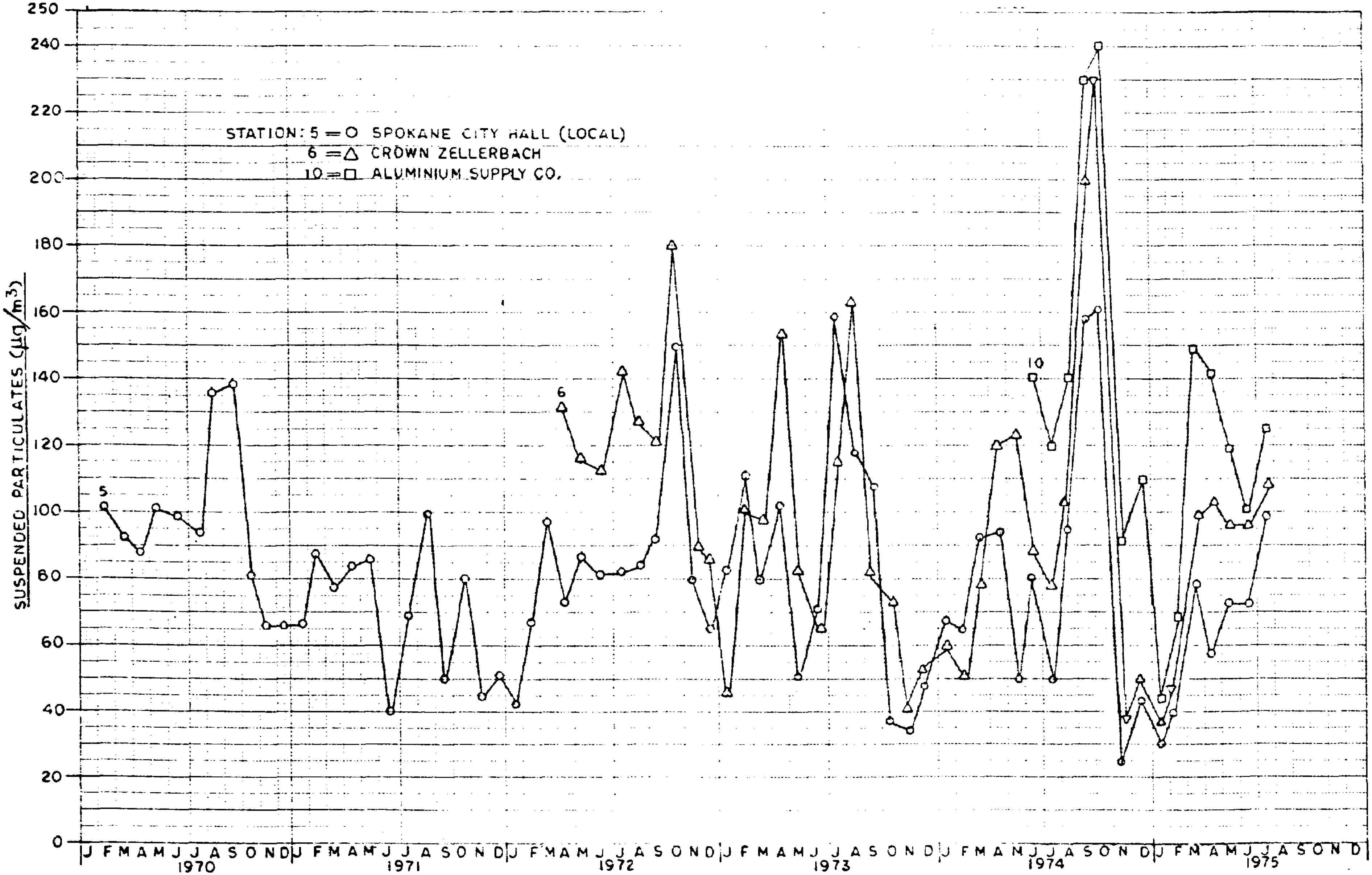


FIGURE 8. HISTORICAL MONTHLY GEOMETRIC MEAN DATA


STATION: 7 = ● GONZAGA UNIVERSITY
8 = △ SPOKANE CITY HALL (FEDERAL)
SUSPENDED PARTICULATES (µg/m³)
0
20
40
60
80
100
120
140
160
180
200
220
240
250
7
8
J F M A M J J A S O N D
1970
1971
1972
1973
1974
1975

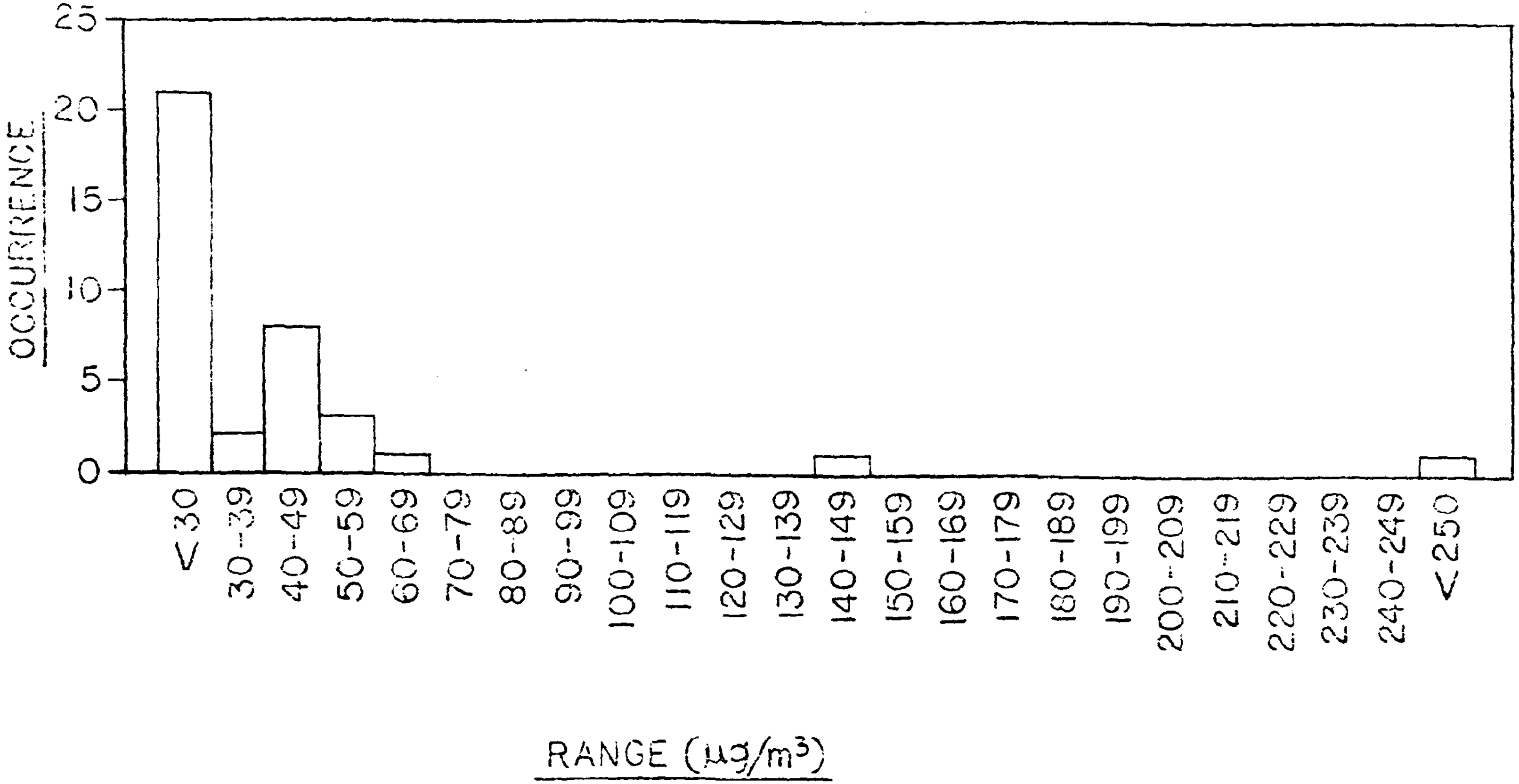


STATION: 5 = O SPOKANE CITY HALL (LOCAL)
6 = △ CROWN ZELLERBACH
10 = □ ALUMINIUM SUPPLY CO.
SUSPENDED PARTICULATES (μg/m3)
250
240
220
200
180
160
140
120
100
80
60
40
20
0
5
6
10
J F M A M J J A S O N D
1970
1971
1972
1973
1974
1975

FREQUENCY DISTRIBUTION

YEAR 1974

STATION # 1

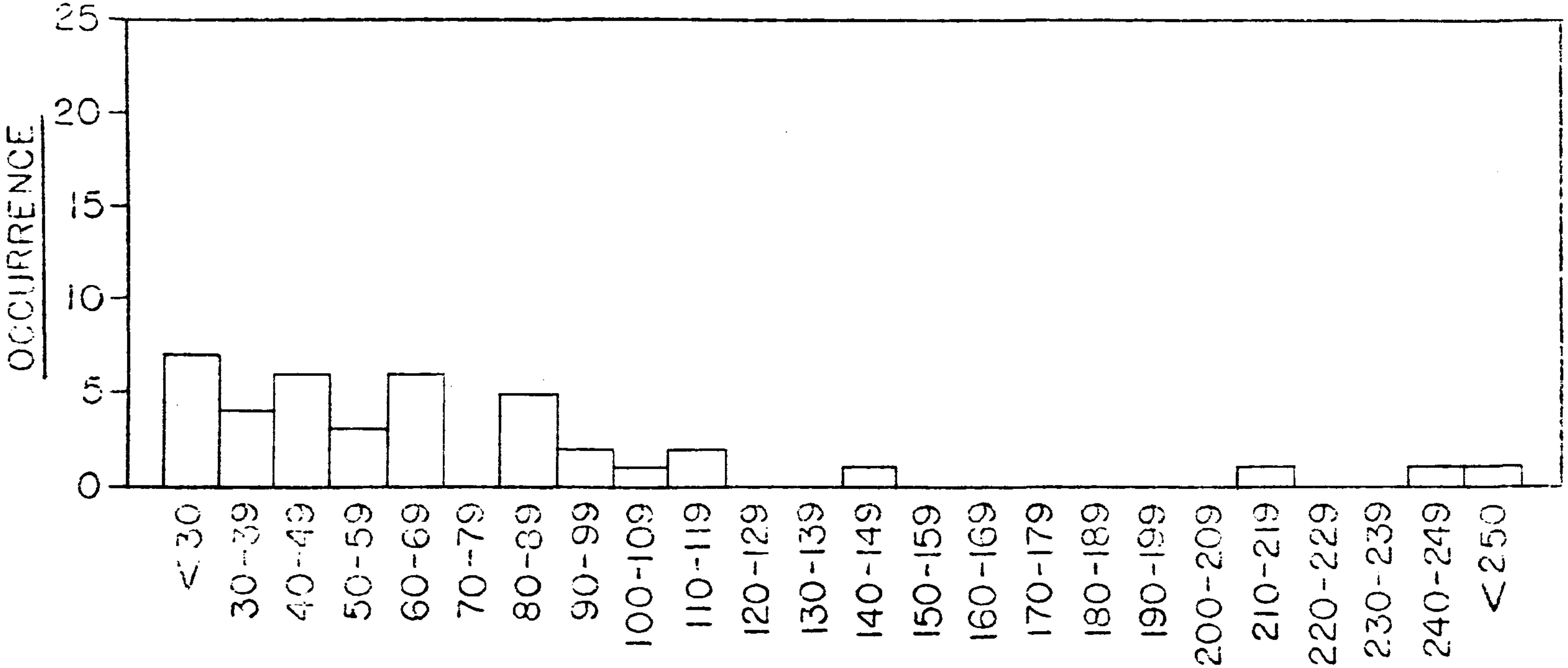


TOTAL SAMPLES: 37

FIGURE 9

FREQUENCY DISTRIBUTION

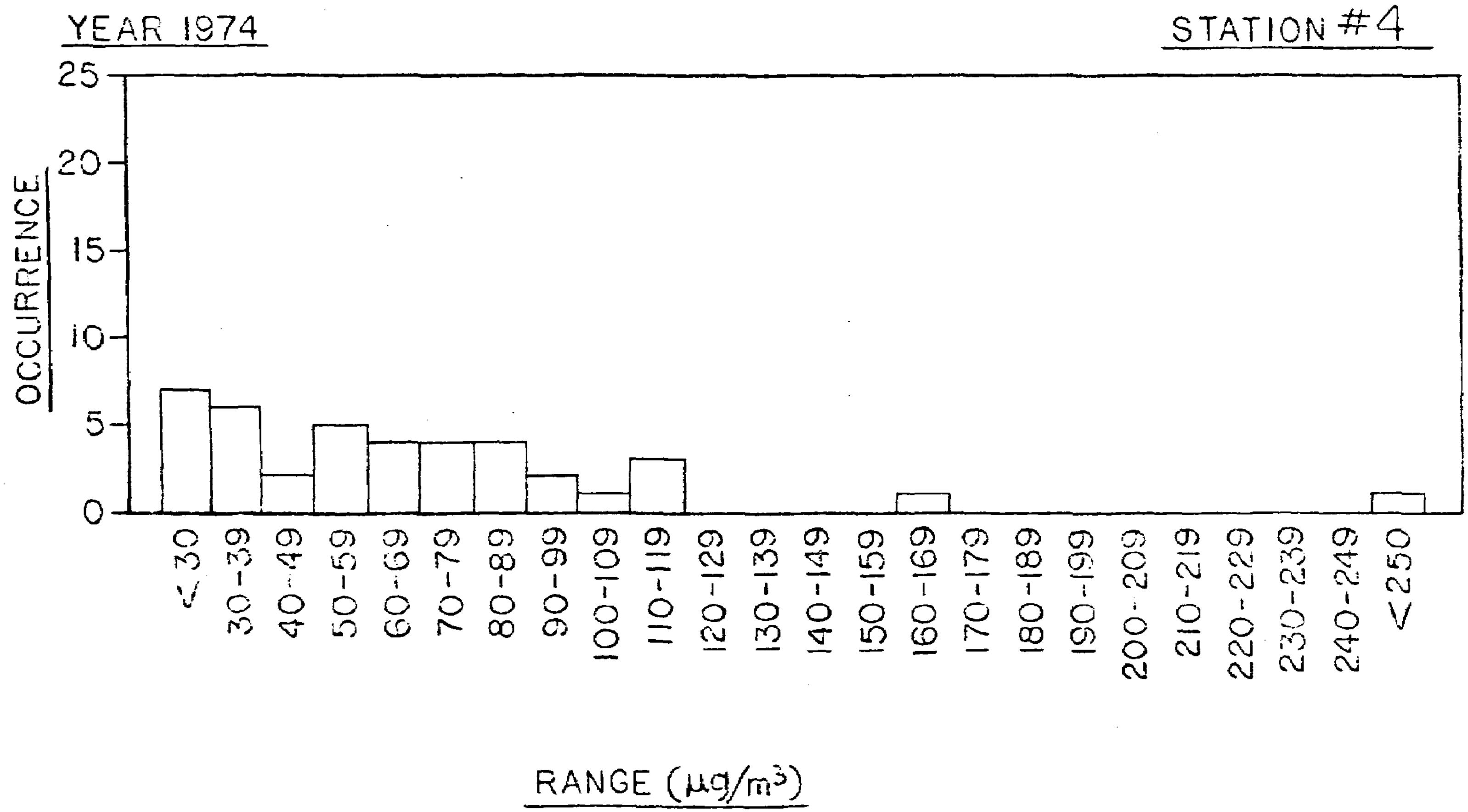
YEAR 1974 STATION # 2



RANGE ($\mu g/m^3$)

