EVALUATION AND VALIDATION OF TOTAL SUSPENDED PARTICULATE NAAQS EXCEEDANCES

FALL RIVER, MASSACHUSETTS 1975 - 1976

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SECTION I

Introduction

The Air Branch asked the Surveillance and Analysis Division (S & A Division) to make a technical evaluation of exceedances of the National Ambient Air Quality Standard (NAAQS) for total suspended particulates (TSP) found in Massachusetts' Southeastern Air Pollution Control District (AQCR 120) and prepare a report to defend these exceedances should they be challanged. The Air Branch also requested an evaluation of the impact of New England Power Company's Brayton Point Power Plant and Montaup Electric Company's Somerset Power Plant on these exceedances.

In response to this request, S & A Division has validated the 17 exceedances of the primary or secondary TSP standards measured at the "Brayton Point Network"[1] in 1975 and 1976 (see Table I-1) evaluated the "Brayton Point Network" sites and two Massachusetts' monitoring sites. In addition, the S & A Division analyzed existing microscopic data, meteorology, a sulfur dioxide/TSP correlation study, local conditions, x-ray fluorescence spectrographic data and chemical analysis data on representative days of high TSP levels.

The S & A Division characterized the types of particulate collected on representative high TSP filters. This was difficult since the high volume sampling method was designed to determine only the total suspended particulate in the ambient air. The glass fiber filter itself complicated

[1]The "Brayton Point Monitoring Network" is an ambient air quality monitoring network established by New England Power Company in 1974 as a condition of a temporary coal burning authority. The company continued to monitor after their Brayton Point Plant switched back to oil in 1975.

TABLE I-1

HIGH PARTICULATE CONCENTRATIONS MEASURED
FROM JANUARY, 1975 - DECEMBER, 1976

Date	Site	Concentration (ug/m^3)
12/05/76	Plymouth Avenue	422
06/11/76	North Main Street	175
04/09/76	North Main Street	213
04/15/76	Plymouth Avenue	153
02/09/76	Plymouth Avenue	468
02/12/76	Plymouth Avenue	173
02/21/76	North Main Street	150
05/15/75	North Main Street	185
05/21/75	North Main Street	156
04/03/75	North Main Street	160
04/12/75	Plymouth Avenue	191
04/18/75	North Main Street	177
03/07/75	Milliken Boulevard	188
03/16/75	Milliken Boulevard	159
03/19/75	Milliken Boulevard	189
02/20/75	Milliken Boulevard	455
01/24/75	Milliken Boulevard	166

many analyses since each filter has a varying background of metals, sulfates, silicate and other constituents. Hence, inorganic analyses were performed over a background from the filter which is by no means constant[2].

No single analyses performed on the subject filters can conclusively pinpoint all the constituents which cause the exceedances, but taken as a whole the evidence provides an insight into the make-up of the major particulates causing the exceedances.

[2]Air Quality Criteria for Particulate Matter, U. S. Department H. E. W., January, 1969.(p. 22).

SECTION II

Validation of TSP Data in AQCR 120

Members of the Air Section and the Analytical Quality Control Co-ordinator have reviewed sampling site locations, standard operating procedures, pertinent calibrations, sample data sheets and other documents necessary to validate and recalculate the 17 high particulate concentrations measured from January, 1975, through December, 1976, at the "Brayton Point Sampling Network" maintained by Environmental Research and Technology, Inc., for the New England Power Company. In addition, a calibration audit was performed on the high volume sampler at the two sites (North Main Street and Plymouth Avenue) which had recorded exceedances and were still operational on August 9, 1977.

In general, the laboratory and field monitoring facilities are operated in an efficient manner with appropriate documentation. There were no major discrepancies noted which would invalidate data. In the Surveillance and Analysis Division's opinion, the high TSP data gathered at the "Brayton Point Sampling Network" between January, 1975, and December, 1976, are valid and appropriate for planning purposes.

On March 10, 1977, Norm Beloin and Allen Oi of the Air Section made site visits to the Read Street, Sharp's Lot, Milliken Boulevard, Plymouth Avenue, and North Main Street sampling sites. An evaluation of the Read Street and Sharp's Lot sites revealed nothing in the site location that would bias or invalidate the data collected. The Milliken Boulevard site may be somewhat influenced by re-entrainment particulates due to its close proximity to Interstate Route I-195 and the fact that the site was located in a large parking lot. The North Main Street site appeared to be a

representative site; however, proximity to major construction of Massachusetts Route 79 during 1975 and 1976 and subsequent rerouting of traffic around the area is believed to have a significant effect on the measured ambient particulate levels. It should be noted that this is a residential area, and the levels recorded at this site would be indicative of the population exposure in this area. At the Plymouth Avenue site, there was a restriction to normal air flow caused by a two-story fire station located 15 feet northeast of the site. In addition, with winds from the northeast direction, although infrequent, there is a possibility of downwash from the fire station chimney which is 45 feet tall and 25 feet northeast from the monitor. This site may also be influenced by re-entrainment particulates due to its close proximity (25 feet) to Plymouth Avenue. As with the North Main Street site, the Plymouth Avenue site is located close to residential housing, and the levels recorded at this site reflect population exposure.

On March 11, 1977, Warren Oldaker, Analytical Quality Control Co-ordinator, and Allen Oi, Air Section, visited the ERT facilities in Concord, Massachusetts, to review procedures for handling TSP filters from the field through their laboratory and to visually inspect the subject filters. Written standard operating procedures for both field and laboratory activities, along with copies of log sheets, field notes, sampler motor calibrations, air flow meter calibrations, and daily check lists. Subsequently, the 17 TSP standard exceedances were re-calculated using the ERT supplied records with no significant difference found between the reported values and the recalculated values.

The following are comments regarding the operational procedures used by the ERT for the TSP monitoring program. These comments are minor in

nature and would not invalidate the data:

1. Written operational procedures in active practice by the ERT staff are not available prior to March 3, 1975.
2. There is no documentation available to show that the magnehelic gage used to measure flow on each sampler was the actual gage used to calibrate the specific sampler prior to January 28, 1976.
3. ERT-SOP 2000-805 Rev. D, dated 1/22/77, states that the relative humidity of the conditioning room snould be less than 60 percent and a temperature of 70°F ± 10°F (27 ± 5.6°C), where as in the Federal Reference Method as published in F. R. Vol. 36, No. 84, Part II, Friday, April 30, 1971, states that filter conditioning environment should be maintained at 15 to 35°C and less than 50 percent relative humidity.
4. On several TSP sampler calibrations (North Main Street, 04/20/75, 12/31/75, 04/16/76) notations were not made of the serial number of the orifice calibration unit used.
5. ERT-SOP 2000-072 Rev B, dated 12/09/76, page 1, does not allow for a five minute warm-up period before a flow is taken on the TSP sampler motor.

As an additional check, a flow calibration audit was performed on the TSP samplers of North Main Street and Plymouth Avenue sites by Allen Oi of the Air Section on August 9, 1977. Although this audit was performed at least eight months after the last exceedance, it gives an overall check on the operational procedures used during the sampling period in question. The results of the audit showed an average difference of -.9 percent at the North Main Street site and -.8 percent at the Plymouth Avenue site. These differences were the result of comparing air volume

flows from an EPA reference device and the calculated flows from ERT's calibration graph. Since there is close agreement, ERT's procedures and calibration routine are judged to be adequate to assure valid TSP data.

SECTION III

Site Survey

This section will describe the ambient particulate monitoring site locations for the New England Power Company's "Brayton Point Monitoring Network" (required by EPA's January, 1975, Temporary Suspension Order) and the two Commonwealth of Massachusetts SIP sites located in Fall River. The enclosed map shows the location of these sites in relation to the New England Power Company's Brayton Point Power Plant and the Montaup Somerset facility. These sites are concentrated to the north and southeast of the plant. The following is a brief discussion of each site:

1. Swansea Marina Site - The site was approximately one mile west northwest of the Brayton Point Power Plant in a generally residential area with a small bay to the west. The sampler was located on the roof of a small shed in a field with only a few isolated trees around. The site appeared to be too close to the plant to measure particulates from the plant and was predominantly in the upwind direction. The site operated only several months in early 1975 with no TSP standard exceedances recorded.
2. Sharp's Lot Site - The site is approximately three miles north northeast of the Brayton Point Power Plant in a rural area. The sampler is located on the roof of a sampling shelter (12 feet above ground level) in a field with good atmospheric ventilation. The ground elevation at the site is 120 feet above mean sea level. The Somerset Station is located 1.9

miles east southeast of the site. There are no other significant sources of pollution within a one mile area of the site. The site has been operated from 1974 to present. No TSP standards exceedances have been reported from this site.

3. Read Street Site - The site is approximately two miles north northeast of the Brayton Point Power Plant in a very low density residential area. The sampler was located on the roof of a sampling shelter (12 feet above ground level) with good atmospheric ventilation. The ground elevation is 50 feet above mean sea level. The site is in a cleared area under the transmission lines from the power plant. The Somerset Station is located 1.9 miles east of the site. There are no major sources within a mile of the site. The site has been operated from 1974 until the present. No TSP standards exceedances have been reported from this site.

4. North Main Street Site - This site is 2.8 miles east northeast of the Brayton Point Power Plant in a high density residential/ industrial area. The ground elevation is 30 feet above mean sea level. The sampler is located on the roof of a sampling shelter (12 feet above ground level) in the corner of a sub-station. The site is surrounded by several two and three story buildings and a rising elevation to the east. The Somerset Station is 0.9 miles north northwest of the site. Although the aggregate contributions of the local sources are significant, no attempt has been made to identify individual sources. North Main Street, a heavily traveled two lane surface street, is 100 feet to the east. The railroad tracks are located 50 feet west.

During 1973 to 1976, Route 79, a multilane surface street, was constructed approximately 1,500-1,000 feet to the north and west. Secondary TSP standard violations have been reported at this site.

5. Milliken Boulevard Site - The site was 1.8 miles east southeast of the Brayton Point Power Plant in a large parking lot. The nearest buildings lay in a north - south direction, approximately 200 feet east of the monitor. These were commercial buildings approximately three stories high. Industrial plants were located at the water's edge about 2,500 feet away. Somerset Station was located 2.7 miles north of the site. There were several major traffic routes in the vicinity. Milliken Boulevard was 50 feet west of the site. I-195 was 500 feet to the north. The sampler was located on the roof of a sampling shelter (12 feet above ground level). Ground elevation was 100 feet above mean sea level. The site was on a hillside sloping upward toward the east. The site was operated only for a few months in late 1974 and early 1975. A primary exceedance and secondary TSP violations were recorded at this site. The EPA Regional Office had this site relocated to the fire station at Plymouth Avenue. The reasons for this move were: (1) that computer modeling did not predict any impact of the Brayton Point Power Plant at this location, (2) that there was no population exposure at the site, (3) that the Commonwealth of Massachusetts site at the Central Fire Station was determined to be a better center city site, and (4) that re-entrainment of particulates would cause elevated TSP levels.

6. Plymouth Avenue Site - This site is 2.4 miles southwest of the Brayton Point Power Plant in a residential/commercial area. This site is on the crest of a hill with a ground elevation of 250 feet. The sampler is located on the roof of a sampling shelter (12 feet above ground level) between the Plymouth Avenue Fire Station and a parking lot for a supermarket. There are single and multiple family housing units proximate to the sampling site in addition to some industrial activity in the immediate area. A major four-lane surface street, Plymouth Avenue, is only 25 feet west of the sampler. The Fall River Incinerator is 3/4 of a mile to the north northeast. Also, the chimney of the fire station (25 feet northeast and 45 feet tall) may, under extremely infrequent conditions, present a downwash problem. There is a tree 40 feet tall five feet southwest of the site. The atmospheric ventilation is good in the direction towards the Brayton Point Power Plant; however, the tree to the southwest and a two-story fire station, 15 feet to the northeast, create some interferences to normal air flow; however, the tree should not influence winter air flow. It should be noted that this site was chosen for SO_2 monitoring, using modeling data and the measurement of particulates was a secondary consideration. Due to the proximity of the sampler to Plymouth Avenue, re-entrainment of particulate matter could occur at this site. This site was operated from early 1975 to early 1977. Both primary and secondary TSP standards violations were reported at this site.

7. Central Fire Station Site - This site is 2.4 miles southeast of the Brayton Point Power Plant in the central business district of Fall River. The ground elevation is 135 feet above mean sea level. The sampler is located on the roof of the Central Fire Station on Bedford Street. The building is two stories tall and has a low parapet around the perimeter of the roof. The roof has a 15 foot tall chimney located 25 feet south southeast of the sampler. The atmospheric ventilation is generally good although some local wind may be channeled along the streets. There also will be some interference to air flow from a three and one half story building 150 feet to the north and a five story building located 1,200 feet to the southwest. Neither obstruction should be significant, although during south southeast winds, downwash from the chimney could occur.

   The general location of the site is commercial and industrial in nature with pockets of multiple family residences. Structures in the area range from two to five stories in height. Somerset Station is two miles to the northwest, and the Fall River Incinerator is 3/4 of a mile to the southeast.

   In general, the site conforms to the EPA guidelines, and the site has been in operation since 1973. There have been no TSP standards violations reported at this site.

8. Globe Street Site - The site is located 2.3 miles south southeast of the Brayton Point Power Plant in a residential/commercial/industrial area. The site is 100 feet above mean sea level. The sampler is located on the roof of the sampling trailer 15

feet above ground level. The site is surrounded by open recreational land and has good atmospheric ventilation. A two-story fire station is located 50 feet southwest of the trailer. The majority of building surrounding the site are two to four story multi-family residences. There are several industrial sources located approximately 1,000 feet to the northwest. Re-entrainment of particulate matter should be minor as the only street near the trailer is Globe Street, a medium duty, two-lane surface street, 50 feet away. The site has been in operation since 1975 and has recorded no TSP standards violations.

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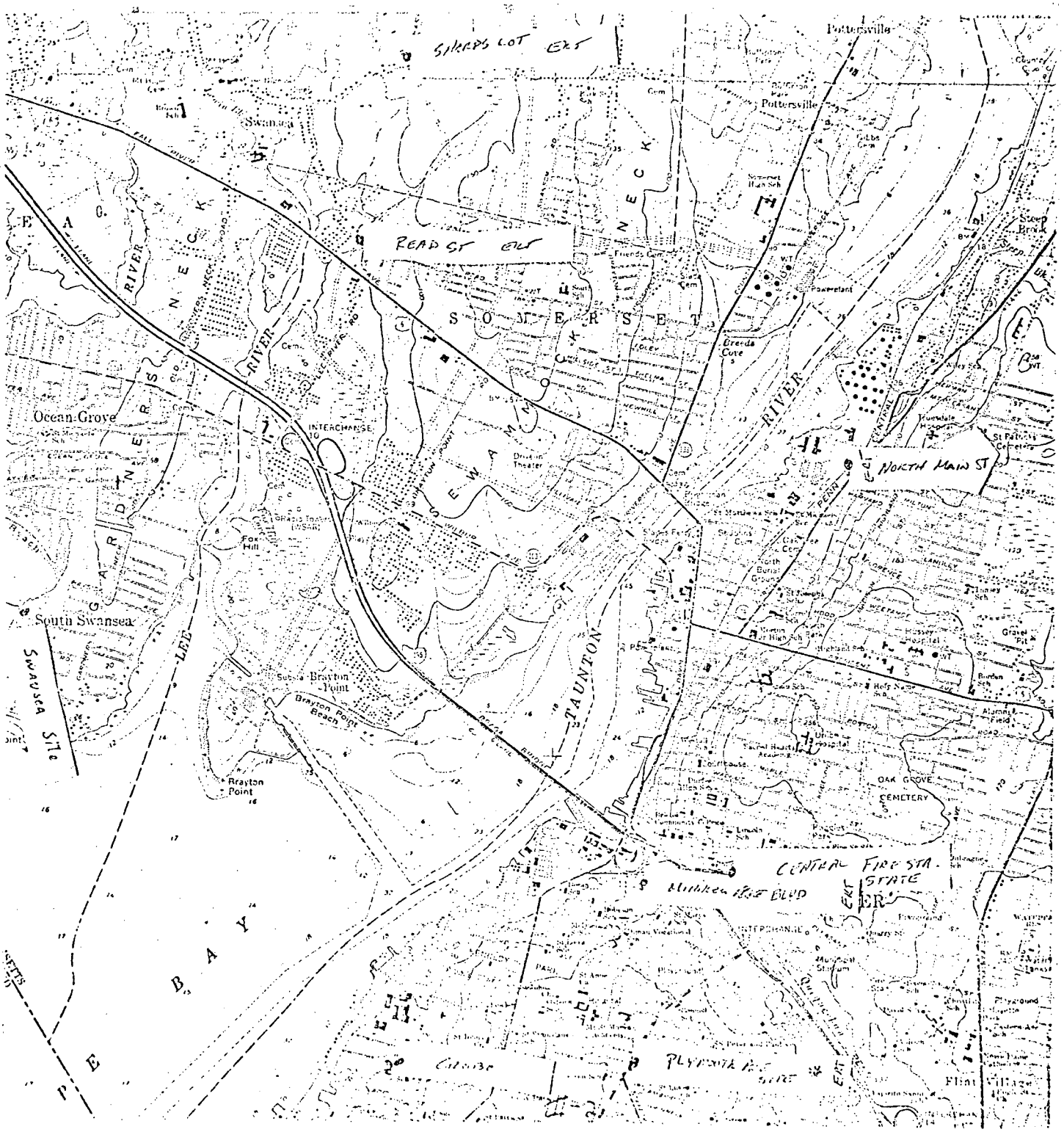
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SECTION IV

Microscopic Analysis

New England Power Company, through its prime consultant, ERT, engaged Eastern Analytical Laboratories (E.A.L.) to do microscopic analyses of seven filters collected from the "Brayton Point Monitoring Network". The microscopic analysis report is included in Appendix A and Warren Oldaker's evaluation of the laboratory and the limitations of the analysis method in Appendix B.

It should be noted that EPA has found a wide variation in the ability of individuals to identify the substances using microscopic techniques. However, a good analyst should be able to provide an indication of the percent variation between major categories.

The results from E.A.L.'s study are summarized on Table IV-1.

TABLE IV-1

SUMMARY OF EASTERN ANALYTICAL LABORATORY

MICROSCOPIC ANALYSIS

Site	Date	Percent Mineral	Flyash	Soot	Biological
Plymouth Avenue	02/09/76	87.8	5.05	4.55	2.59
	02/12/76	67.2	6.3	26.5	0
	04/15/76	75.9	4.5	19.0	0.5
	06/11/76	74.4	4.7	19.9	1.1
	12/05/76	84.5	10.1	5.4	Trace
North Main Street	04/09/76	87.0	3.8	7.3	1.9
	06/11/76	72.1	12.1	11.3	4.4

Definitions:

Mineral - transparent to translucent, colorless, red, yellow, occasionally green, angular, cleaved, rounded, often birefringent.

Flyash - vitreous transparent colorless, red, yellow, greenish, orange, and brown, spherical to equant irregular.

Soot - opaque, dull to vitreous luster, black to very slightly colored (reflected light) tubular, elongate, spherical, irregular, angular, lacy, frothy.

Biological - transparent to translucent, colorless, green, red, brown, yellow, spherical, equant, symmetrical, elongate, occ. textured.