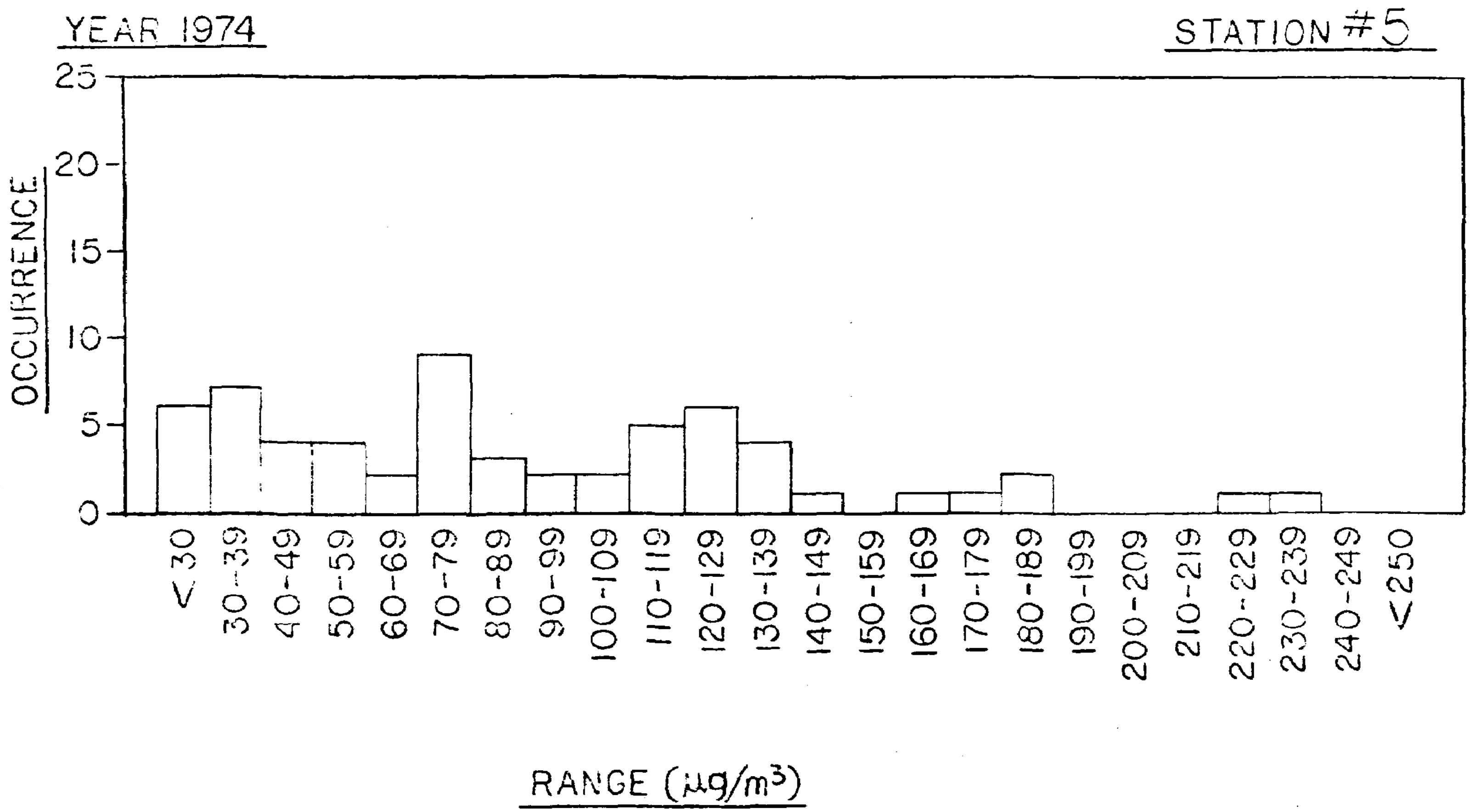
TOTAL SAMPLES:40

FREQUENCY DISTRIBUTION



TOTAL SAMPLES:40

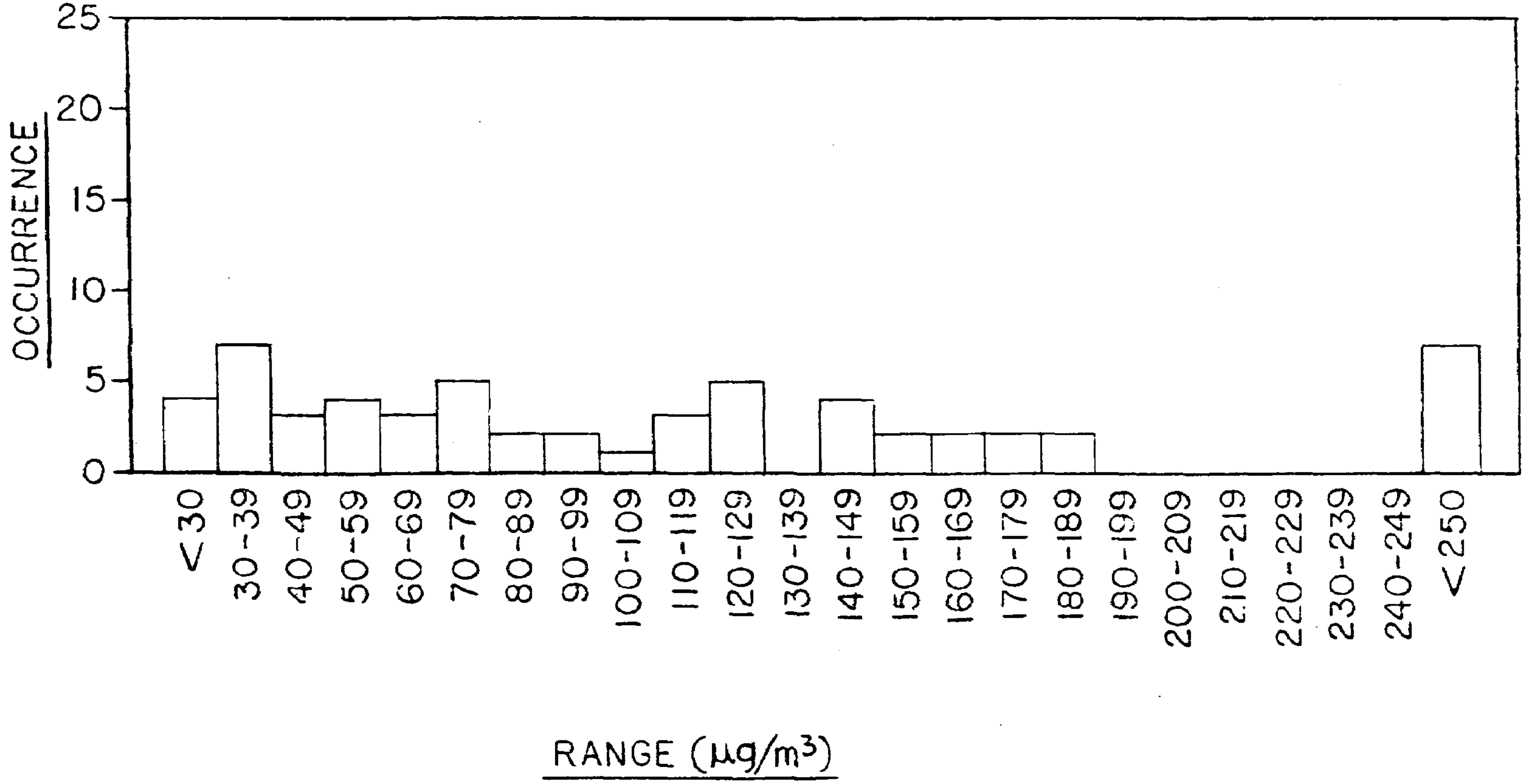
FREQUENCY DISTRIBUTION



TOTAL SAMPLES:61

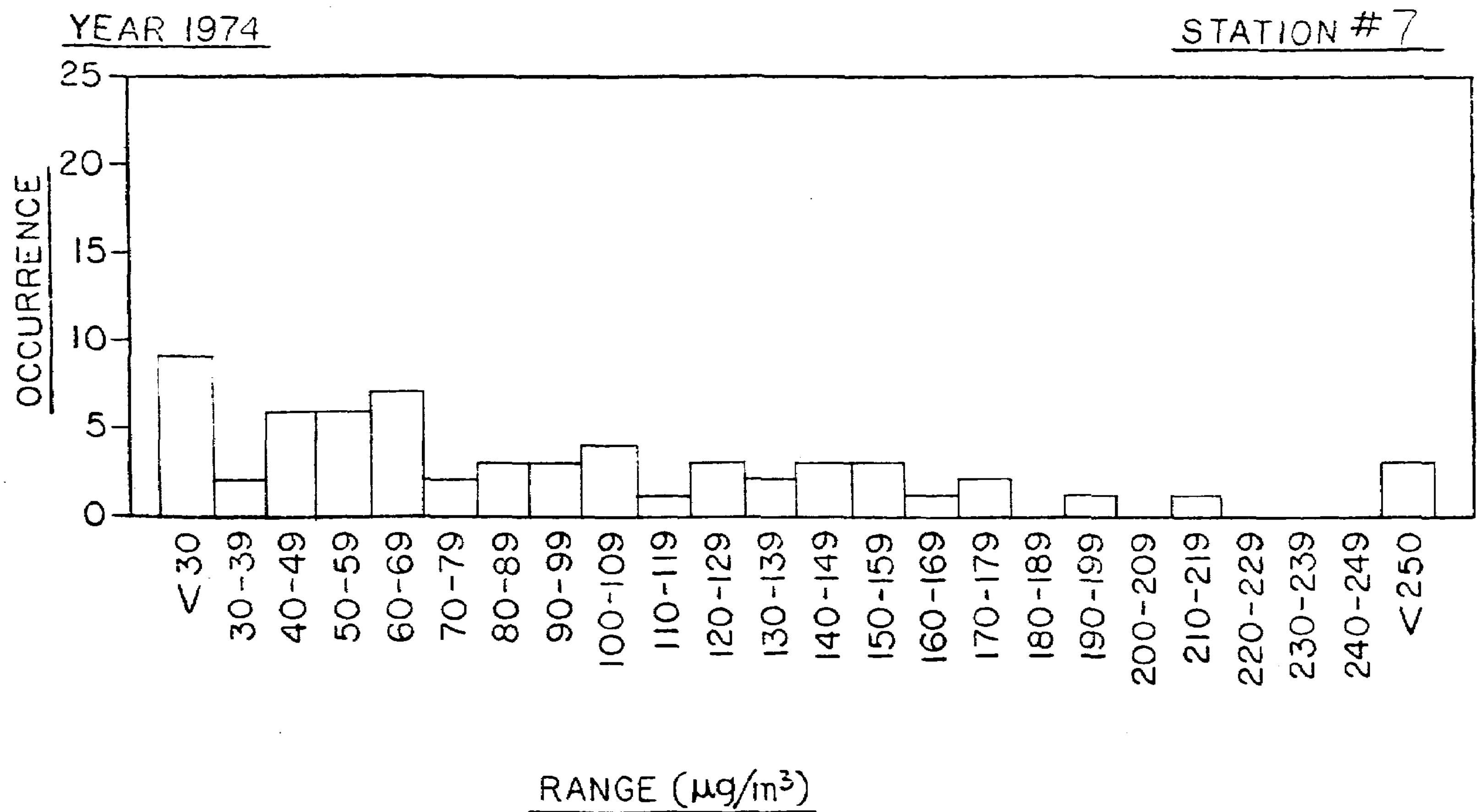
FREQUENCY DISTRIBUTION

YEAR 1974 STATION #6



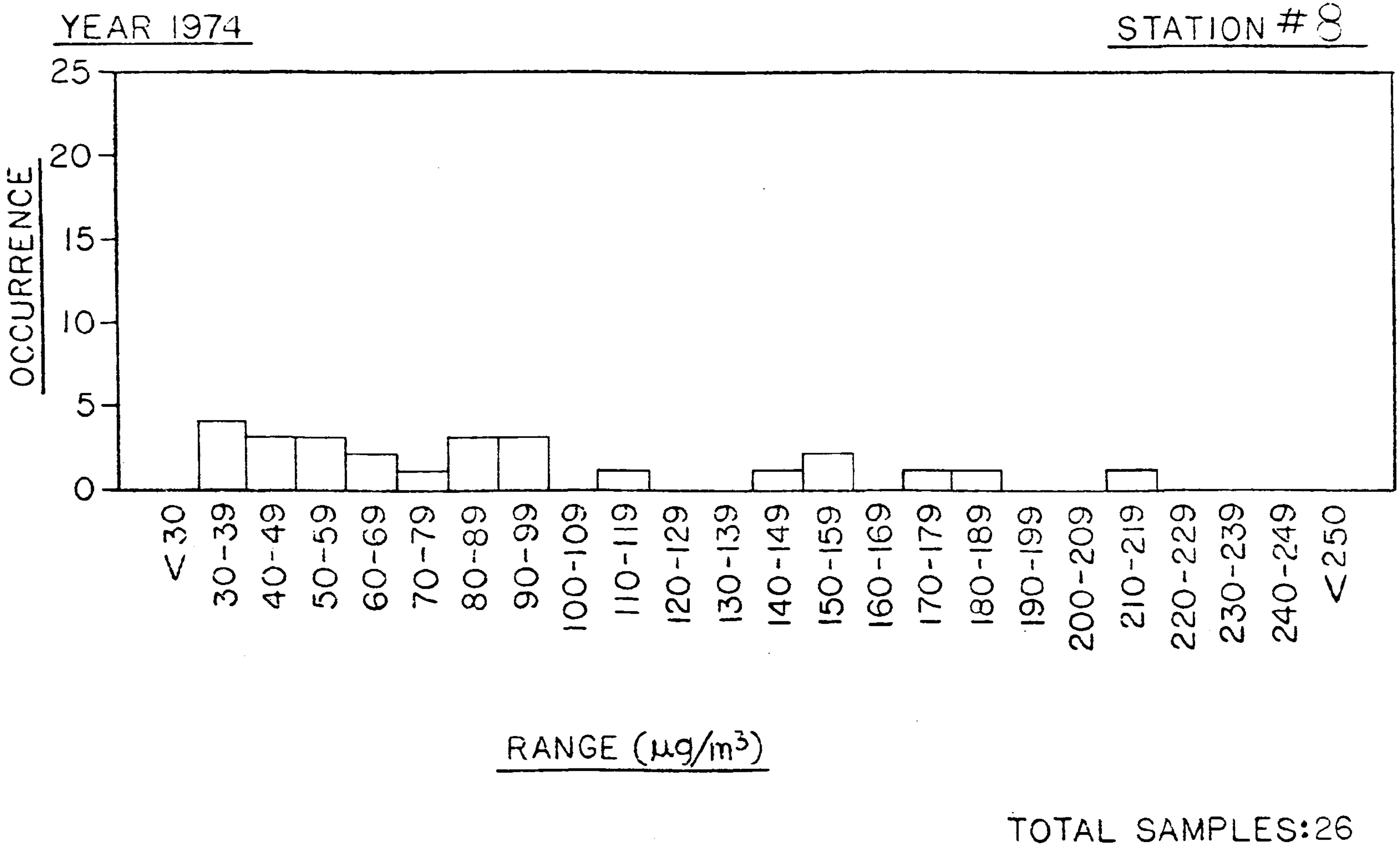
TOTAL SAMPLES: 58

FREQUENCY DISTRIBUTION



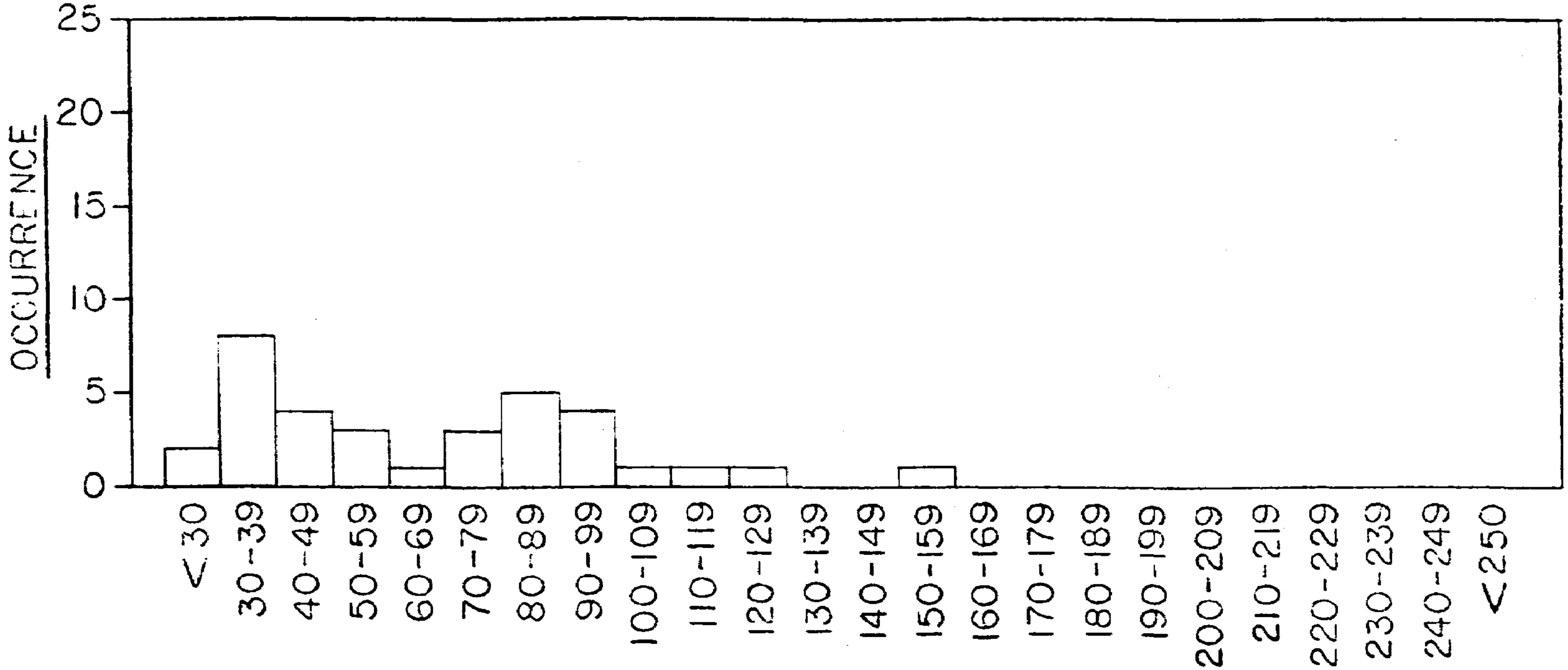
TOTAL SAMPLES: 63

FREQUENCY DISTRIBUTION



FREQUENCY DISTRIBUTION

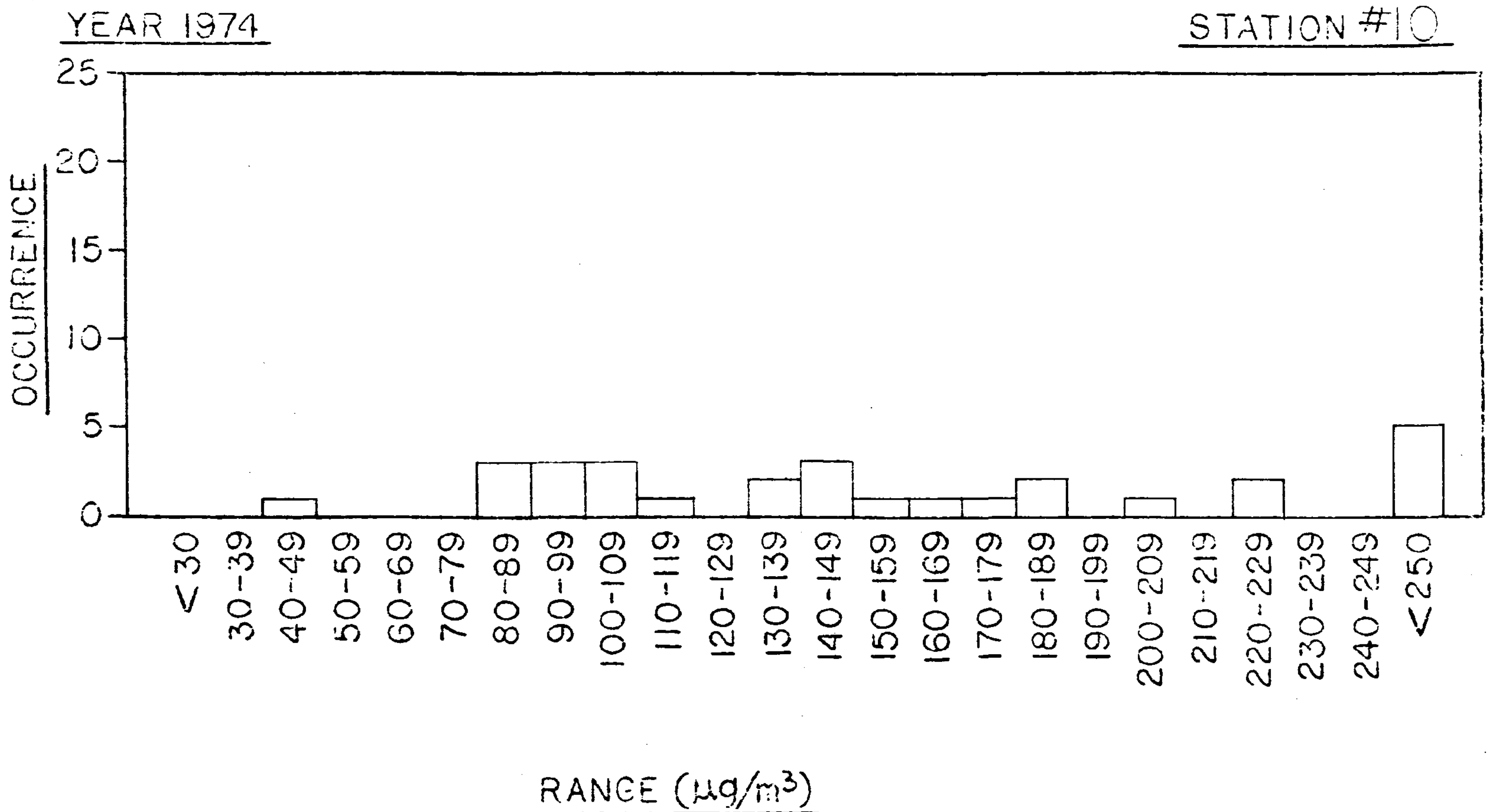
YEAR 1974 STATION #9



RANGE (μg/m³)

TOTAL SAMPLES: 34

FREQUENCY DISTRIBUTION



TOTAL SAMPLES:29

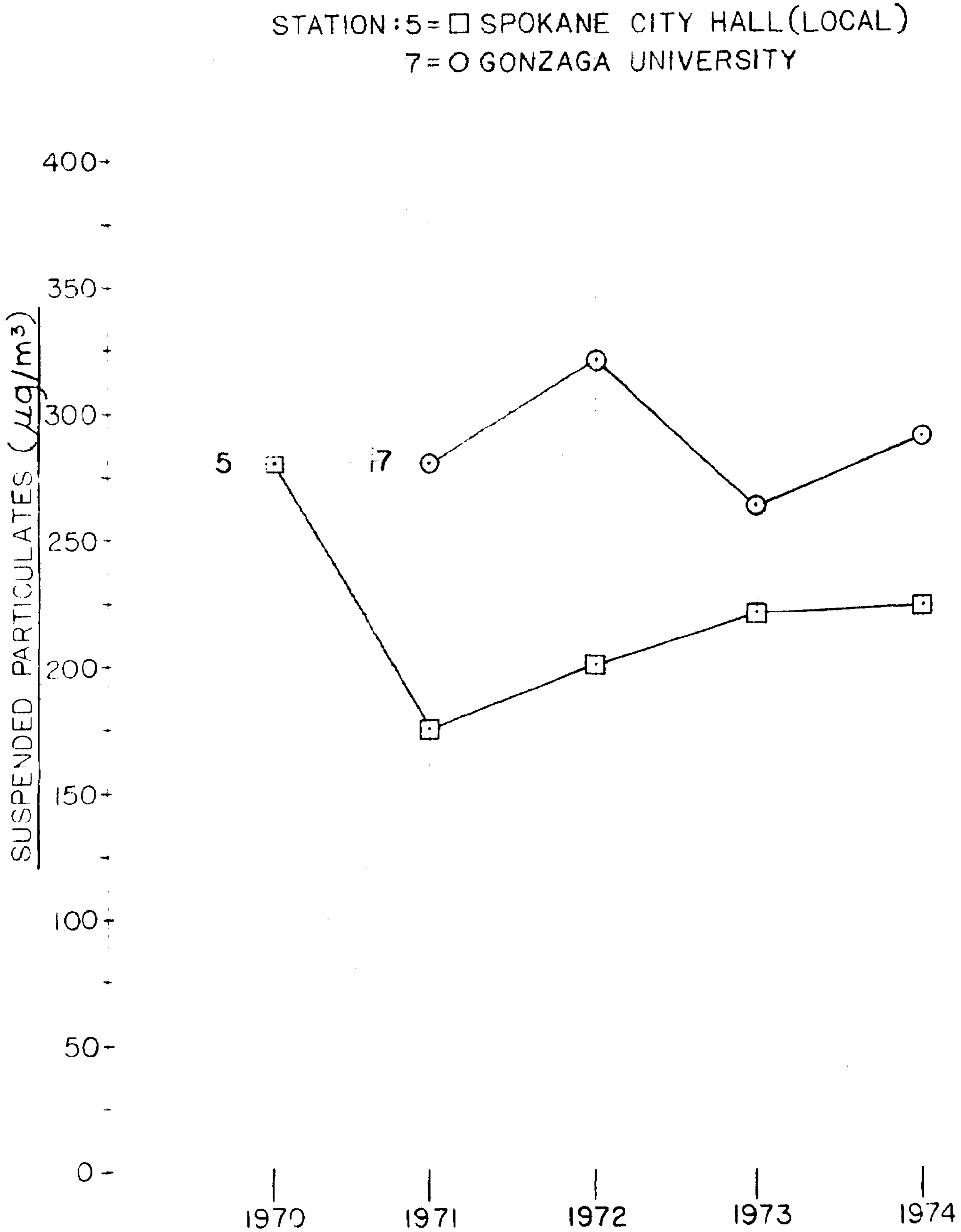


FIGURE 10. HISTORICAL SECOND HIGHEST 24 HR. DATA AT SPOKANE CITY HALL (LOCAL) AND GONZAGA UNIVERSITY

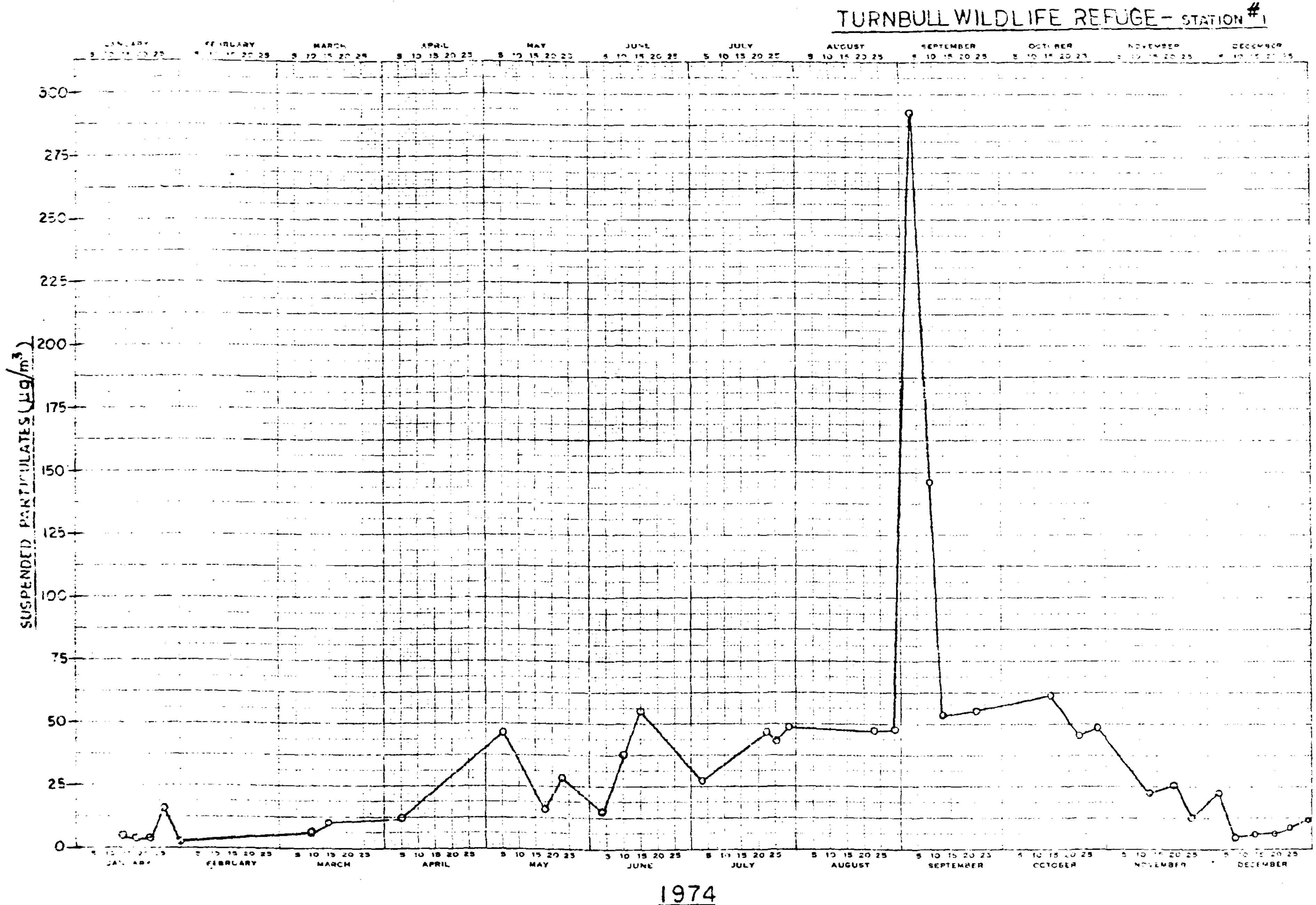


FIGURE 11. PLOT OF 24-HOUR CONCENTRATIONS

TURNBULL WILDLIFE REFUGE - STATION #1

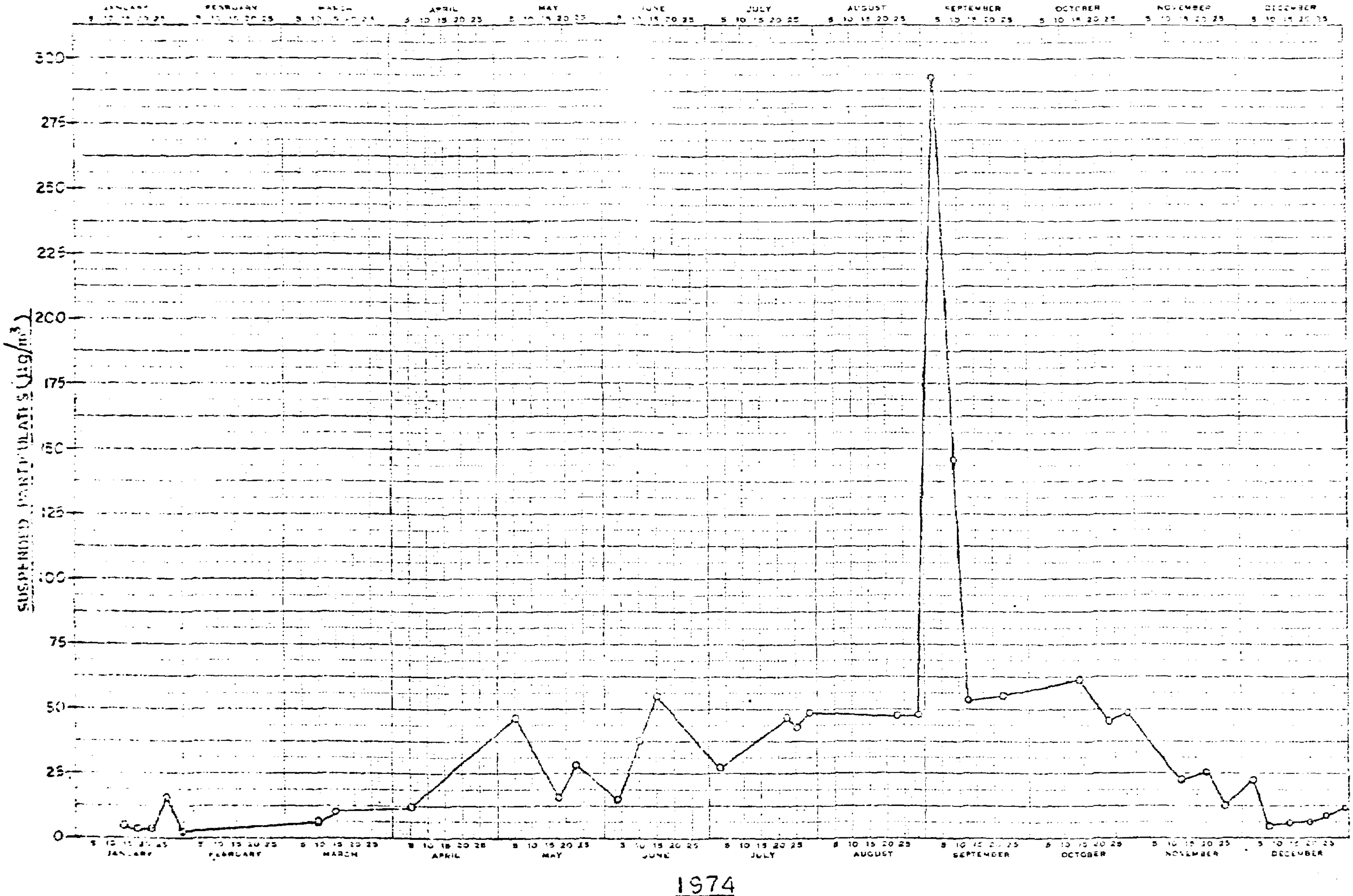
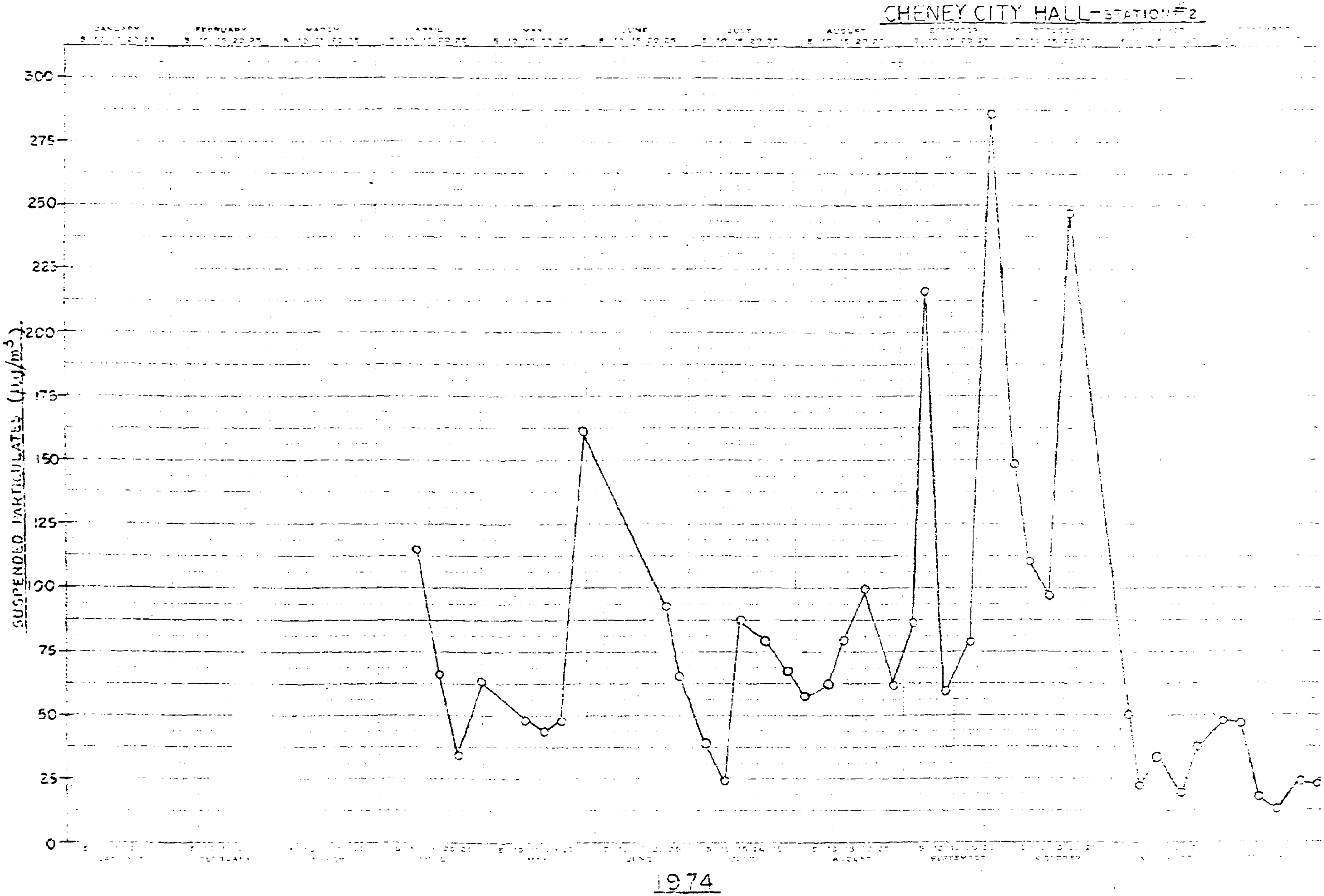
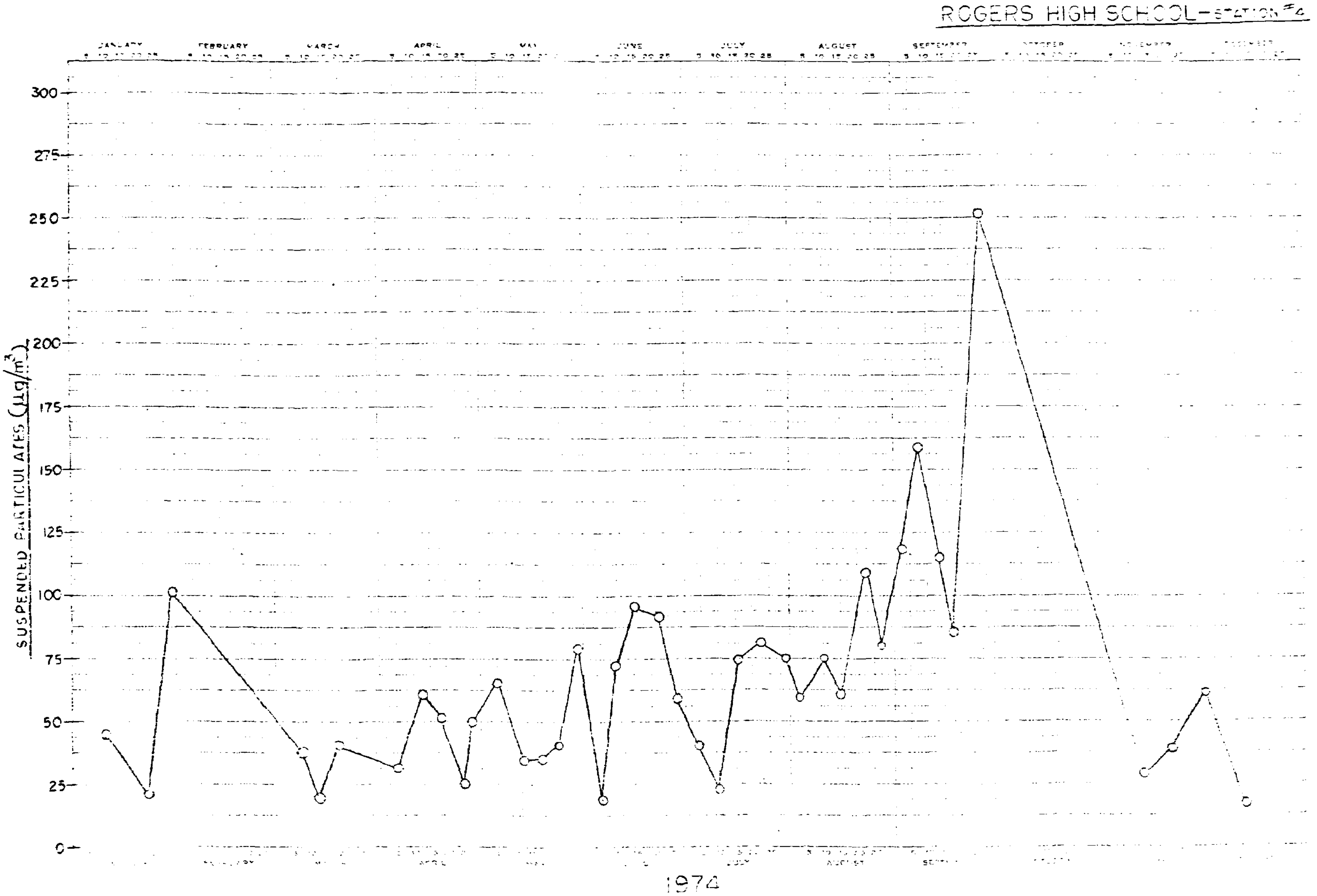
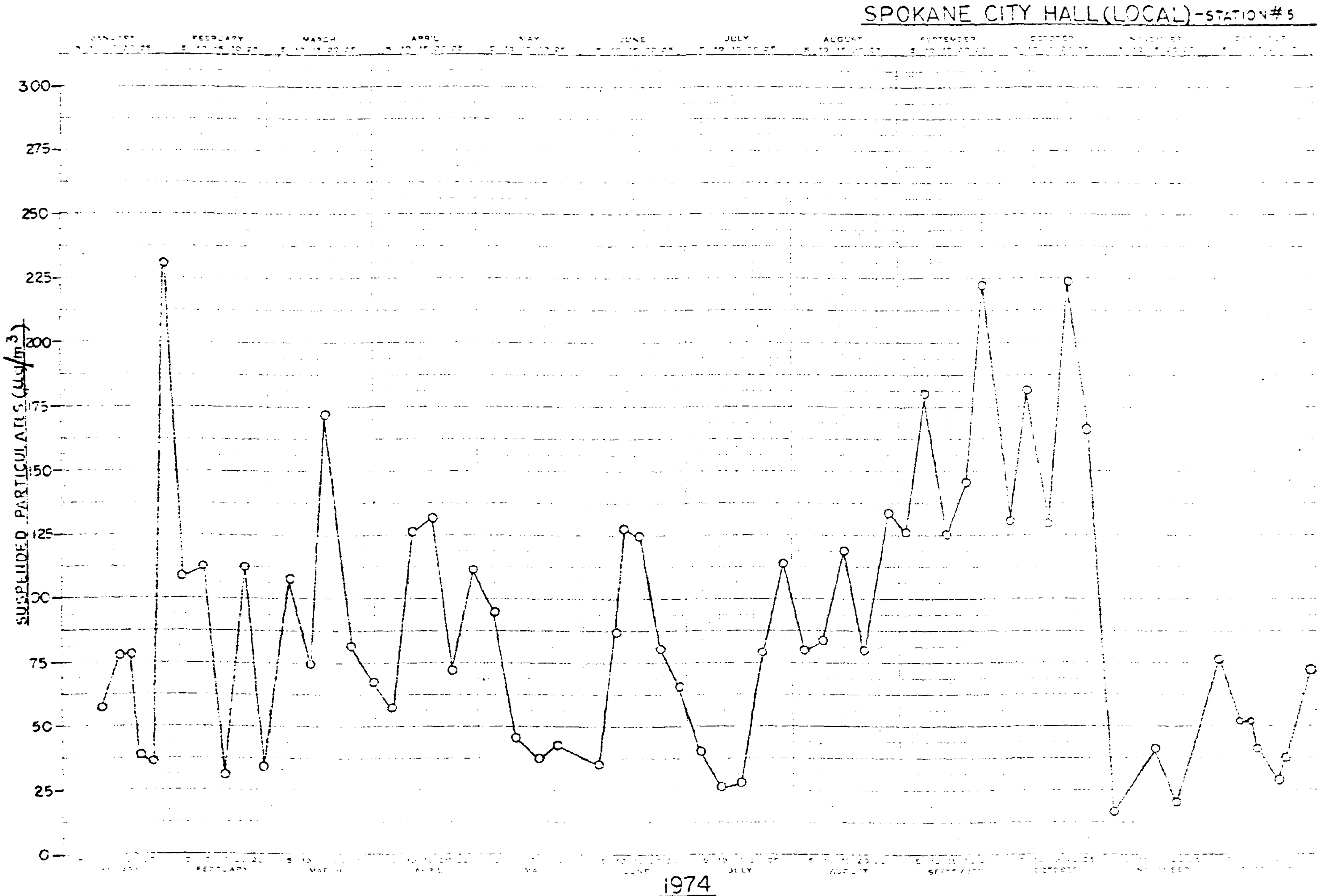


FIGURE 11. PLOT OF 24-HOUR CONCENTRATIONS


CHENEY CITY HALL-STATION #2
SUSPENDED PARTICULATES (μg/m³)
300
275
250
225
200
175
150
125
100
75
50
25
0
1974

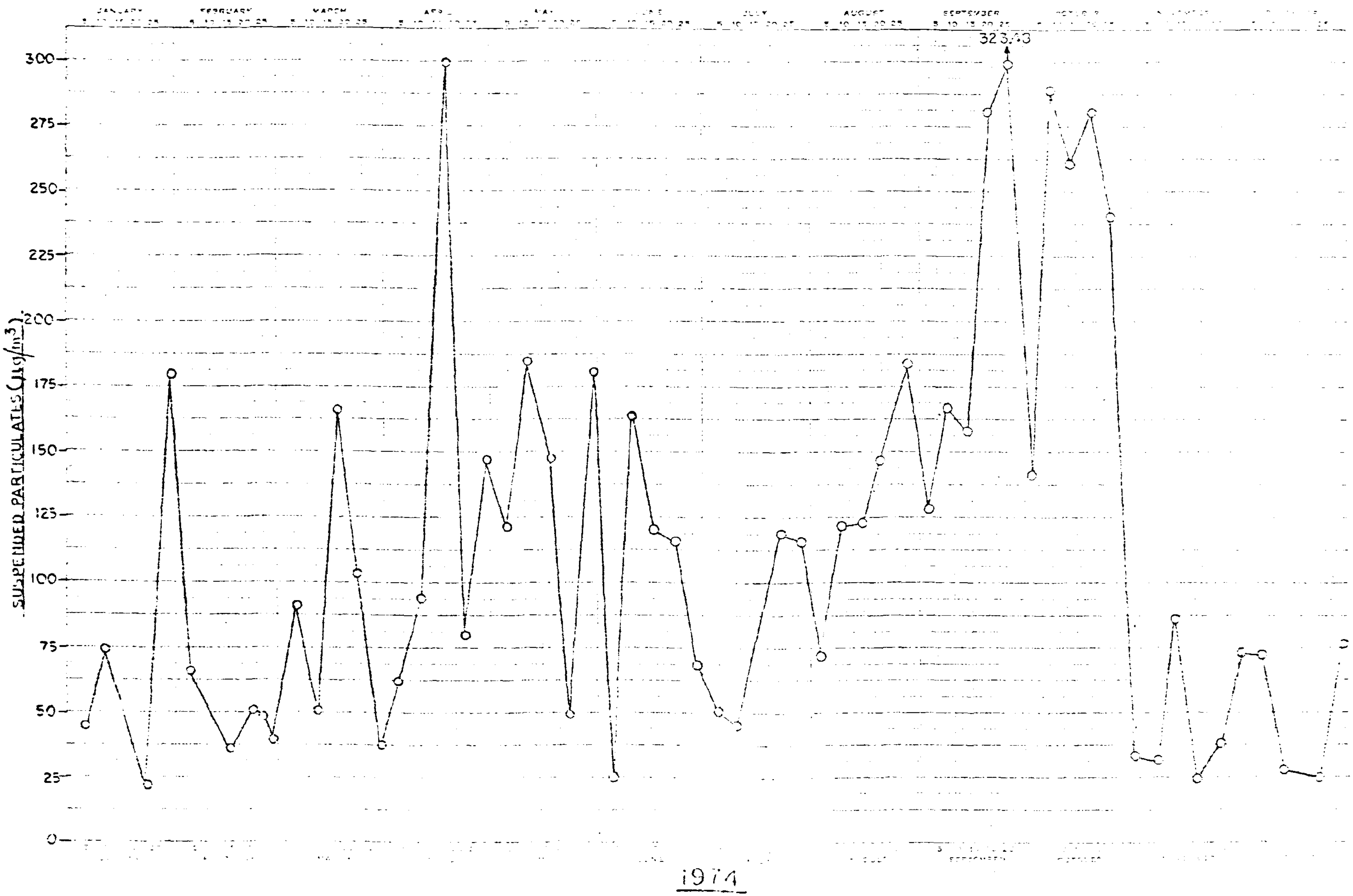


ROGERS HIGH SCHOOL - STATION #4
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
SUSPENDED PARTICULATES (μg/m³)
300
275
250
225
200
175
150
125
100
75
50
25
0
1974