Densities[1] - used in the weight percent calculations are as follows:

Mineral - 2.65 to 2.9, with 2.8 being used most often
Flyash - 2.1, all cases
Soot - 1.1, all cases
Biological - 0.9, all cases

Section V

Meteorological Aspects of Elevated TSP Concentrations in Fall River, MA

Prepared by Val Descamps, Regional Meteorologist

1. Introduction: The Regional Meteorologist analyzed the meteorlogy accompanying the days on which elevated TSP concentrations occurred in Fall River. This analysis forms part of the technical analysis of elevated TSP levels found by the "Brayton Point Monitoring Network" in the Southeast Massachusetts Air Pollution Control District.

2. Purpose of Analysis: To determine the contribution of meteorological factors to the high TSP concentrations and estimate the impact of Brayton Point and Somerset power plants on the high concentrations.

3. Background: The S&A Division identified 17 days in 1975 and 1976 having concentrations greater than the secondary NAAQS for TSP. These are listed in Table V-1.

4. References: The daily weather maps and the Local Climatological Data for Green Airport, Warwick, RI are the main references consulted. The wind vector azimuths and speed are also listed in Table V-1. For nine of the days, all the LCD's for New England were used to obtain a regional picture of the meteorology.

5. Patterns: Before looking at individual days, the days were sorted to identify patterns. With this small sample, however, it is difficult to attach significance to the patterns observed.

a. Days of the week: Sorting the days by day of the week shows:

	S	M	T	W	TH	F	S
Number of Violations:	2	1	0	2	4	5	3

This indicates that the period Thursday, Friday, and Saturday has higher particulate concentrations than the other days of the week. It is possible that this reflects increased VMT at the end of the week.

b. Month: Sorting by month shows:

Month	Cases
January	1
February	4
March	3
April	5
May	2
June	1
December	1

The peaking of the violations in February and April has several causes which will be discussed in paragraph 7.

6. Procedure: Time did not permit all the checking and comparison that might be desirable. It would, for example, have been desirable to investigate why a cause advanced for a high concentration at one location did not affect receptors at other locations.

7. Results: The results of the meteorological evaluation are noted below. The days are categorized under several headings. These headings indicate factors that might be contributing to the high values or mark the day as unusual or seem to indicate clearly the cause of the high concentrations.

   a. Rain: Rain usually reduces TSP levels. When standard exceedances occur with rain, these days deserve special attention. Days with rain and TSP standard exceedances are listed in Table V-2.

      An explanation for these concentrations is not readily apparent. Sea salt could contribute on the order of 20-25 ug/m^3 but, even so, the weight of the remaining TSP is still considerable. The incident of 3 April is especially difficult to explain because 1.6 inches of rain over a 14-hour period should have reduced TSP significantly.

   b. Street Sanding: Street sanding can contribute significantly to TSP. Days on which this occurred have been identified in Sections VII. These include the two days with concentrations in the 400 ug/m^3 range. Days on which sanding occurred are listed in Table V-3.

As can be seen from the table, precipitation did not occur on the sanding days which means sanding occurred on probably partly dry streets. This is highly favorable for pulverizing the sand and for broadcast by wind action. Vector wind directions were generally 30^{o} to 70^{o} off from a line connecting Brayton Point to the monitors. This makes estimating the impact of Brayton Point on the monitors more difficult. It also makes it more likely that street sanding was the important contributor to these high values.

c. Transport: Transport can contribute significantly to TSP amounts. A Connecticut statistical study indicates up to 60 ug/m^3 as coming into Connecticut from the NYC-NJ area. Days on which transport is believed to have occurred are listed in Table V-4.

Only January 24 and April 18, 1975 have been documented to produce a reasonable argument for transport. On the other hand, February 21, 1976 and May 15, 1975 only suggest transport because of the synoptic situation. The impact of transport was not fully felt on these days because a synoptic situation favorable for transport did not exist the entire 24 hours. Notice that February 21 is also a day on which street sanding occurred.

d. Sulfates: Sulfates under favorable conditions can compose 40-60 ug/m^3 of a 24-hour TSP sample. Two days are identified as potential sulfate days. One day, June 11, 1976, is a significant high sulfate day. It is estimated from sulfate measurements in Metropolitan Boston and Rhode Island that background sulfate concentrations in the Brayton Point area could have reached 50 ug/m^3. (Table V-5).

The problem is identifying the origin of the sulfates. On June 11, 1976, sulfate transportation from outside New England probably took place; it is also equally true that local conditions were highly favorable for sulfate production. Some sulfate information on May 21, 1975 is available (See Section VIII). It also was a day with ozone violations in the area and high temperatures; both are conditions favorable for SO_2 conversion to SO_4's.

e. Plume Effect: Comparing the vector wind direction with the orientation of the monitors with Brayton Point and Somerset plant provides a means of estimating the effect of those plumes. Days on which these azimuths agreed within 30° are shown in Table V-6.

The wind vectors are in a horizontal plane; thus, do not show the effect of plume rise and site elevation. Therefore, the site may not be impacted by the plume even though the wind vector was showing that possibility.

f. Fugitive Dust: The elevated TSP concentrations on two days appear to have been caused by either fugitive dust or area sources of TSP. (Table V-7).

Both monitors are sufficiently removed from the path of the Brayton Point plume to make the contribution from that point minimal. On April 9, the winds have an average velocity of 15 mph. At that velocity blowing dust and soil is likely. On April 15, the average speed is 9 mph but gusts to 20 mph occurred in the afternoon.

TABLE V-1

High Particulate Concentrations Measured

Date	Day	Site	Wind Vector* ^{o}/mph	Concentration (ug/m^{3})
12/5/76	Sunday	Plymouth Avenue	290^{o}/5	422
6/11/76	Friday	North Main Street	240^{o}/12	175
4/9/76	Friday	North Main Street	30^{o}/13	213
4/15/76	Thursday	Plymouth Avenue	230^{o}/8	153
2/9/76	Monday	Plymouth Avenue	340^{o}/5	468
2/12/76	Thursday	Plymouth Avenue	280^{o}/10	173
2/21/76	Saturday	North Main Street	210^{o}/7	150
5/15/75	Saturday	North Main Street	180^{o}/8	185
5/21/75	Wednesday	North Main Street	150^{o}/3	156
4/3/75	Thursday	North Main Street	160^{o}/5	160
4/12/75	Saturday	Plymouth Avenue	300^{o}/7	191
4/18/75	Friday	North Main Street	170^{o}/8	177
3/7/75	Friday	Milliken Boulevard	170^{o}/6	188
3/16/75	Sunday	Milliken Boulevard	230^{o}/5	159
3/19/75	Wednesday	Milliken Boulevard	140^{o}/12	189
2/20/75	Thursday	Milliken Boulevard	280^{o}/8	455
1/24/75	Friday	Milliken Boulevard	220^{o}/8	166

*From T. F. Green Airport, Warwick, RI

TABLE V-2

TSP Standard Exceedances on Rain Days

Date	Monitor Location	Rainfall Amount (in)	Rainfall Duration (hrs)	Vector Wind (o/mph)	Difference Brayton Point	Difference Somerset	TSP_3 ug/m
March 7, 1975	Milliken	.08	5	170/6	125	168	188
March 19, 1975	Milliken	.45	7	140/12	155	123	189
April 3, 1975	Milliken	1.67	14	160/5	135	143	160

*Difference between mean wind azimuth and azimuth to the power plants.

TABLE V-3

Meteorological Data on Days with TSP Standard Exceedances and Street Sanding Operations

Date	Monitor Location	Rainfall/Snowfall yes/no Monitoring Day	Rainfall/Snowfall amt. (in) Monitoring Day	Rainfall/Snowfall yes/no Day Before	Rainfall/Snowfall amt. (in) Day Before	TSP Concentration (ug/m^3)	Vector Wind (^{o}/mph)	Difference* Brayton Point	Difference* Somerset
Dec. 5, 1976	Plymouth Ave.	yes	Trace	yes	.02	422	290/5	22^o	82^o
Feb. 9, 1976	Plymouth Ave.	no	0	yes	.01	468	340/5	28^o	32^o
Feb. 12, 1976	Plymouth Ave.	no	0	no	0	173	280/10	32^o	92^o
Feb. 21, 1976	North Main	no	0	yes	Trace	150	210/7	40^o	135^o
March 16, 1975	Milliken	no	0	yes	.08	159	230/5	65^o	147^o

*Difference between mean wind azimuth and azimuth to the power plants.

TABLE V-4

Meteorological Data on Transport Days with TSP Standard Exceedances

Day	Monitoring Location	Concentration TSP (ug/m^3)	Vector Wind ($^\circ$/mph)	Difference* Brayton Point	Somerset
Jan. 24, 1975	Milliken	166	$220^\circ/8$	75°	157°
Feb. 21, 1976	North Main	150	$210^\circ/7$	40°	135°
April 18, 1975	North Main	177	170/8	80°	185°
May 15, 1975	North Main	185	180/8	70°	165°

*See Table V-2

TABLE V-5

Meteorological Data on Sulfate Days with TSP Standard Exceedances

Date	Monitor Location	Vector Wind ($^\circ$/mph)	Difference Brayton Point	Somerset	TSP Concentration (ug/m^3)
May 21, 1975	North Main	150/3	100°	165°	156
June 11, 1976	North Main	240/12	10°	105°	175

TABLE V-6

Days with Possible Impact of Plumes

Date	Monitor Location	Azimuths to Brayton Pt./Somerset	Vector Wind °mph	Difference in degrees	TSP Conc.
Brayton Point					
02/20/75	Milliken	295°/17	280°/8	15°	455
12/05/76	Plymouth	312°/12	290°/5	22°	422
06/11/76	North Main St.	250°/345	240°/12	10°	175
02/12/76	Plymouth	312°/12	280°/10	32°	173
04/12/75	Plymouth	312°/12	300°/7	12°	191
Somerset					
NONE					

TABLE V-7

Meteorological Data on Fugitive Dust Days with TSP Exceedances

Date	Monitor Location	Azimuths to Brayton Pt.	Vector Wind	Difference		Conc.	Rain Day Before Yes/No
				Brayton Pt.	Somerset		
4/9/76	North Main St.	250°	030/13	140°	45°	213	No
4/15/76	Plymouth Avenue	312°	230/8	82°	142°	153	No

SECTION VI

Correlation Study

The Massachusetts Department of Environmental Quality Engineering has run a simple statistical correlation between TSP 24 hour values and SO_2 24 hour values as collected at the Plymouth Avenue site (Appendix C). In this study, they found a weak positive linear relationship between the two pollutants with a $r = .31$. This correlation suggests that combustion of sulfur containing fossil fuels was not strongly associated with particulate concentration levels at this site during the period of this analysis.

It follows that the burning of fossil fuel at the Brayton Point and Somerset facilities (by far the largest fossil fuel users in the area) were not strongly associated with the particulate concentration levels at the Plymouth Avenue site during the period of analysis, and other unidentified activites or factors were a major influence or cause of particulate concentration levels.

SECTION VII

Local Conditions

The following sources were checked to validate data on the days in question and to provide additional insight into any unusual occurrences which may have impacted the sampler on those days.

Fall River Water Department - Henry Depin

Fall River Public Library - Fall River Herald News

Community Development Agency - Steve Caruso

Fall River Fire Department - Chief Ferze

Fall River Public Works Department-Street Division - J. Al Guillemette

Building Inspector - Building Permits

S. E. Massachusetts A. P. C. D. - Robert Donaldson, Director

- Richard Slein, Air Pollution Control Eng.

01/24/75 - Friday - Milliken Boulevard - 166 ug/m^3

- No sweeping, sanding or fires occurred on this day.
- There were no complaints or violations reported by the S. E. Massachusetts A. P. C. D.

02/20/75 - Thursday - Milliken Boulevard - 455 ug/m^3

- No sweeping, sanding or fires occurred on this day.
- There were two citizen complaints of soot from Brayton Point (1/2 mile northwest of site, 1/4 mile northeast of site). The complaints proved negative.

03/07/75 - Friday - Milliken Boulevard - 188 ug/m^3

- No sweeping, sanding or fires occurred on this day.
- A citizen from Swansea complained of soot, which proved to be negative.

03/16/75 - Sunday - Milliken Boulevard - 159 ug/m^3

- There was a snowstorm on March 15, and sanding might have taken place.
- No complaints, violations or fires were reported.

03/19/75 - Wednesday - Milliken Boulevard - 189 ug/m^3

- No sweeping, sanding or fires were reported.
- There was a soot complaint from a citizen about Brayton Point which proved negative.

04/03/75 - Thursday - North Main Street - 160 ug/m^3

- No fires were reported on this day.
- Street sweeping operations took place on this day south of the site (Winter, Highrock, June, French, Lincoln and Pierce Streets 1/2 to 1 mile away from the site).
- No violations were reported; however, there was a complaint on April 2 from a Somerset citizen (1/4 mile northeast of site) of sea salt deposits from Brayton Point. This was the result of the cooling lagoon causing immediate fallout. It is unlikely that this would effect the site.

04/12/75 - Saturday - Plymouth Avenue - 191 ug/m^3

- No fires, complaints or violations were reported.
- A night sweeper operated from Podman Street and Brayton Avenue to Plymouth Avenue.

04/18/75 - Friday - North Main Street - 177 ug/m^3

- No fires, complaints or violations were reported.
- Street sweeping occurred on Elsbree, Chestnut, Hemlock and Florence Streets (less than 1/2 mile south of the site).

05/15/75 - Saturday - North Main Street - 185 ug/m^3

- No fires or street sweeping occurred.

- A violation (6.1) was reported at Massachusetts Realty Company, 18 Pocasset Street, (2 miles south of site).

05/21/75 - Wednesday - North Main Street - 156 ug/m^3

- No fires, violations or complaints were reported.
- Sweeping occurred on Langley Street (less than 1/2 mile south of site).

02/21/76 - Saturday - North Main Street - 150 ug/m^3

- No fires, complaints or violations were reported.
- Possible sanding and salting took place.

02/09/76 - Monday - Plymouth Avenue - 468 ug/m^3

- On February 8, 1976, a fire was reported at 68 Webster Street (1 1/2 miles east of site).
- Possibly emergency hill sanding was done.
- No violations were reported by the S. E. Massachusetts A. P. C. D.; however, there was a complaint of opacity (6.1.2) from an unknown tanker at Brayton Point (2 miles northwest of site).

02/12/76 - Thursday - Plymouth Avenue - 173 ug/m^3

- No fires, violations or complaints were reported.
- There was general sanding in site area.

04/09/76 - Friday - North Main Street - 213 ug/m^3

- No fires, street sweeping, violations or complaints were reported.
- Piles of sand from road sanding operations were removed from Pierce and Rock Streets in uncovered trucks (1 mile south of site) to landfill area (4 miles northwest of site). Most likely the route used was North Main Street.
- Reconstruction of roadway was being done during this period.

04/15/76 - Thursday - Plymouth Avenue - 153 ug/m^3

- No sweeping, sanding, violations or complaints were reported.

- There were two fires on April 12. The first was a grass fire on Ludlow Street (3/4 mile southeast of site). The second was a boiler backfire at 18 Morgan Street (1 1/2 miles north of site).

06/11/76 - Friday - North Main Street - 175 ug/m^3

- No fires were reported on June 11. There was a brush fire at the Firestone plant parking lot (2 miles south southwest of the site) on June 10.
- There was no street cleaning.
- On June 10, the No. 4 stack at New England Power was emitting smoke (6.1). It was put down immediately.
- Reconstruction of roadway was being done at this time.

12/05/76 - Sunday - Plymouth Avenue - 422 ug/m^3

- A news article from the Herald News (Monday, December 6) reports "sanders hit the road around 3 Saturday afternoon . . .". There was light snow accumulation, and general sanding was carried out through all the City.
- A permit was issued for construction of a self-service Shell station (Permit No. 329 issued 11/01/76). Demolition of the old building and construction of the new station was probably ongoing at the time of the violation (3/4 mile southeast of site).
- Two fires occurred in the site vicinity. The first on December 3 in an apartment at Maple Gardens (3/4 mile southeast of site). "Heavy black smoke" was noted on the fire report. The second fire on December 5 was at 289 Belmont Street (1 1/2 miles north of Plymouth Avenue, below Presidents Avenue).

Section VIII

X-Ray Fluorescence and Chemical Analysis

In an attempt to identify the cause of the exceedances of the NAAQS, six filters were selected for analysis using the x-ray fluorescence spectrograph (XRF). The two exceedances of the primary NAAQS recorded on 2/9/76 and 12/5/76 along with four samples which showed only exceedances of the secondary NAAQS. For continuity of analysis, the six samples were the same samples which were subjected to microscopic analysis described in Section IV. The filter from the primary exceedance on 2/20/75 was not included due to problems with the Milliken Boulevard site described in Section III, Site Evaluations.

To help identify the elements which caused the exceedances, five additional filters not showing exceedances of the NAAQS were also analyzed. These filters were from days just prior to or after the recorded exceedances. For comparison, the filters were paired as shown in Table VIII-1.

It was evident from previous work that roadway entrainment could be a problem; therefore, samples of the road dust, near the monitors collected on 7/22/77, were analyzed for comparison with the filter analysis. Since some of the exceedances, particularly the primary exceedances, occurred during sanding operations, a sample of the Fall River Department of Public Works road sand pile was collected and analyzed. To separate the particulates too large to be re-entrained, the road dust and sand samples were sieved.

TABLE VIII - 1

PAIRING OF FILTERS FOR XRF ANALYSES

Type	Date	Filter Number	TSP Concentration	Spectrum Number
Plymouth Avenue Site				
High	02/09/76	105689	468 ug/m^3	2, 14
Low	02/06/76	105690	54 ug/m^3	3, 14
High	02/12/76	105688	173 ug/m^3	4
Low	02/06/76	105690	54 ug/m^3	3
High	04/15/76	117929	153 ug/m^3	5, 15
Low	04/12/76	117928	67 ug/m^3	6, 15
High	12/05/76	136228	422 ug/m^3	7, 13
Low	12/02/76	148955	48 ug/m^3	8, 13
North Main Street Site				
High	04/09/76	117916	213 ug/m^3	9, 17
Low	04/06/76	117915	74 ug/m^3	10, 17
High	06/11/76	123940	175 ug/m^3	11, 18
Low	06/14/76	123941	88 ug/m^3	12, 18

York Research Corporation conducted a Method 5 emission test on Unit No. 2 at the Brayton Point facility in July, 1977. One of the filters from that test was subjected to XRF analysis (Spectrum 1).

Additional XRF analysis was performed on filters collected on May 21, 1975 from the South Swansea site (TSP level 94 ug/m^3), Plymouth Avenue site (TSP level 131 ug/m^3) and North Main Street (TSP level 156 ug/m^3). This day was determined in Section V to be a high sulfate day based upon sulfate data from the "Brayton Point Network". Sulfate values of 20.9, 22.9, and 28 ug/m^3 were recorded at the South Swansea Plymouth Avenue and the North Main Street sites, respectively, for that day. The XRF analysis (spectrums 24-29) showed moderately high levels of sulfur which were not seen on any of the other previous spectrums.

The evidence points to an area-wide air mass containing sulfur compounds (primarily sulfates) causing elevated TSP levels on May 21, 1975.

The following laboratory notes were prepared by Dr. Thomas Spittler on his XRF analyses of the samples.

1. No evidence from stack test filter that measurable stack emissions significantly impact hi vol samplers. Reason: High vanadium found in stack filter (Spectrum 1), low or nonmeasurable vanadium in filters (both on high and low days), Spectrums 2 through 12.

2. Little or no evidence of significant sulfur impact on hi vols from stack emissions. Reason: No elevated S in hi-low pairs, Spectrums 13 and 14. In one pair of samples, Spectrum 15, a higher sulfur peak occurs.

3. There is significant evidence of the possible impact of road sanding on at least two days, Spectrum 13 and 14. In both pairs, the highest TSP days both coincide with occurrence of road sanding, and also show greatly elevated concentrations of Cl, K, Ti, and Fe. It is likely that Cl and K are constituents of the salt part of a road sanding mixture. The high Ti and Fe are definitely typical of the sand used (Brayton Point sand-dry-Spectrum 16). This sand sample, when analyzed under vacuum to emphasize the Cl region of the XRF spectrum did not show high Cl. There was some indication that the sand measured here had not been mixed with salt as it undoubtedly was when applied in 1976.

In the case of the 4/6-9/76 (Spectrum 17) pair and the 6/11-14/76 pair (Spectrum 18), again the pattern of higher Cl, K, Ti, and Fe is present but not nearly so pronounced as in the winter samples. This may reflect some re-entrainment of road sand which still has some salt present in it.

4. No case can be made from the XRF evidence for significant re-entrainment of roadside dirt. This dirt has a typically high Fe and Ti content (Main Street and Plymouth dirt Spectrums 19-22). However, all these samples show high Pb but no Br. If this sample was impacting the filters significantly and if Pb is finely divided so it will re-entrain (for which we have no evidence pro or con), then one would expect to see Pb/Br ratios higher than the typical Pb/Br of 3/2 as seen in all the hi vol samples run. It is difficult to assess this impact quantitatively. Hence, little can be concluded about loose soil re-entrainment.

5. An assessment was made of the possible error resulting from using only one small area of a hi vol filter for XRF analysis. To test the validity of this procedure, one hi vol filter (No. 123940) was cut in five separate locations and each filter sample run in a different ink color on one XRF spectral plot (Spectrum 23) on 8/29/77. The result is less than $\pm$ ten percent difference in most peaks. Some of this difference can be attributed to the short run time (50 seconds) and the consequent statistical fluctuation which results from a relatively low count density. For all practical purposes, there is no significant difference in the five samples run.

To confirm the low level of nickel and vanadium found on the filters, one filter was extracted ana analyzed on the atomic absorption spectrophotometer. The sample of filter 105690, collected at the Plymouth Avenue site on 2/6/77, showed concentrations of nickel of less than ug/m^3 and vanadium of less than 0.05 ug/m^3.

Sulfate analysis performed on Filters 105689 (Plymouth Avenue 2/9/76) and 105690 (Plymouth Avenue 2/6/76) showed concentrations of about 11 and 8 ug/m^3, respectively.

X-RAY FLUORESCENCE SPECTRUM

Stk. 1

Conditions _____

Taped _____

Analysis Date:

Sample I.D. Filter - stack test #1 - FLS-4174-0.48975.

Operator PS Date: 8-24-77.

Sec: Non Vac ✓

Filter Pb Shield Al

kV 30.0 Ma 1.00 Gain _____

Time 200 Sec. _____ (_____ Ct.)

Chart _____ Span _____

Marker _____ 1 K

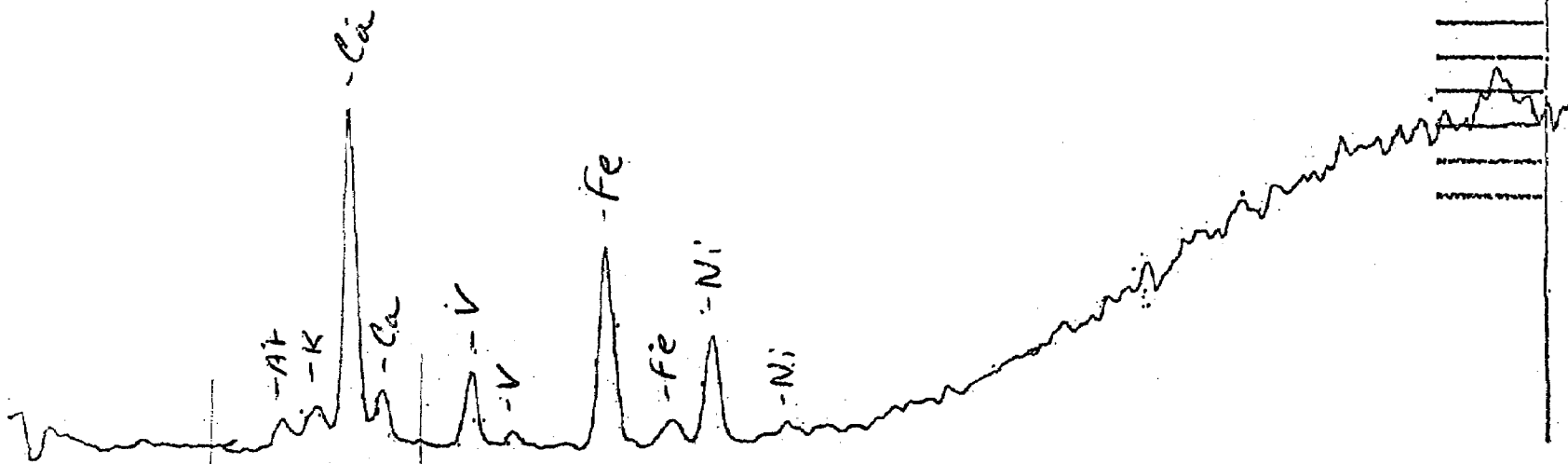
Std. curve No. _____

Cono ____ Pk. Hgt.

By chart # _____

of / /

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		



Brayton Point Stack Test Filter
collected on 7/25/77

Spectrum 1

X-RAY FLUORESCENCE SPECTRUM

818-4

Conditions _____

Taped _____

Analysis Data:

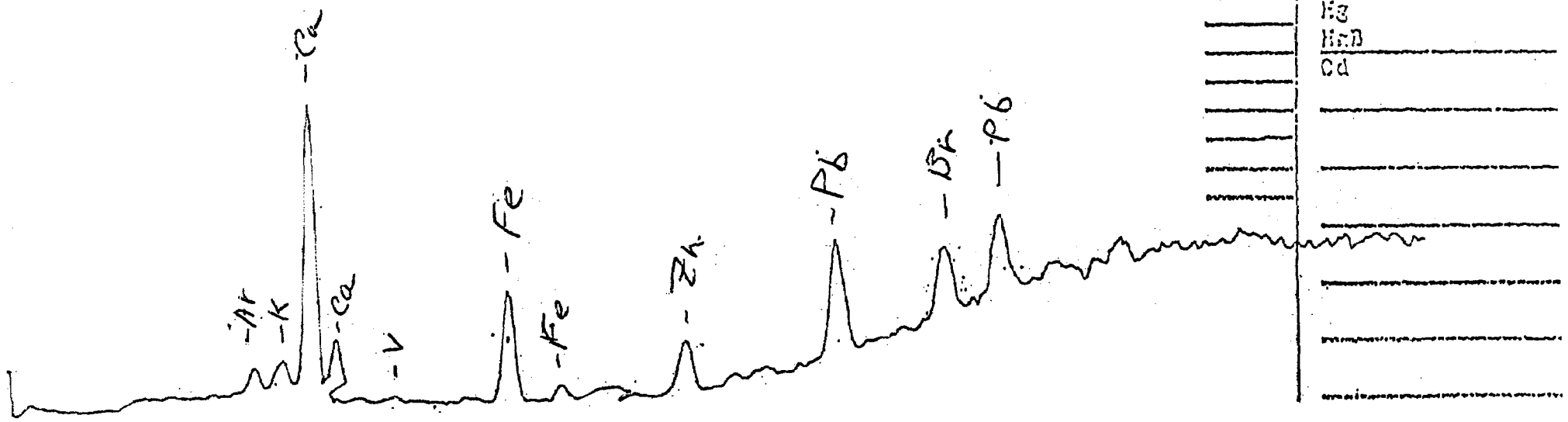
Sample I.D. 105690
Operator RB Date: 8-8-77
Vac. ____ Non Vac ✓
Filter Rh Shield Th
kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. _____ (_____ Ct.)
Start _____ Span _____
Number _____ 1 X

Std. curve No. _____

Conc ____ Pk. Hgt.

By chart # _____
of / /

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		



Plymouth Ave. Filter
2/6/76 54 ug/m^3

Spectrum 2

X-RAY FLUORESCENCE SPECTRUM

P/P-J

Conditions _____

Taped _____

Analysis Date:

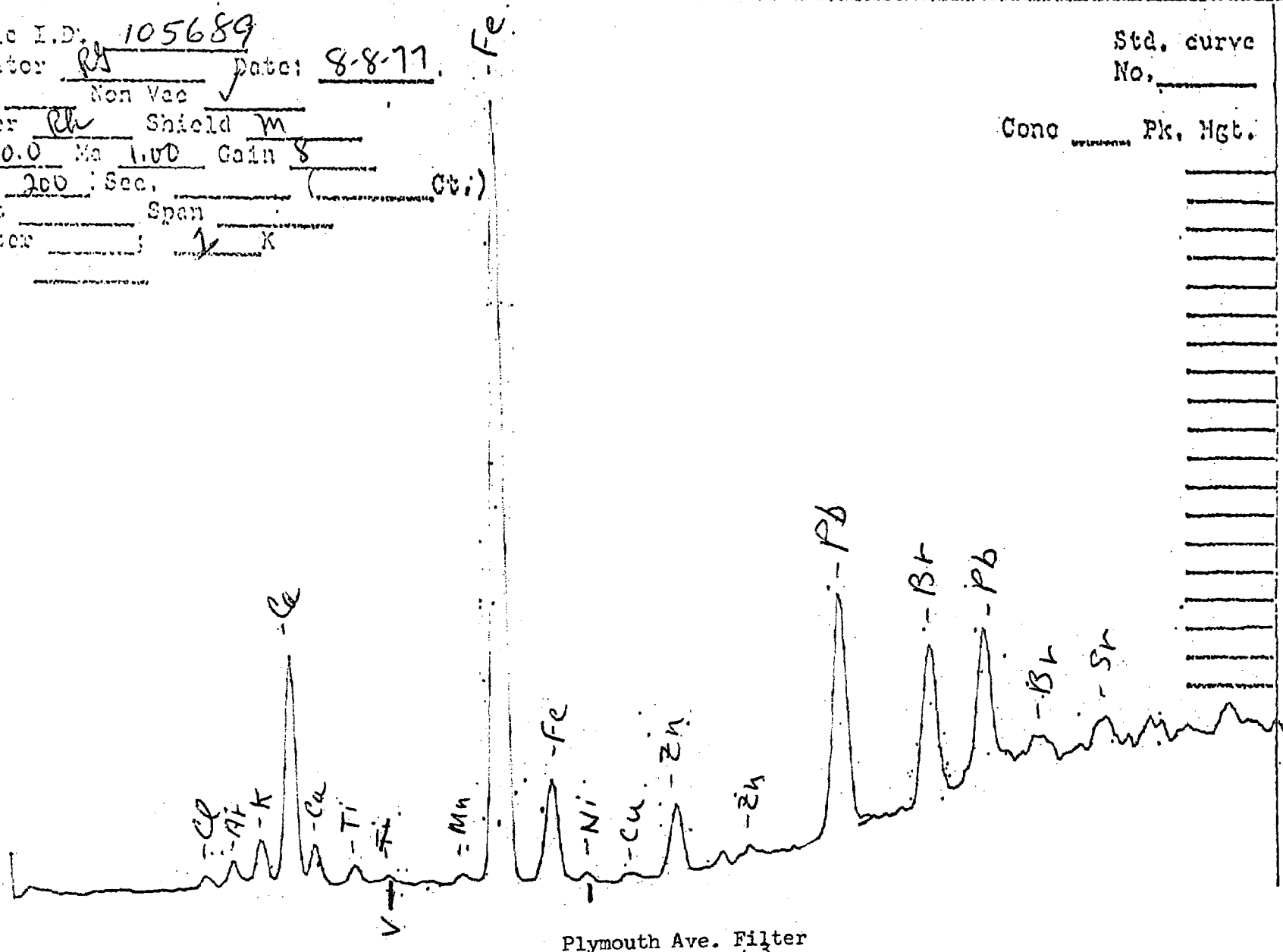
Sample I.D. 105689
Operator RS Date: 8-8-77
Vac: ____ Non Vac ✓
Filter Rh Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. _____ (_____ Ct.)
Start _____ Span _____
Number _____ 1 X

Std. curve No. _____

Conc ____ Pk. Hgt.

By chart # _____
of / /
Elem. mm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Hg
HgB
Cd



Plymouth Ave. Filter
2/9/76 468 ug/m^3

Spectrum 3

X-RAY FLUORESCENCE SPECTRUM

8/8-11

Conditions

Taped

Analysis Data:

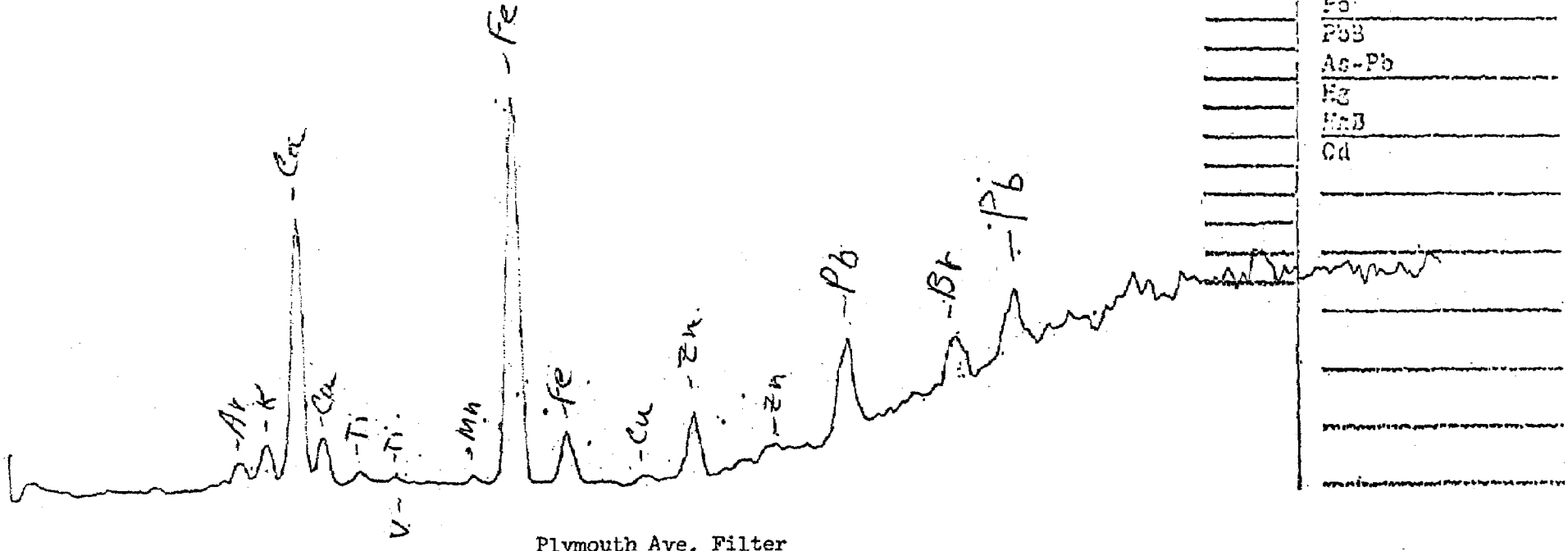
Sample I.D. 105688
Operator RS Date: 8-8-77
Vac: Non Vac
Filter Cu Shield Mo
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. (Ct;)
Start Span
Number 1 K

Std. curve No.

Conc Pk. Hgt.

By chart # Final
of 1 1
Elem. nm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Br
BrB
Cd



Plymouth Ave. Filter
2/12/76 173 ug/m3

Spectrum 4

X-RAY FLUORESCENCE SPECTRUM

818-5

Conditions

Taped

Analysis Data:

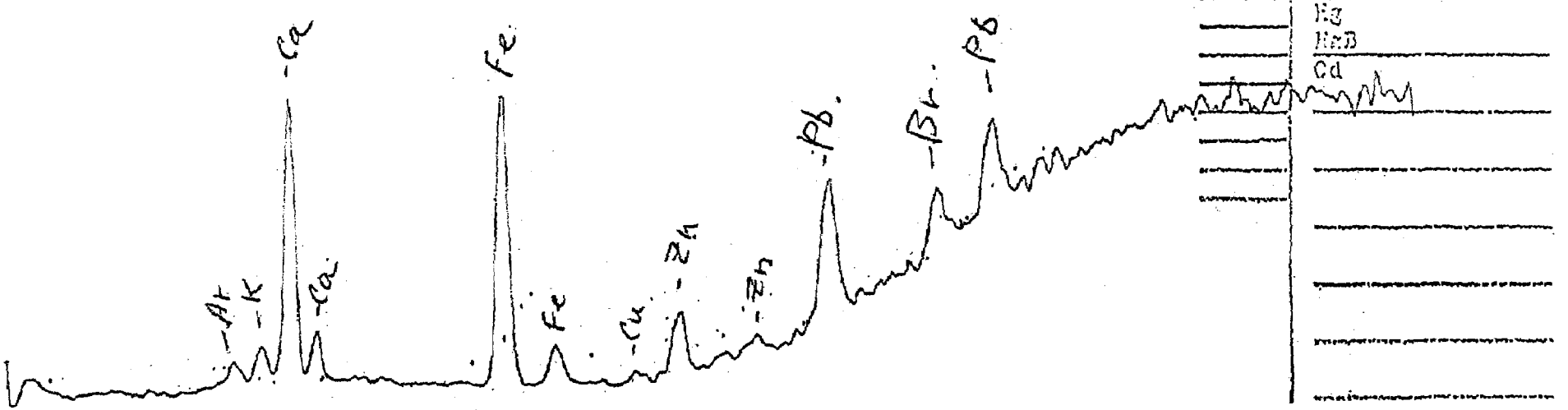
Sample I.D. 117929
Operator RT Date: 8-8-77
Vac: Non Vac ✓
Filter Cu Shield Th
kV 30.0 Ma 1.00 Gain 8
Time 200 Sec. (Ct.)
Start Span
Marker ; 1 K

Std. curve No.

Conc Pk. Hgt.

By chart #
of / /

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		



Plymouth Ave. Filter
4/15/76 153 ug/m^3

Spectrum 5

X-RAY FLUORESCENCE SPECTRUM

8/8-10

Conditions _____

Taped _____

Analysis Data:

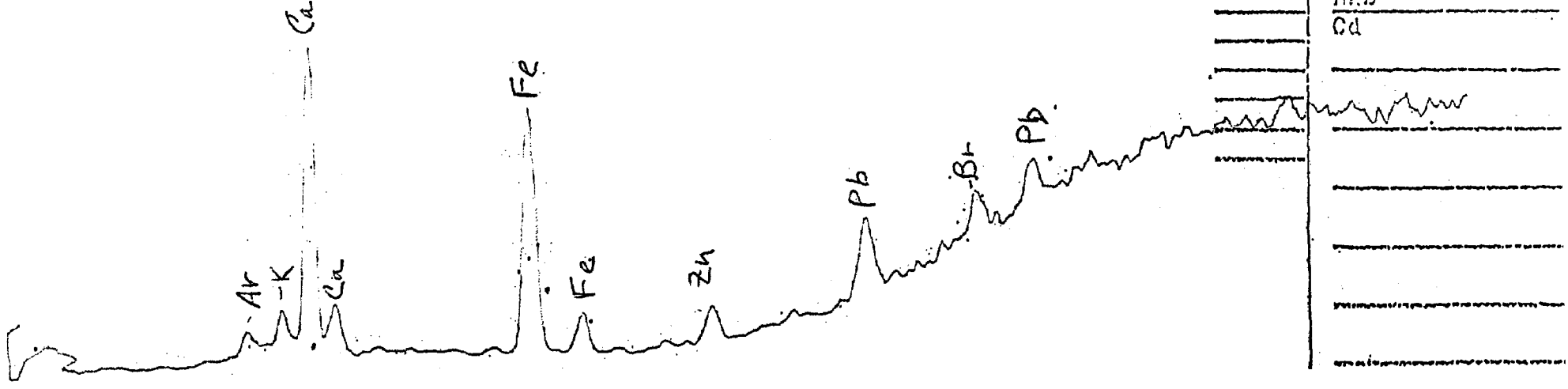
Sample I.D. 117928
Operator RJ Date: 8-8-77
Vac: ____ Non Vac ✓
Filter Rh Shield Th
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. _____ (_____ Ct;)
Start _____ Span _____
Quarter _____; 1 K

Std. curve No. _____

Conc _____ Pk. Hgt.