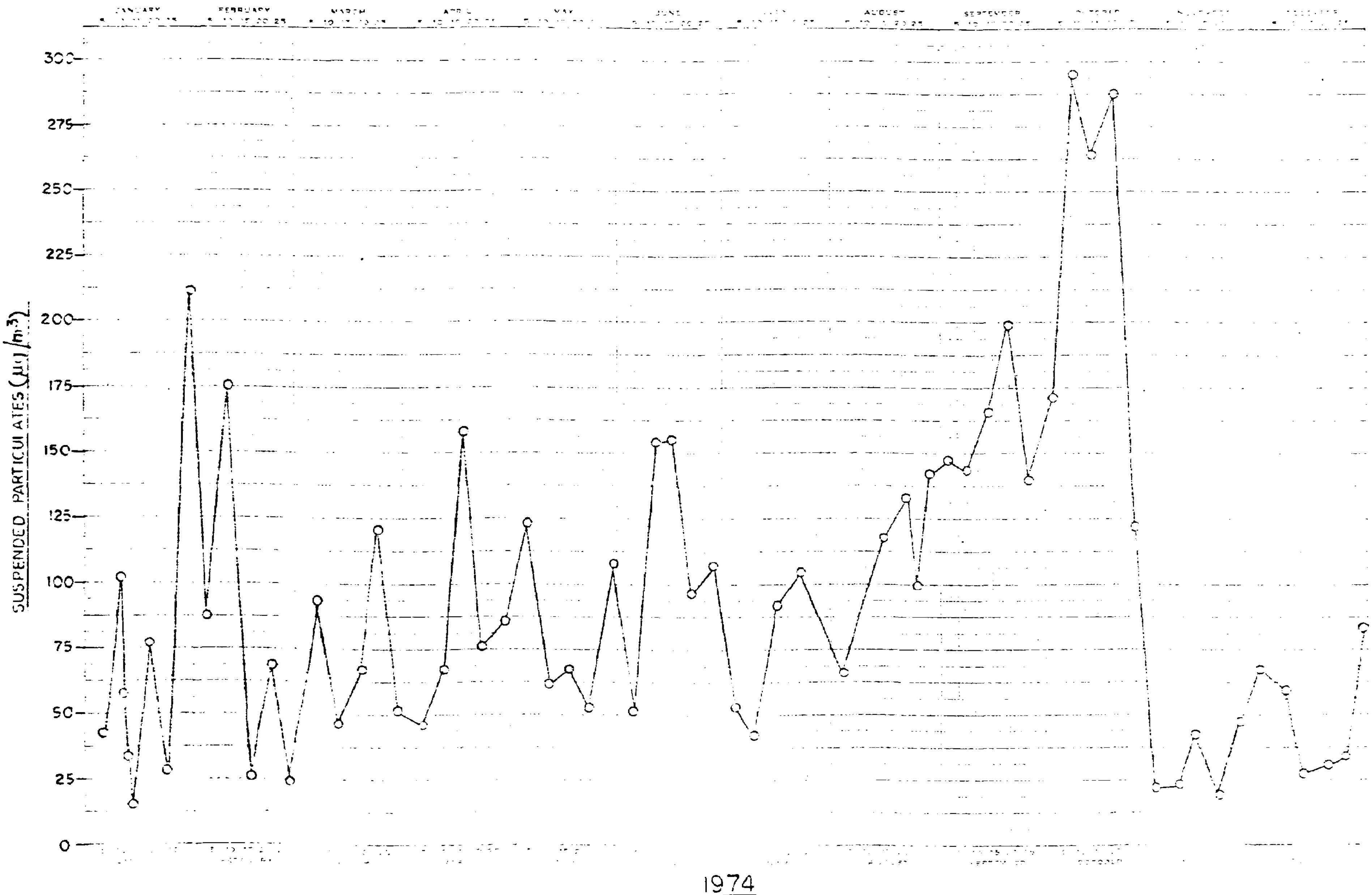


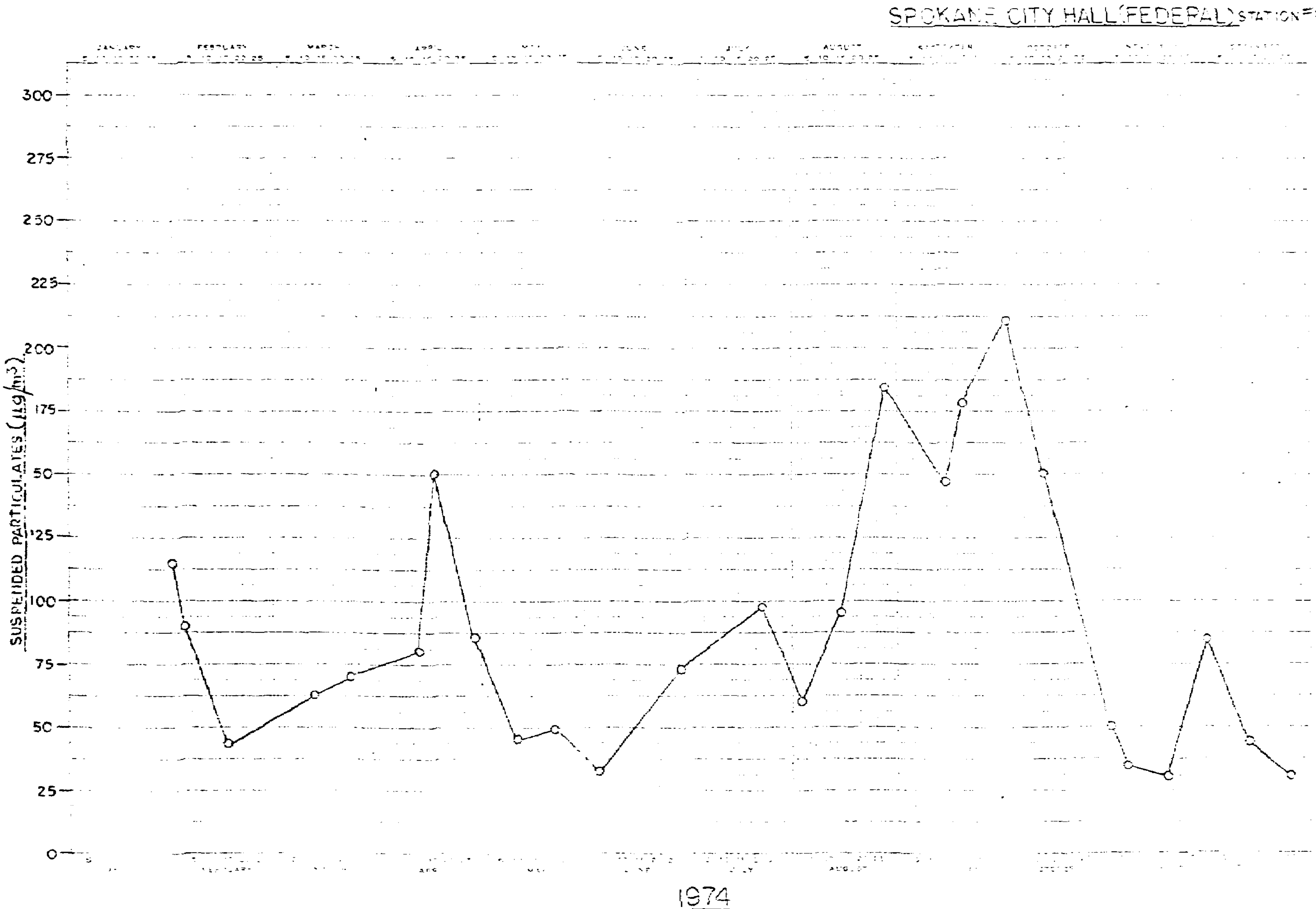
SPOKANE CITY HALL (LOCAL) - STATION #5
SUSPENDED PARTICULATES (µg/m3)
300
275
250
225
200
175
150
125
100
75
50
25
0
1974

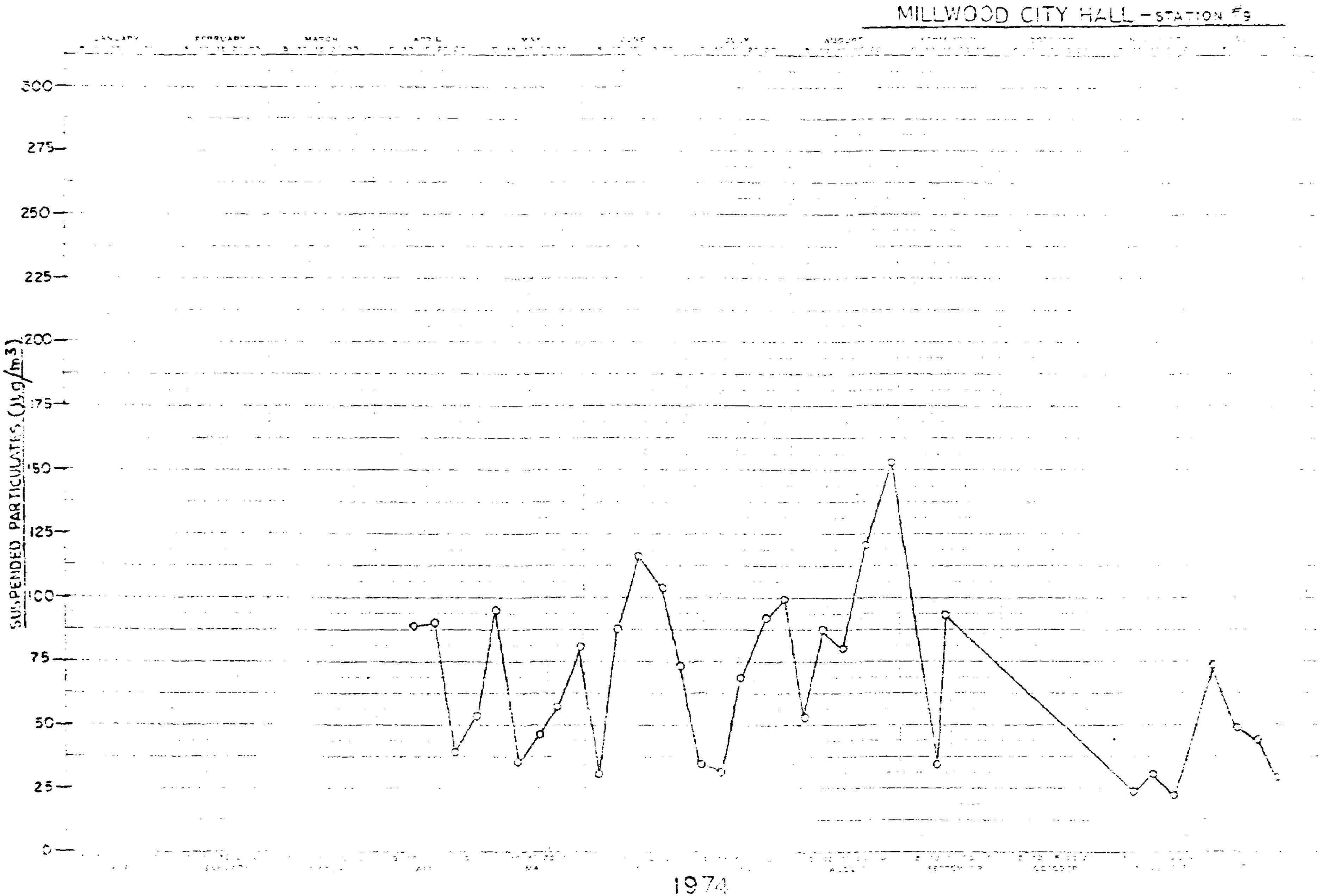
CROWN ZELLERBACH - STATION #5



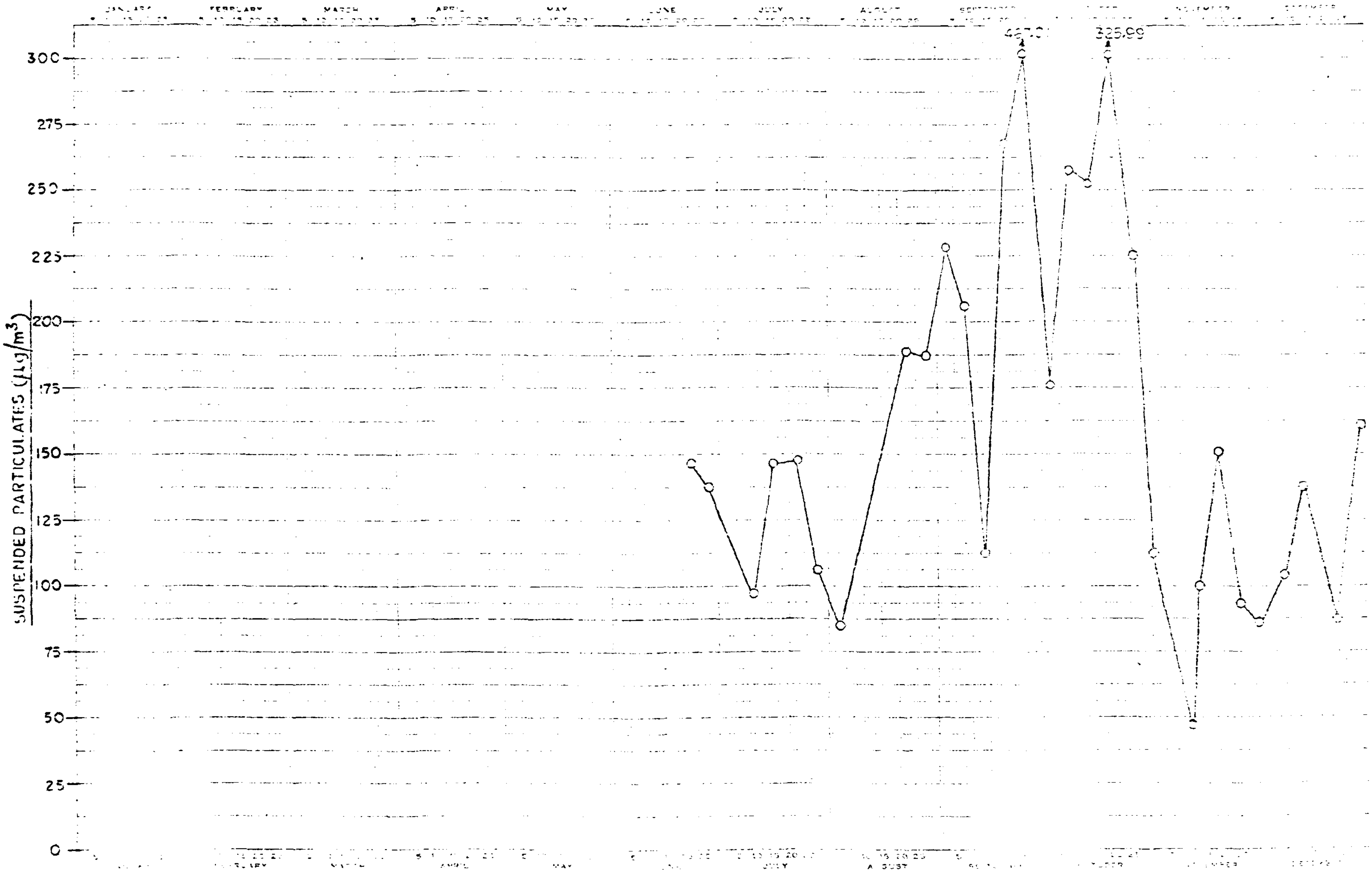
GONZAGA UNIVERSITY — STATION #7



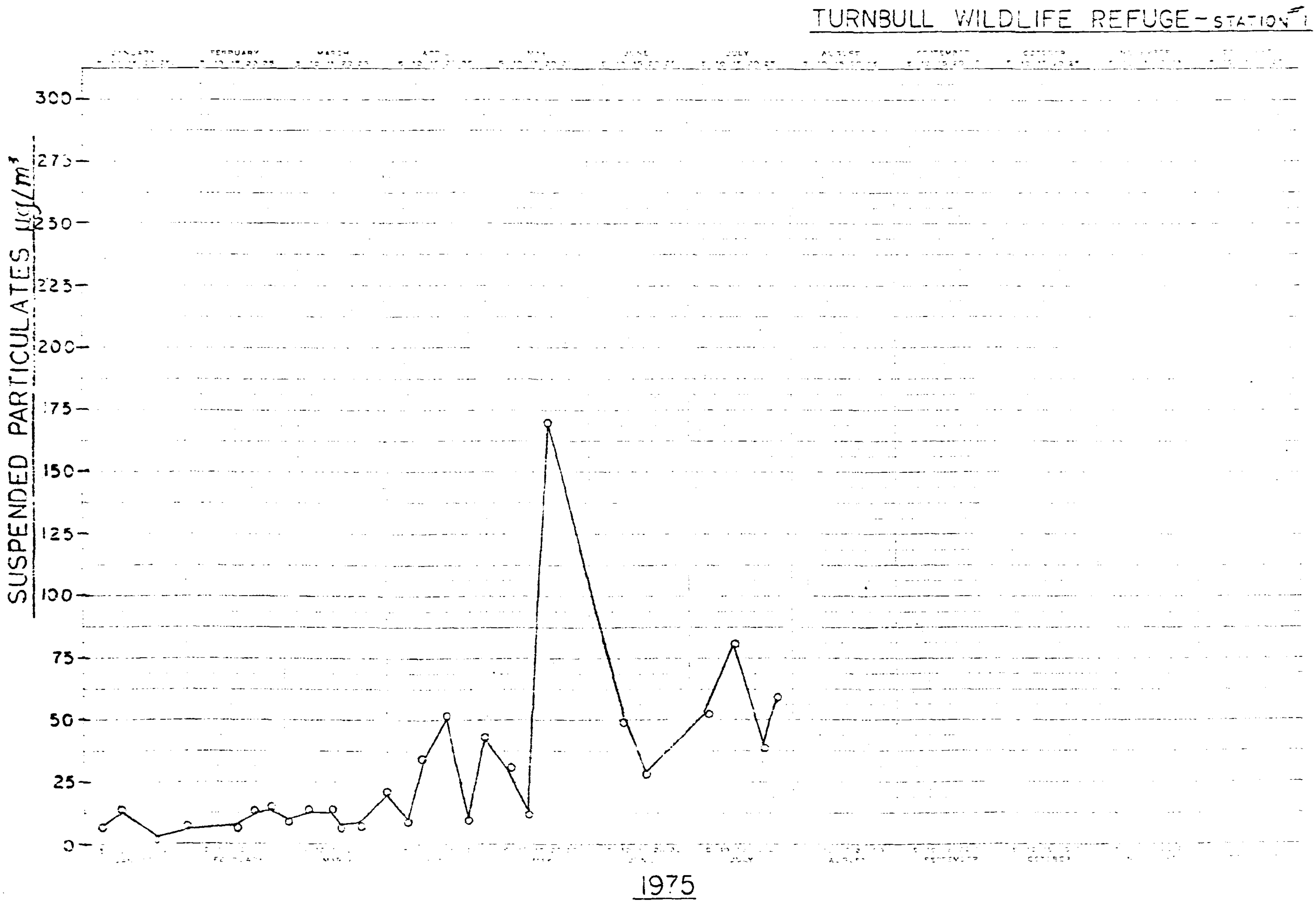

SPOKANE CITY HALL (FEDERAL) STATION #8
300
275
250
225
200
175
150
125
100
75
50
25
0
SUSPENDED PARTICULATES (µg/m³)
1974