By chart # _____
of / /
Elem. mm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Hg
HgB
Cd



Plymouth Ave. Filter
4/12/76 67 ug/m^3

Spectrum 6

X-RAY FLUORESCENCE SPECTRUM

818-1

Conditions _____

Taped _____

Analysis Data:

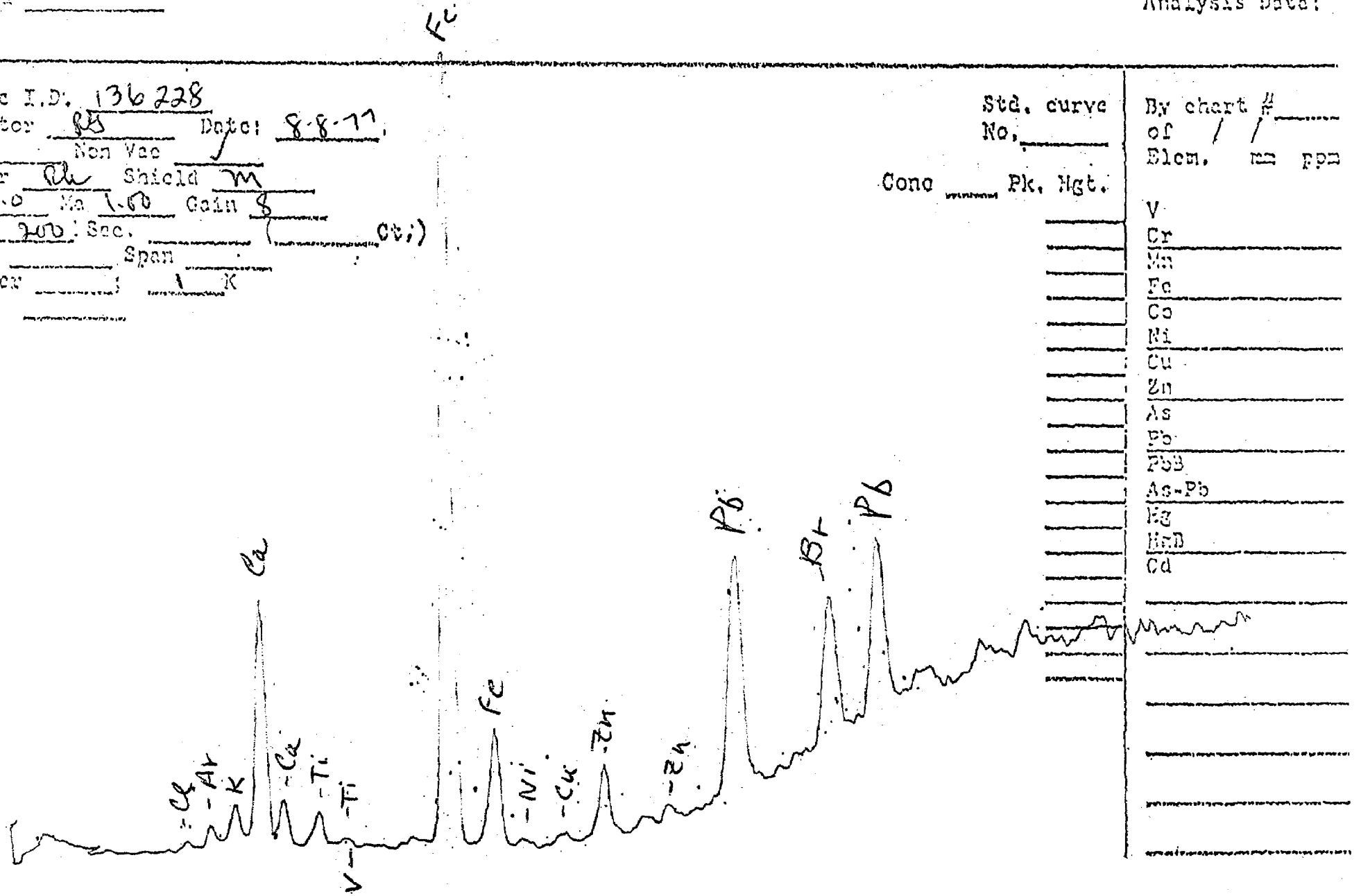
Sample I.D. 136228
Operator RS Date: 8-8-77
Vac: ___ Non Vac ✓
Filter Rh Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. _____ (_____ Cts)
Start _____ Span _____
Number _____ 1 K

Std. curve No. _____

Conc ____ Pk. Hgt.

By chart # _____
of / /

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		



Plymouth Ave. Filter
12/5/76 422 ug/m^3

Spectrum 7

X-RAY FLUORESCENCE SPECTRUM

818-2

Conditions_____

Taped _____

Analysis Data:

Sample I.D. 148955
Operator RS Date: 8-8-77
Vac. ____ Non Vac ✓
Filter Rh Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 ; Sec. _____ (_____ Ct;)
Start _____ Span _____
Number _____; 1 K

Std. curve No._____

Conc _____ Pk. Hgt.

By chart #_____
of / /
Elem. mm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Hg
HgB
Cd

Plymouth Ave. Filter
12/2/76 48 ug/m3

Spectrum 8

X-RAY FLUORESCENCE SPECTRUM

818-8

Condition: _____

Taped _____

Analysis Data:

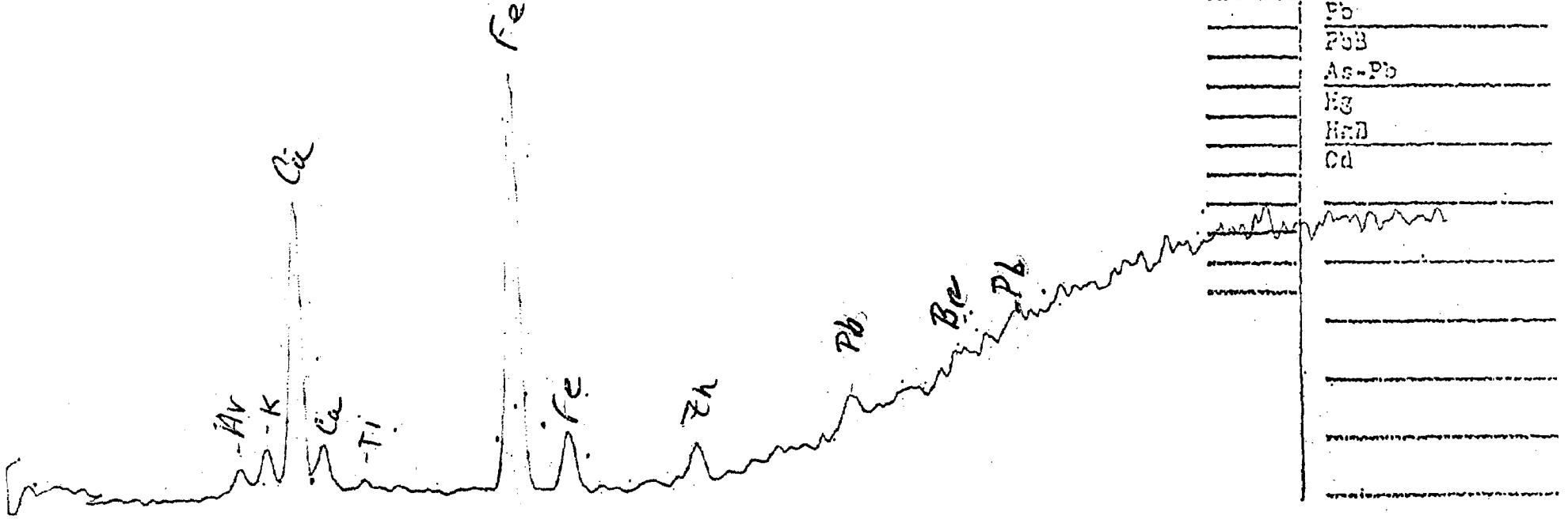
Sample I.D. 117916
Operator RS Date: 8-8-77
Vac: ____ Non Vac ✓
Filter Cu Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. _____ (_____ Ct.)
Start _____ Span _____
Quantex _____; 1 K

Std. curve No. _____

Conc _____ Pk. Hgt.

By chart # _____
of / /

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		



North Main St. Filter
213 ug/m^3 4/9/76

Spectrum 9

X-RAY FLUORESCENCE SPECTRUM

818-7

Conditions_____

Taped _____

Analysis Date:

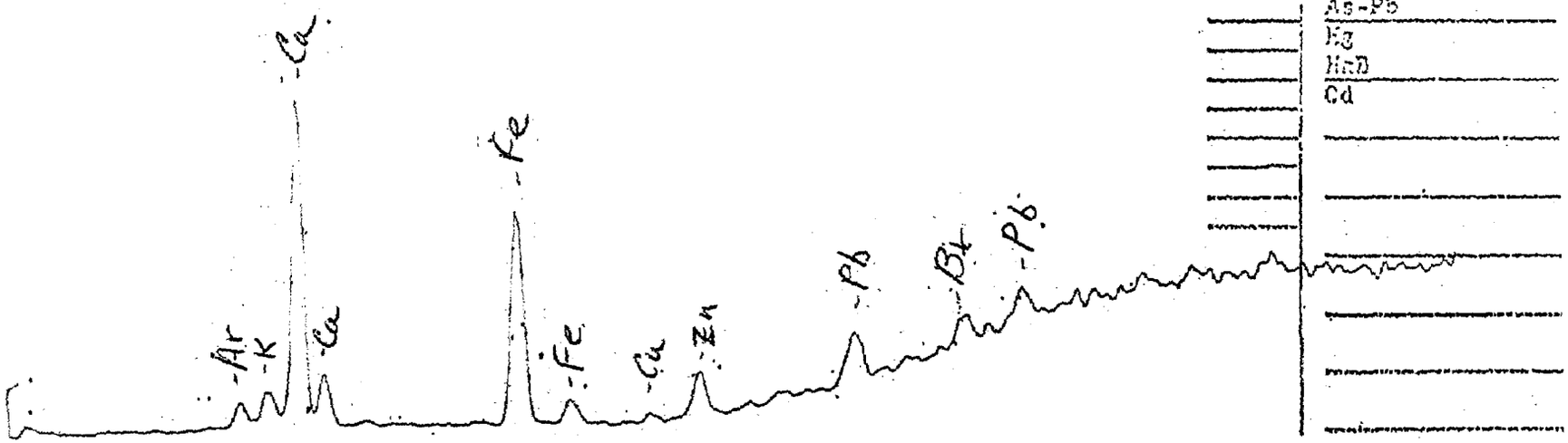
Sample I.D. 117915
Operator RH Date: 8-8-77
Vac. _____ Non Vac ✓
Filter Rh Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. _____ (_____ Ct;)
Start _____ Span _____
Number _____ 1 X

Std. curve No._____

Conc ____ Pk. Hgt.

By chart #_____
of / /
Elem. nm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Kβ
MnO
Cd



North Main St. Filter
4/6/76 74 ug/m^3

Spectrum 10

X-RAY FLUORESCENCE SPECTRUM

8/8-6

Conditions _____

Taped _____

Analysis Data:

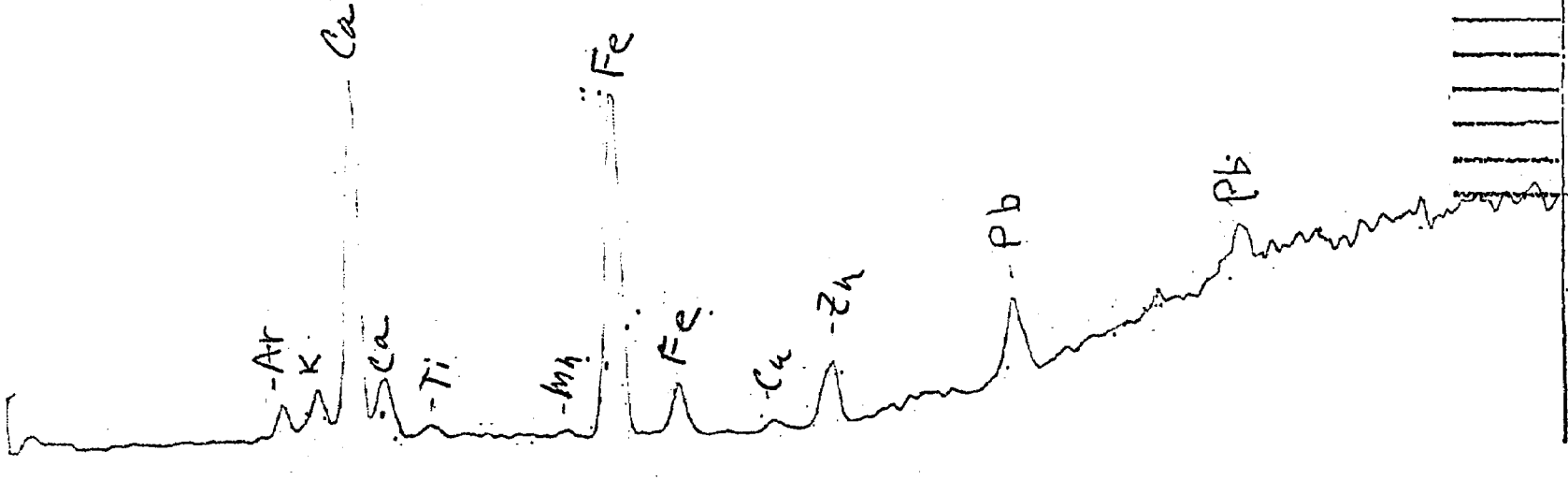
Sample I.D. 123940
Operator PS Date: 8-8-77
Vac. ____ Non Vac ✓
Filter Rh Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. _____ (_____ Ct.)
Start _____ Span _____
Number _____ 1 X

Std. curve No. _____

Conc _____ Pk. Hgt.

By chart # _____
of / /
Elem. mm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Hg
HgB
Cd



North Main St. Filter
175 ug/m^3 6/11/76

Spectrum 11

X-RAY FLUORESCENCE SPECTRUM

818-5

Conditions: _____

Taped _____

Analysis Date:

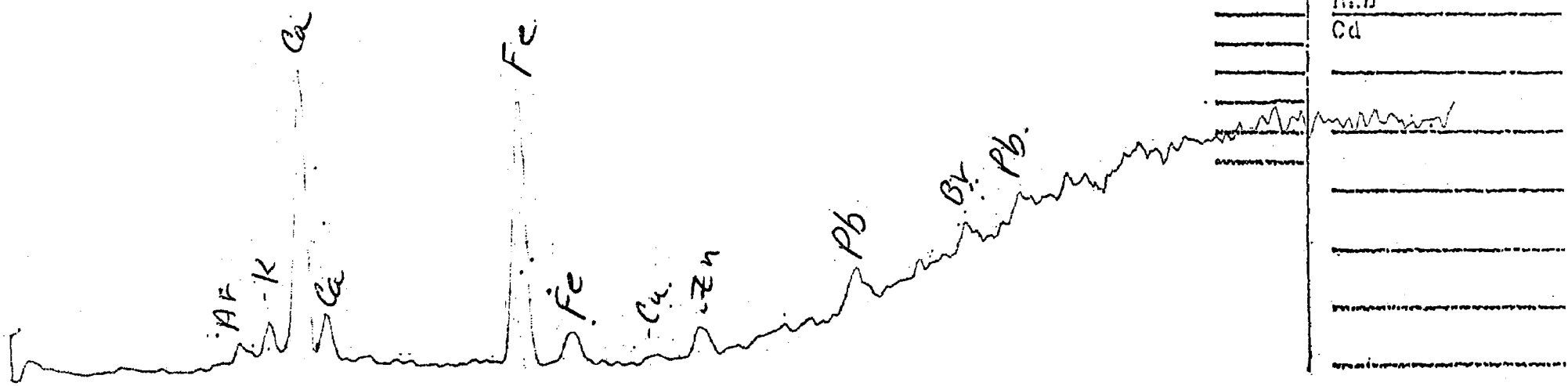
Sample I.D. 123941
Operator [illegible] Date: 8-8-77
Vac: _____ Non Vac ✓
Filter Cu Shield Al
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. _____ (_____ Ct.)
Start _____ Span _____
Number _____; 1 K

Std. curve No. _____

Conc _____ Pk. Hgt.