MILLWOOD CITY HALL - STATION #9
SUSPENDED PARTICULATES (µg/m3)
300
275
250
225
200
175
150
125
100
75
50
25
0
1974

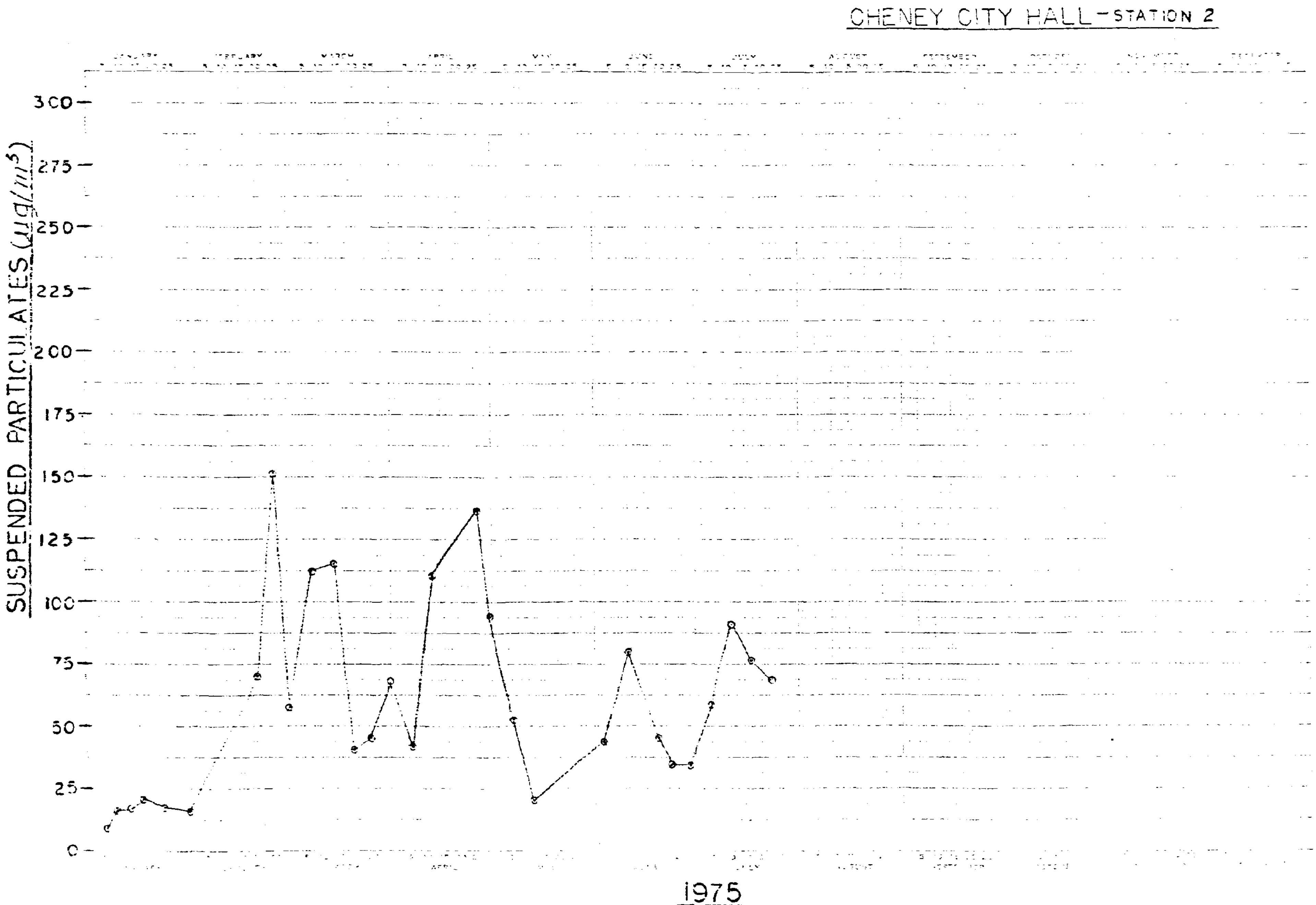
ALUMINUM SUPPLY CO. — STATION 10.



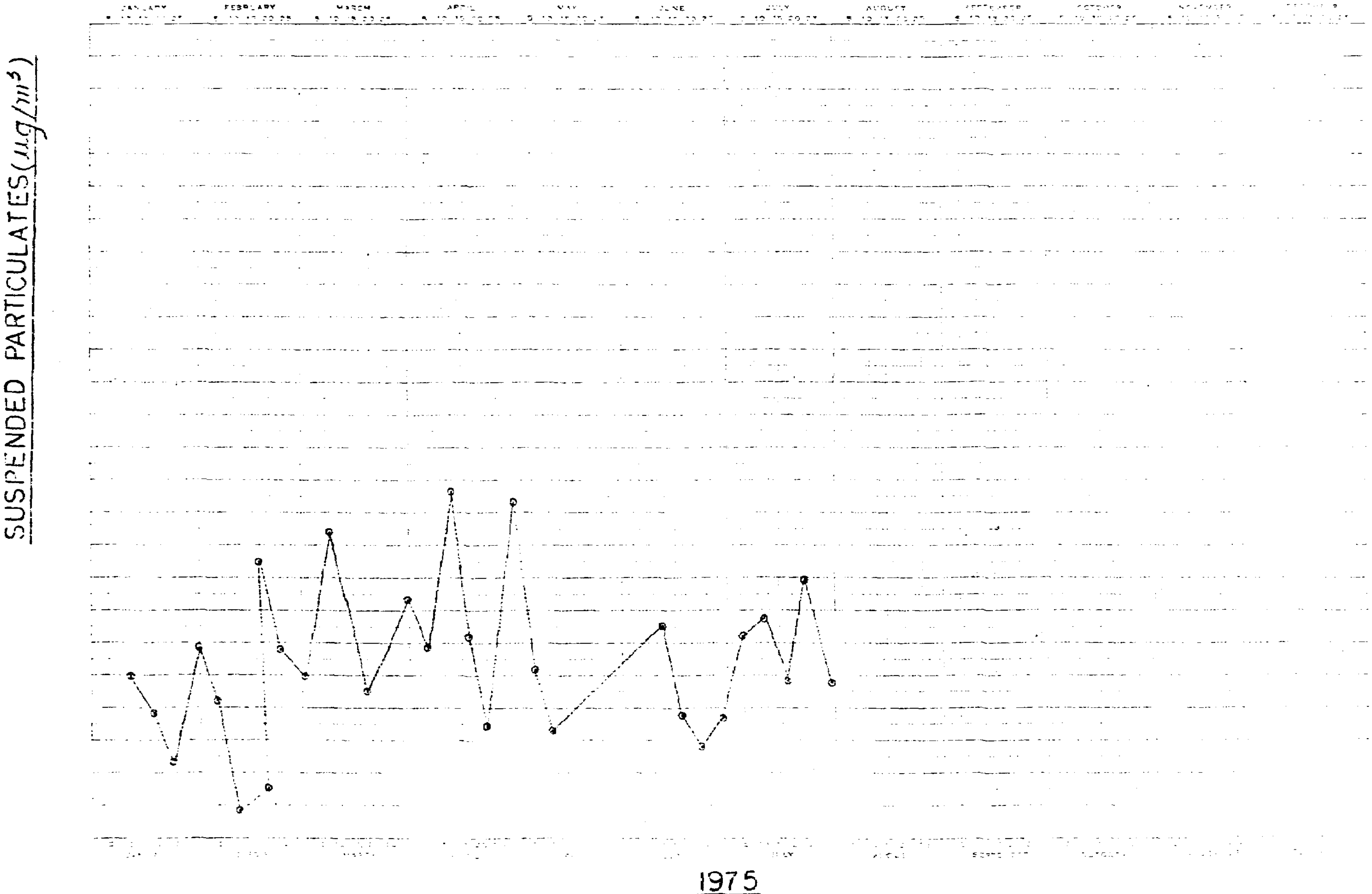
1974

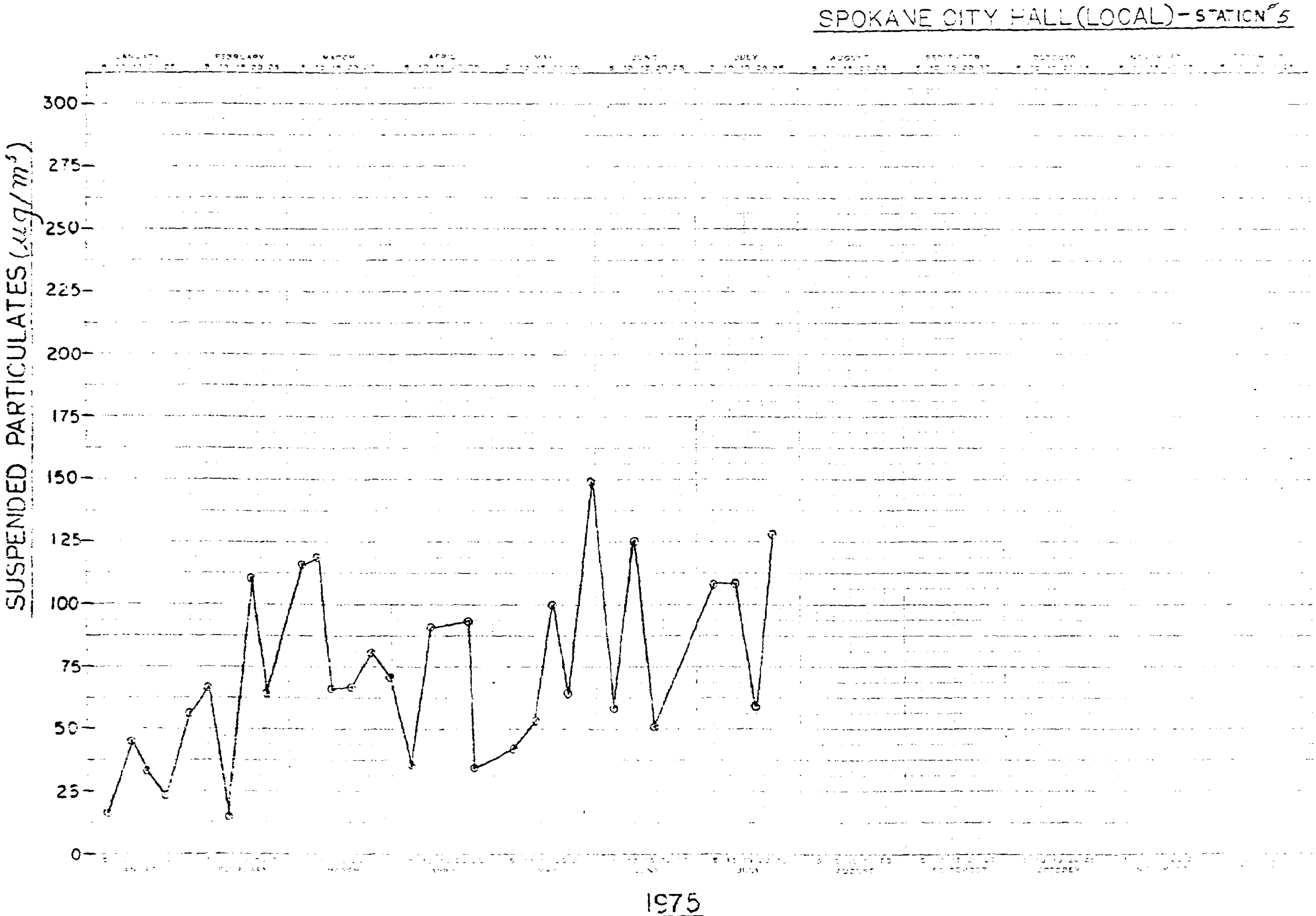


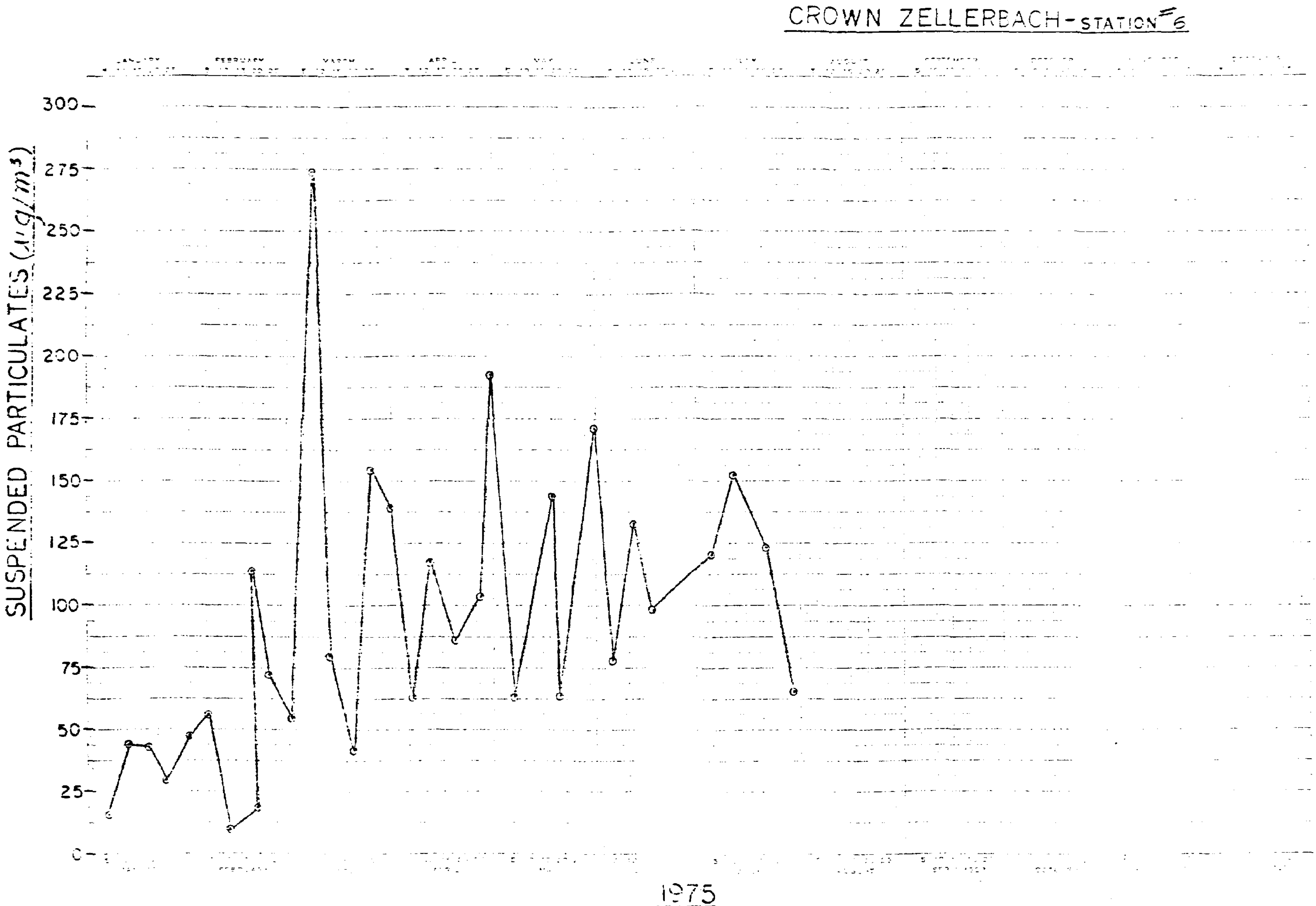
TURNBULL WILDLIFE REFUGE - STATION 1
SUSPENDED PARTICULATES µg/m³
300
275
250
225
200
175
150
125
100
75
50
25
0
1975