By chart # _____
of / /
Elem. mm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Hg
HgB
Cd



North Main St. Filter
6/14/77 88 ug/m^3

Spectrum 12

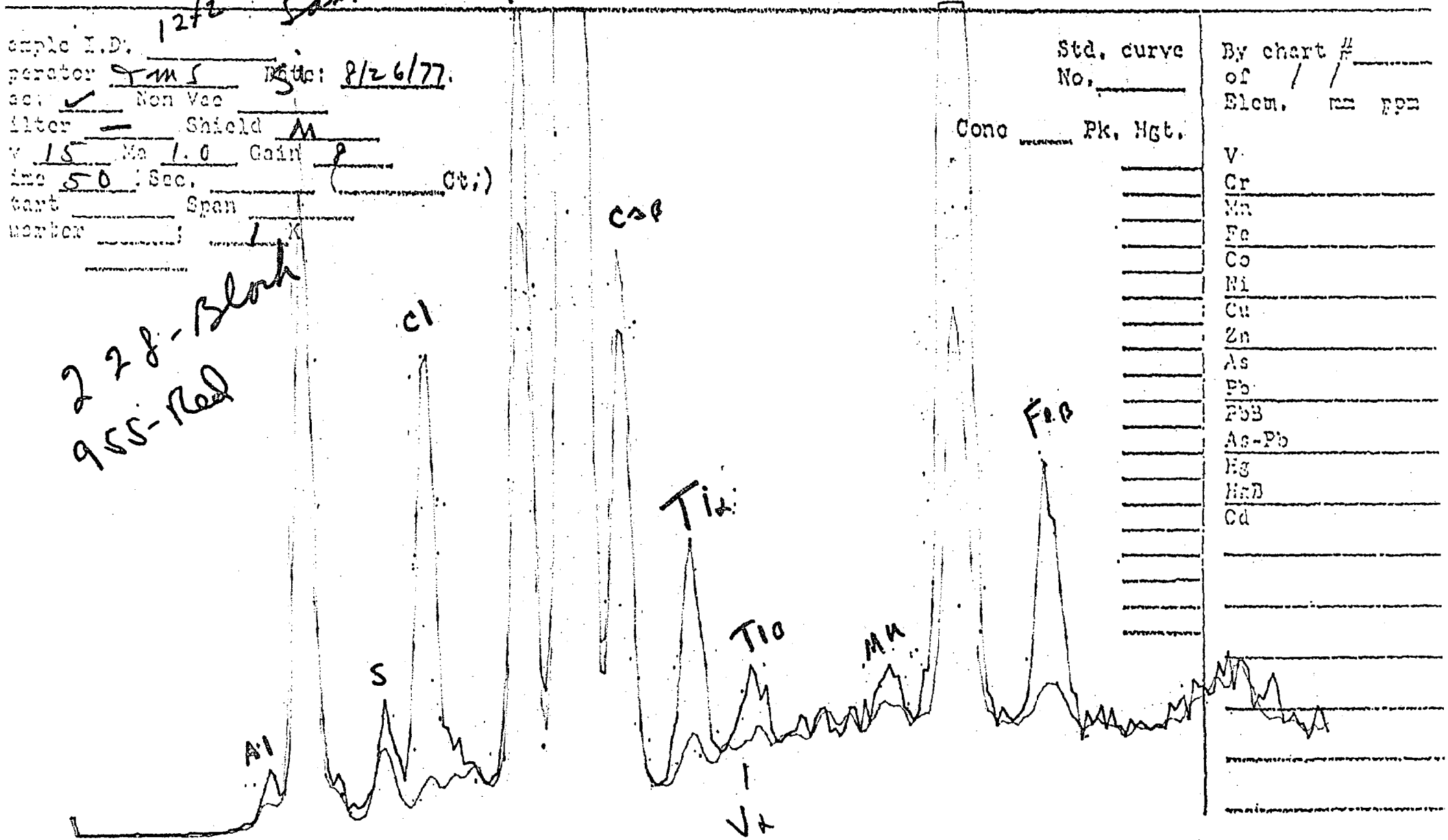
X-RAY FLUORESCENCE SPECTRUM

8126-1

Conditions Li-Vol-1

Taped _____

Analysis Data:



Plymouth Ave. Filters
12/5/76- 422 ug/m^3 Black
12/2/76- 48 ug/m^3 Red

Spectrum 13

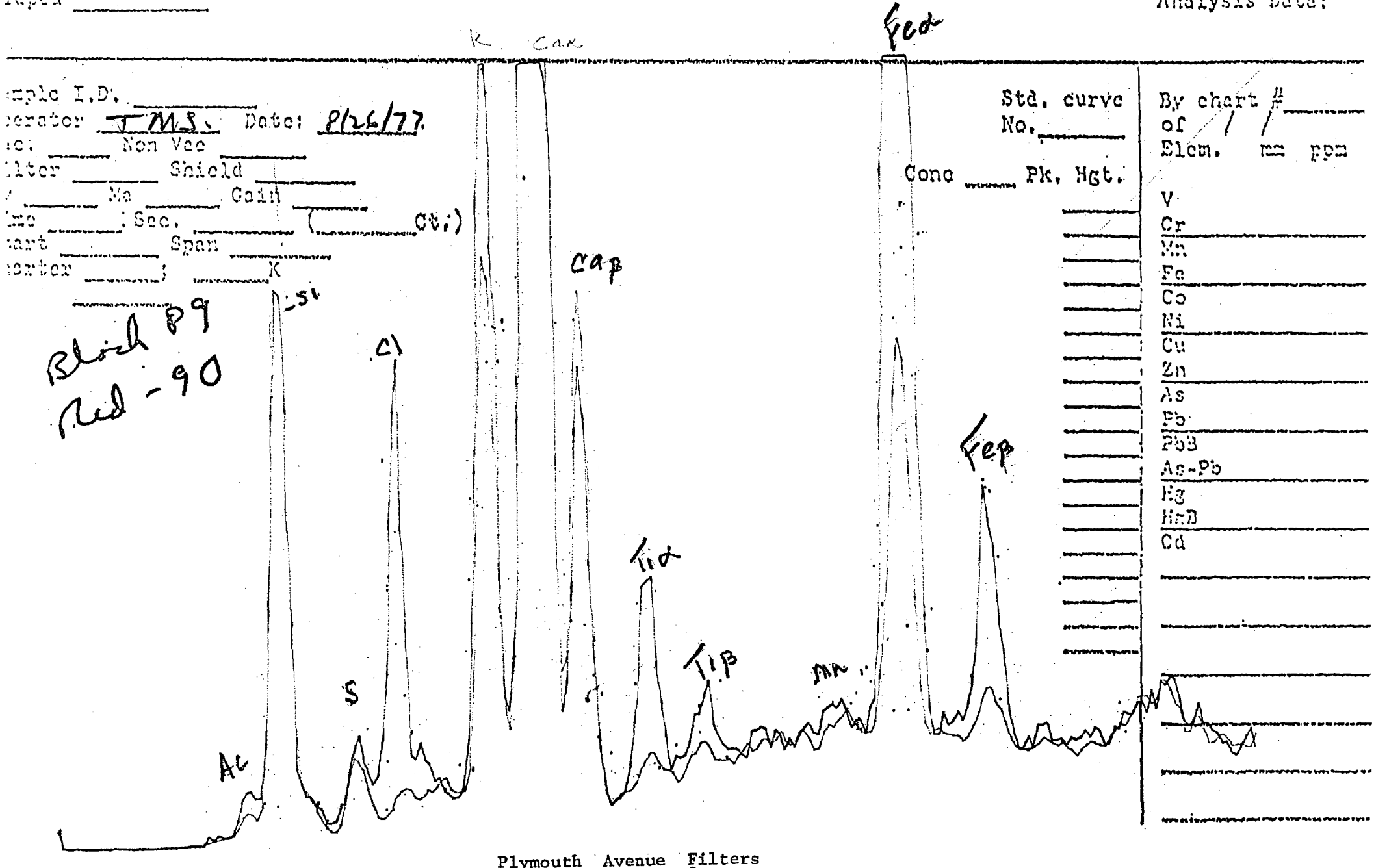
X-RAY FLUORESCENCE SPECTRUM

#8126-2

Conditions _____

Taped _____

Analysis Data:



Sample I.D. _____

Operator TMS. Date: 8/26/77

Sec. _____ Non Vac _____

Filter _____ Shield _____

_____ Ma _____ Gain _____

Time _____ Sec. _____ (_____ Ct;)

Chart _____ Span _____

Number _____; _____ K

Std. curve No. _____

Conc _____ Pk. Hgt.

By chart # _____

of / /

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		

Plymouth Avenue Filters
2/9/76 - 468 ug/m^3 Black
2/6/76 - 54 ug/m^3 Red

Spectrum 14

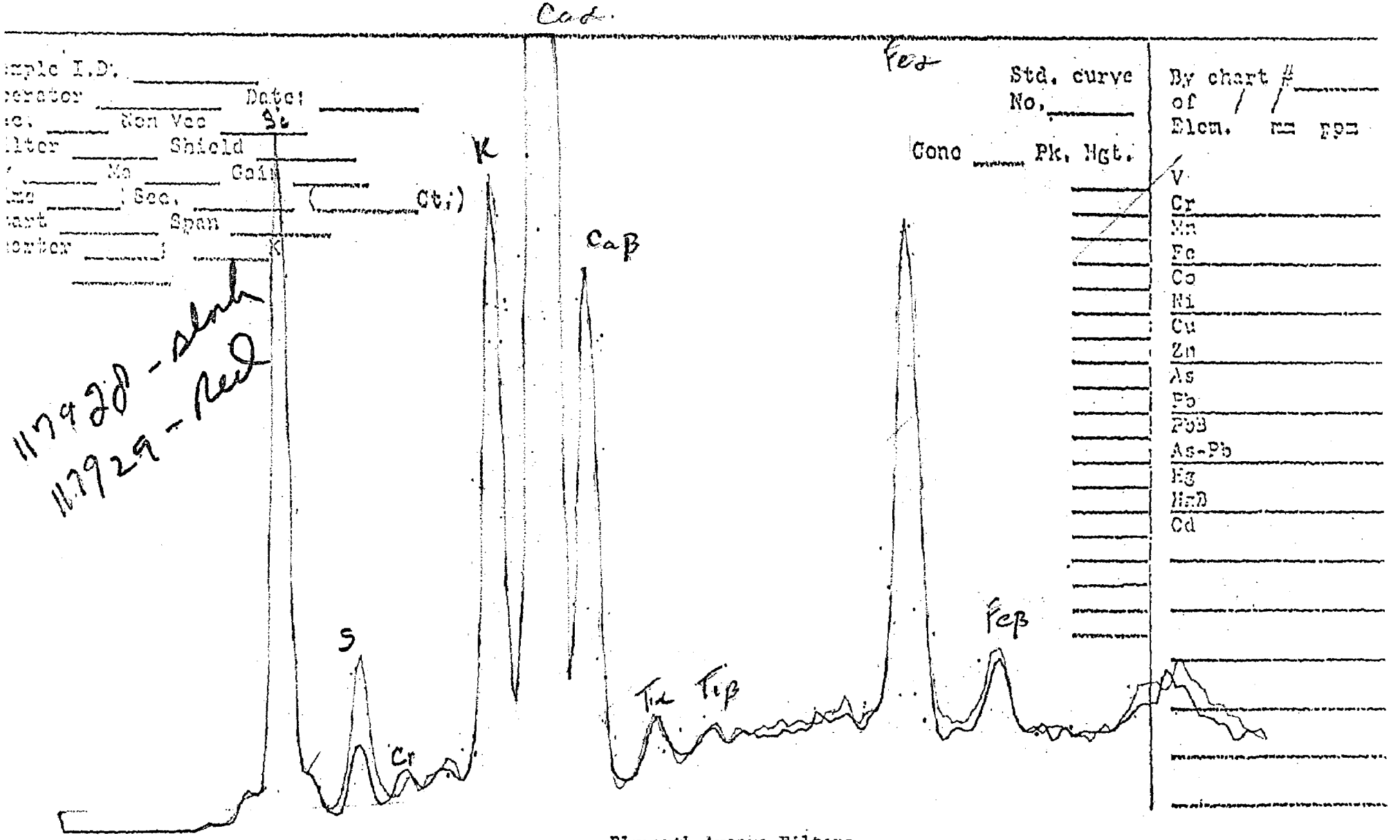
X-RAY FLUORESCENCE SPECTRUM

8/26-5

Conditions _____

Taped _____

Analysis Data:



Plymouth Avenue Filters
4/15/76 - 153 ug/m^3 - Red
4/12/76 - 67 ug/m^3 - Black

Spectrum 15

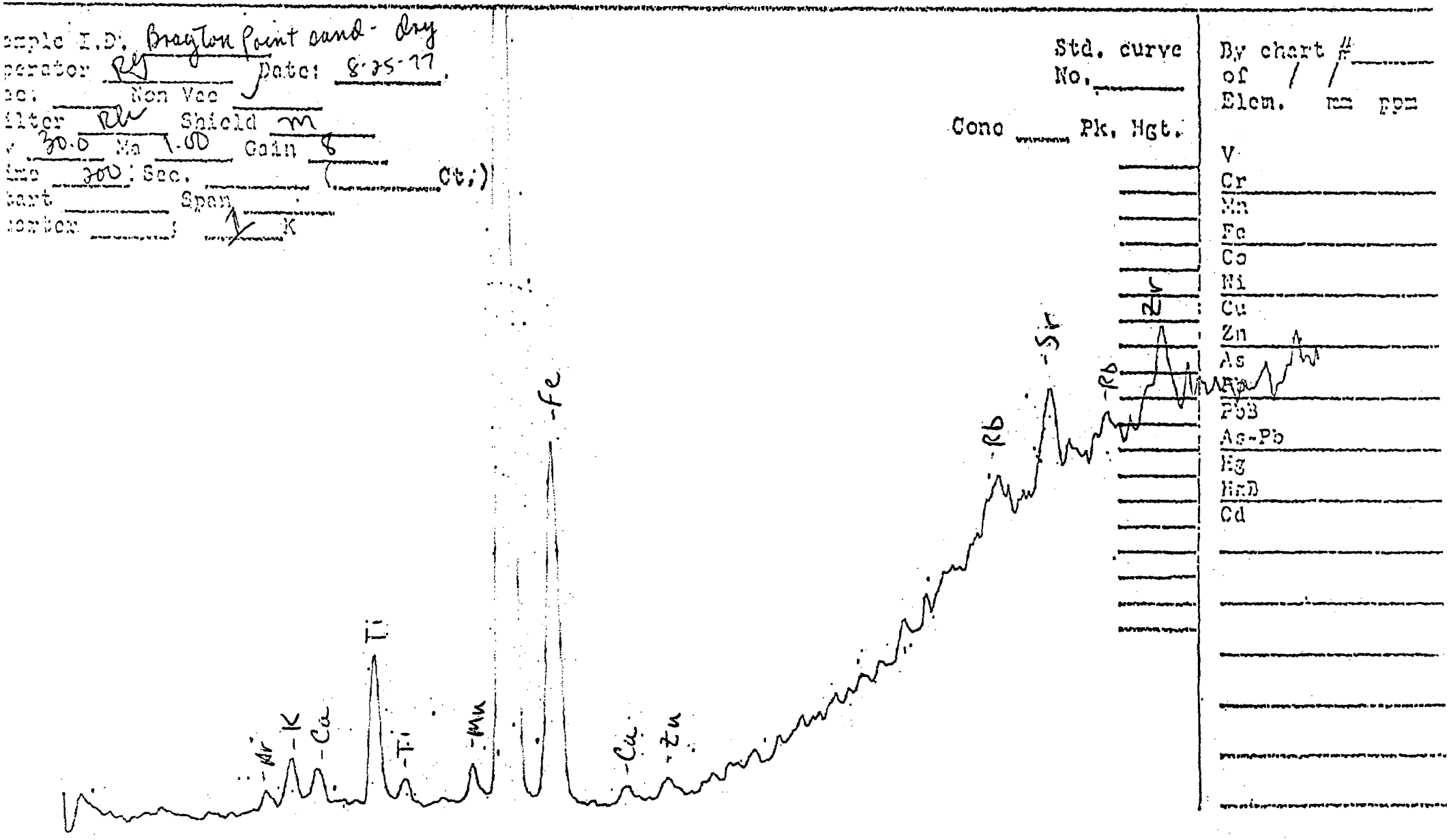
X-RAY FLUORESCENCE SPECTRUM

#8125-1

Conditions

Taped

Analysis Data:



Fall River Public Works' Sand Pile
Sample Collected in August/1977
Dry-Sample

Spectrum 16

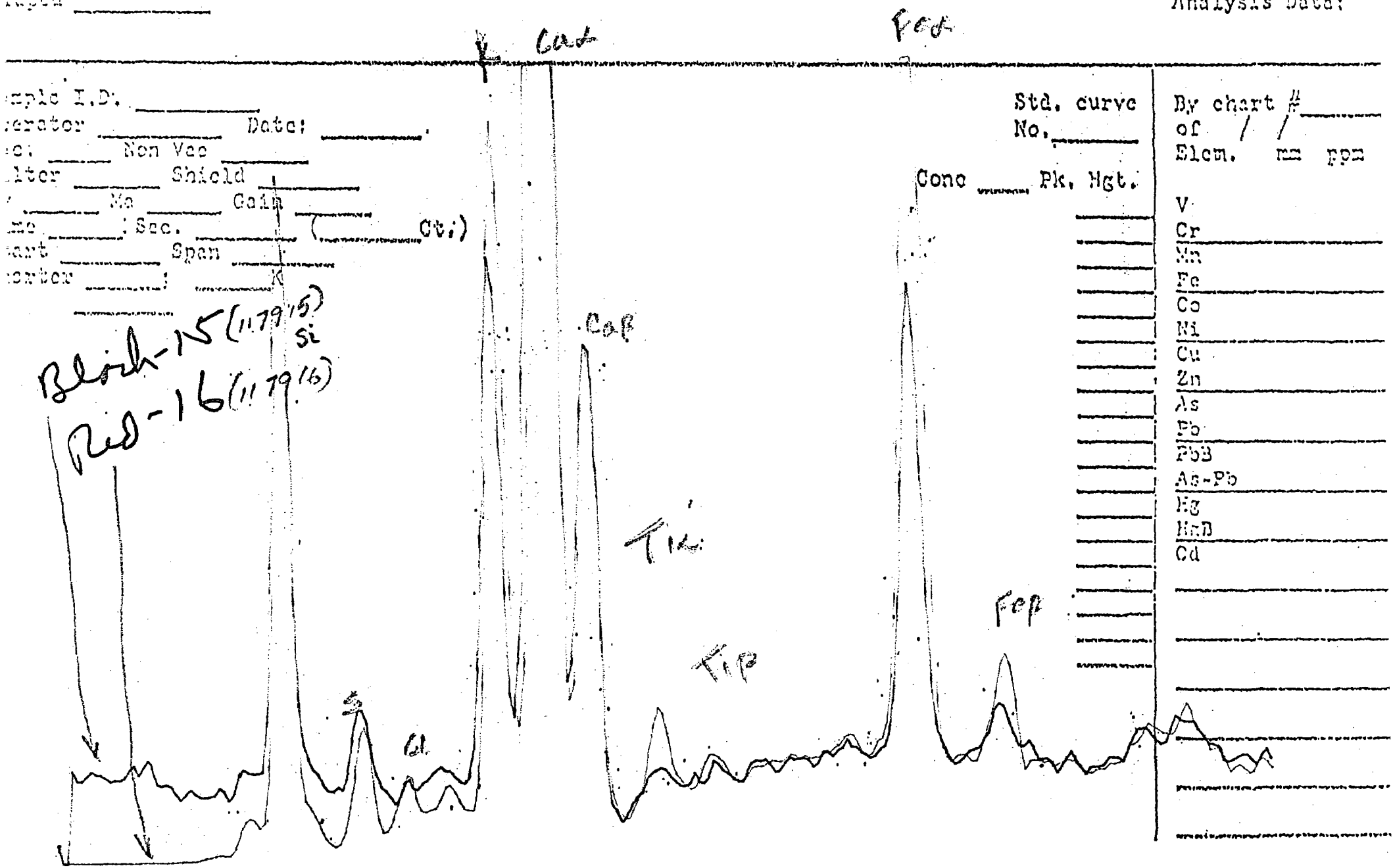
X-RAY FLUORESCENCE SPECTRUM

8126-4

Conditions _____

Taped _____

Analysis Date:



North Main Street Filters
4/9/76 - 213 ug/m^3 - Red
4/6/76 74ug/m^3 - Black

Spectrum 17

X-RAY FLUORESCENCE SPECTRUM

#8/26-3

Conditions__________

Taped __________

Analysis Data:

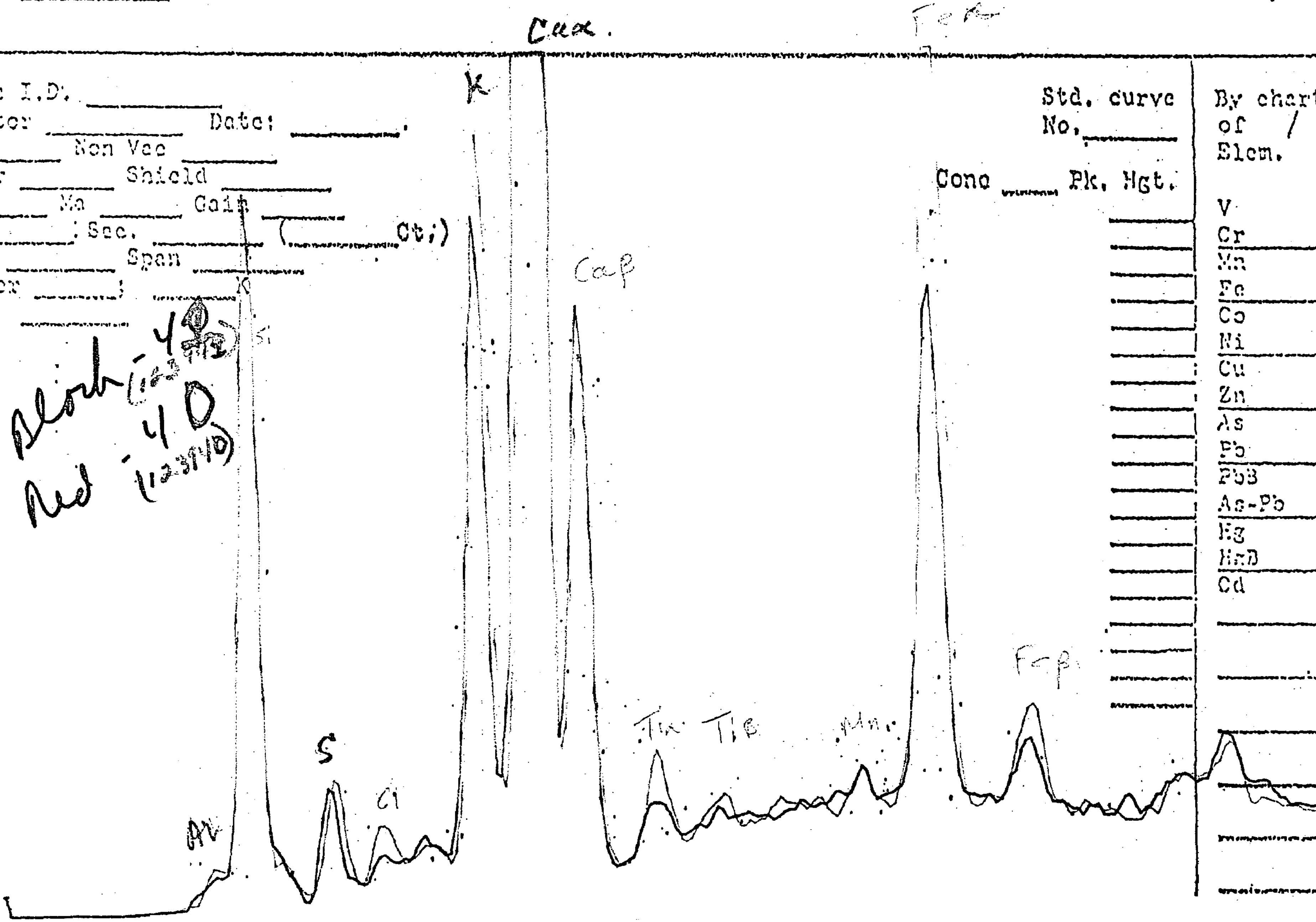
ample I.D. __________
perator __________ Date: __________
ac. ____ Non Vac ______
ilter ______ Shield ______
v ______ Ma ______ Gain ______
ime ______; Sec. ______ (______Ct;)
tart ______ Span ______
order ______; ______

Std. curve No.______

Conc ____ Pk. Hgt.

By chart #______
of / /
Elem. mm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Hg
HgB
Cd



North Main Street Filters
6/11/76 175ug/m^3 - Black
6/14/76 88ug/m^3 - Red

Spectrum 18

X-RAY FLUORESCENCE SPECTRUM

#8115-1

Conditions Dirt

Taped

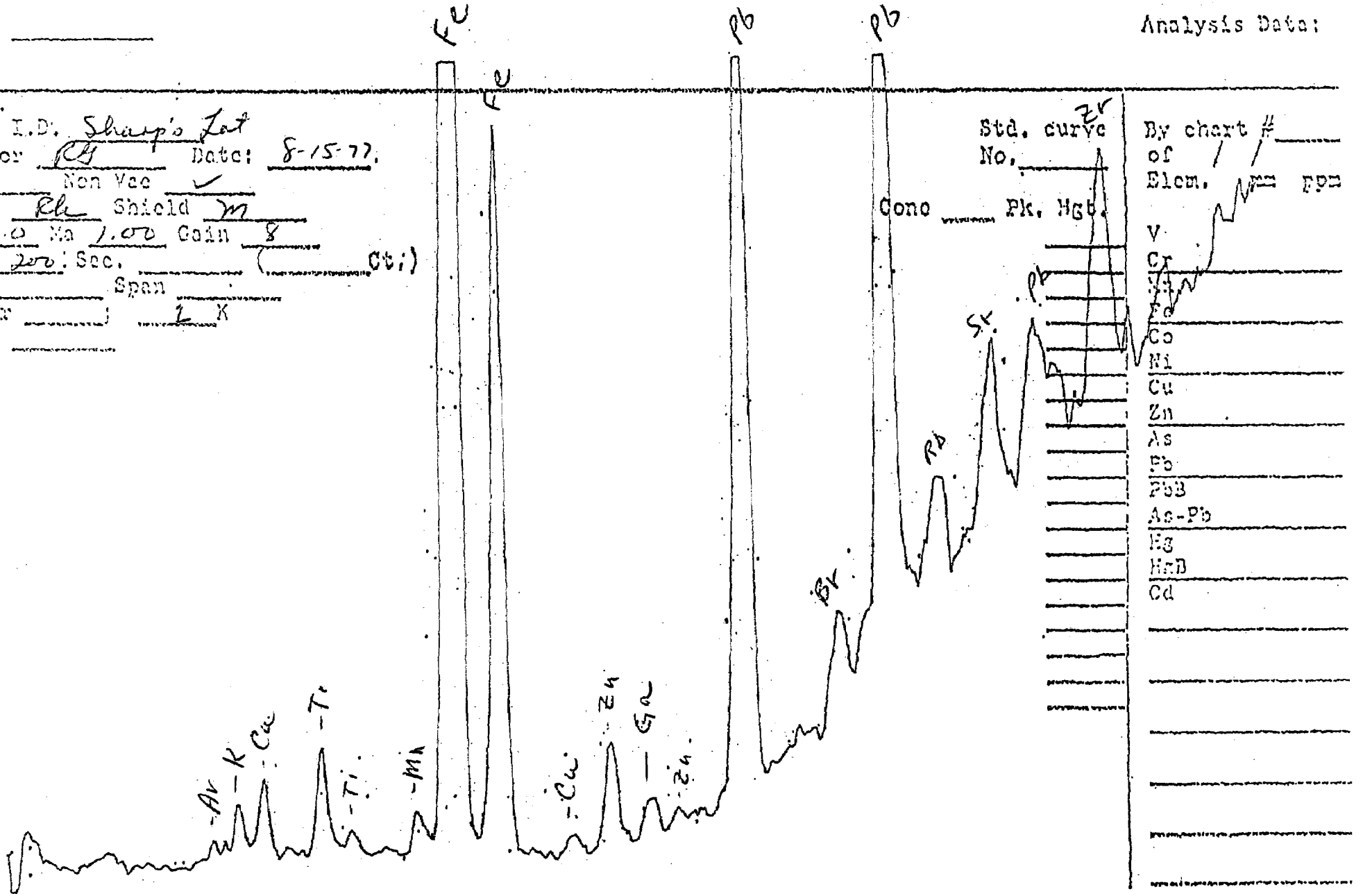
Analysis Data:

Sample I.D. Sharp's Lot
Operator RG Date: 8-15-77
Vac: Non Vac ✓
Filter Rh Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. (Ct;)
Start Span
Number 2 X

Std. curve No.
Conc Pk. Hgt.

By chart # / /
of
Elem. ppm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Hg
HgB
Cd



SHARPS LOT _ ROADSIDE DIRT

Spectrum 19

X-RAY FLUORESCENCE SPECTRUM

8115-2

Conditions

Taped

Dust

Analysis Data:

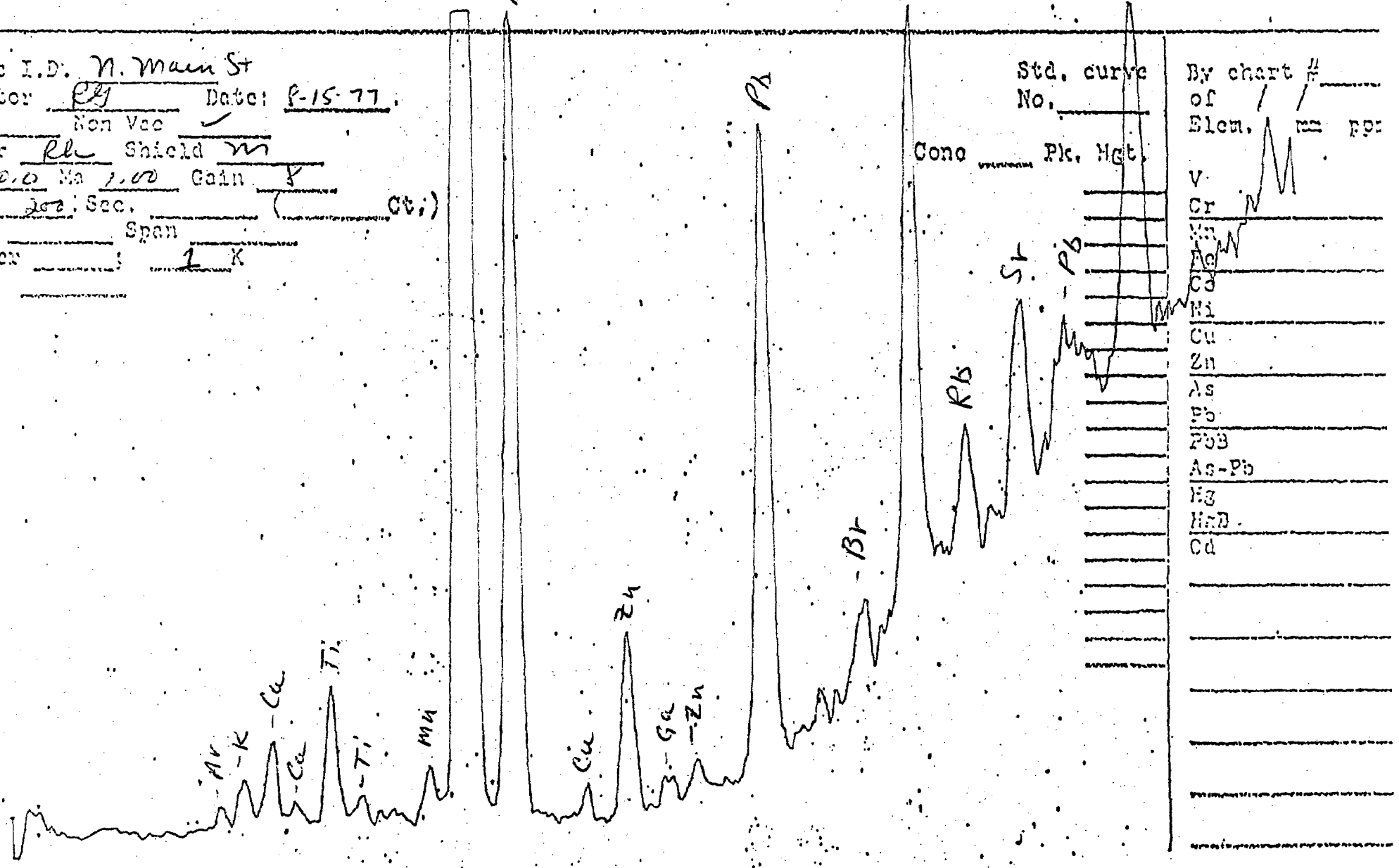
Sample I.D. N. Main St
Operator RJ Date: 8-15-77
Vac: Non Vac ✓
Filter Rh Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. (Ct;)
Start Span
Number ; 1 K

Std. curve No.

Conc Pk. Hgt.

By chart #
of / /
Elem. ppm

V
Cr
Mn
Ag
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Rb
RbD
Cd



NORTH MAIN STREET _ ROADSIDE DIRT

Spectrum 20

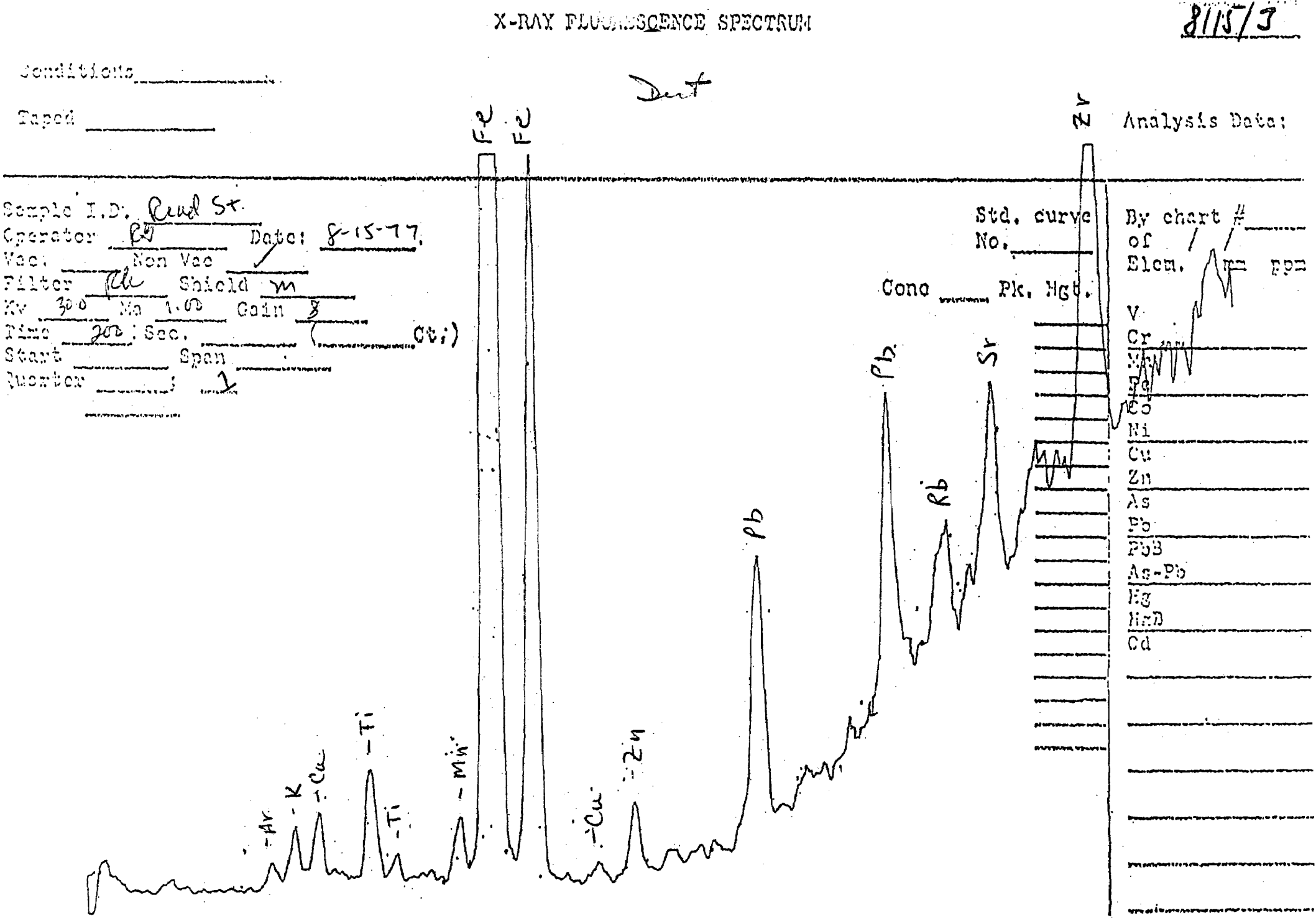
X-RAY FLUORESCENCE SPECTRUM

8115/3

Conditions _____

Taped _____

Dirt



Analysis Data:

Sample I.D. Read St.

Operator RD Date: 8-15-77

Vac: _____ Non Vac ✓

Filter Cu Shield M

Kv 30.0 Ma 1.00 Gain 8

Time 200 Sec. _____ (_____ Ct;)

Start _____ Span _____

Quarter _____ ; 1

Std. curve No. _____

Conc _____ Pk. Hgt.

By chart # _____

of / /

Elem.	ppm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		

READ STREET ROADSIDE DIRT

Spectrum 21

X-RAY FLUORESCENCE SPECTRUM

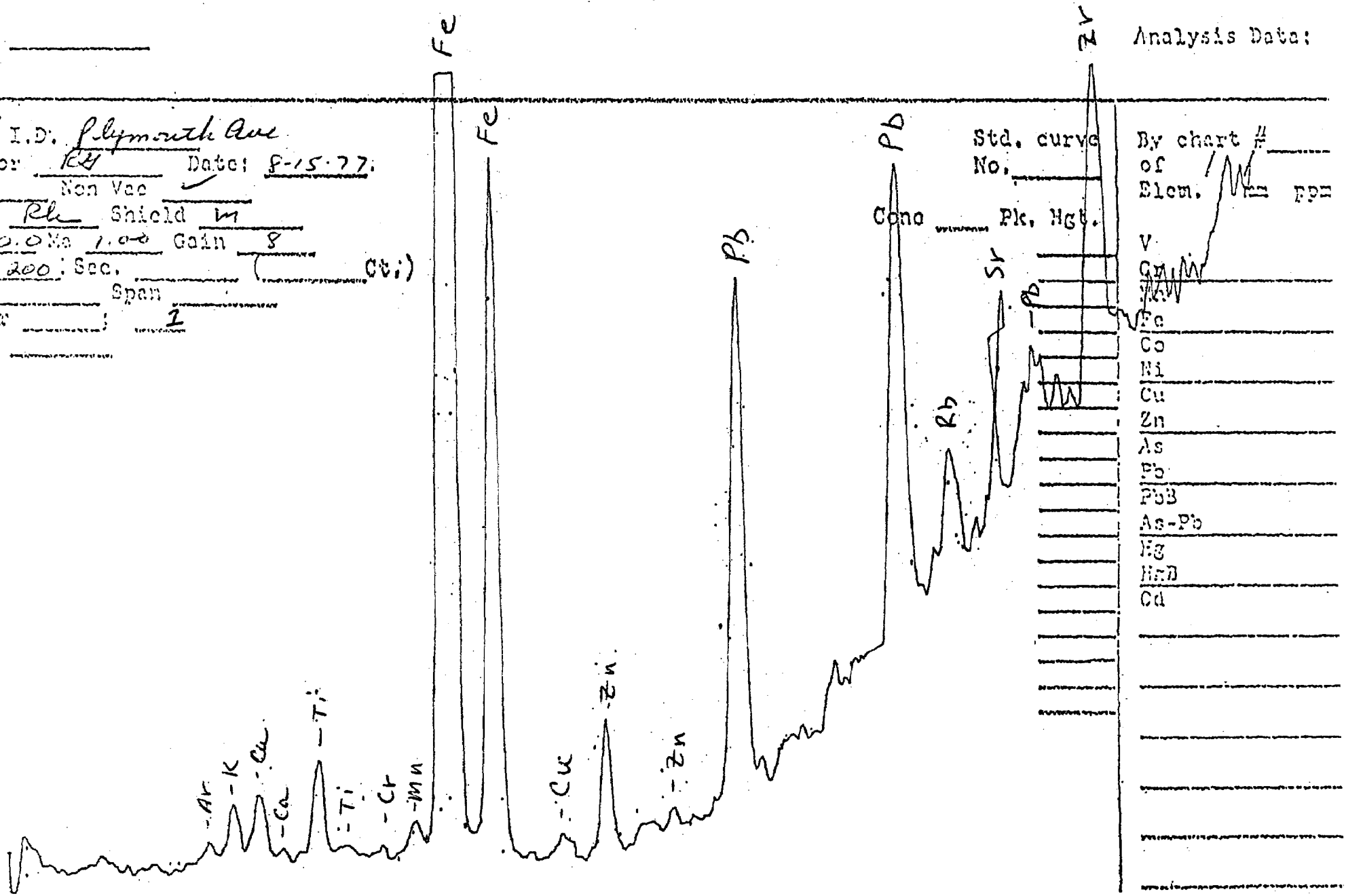
8175-4

Conditions Dirt

Taped

Analysis Data:

Sample I.D. Plymouth Ave
Operator KH Date: 8-15-77
Vac: Non Vac ✓
Filter Rh Shield M
Kv 30.0 Ma 1.00 Gain 8
Time 200 Sec. (Ct;)
Start Span
Number ; 1



Std. curve No.
Conc Pk. Hgt.