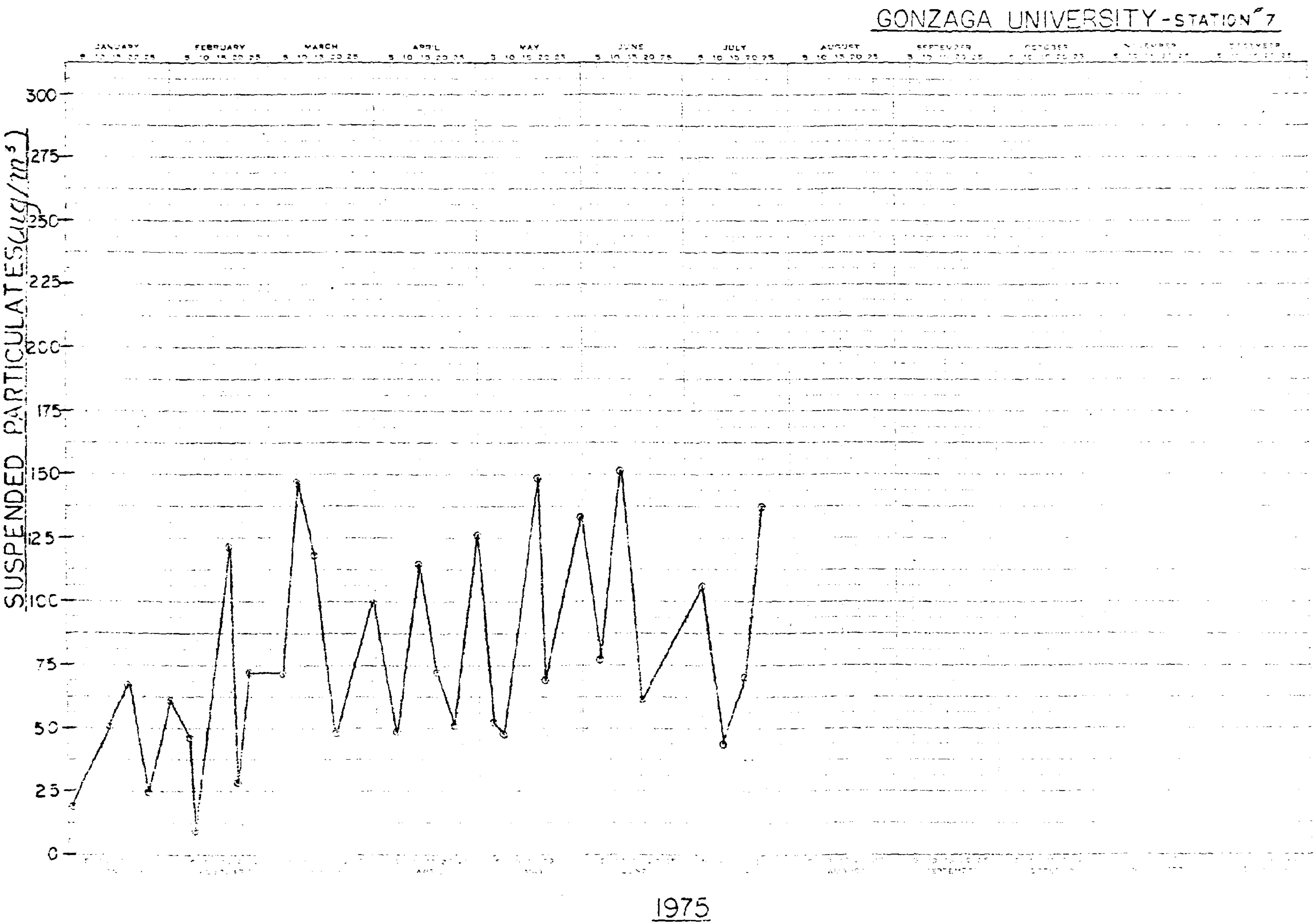

CHENEY CITY HALL - STATION 2
SUSPENDED PARTICULATES (µg/m³)
300
275
250
225
200
175
150
125
100
75
50
25
0
1975

ROGERS HIGH SCHOOL - STATION #4

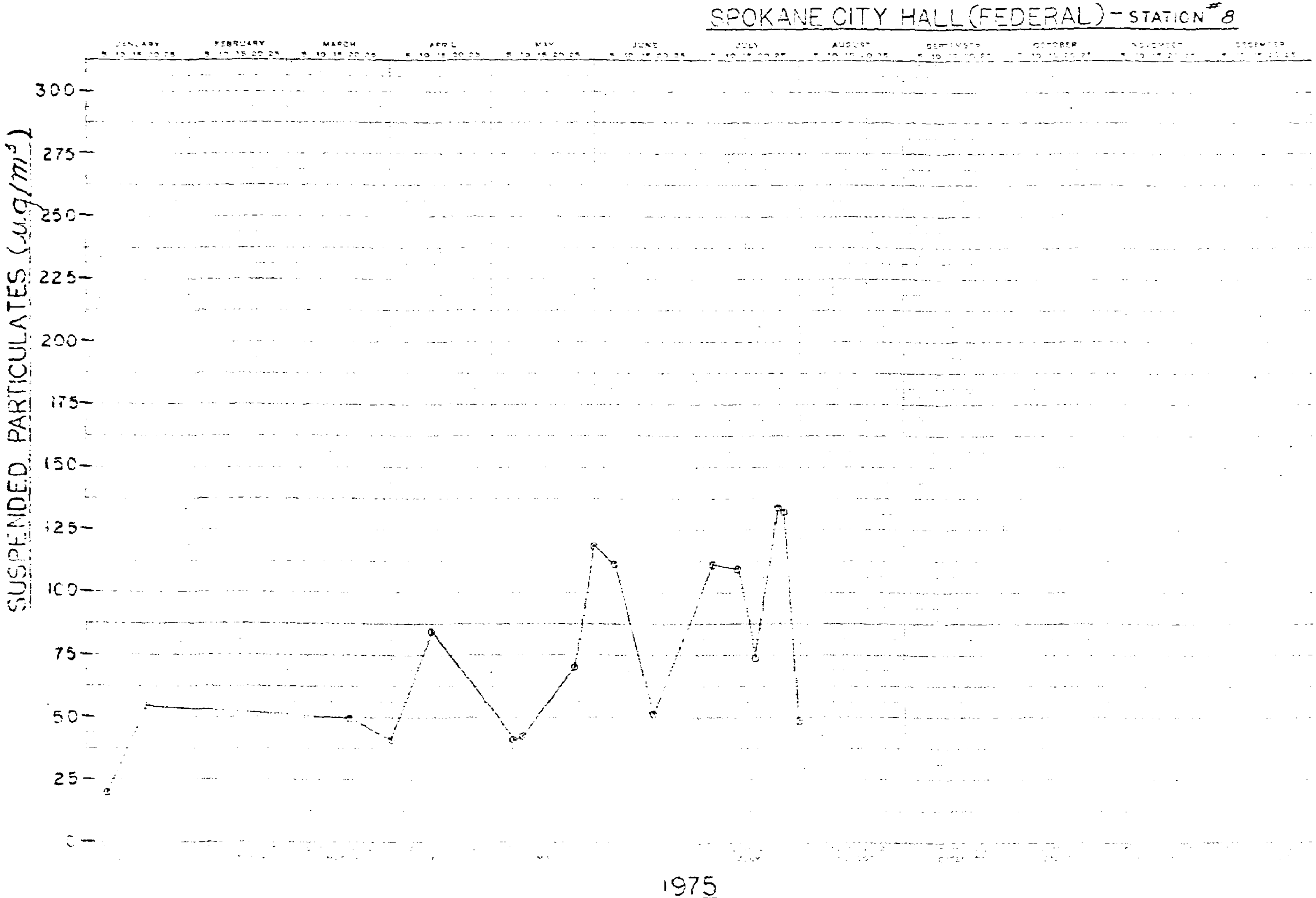


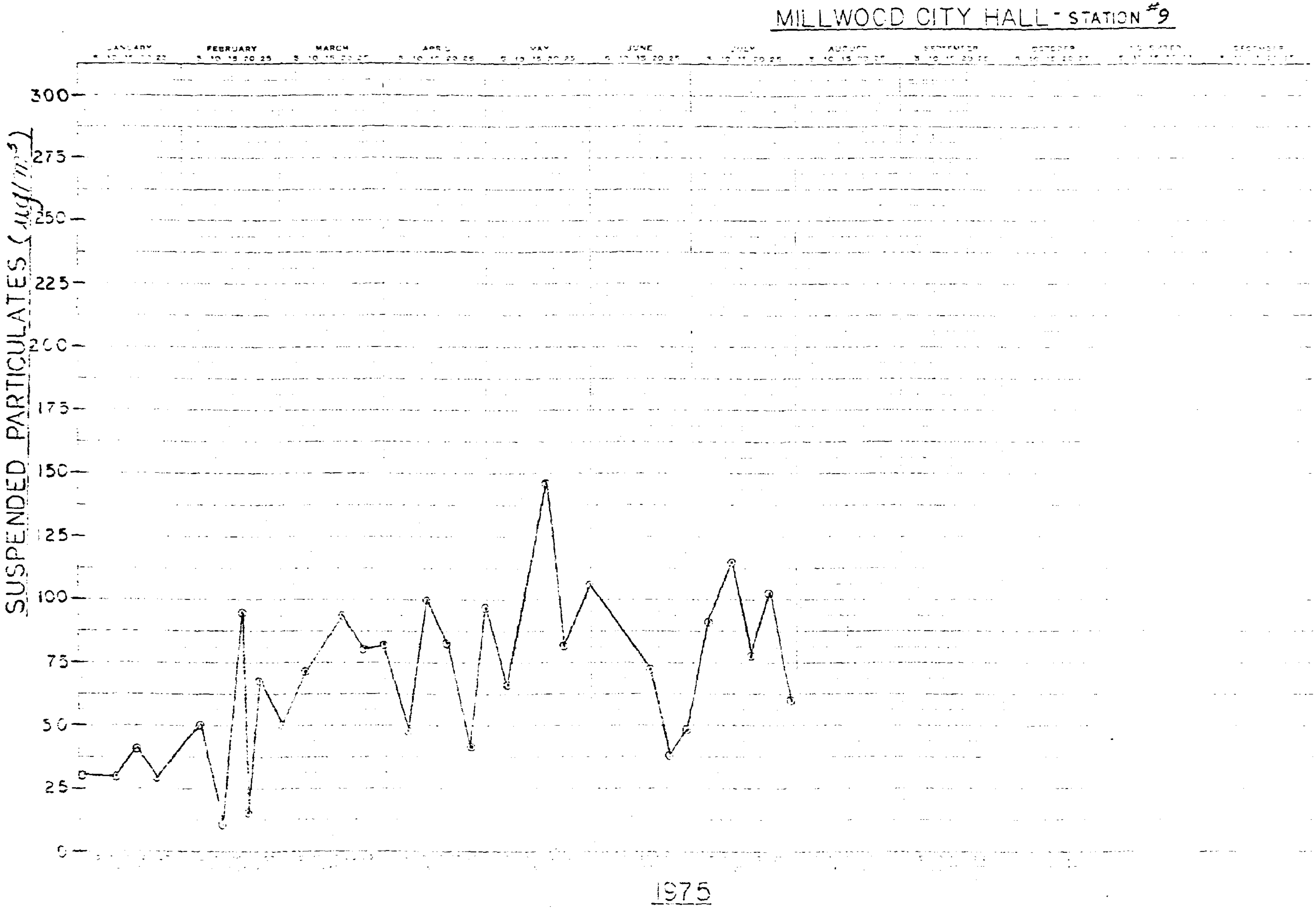

SPOKANE CITY HALL (LOCAL) - STATION 5
SUSPENDED PARTICULATES (μg/m³)
300
275
250
225
200
175
150
125
100
75
50
25
0
1975

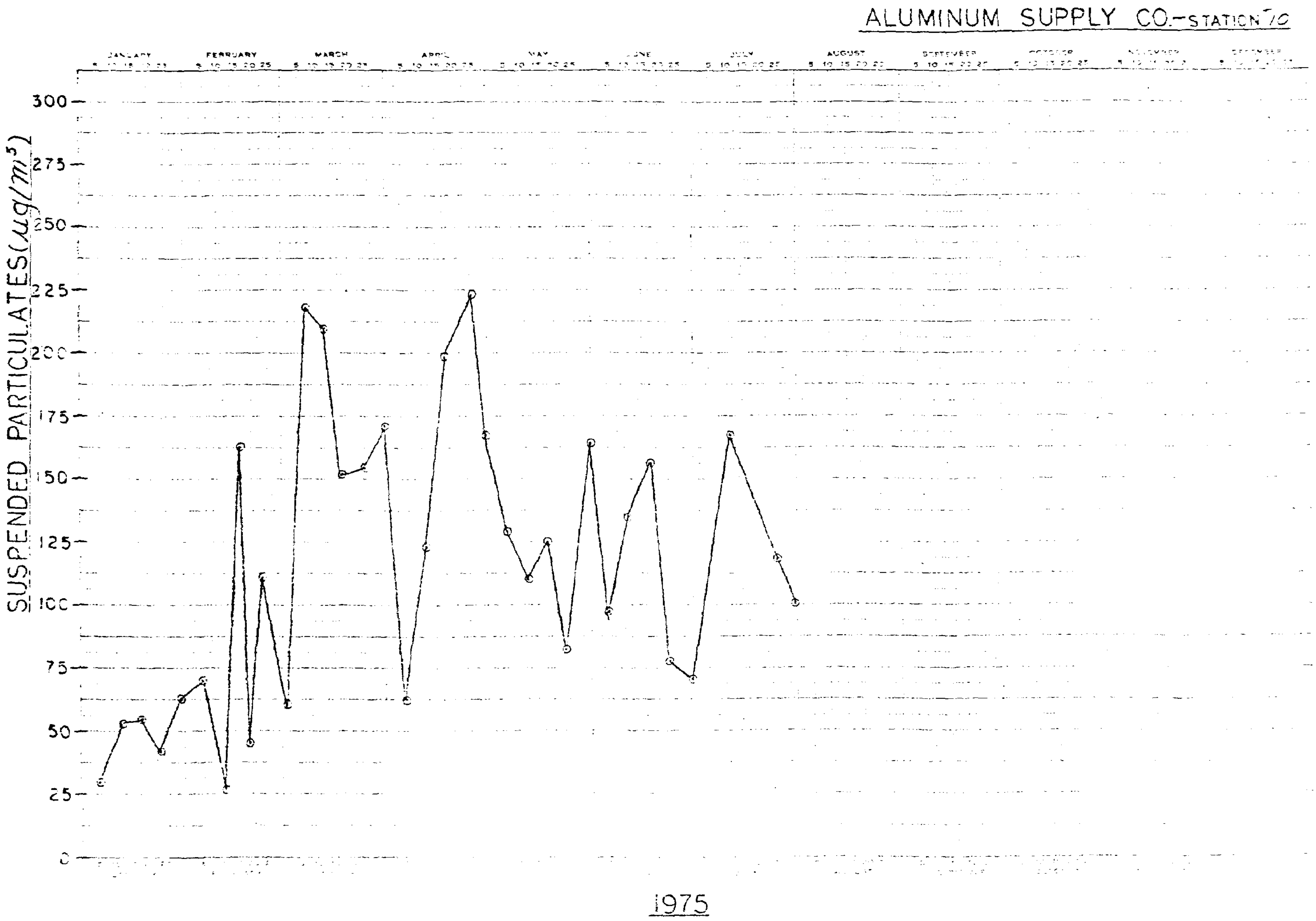

CROWN ZELLERBACH - STATION #6
SUSPENDED PARTICULATES (μg/m³)
300
275
250
225
200
175
150
125
100
75
50
25
0
1975



GONZAGA UNIVERSITY-STATION #7
SUSPENDED PARTICULATES (ug/m³)
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
300
275
250
225
200
175
150
125
100
75
50
25
0
1975


SPOKANE CITY HALL (FEDERAL) - STATION # 8
SUSPENDED PARTICULATES (µg/m³)
300
275
250
225
200
175
150
125
100
75
50
25
0
1975


MILLWOOD CITY HALL - STATION #9
FEBRUARY
MARCH
MAY
JUNE
300
275
250
225
200
175
150
125
100
75
50
25
0
SUSPENDED PARTICULATES (µg/m³)
1975


ALUMINUM SUPPLY CO.-STATION 7C
SUSPENDED PARTICULATES ($\mu g/m^3$)
300
275
250
225
200
175
150
125
100
75
50
25
0
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
1975

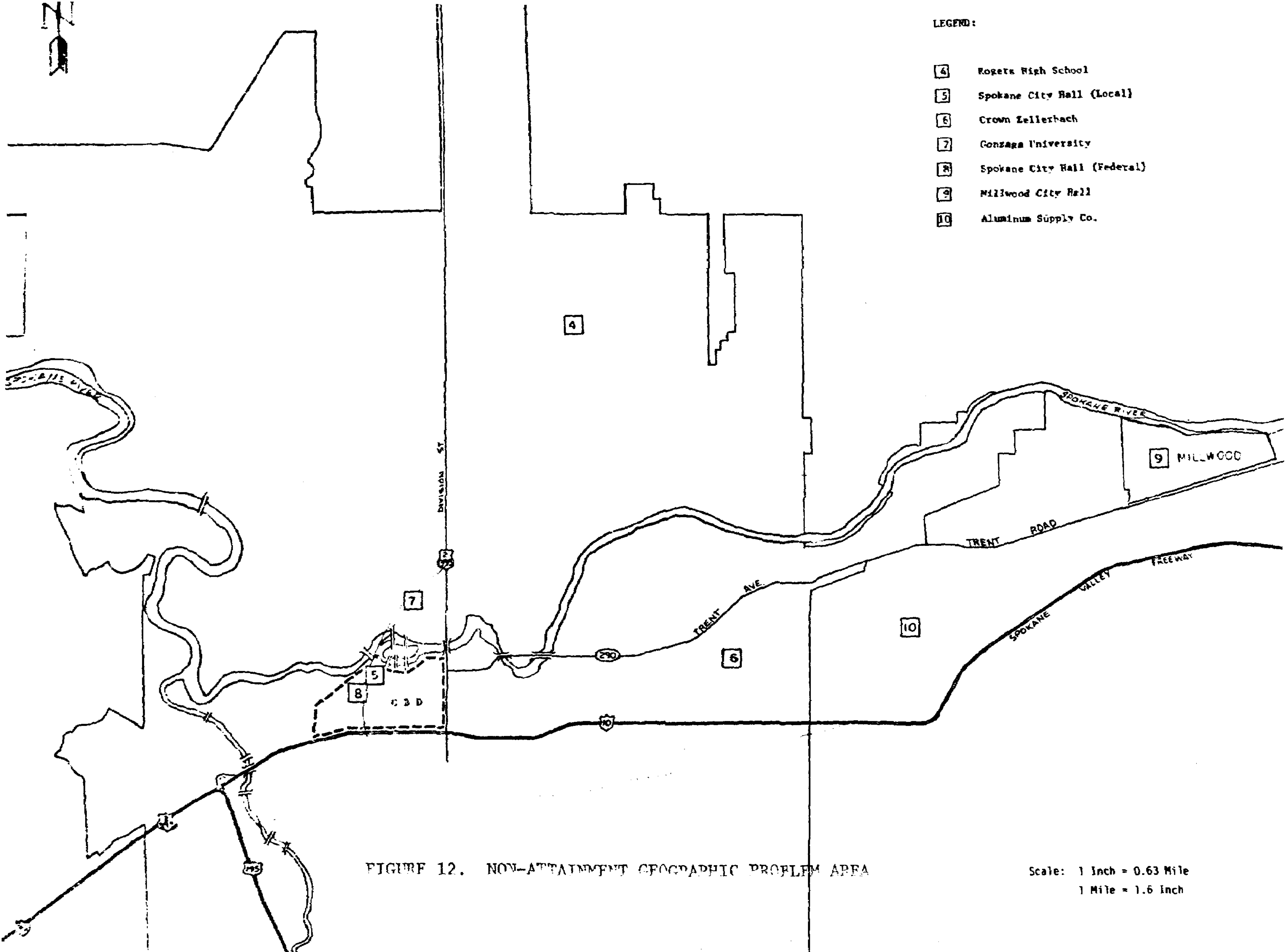


FIGURE 12. NON-ATTAINMENT GEOGRAPHIC PROBLEM AREA

Scale: 1 Inch = 0.63 Mile
1 Mile = 1.6 Inch

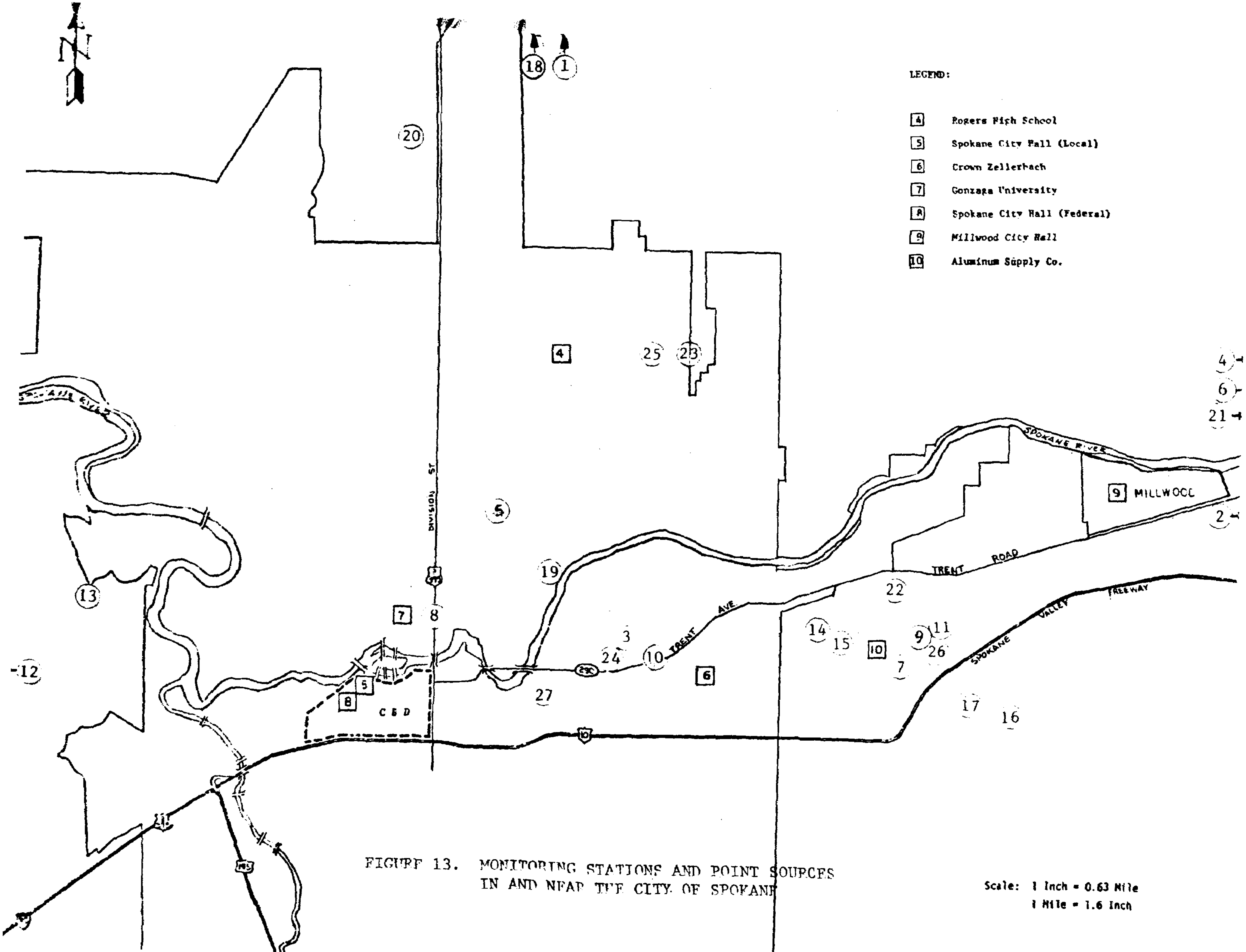


FIGURE 13. MONITORING STATIONS AND POINT SOURCES IN AND NEAR THE CITY OF SPOKANE

Legend:

Point Sources and Emissions in Tons Per Year

1. Kaiser Mead - 1482 tpy
2. Kaiser Trentwood - 125 tpy
3. Long Lake Lumber - 106 tpy
4. Imperial Wood Products - 24 tpy
5. Spokane Pres-to-log - 37 tpy
6. Sentex Veneer - 27 tpy
7. Spokane Seed - 34 tpy
8. Boyd Conlee - 30 tpy
9. Inland Empire Pea Growers - 9 tpy
10. Inland Farmers - 6 tpy
11. Western Farmers - 6 tpy
12. United Paving - 20 tpy
13. Central Premix (Gov. Way) - 28 tpy
14. Central Premix (Carnahan Rd.) - 10 tpy
15. Acme Concrete - 11 tpy
16. Ace Concrete - 70 tpy
17. Inland Asphalt - 45 tpy
18. S & F Construction - 11 tpy
19. Washington Water Power - 59 tpy
20. Inland Foundry - 13 tpy
21. Spokane Steel Foundry - 7 tpy
22. American Recycling - 15 tpy
23. Hillyard Processing - 20 tpy
24. N. Pacific Grain Terminal - 12 tpy
25. Burlington Northern (boiler) - 7 tpy
26. N. W. Sandblasting - 5 tpy
27. Centennial Mills - 5 tpy