By chart # / of
Elem. ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Rb
Hg
Cd

Plymouth Avenue
Roadside Dirt

Spectrum 22

X-RAY FLUORESCENCE SPECTRUM

#8-17

onditions -V l-2

aped ____

ple I.D. 5 cuts of Filter #123940

rator ____ Date: 8/29/77

✓ Non Vac

ter — Shield M

15 Ma 1.0 Gain 16

50 Sec. ____ (____ Ct;)

rt ____ Span ____

mber ____ ; 5 K

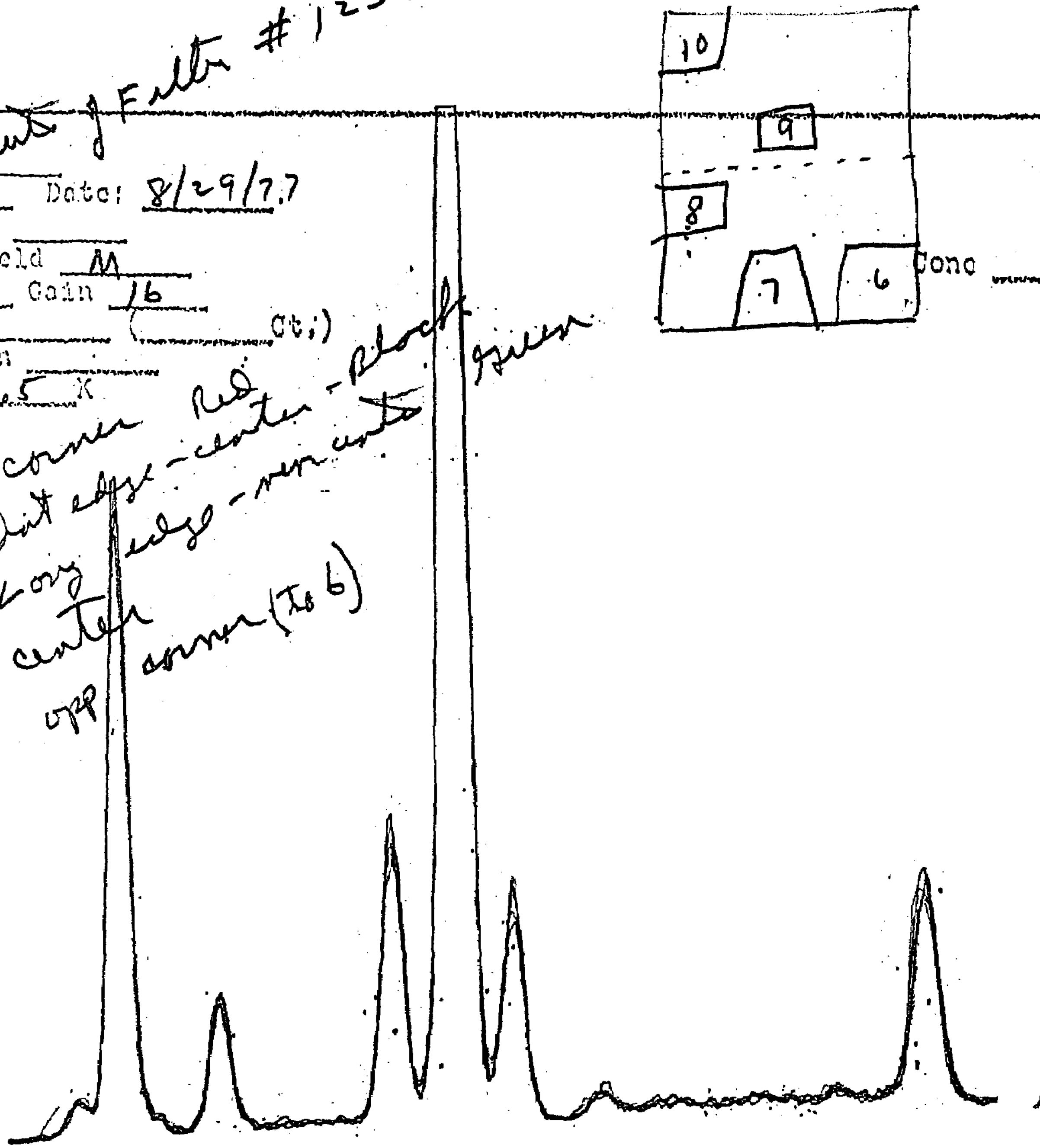
#6 corner Red

#7 short edge - center - black

#8 Long edge - near center green

#9 center

#10 opp corner (to 6)



Analysis Data:

Std. curve No. ____

Conc ____ Pk. Hgt.

By chart # ____ of / /

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		

Filter Representativeness Test

Spectrum 23

X-RAY FLUORESCENCE SPECTRUM

6

Conditions LLiv8-2

Taped ______ Analysis Data:

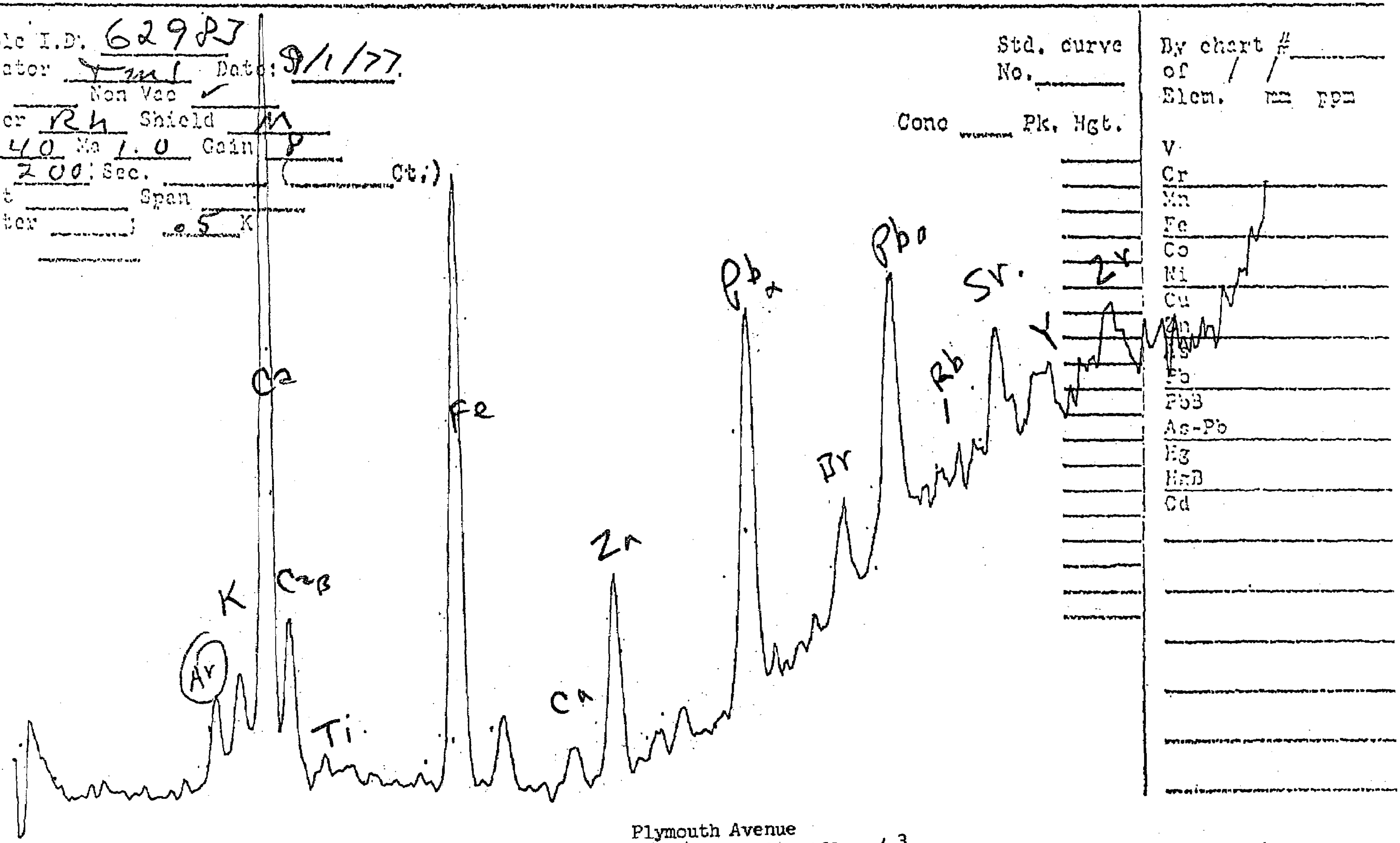
Sample I.D. 6298J
Operator Tml Date: 9/1/77
Vac. ____ Non Vac ✓
Filter Rh Shield Mo
kV 40 Ma 1.0 Gain 8
Time 200 Sec. ______ (______Ct.)
Start ______ Span ______
Marker ______ .5 K

Std. curve No. ______

Conc ____ Pk. Hgt.

By chart # ______ of / /

Elem. mm ppm



Plymouth Avenue
5/21/75 TSP 131 ug/m^3
Sulfates 22.9 ug/m^3

Spectrum 24

X-RAY FLUORESCENCE SPECTRUM

#1

Conditions: W-Vol-1

Taped _____

Analysis Data:

Sample I.D. 629 P3

Operator TMC Date: 9/1/77

Sec: ↙ Non Vac

Filter — Shield M

V 15 Ma 1.0 Gain 16

Time 50 ; Sec. _____ (_____ Ct;)

Start _____ Span _____

Counter _____; .5 K

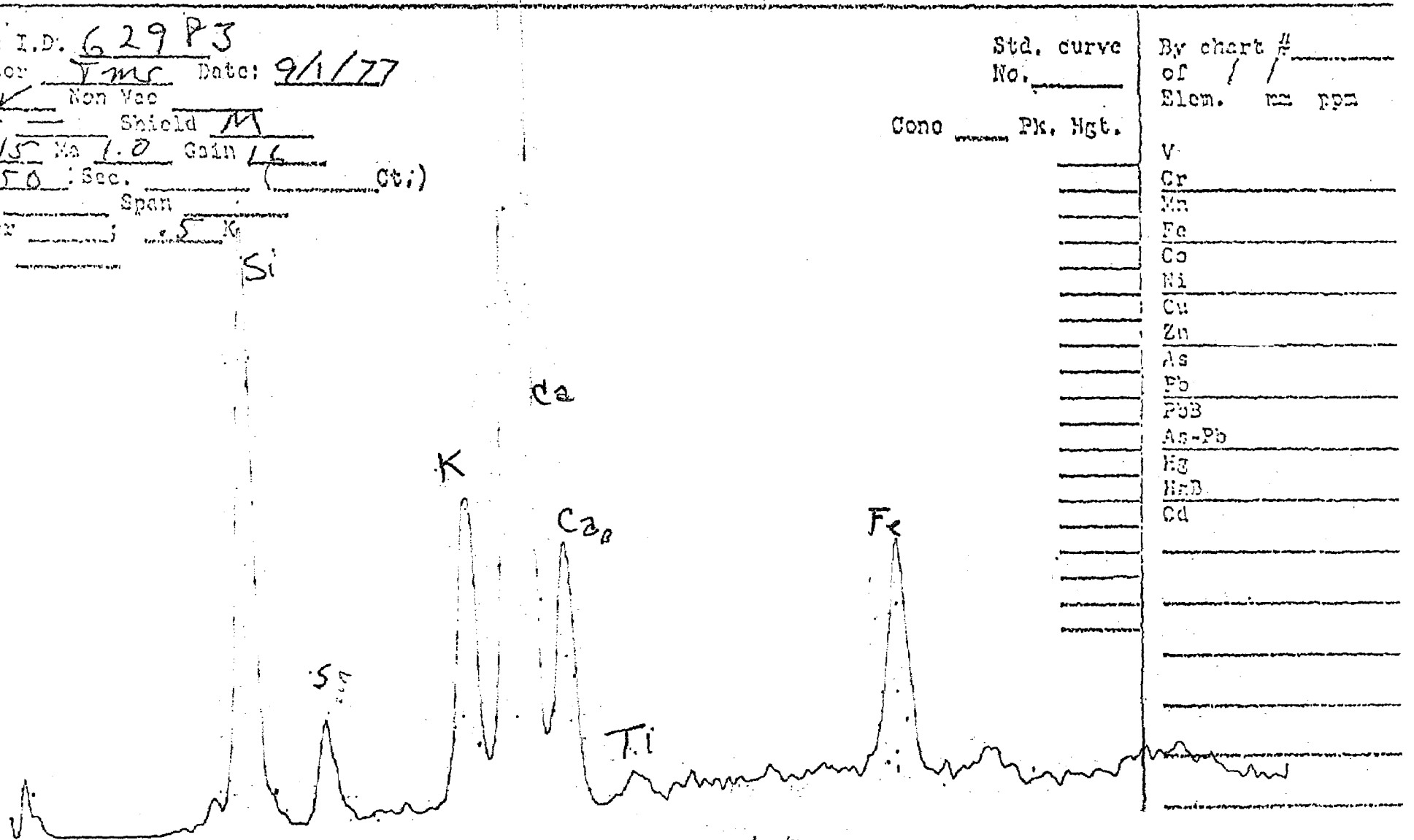
Std. curve No. _____

Cono ____ Pk. Hgt.

By chart # _____

of 1 1

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Hg		
HgB		
Cd		



Plymouth Avenue 5/21/75
TSP 131 ug/m^3 Sulfates 22.9 ug/m^3

Spectrum 25

X-RAY FLUORESCENCE SPECTRUM

#2

Conditions Fe-Ul-1

Taped _____

Analysis Data:

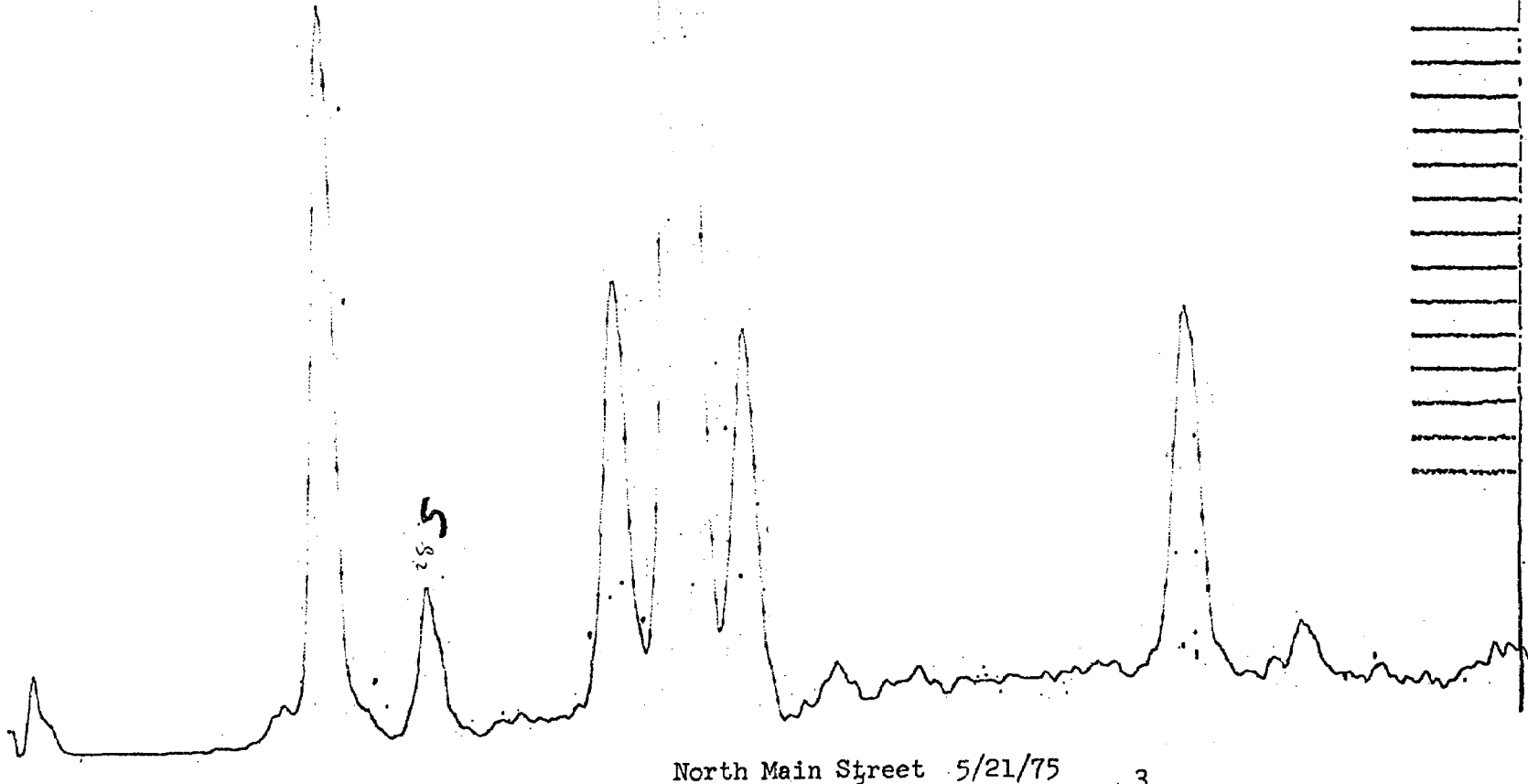
Sample I.D. 63601
Operator TMS Date: 9/1/77.
Sec. ____ Non Vac _____
Filter _____ Shield _____
V _____ Ma _____ Gain _____
Time _____ Sec. _____ (_____ Ct;)
Chart _____ Span _____
Number _____; _____ K

Std. curve No. _____

Conc ____ Pk. Hgt.