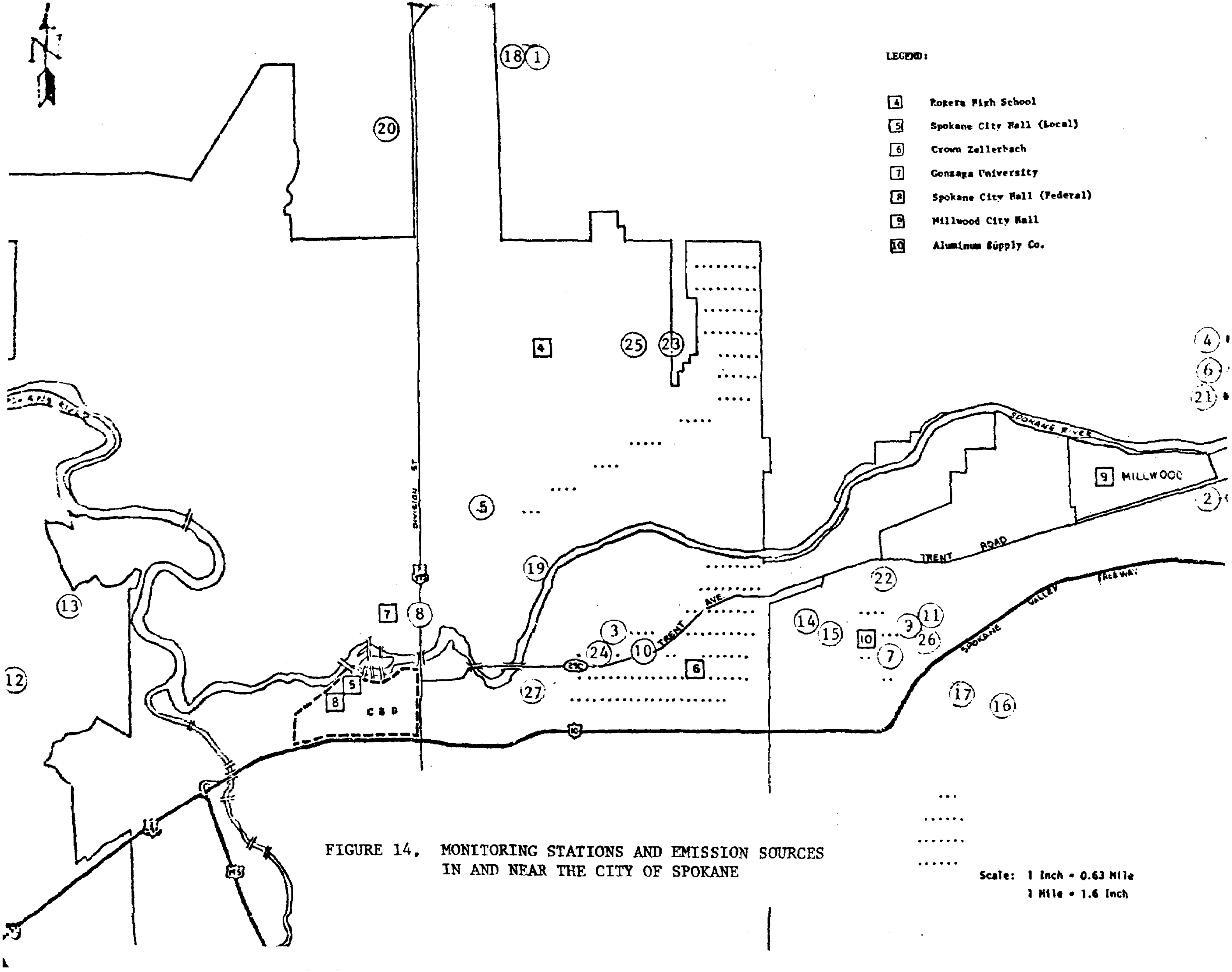


FIGURE 14. MONITORING STATIONS AND EMISSION SOURCES IN AND NEAR THE CITY OF SPOKANE

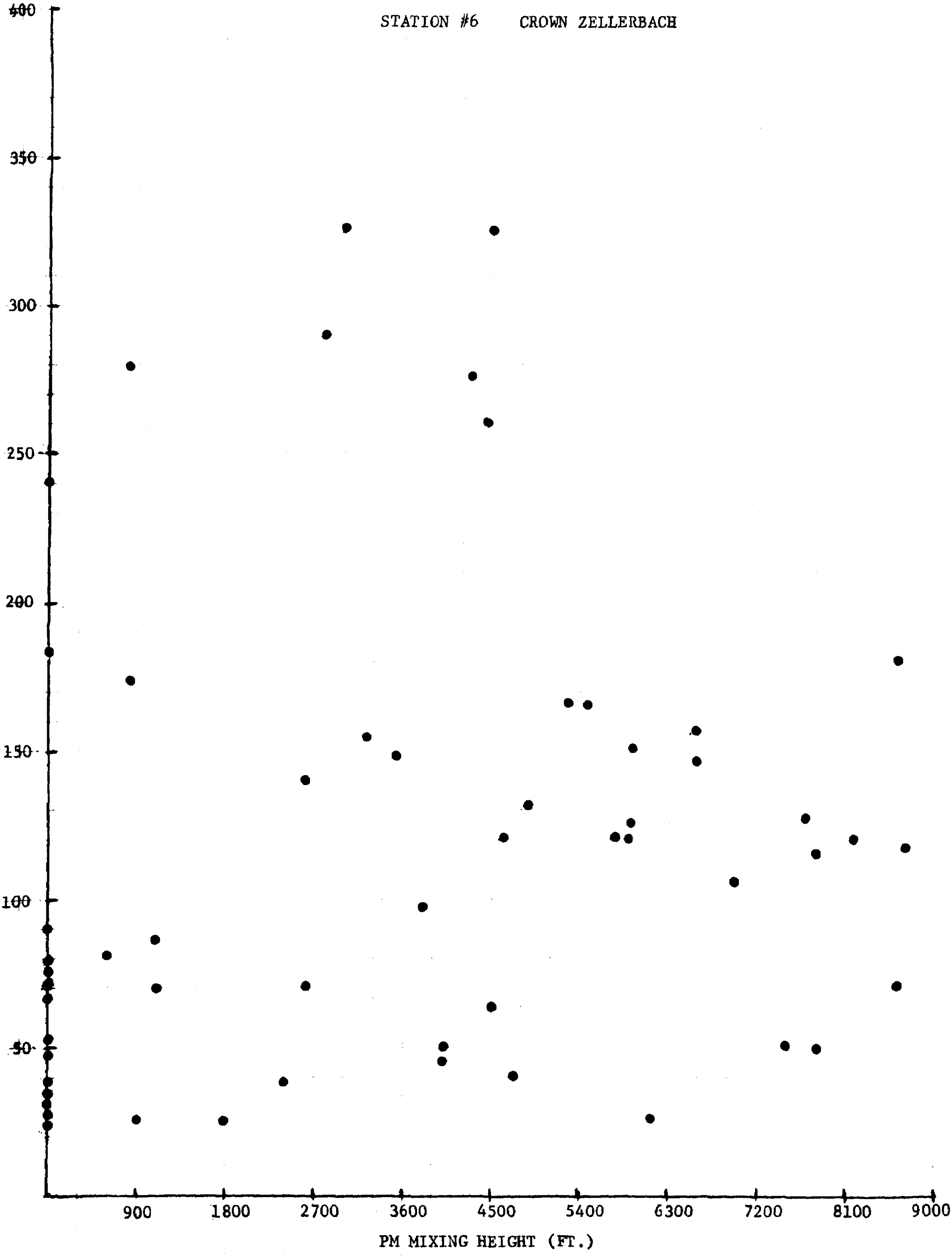
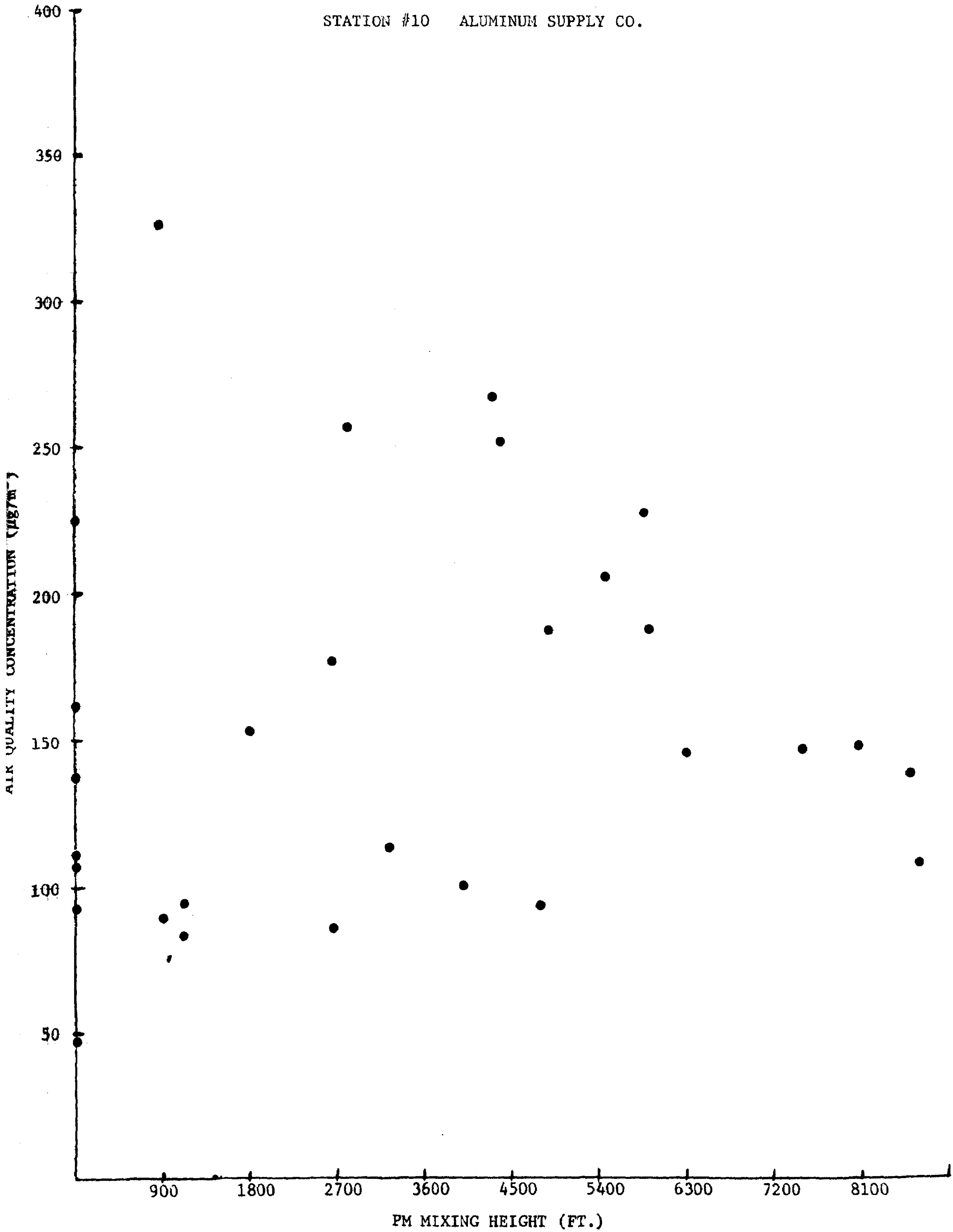


FIGURE 15 AMBIENT DATA VERSUS MIXING HEIGHT


STATION #10 ALUMINUM SUPPLY CO.
400
350
300
250
200
150
100
50
AIR QUALITY CONCENTRATION (µg/m³)
900
1800
2700
3600
4500
5400
6300
7200
8100
PM MIXING HEIGHT (FT.)

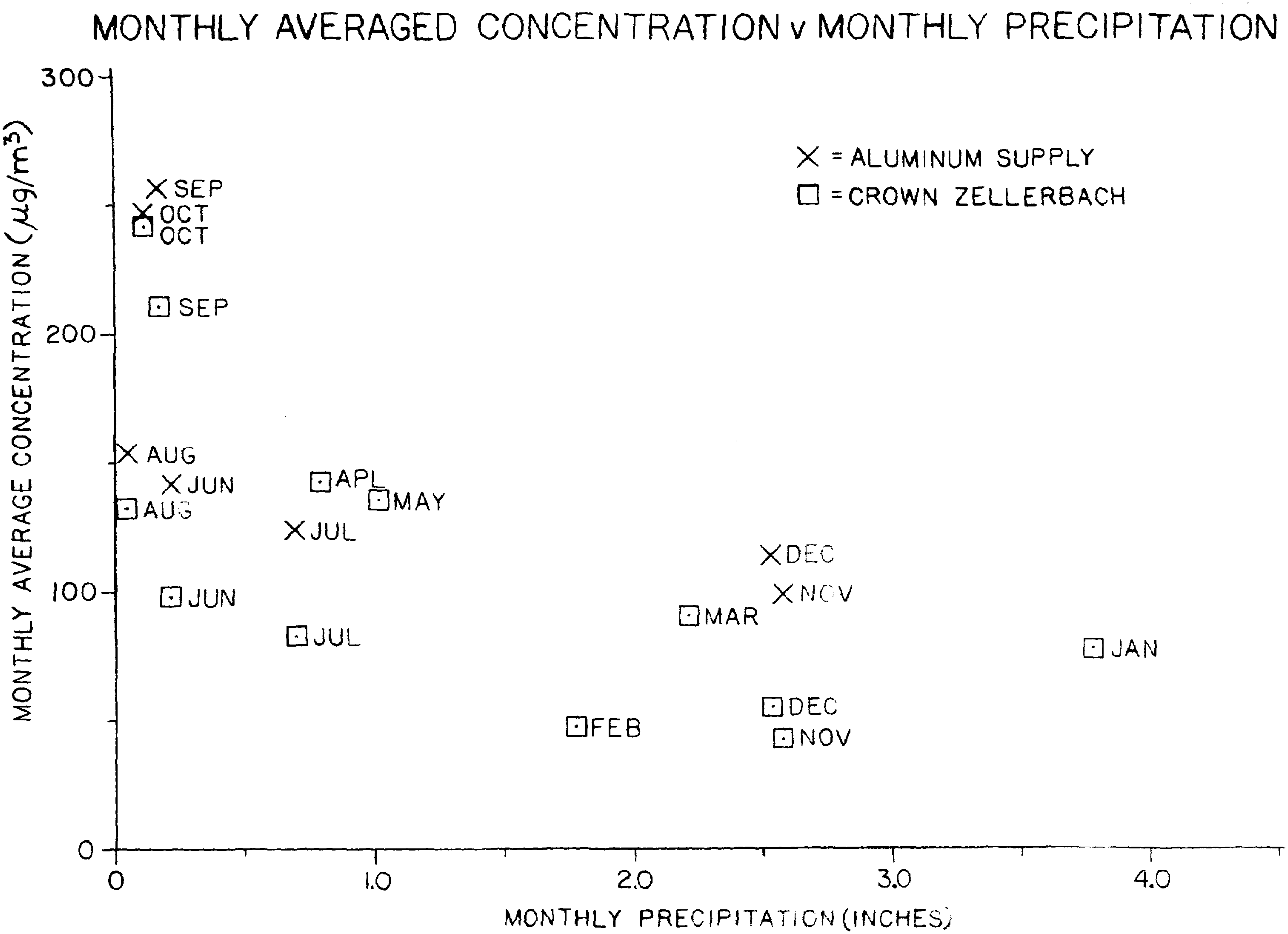


FIGURE 16. MONTHLY AIR QUALITY DATA VERSUS PRECIPITATION

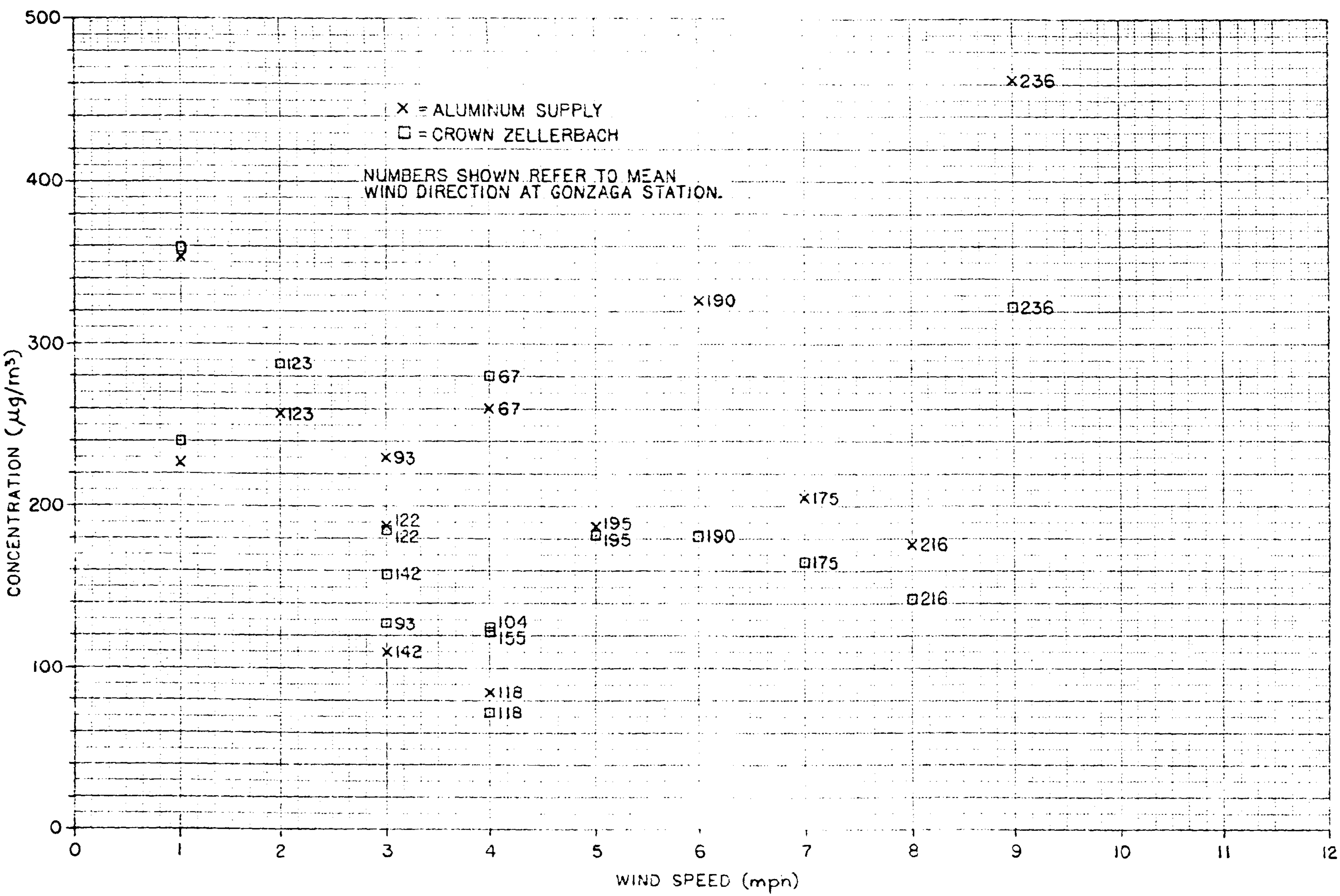


FIGURE 17. DAILY AIR DATA VERSUS WIND SPEED/DIRECTION

TABLE 1. MONITORING STATION DESCRIPTIONS

Station Name	Station ID Number SAROAD/DOE/SCAPCA	Address	Sampler Height	Operating Agency	Areal Comments
Turnbull Wildlife Refuge	492060002I01 3250004E 1	Nat'l Wildlife Refuge, Cheney	15'	Spokane APCA	Located in rural area. Background station.
Cheney City Hall	49032002F01 3214002E 2	2nd and D St., Cheney	30'	Spokane APCA	Commercial and residential oriented. Near center of town. One block from flour mill, 4 blocks from 12 grain storage towers.
Rogers High School	492040017I01 3278006E 4	Helena and Wellesly Streets	30'	Spokane APCA	Residential oriented site.
Spokane City Hall (Local)	492040011F01 3278001A 5	221 N. Wall St.	70'	Wash. DOE	Commercial oriented site. Located in downtown area.
Crown Zellerbach	492040016I01 3278009E 6	3530 E. Ferry	25'	Spokane APCA	Industrial oriented site. Long Lake Lumber, Centennial Mill, N. Pacific Grain Growers. Lehigh Cement within 1 mile, surrounding dusty roads.
Gonzaga University	492040012F01 3278060A 7	302 E. Boone St.	15'	Wash. DOE	Commercial and industrial oriented. Coast Trading. Central Premix and Inland Metals within 1 mile.
City Hall (Federal)	492040001A01 - 8	221 N. Wall St.	70'		Same as Spokane City Hall (Local).
Millwood City Hall	492060002I01 3250004E 9	9103 E. Frederick, Millwood	20'	Spokane APCA	Commercial and residential oriented. [illegible] yards from Inland Empire Paper. Unpaved roads west of site.
Aluminum Supply Co.	- - 10	800 N. Fancher Road	15'	Spokane APCA	Industrial oriented site. Spokane Seed, Inland Asphalt, Acme Concrete, Central Premix, Inland Empire Peagrowers, American Recycling Western Farmers all approx. 1/2 mile. Local truck traffic, unpaved roads.

TABLE 2. 1974/1975 ANNUAL GEOMETRIC MEANS

Primary Standard for Annual Geometric Mean - 75$\mu g/m^3$

Secondary Guide for Annual Geometric Mean - 60$\mu g/m^3$

Station Name	Station ID Number SCAPCA	1974 Number of Samples	1974 Annual Geometric Mean ($\mu g/m^3$)	FY 1975* Number of Samples	FY 1975* Annual Geometric Mean ($\mu g/m^3$)
Turnbull Wildlife Refuge	1	37	21.1	45	21.5
Cheney City Hall	2	40	59.4	55	50.9
Rogers High School	4	40	55.1	45	62.8
Spokane City Hall (Local)	5	61	75.2	58	65.5
Crown Zellerbach	6	58	90.0	57	83.3
Gonzaga University	7	63	75.5	59	73.2
Spokane City Hall (Federal)	8	26	74.9	25	68.7
Millwood City Hall	9	34	59.3	46	55.3
Aluminum Supply Co.	10	29	148.2**	58	119.3

*Although annual standards are based upon a calendar year, data for the Fiscal Year are presented to depict 12 month means from the most current data available.

**Station operated only last 7 months of year

TABLE 3. 1970-1974 ANNUAL GEOMETRIC MEANS

Primary Standard for Annual Geometric Mean - 75 μg/m^3

Secondary Guide for Annual Geometric Mean - 60 μg/m^3

Station Name	SCAPCA Station ID Number	1970		1971		1972		1973		1974		FY 1975	
		# of Samples	Annual Geo. Mean	# of Samples	Annual Geo. Mean	# of Samples	Annual Geo. Mean	# of Samples	Annual Geo. Mean	# of Samples	Annual Geo. Mean	# of Samples	Annual Geo. Mean
Turnbull Wildlife Refuge	1			35	21.5	86	21.0	39	22.0	37	21.1	45	21.[illegible]
Cheney City Hall	2									40	59.4	55	50.9
Rogers High School	4					65	76.2	54	67.0	40	55.[illegible]	45	62.[illegible]
Spokane City Hall (Local)	5	91	90.6	56	66.4	91	82.1	58	73.2	61	75.2	58	65.[illegible]
Crown Zellerbach	6					60	120.5	52	87.1	58	90.0	57	83.3
Gonzaga University	7			57	98.7	100	110.7	68	82.4	63	75.5	59	73.2
Spokane City Hall (Federal)	8			25	81.5	29	99.8	22	118.5	26	71.9	25	55.7
Millwood City Hall	9									34	59.0	46	55.3
Aluminum Supply Co.	10									29	149.2*	58	125.5

*Geometric mean based upon data available only for the last 7 months of the year.

TABLE 4 1974 SECOND HIGHEST 24-HOUR VALUES

Primary Standard for Second Highest 24-hour Value - 260 $\mu g/m^3$

Secondary Standard for Second Highest 24-hour Value - 150 $\mu g/m^3$

Station Name	SCAPCA Station ID Number	Number of Samples	Second Highest 24-hr. Ave. ($\mu g/m^3$)	Number of Samples Above Primary Standard	Number of Samples Above Secondary Standard
Turnbull Wildlife Refuge	1	37	147	-	1
Cheney City Hall	2	40	249	-	3
Rogers High School	4	40	161	-	2
Spokane City Hall (Local)	5	61	225	-	6
Crown Zellerbach	6	58	323	5	15
Gonzaga University	7	63	288	2	11
Spokane City Hall (Federal)	8	26	186	-	5
Millwood City Hall	9	34	122	-	1
Aluminum Supply Co.	10	29	326	2	16

TABLE 5. SOURCE CATEGORY PARTICULATE EMISSION INVENTORY

Source Category	Most Recent Emissions 1975	Most Recent Emissions 1973	Percent of Total Emissions
Process Losses			
Aluminum Manufacturing	1627		11.3
Wood Products Manufacturing	194		1.4
Grain Handling	117		.8
Asphalt/Concrete	195		1.4
Foundries	20		.1
Other	20		.1
	2155		15.1
Fuel Combustion			
Residential	280		1.9
Other	71		.5
	351		2.4
Transportation	1578		11.1
Solid Waste Disposal			
Slash Burning		663	4.6
Open Burning		449	3.5
On-site Incineration		1188	8.2
		2350	16.3
Miscellaneous			
Unpaved Roads		7500	52.0
Structural Fires		156	1.1
Construction Land Area		120	.8
Other		191	1.3
		7967	55.2
Total 14,370			100.0

TABLE 6. POINT AND AREA SOURCE PARTICULATE EMISSION INVENTORY FOR SIGNIFICANT SOURCES

Source Category	Most Recent Emissions (TPY)			1973 Emissions (TPY)
	1975	1973	Percent of Total Emissions	
Point Sources				
Kaiser Meade	1482		10.3	2877
Kaiser Trentwood	125		.9	564
Hillyard Processing	20		.1	
Long Lake Lumber	106		.7	396
Imperial Wood Products	24		.2	
Spokane Pres-to-log	37		.3	
Suntex Veneer	27		.2	119
PaLouse Seed Co. (Fairfield)	7		.1	
Spokane Seed	34		.2	112
Rockford Grain Growers (Mead)	5		0.0	
Boyd-Conlee	30		.2	
Inland Empire Pea Growers	9		.1	
Centennial Mills	5		0.0	
Inland Farmers	6		0.0	
Western Farmers	6		0.0	
National Biscuit Co. (Cheney)	15		.1	
United Paving	20		.1	30
Central Premix (Gov Way)	28		.2	
Central Premix (Carnahan Road)	10		.1	
Acme Concrete	11		.1	
Ace Concrete	70		.5	
Inland Asphalt	45		.3	11

TABLE 6. POINT AND AREA SOURCE PARTICULATE EMISSION INVENTORY FOR SIGNIFICANT SOURCES (cont)

Source Category	Most Recent Emissions (TPY)			1973 Emissions (TPY)
	1975	1973	Percent of Total	
S & F Construction	11		.1	
Burlington Northern Boiler (Hillyard)	7		.1	
Washington Water Power	59		.4	15
Fairchild AFB Boilers	5		0.0	
Inland Foundry	13		.1	13
Spokane Steel Foundry	7		.1	
American Recycling	15		.1	
N.W. Sandblasting	5		0.0	
Subtotal 2244			15.6	
<u>Area Sources</u>				
Unpaved Roads		7500	52.0	
On-site Incineration		1188	8.2	
Slash Burning		663	4.6	
Transportation	1578		10.9	914
Open Burning		449	3.5	
Residential	280		1.9	380
Structural Fires		156	1.1	
Construction Land Area		120	.8	
Other		191	1.3	
Subtotal 12,175			84.3	
TOTAL - 14,419			100	

TABLE 7. SPOKANE AIRPORT/GONZAGA UNIVERSITY METEOROLOGICAL DATA

	1974 - Spokane International Airport			1974 - Gonzaga University		Norms Thru 1974- Spokane Int'l Airport	
Month	Resultant Wind Direction (Degrees)	Resultant Wind Speed (MPH)	Average Wind Speed (MPH)	Average Wind Direction (Degrees)	Average Wind Speed (MPH)	Prevailing Wind Direction	Average Wind Speed (MPH)
January	200	8.9	14.0	178	8	NE	9.0
February	190	8.2	12.1	183	6	SSW	9.0
March	210	7.2	12.2	172	6	SSW	9.5
Average	200	8.0	12.8	178	7		9.2
April	200	6.0	10.9	169	7	SW	9.8
May	210	7.2	10.2	189	7	SSW	8.8
June	210	6.0	9.4	179	6	SSW	8.7
Average	207	6.4	10.2	179	7		9.1
July	210	4.8	8.7	176	6	SW	8.2
August	190	2.5	8.7	158	5	SW	8.0
September	210	0.8	8.4	147	4	NE	8.1
Average	203	2.7	8.6	160	5		8.1
October	180	1.2	6.8	112	2	SSW	8.1
November	180	3.5	8.8	125	4	NE	8.2
December	190	5.3	9.7	121	3	NE	8.7
Average	183	3.3	8.4	113	3		8.3
Year	200	5.1	10.0	159	5.3	SSW	8.7

TABLE 8. FREQUENCY OF ADVERSE VERTICAL MIXING CONDITIONS AT SPOKANE AIRPORT

Month	Adverse Mixing Frequency (Percent)	
	4 A.M.	4 P.M.
January 1974	100%	92%
February	100%	52%
March	100%	48%
April	100%	36%
May	100%	29%
June	100%	10%
July	100%	6%
August	100%	-0-
September	100%	6%
October	100%	35%
November	100%	93%
December	100%	100%

TABLE 9: SUMMARY OF STABILITY DATA; SPOKANE INTERNATIONAL AIRPORT, 1974

	Dec., Jan., Feb.		March, April, May		June, July, Aug.		Sept. Oct. Nov.		Annual	
Stability	Freq.	Wind kts	Freq.	Wind kts	Freq.	Wind kts	Freq.	Wind kts	Freq.	Wind kts.
A.	0.0	-	0.0	-	1.0	4-6	0.0	-	0.2	4-6
B.	0.4	1-3	2.2	4-6	11.8	4-6	3.8	7-10	4.6	4-6
C.	3.6	7-10	9.0	7-10	19.6	7-10	11.8	7-10	11.0	7-10
D.	23.8	11-16	36.5	11-16	17.7	11-16	21.2	11-16	24.8	11-16
E.	52.6	7-10	31.8	7-10	15.8	7-10	24.3	7-10	31.0	7-10
F.	19.6	7-10	20.5	4-6	34.2	4-6	38.9	0-3	28.3	4-6
TOTAL	100	7-10	100	7-10	100	7-10	100	4-6	100	7-10

TABLE 10. 1974 WEEKDAY/WEEKEND AIR QUALITY DATA AT ALUMINUM SUPPLY COMPANY/CROWN ZELLERBACH

Station Name	Geometric Mean ($\mu g/m^3$)		
	All Samples	Weekday Samples	Weekend Samples
Crown Zellerbach	90.0	87.9	96.8
Aluminum Supply Company	148.2	152.4	139.3

TABLE 11 AIR QUALITY/METEOROLOGICAL DATA FOR 8 SELECTED DAYS

1974 Date	Day of Week	Suspended Particulates ($\mu g/m^3$)* #5	#6	#7	#8	#10	Average Temp. Gonzaga/ Airport (Degrees)	Wind Direction Average Gonzaga (Degrees)	Wind Direction Resultant Airport (Degrees)	Average Wind Speed Gonzaga/ Airport (MPH)	Mixing Height Morning/ Afternoon (Ft)	Comments
4/17	Wed.		324	159	151		50/ 46	97	60	4/ 7.2	0/ 4500	No Precipitation
3/27	Tues.		184		186	188	75/ 73	122	350	3/ 5.9	0/ 4900	No Precipitation
9/8	Sun.	180	168			206	66/ 62	175	220	7/ 9.9	0/ 5500	No Precipitation
9/20	Fri.		279	199	177	266	65/ 64	67	30	4/ 7.8	0/ 4300	No Precipitation
9/26	Thurs.	224	323			467	61/ 55	236	280	9/ 19.0	0/ 3000	Trace**
10/8	Tues.	182	289	293		257	-/ 53	123	40	2.3/ 6.0	0/ 2800	No Precipitation
10/14	Mon.		261	263	150	253	-/ 44	47	200	1.1/ 3.9	0/ 4400	No Precipitation
10/20	Sun.	225	281	288		326	-/ 47	151	210	5.7/ 12.9	0/ 800	No Precipitation

* #5 Spokane City Hall (Local)
#6 Crown Zellerbach
#7 Gonzaga University
#8 Spokane City Hall (Federal)
#10 Aluminum Supply Company

** Blowing dust observed at airport from 1215-1310 hours PST. Visibility limited to 5 miles.

TABLE 12 INITIAL SIP REDUCTION REQUIREMENTS

Year of Record	Site No.	Location	Highest 24-Hr Value	Next Highest 24-Hr Value	Annual Geo. Mean	Background Value	Reduction Needed to Meet	
							Primary Standard	Secondary Guide
1970	5	Spokane City Hall (Local)	479	282	89 $\mu g/m^3$	30 $\mu g/m^3$	23%	49%

TABLE 13 REVISED SIP REDUCTION REQUIREMENTS

Year of Record	Site No.	Location	Highest 24-Hr Value	Next Highest 24-Hr Value	Annual Geo. Mean	Background Value	Reduction Needed to Meet	
							Primary Standard	Secondary Guide
1972	6	Crown Zellerbach	-	-	120.5 $\mu g/m^3$	30 $\mu g/m^3$	51%	67%

TABLE 14. COMPARISON OF 1970 AND 1973 EMISSIONS INVENTORY

Source Category	Emissions T/Yr	
	1970	1973
Process Losses		
Aluminum plants		2877
Wood manufacturing		515
Grain handling		367
Asphalt batch plants		27
Other		657
	4592	4443
Fuel Combustion		
Wood fired boilers	877	
Area coal	1051	
Residential		380
Other	323	15
	2251	395
Transportation	784	914
Solid Waste Disposal		
Wigwam burners		
Slash burning	90	663
Open burning	9	499
On site incineration	53	1188
	152	2350
Miscellaneous		
Dirt roads		7500
Structural fires		156
Construction land area		120
Other	800	191
	800	7967
Total	8579	16,069

TABLE 15. REVISED EMISSION REDUCTIONS BASED ON REVISED INVENTORY ONLY

SIP Identified Percentage Reduction Needed to Meet		Previous Emission Total	Previous Emission Reduction Needed to Meet		Modified Emission Total	Modified Emission Reduction Needed to Meet	
Primary Standard	Secondary Guide		Primary Standard	Secondary Guide		Primary Standard	Secondary Guide
23%	49%	8579 T/Yr	1973 T/Yr	4203 T/Yr	16,060 T/Yr	3696 T/yr	7874 T/Yr

TABLE 16. COMPARISON OF GROWTH DATA

Category	Growth Projections 1970-1975	Actual Growth 1970-1975
Population	3%	2.3% (City) 12.8% (County)
Industrial	Rated capacity of existing sources, new sources currently under construction	.7% (City)

Agency/Regulation Number/Category	Control Strategy Limitation	Limitation Defined by Reasonably Available Control Technology
APCA Regulation I Visual Emissions	Not to equal or be darker than No. 2 Ringelmann or 40% opacity except 3 minutes in any one-hour period for existing sources Not to equal or be darker than No. 1 Ringelmann or 20% opacity except 3 minutes in any one-hour period for new sources and (in revised regulations not yet in approved SIP) for all sources after July 1, 1975.	The emission of visible air pollutants can be limited to a shade or density equal to but not darker than that designated as No. 1 on the Ringelmann chart or 20 percent opacity except for brief periods during such operations as soot blowing and startup. This limitation would generally eliminate visible pollutant emissions from stationary sources.
igitive Dust Control (Not part of control strategy limitation but contained in SCAPCA "Guidelines for Control of Air Pollution from Parking Lots, Roadways, and Open Areas.)	Roadways: Private roads shall be controlled by paving, oiling or other surface treatment which prevents visible dust emission and mud carryout. Good housekeeping measures shall be used to minimize the accumulation of mud or dust on the surface of roads. Unpaved shoulders shall be maintained in such a way as to minimize visible dust being generated by wind or traffic. Parking Lots: Parking lots shall be controlled by paving, oiling or other surface treatment which prevents visible dust emission and mud carryout. Good housekeeping measures shall be used to minimize the accumulation of mud or dust on the surface of parking areas. Open Areas: Unpaved open areas shall be controlled by vegetation cover or other equally effective method of minimizing wind blown dust. Construction, Repair and Cleaning: Visible dust generated by construction, repair and cleaning of roads and parking areas shall be minimized by methods such as wetting and the use of chemical suppressants. In addition, at the end of each shift all public roadways shall be cleaned of mud and dust.	Reasonable precautions can be taken to prevent particulate matter from becoming airborne. Some of these reasonable precautions include the following: (a) Use, where possible, of water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads or the clearing of land; (b) Application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces which can give rise to airborne dusts; (c) Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials. Adequate containment methods can be employed during sandblasting or other similar operations; (d) Covering , at all times when in motion, open bodied trucks, transporting materials likely to give rise to airborne dusts; (e) Conduct of agricultural practices such as tilling of land, application of fertilizers, etc. in such manner as to prevent dust from becoming airborne; (f) The paving of roadways and their maintenance in a clean condition; (g) The prompt removal of earth or other material from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water, or other means.

Agency/Regulation Number/Category	Control Strategy Limitation	Limitation Defined by Reasonably Available Control Technology
en Burning Restrictions	Prohibited, except for the following: • fires set for religious ceremonies, recreational purposes and cooking of food for human consumption • fires from flares, torches, and waste gas burners • fires authorized by a Fire Chief, Fire Mashal or head of a local fire district	
cinerator	Approved multiple chamber or equivalent. (See also grain loading limitation)	
egulation II Grain Loading	0.1 grains per standard cubic foot for non-combustion sources (0.095 lbs/100 lbs refuse) 0.1 grains per standard cubic foot @ 12% CO_2 for combustion sources (.17 lbs/10^6 BTU) Maximum emission rate of 40 pounds per hour.	<u>Incineration:</u> The emission of particulate matter from any incinerator can be limited to 0.20 pound per 100 pounds (2 gm/kg.) of refuse charged. This emission limitation is based on the source test method for stationary sources of particulate emissions which will be published by the Administrator. This method includes both a dry filter and wet impingers and represents particulate matter of 70°F. and 1.0 atmosphere pressure. <u>Fuel Burning Equipment</u>: The emission of particulate matter from fuel burning equipment burning solid fuel can be limited to 0.20 pound per million B.t.u. (0.54 gm/10^6 gm-cal) of heat inputs. This emission limitation is based on the source test method for stationary sources of particulate emissions which will be published by the Administrator. This method includes both a dry filter and wet impingers and represents particulate matter of 70°F. and 1.0 atmosphere pressure. <u>Process Industries - General</u>: The emission of particulate matter for any process source can be limited in a manner such as in Table I. Process weight per hour means the total weight of all materials introduced into any specific process that may cause any emission of particulate matter. Solid fuels charged are considered as part of the process weight, but liquid and gaseous fuels and combustion air are not. For a cyclical or batch operation, the process weight per hour is derived by dividing the total process weight by the number of hours in one [illegible] operation [illegible] the [illegible]

Agency/Regulation Number/Category	Control Strategy Limitation	Limitation Defined by Reasonably Available Control Technology
Regulation II (continued) Grain Loading		process to the completion thereof, excluding any time during which the equipment is idle. For a continuous operation, the process weight per hour is derived by dividing the process weight for a typical period of time. TABLE 1 Process weight rate (lbs./hr.) — Emission rate (lbs./hr.) 50 . . . . 0.36 100 . . . . 0.55 500 . . . . 1.53 1,000 . . . . 2.25 5,000 . . . . 6.34 10,000 . . . . 9.73 20,000 . . . . 14.99 60,000 . . . . 29.60 80,000 . . . . 31.19 120,000 . . . . 33.28 160,000 . . . . 34.85 200,000 . . . . 36.11 400,000 . . . . 40.35 1,000,000 . . . . 46.72
DE Chapter 18-16 Field Burning	Open burning of field grasses shall be prohibited after the 1973 harvest. Open burning of all turf grasses scheduled for the tear out shall be prohibited effective in 1975	
Chapter 18-32 Primary Aluminum Plants	15 lbs/ton of aluminum produced on a daily basis	
Chap. 19-04 Visual Emissions	For all new sources and after July 1, 1975 for all sources, no person shall cause or permit the emission for more than 3 minutes in any one hour, or an air contaminant from any source which at the emission point exceeds 20% opacity.	

TABLE 18. POINT SOURCE COMPLIANCE STATUS

Total Point Sources - 27	
Greater than 1000 T/Yr	1
Less than 1000 but greater than 100 T/Yr	2
Less than 100 T/Yr	24

Point Source Compliance Status	
In compliance	22
In compliance with schedule	3
Not in compliance with schedule	2

TABLE 19. POINT SOURCES KNOWN TO BE OUT OF COMPLIANCE AS OF NOVEMBER 28, 1975

	Emissions (TPY)	Compliance Date
Out of Compliance Meeting Schedule		
Boyd Conlee	30	4/30/76
Inland Empire Pea Growers	9	7/2/76
Inland Foundry	13	3/31/76*
Out of Compliance Not Meeting Schedule		
Spokane Seed	34	7/1/76
Washington Water Power**	59	?

* Date obtained from information provided in SCAPCA "Board Meeting Minutes - October 27, 1975.

** Based on a December 15, 1975 conversation with Rick White of the Region X Air Compliance Branch, the Washington Water Power boiler is out of compliance for only approximately 30 minutes each day during soot blowing operations and only during those periods when oil is burned.

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4. Title and Subtitle Evaluation of National Ambient Air Quality Standards (NAAQS) Nonattainment: Methodology and Example Total Suspended Particulate Analysis for Spokane County	5. Report Date January 1976 6.
7. Author(s) Victor Yamada & Robert Missen (PES), Michael Schultz (EPA-RX)	8. Performing Organization Rept. No.
9. Performing Organization Name and Address Pacific Environmental Services, Inc. 1930 - 14th Street Santa Monica, California 90404	10. Project/Task/Work Unit No. Task Order No.: 16 11. Contract/Grant No. BOA No. 68-02-1378
12. Sponsoring Organization Name and Address Air Programs Branch, Air & Hazardous Materials Division EPA - Region X 1200 Sixth Avenue, Seattle, WA 98101	13. Type of Report & Period Covered July 1975 - January 1976 14.

15. Supplementary Notes

16. Abstracts A methodology is presented to assess reasons for nonattainment of NAAQS and to propose corrective actions which would lead to attainment of the standards. An application of this methodology to evaluate the TSP nonattainment situation in Spokane County is also presented. The methodology, tailored primarily for TSP and SO_2, consist primarily of: (1) a logical, primarily nonmodeling approach to identifying source-receptor relationships and (2) an analysis of the development, implementation, and enforcement of the existing SIP. Likely catagories of corrective actions are also presented.

The primary area of TSP nonattainment in Spokane County extends in a band from the Spokane City Center east-northeast for approximately 3½ miles through the industrial corridor. Likely major reasons for nonattainment include fugitive dust from unpaved roads and fugitive industrial emissions. Recommendations include control of emissions from unpaved roads in the city and conducting an ambient monitoring study to assess the impact of fugitive emissions from gravel operations.

17. Key Words and Document Analysis. 17a. Descriptors

1. Air Pollution
2. Dust
3. Aerosols
4. Sulfur Dioxide
5. Regulations - Pollution
6. Standards

17b. Identifiers/Open-Ended Terms

1. National Ambient Air Quality Standards
2. Attainment of Ambient Air Quality Standards
3. Nonattainment Evaluation
4. Control Strategy Revision
5. Spokane County

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Unlimited	UNCLASSIFIED	143
	20. Security Class (This Page) UNCLASSIFIED	22. Price