By chart # _____
of / /
Elem. mm ppm

V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Pb
PbB
As-Pb
Hg
HgB
Cd



North Main Street 5/21/75
TSP 156 ug/m^3 Sulfates 28 ug/m^3

Spectrum 26

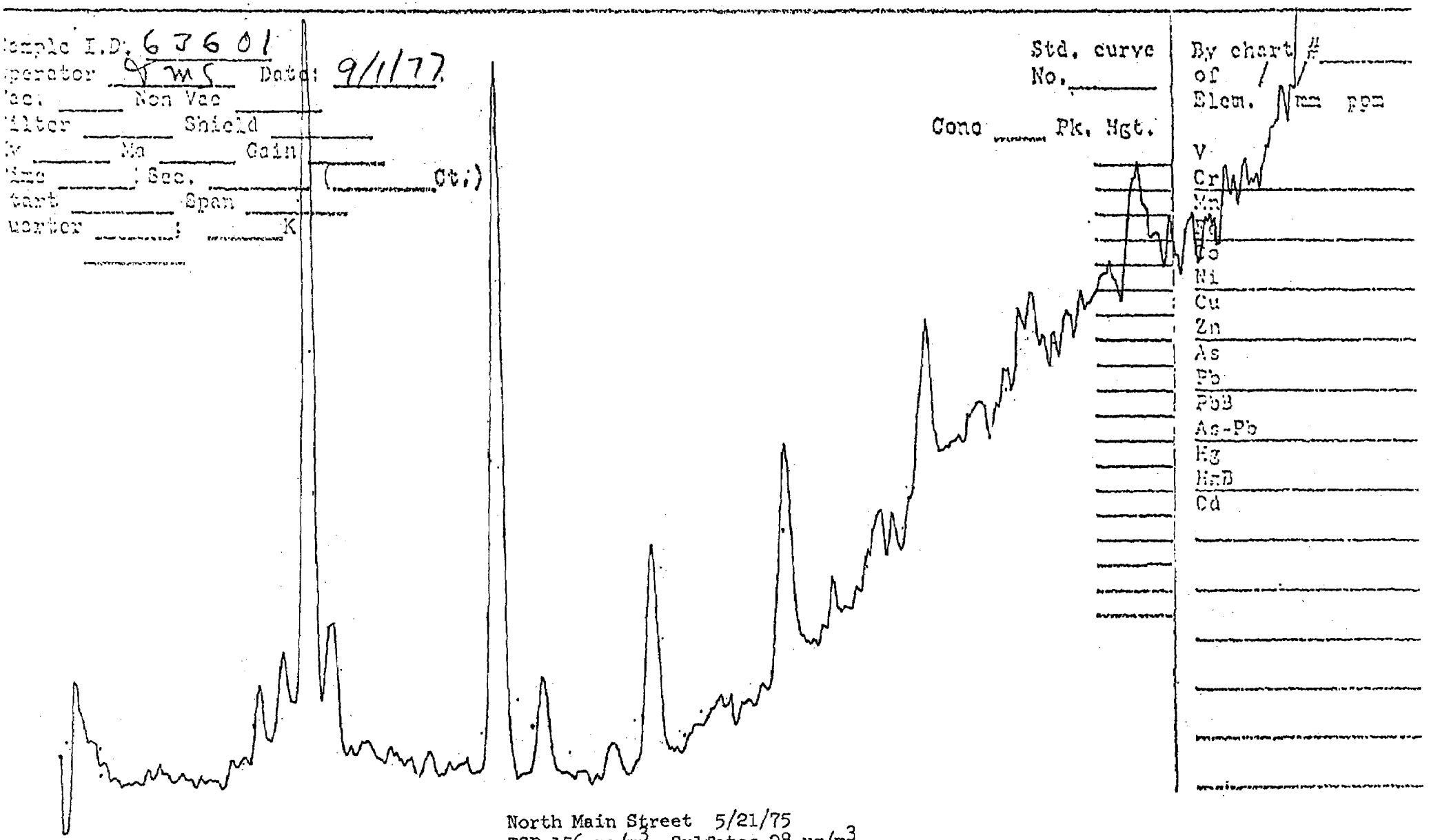
X-RAY FLUORESCENCE SPECTRUM

#8

Conditions Ti Vol - 2

Taped _____

Analysis Data:



North Main Street 5/21/75
TSP 156 ug/m^3 Sulfates 28 ug/m^3

Spectrum 27

X-RAY FLUORESCENCE SPECTRUM

5

Conditions 1/4 Vol -1

Taped _____

Analysis Data:

Sample I.D. 6378 J

Operator TMS Date: 9/1/77

Vac. _____ Non Vac _____

Filter _____ Shield _____

kv _____ Ma _____ Gain _____

Time _____ Sec. _____ (_____ Ct;

Start _____ Span _____

Marker _____; _____ K

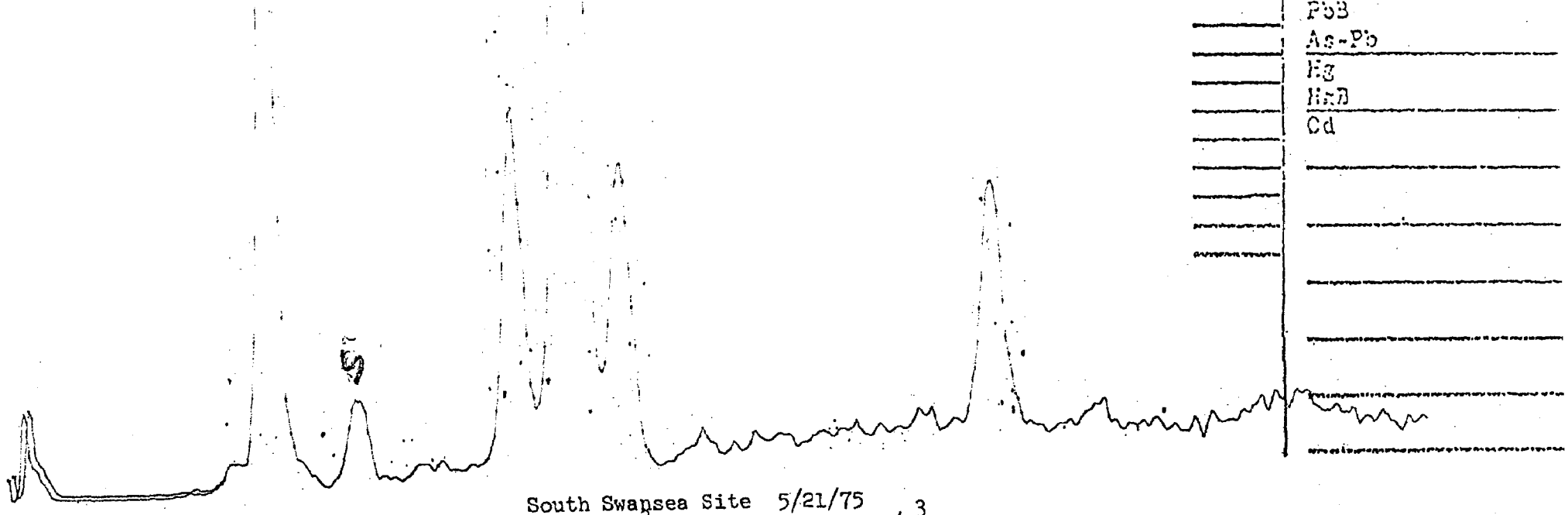
Std. curve No. _____

Cono ____ Pk. Hgt.

By chart # _____

of / /

Elem.	mm	ppm
V		
Cr		
Mn		
Fe		
Co		
Ni		
Cu		
Zn		
As		
Pb		
PbB		
As-Pb		
Br		
BrB		
Cd		



South Swansea Site 5/21/75
TSP 74ug/m^3 Sulfates 20.9 ug/m^3

Spectrum 28

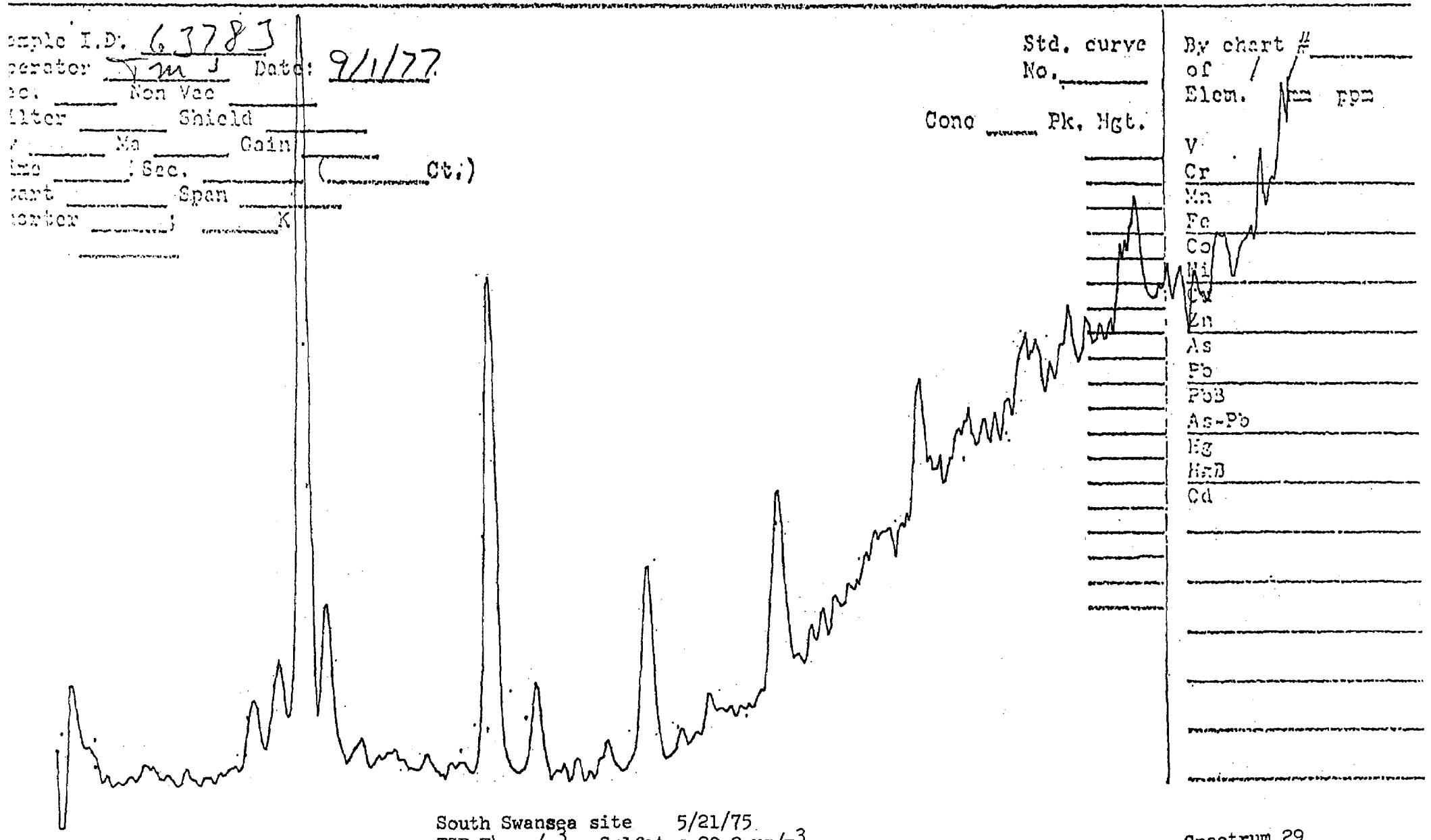
X-RAY FLUORESCENCE SPECTRUM

#7

Conditions Air Vol - 2

Taped _____

Analysis Data:



South Swansea site 5/21/75
TSP 74 ug/m^3 Sulfates 20.9 ug/m^3

Spectrum 29

SECTION IX

Discussion

Due to the lack of time and resources, not all the exceedances could be evaluated. However, the two primary NAAQS exceedances at Plymouth Avenue site and four other secondary NAAQS exceedances were evaluated as typical of the rest of the exceedances.

February 9, 1976, Plymouth Avenue, a primary TSP (468 ug/m^3) NAAQS exceedance.

The x-ray fluorescence analysis of the filters showed high values of iron, titatium, chlorine, and potassium indicating that the filter was heavily impacted by a road sanding operation. The optical analysis of the filter showed 88 percent of the catch is in the mineral group (chiefly quartz). The Fall River Department of Public Works reported that emergency sanding of hills was conducted on this date, but they were not positive of which roads were sanded. It should be noted that the site is located at the crest of a hill.

The XRF analysis also showed that the nickel and vanadium were low and the sulfate analysis shows relatively low sulfate levels (13 ug/m^3), in addition, the optical analysis flyash and soot to be less than ten percent of the filter catch. This indicates that sources burning high vanadium fuel were not impacting the monitor.

The winds were generally from the north northeast for most of the day indicating possible impact from the Somerset Station.

Based upon the information available, several conclusions can be drawn:

1. The Brayton Point facility did not significantly contribute to the exceedance.
2. Though the wind direction indicated possible contribution from the Somerset Station, filter analysis does not indicate any significant contribution from that source.
3. The major portion of the filter catch appears to be from the road sanding operation which occurred on that date, or re-entrainment of the new sand.

February 12, 1976, a secondary (174 ug/m^3) NAAQS exceedance at Plymouth Avenue site.

The optical microscopic analysis of the filter show that 67 percent of the filter catch was in the mineral group. The XRF analysis showed moderately high levels of iron and titatium. This indicates impaction of the sanding operation which occurred to this date.

The optical analysis showed a high portion, 26 percent of the catch was soot from low temperature combustion, while only 6 percent of the filter catch fell into the flyash category (from high temperature combustion). In addition, the XRF analysis showed low nickel and vanadium levels on the filter.

The wind direction did not indicate any impaction from Brayton Point or the Somerset facilities.

Based upon the information available, several conclusions can be drawn:

1. The Brayton Point facility and the Somerset facility did not significantly contribute to the exceedance.
2. The sanding operation appeared to impact the monitor.

3. A low temperature combustion source also impacted the monitor. April 9, 1976, a secondary (213 ug/m^3) NAAQS exceedance at North Main Street.

The optical microscopy work showed a high mineral content (87 percent) in the filter catch. This fact is reinforced by the XRF analysis which showed high potassium and moderate levels of iron and titatium. In addition, low values of chloride were found by XRF which indicates the mineral (sand) material was not from a road sanding/salting operation as there were no such operations recorded on this day. However, the public works records state that piles of road sand (old material with salt component washed out) collected from the Pierce and Rock Street area (one mile south of the North Main site) were moved in open trucks to the landfill area (four miles northwest) and disposed of. The most likely route used was North Main Street. Due to the high average wind (15 mph) for the day, it is very likely that this material was a major contributer to the exceedance. At the same time, construction of Route 79 to the north and west of the site very likely added to the exceedance. Although the wind direction indicates a possible contribution from the Somerset facility, the low sulfur, nickel, and vanadium from XRF analysis indicates very little contribution.

The following conclusions can be drawn from the above information:

1. No significant impact was indicated from either Brayton Point or Somerset facilities.
2. Road sand (not from salt/sanding operation) via trucking operation and the Route 79 construction activity were major contributers to the exceedance.

April 15, 1976, Plymouth Avenue, an exceedance of secondary NAAQS.

The optical microscopy results showed 76 percent of the filter catch to be mineral and 19 percent to be soot. The XRF results showed moderate Iron and Potassium, low Chlorine, Titatium, Nickel and Vanadium and high sulfur. The ratio of lead to bromine was 1.5 to 1. No street sanding or sweeping was performed on that day. No fires were reported. The meteorological conditions were gusty southwest winds.

Based upon the information available, several conclusions can be drawn:

1. The wind direction was such that neither the Brayton Point nor the Somerset Station could impact upon the site.
2. The gusty winds blowing across the road to the site contributed to the high mineral content on the filter. (It should be noted that this exceedance was only two percent above the NAAQS.) This is supported by the lead to bromine ratio of 1.5 to 1 suggesting the presence of "old" street sand. The low chlorine indicates that the salt has been "washed out".
3. As there are no major sources to the southwest, no conclusions can be drawn for the relatively high soot content 19 percent. (Emissions from vehicle exhaust will contribute to the soot content.) Also unexplained is the relatively high sulfur content on the filter. Although no analysis was made for sulfates, this would only represent a small percentage of the total filter weight.

June 11, 1976, a secondary (175 ug/m^3) NAAQS exceedance at North Main Street site.

The wind on this date was from the south southwest and averaged ten miles per hour similar to the condition on June 10, 1976. On the 10th,

there was a brush fire two miles to the south southwest of the monitor. The wind direction indicates that there would be no impaction from either the Brayton Point nor the Somerset facilities.

The optical microscopic analysis of the filter showed 72 percent of the catch was in the mineral group. The XRF analysis showed a moderate level iron and the lead to bromine ratio was relatively high indicating that some re-entrainment occurred on that date.

High levels of sulfates were reported throughout Massachusetts and Rhode Island on this date; however, XRF analysis of the filter indicated no increase in the sulfur level.

Based upon the available information, the following conclusions can be drawn:

1. The Brayton Point and the Somerset facilities did not significantly contribute to the exceedance.
2. The brush fire on June 10, 1976, could have impacted the monitor.
3. Road dust re-entrainment appear to have impacted the monitor.

December 5, 1976, a primary TSP (422 ug/m^3) NAAQS exceedance at Plymouth Avenue.

The optical microscopy showed 85 percent of the filter catch to be mineral, 10 percent to flyash, and 5 percent soot. The XRF results showed high Iron, Titatium, Chlorine, and Potassium; low Nickel, Sulfur, and Vanadium. The lead to bromine was between 1.5 to 1 and 1 to 1. There was street sanding on that day. A fire on Belmont Street, 1 1/2 miles north of the site, was also reported on that date. The meteorological conditions were a trace of snow (.3 inches of snow fell the day before) with winds at 5 mph from the northwest.

Based on this limited data, the following conclusions can be drawn:

1. The fact that the wind was from the northwest and the low Nickel, Vanadium, and Sulfur levels indicate that neither Brayton Point nor the Somerset Station contributed significantly to the violation. The ten percent flyash would represent products of high temperature combustion as emissions from incinerators, industrial boilers, power plants, or fires. The fire to the north may have affected the soot and flyash contributions.
2. The most probable cause for the high reading was the street sanding. Both the optical results 85 percent minerals and the XRF results of high Iron, Titatium, and Chlorine indicate the presence of sand and salt. The slightly higher than 1 to 1 of the lead to bromine ratio also indicates street sand which has been applied within a day or two. There was street sanding both the day before and on the day in question.

Table IX-1 summarizes the data available on 12 of the 17 TSP standard exceedances. The other five exceedances occurred at the Milliken Boulevard site and were not evaluated for reasons stated in Section III.

Other Data

The State of Massachusetts correlation study of the TSP and SO_2 at Plymouth Avenue site indicates a very weak positive linear relationship between TSP and SO_2 levels. This suggests that combustion of sulfur containing fossil fuels was not strongly associated with particulate concentrations.

As stated in Section V, May 21, 1975, was identified as a potential high sulfate day. This theory was substantiated by sulfate analysis performed by ERT and XRF analysis by the S & A Division discussion in

Section VIII. Other XRF spectrums did not show elevated sulfur levels as appeared on May 21, 1975.

The two State monitoring sites on Globe Street and Bedford Street did not show any exceedances during the two year period (see 1975 and 1976 Annual Report on air quality in New England). These sites conform to EPA guidelines on monitoring and yet did not record standard violations. This strongly indicates that most exceedances were localized problems around the monitors rather than an area problem which would be caused by major point sources as the Brayton Point and Somerset Power Plants.

TABLE IX-1

SUMMARY OF INFORMATION ON TSP STANDARD EXCEEDANCES

Date: 12/05/76 Site: Plymouth Avenue TSP: 422 ug/m^3

Wind Vector: 290°/5mph - shows possible influence from Brayton Point Plant, but no influence from Somerset Plant.

Optical Microscopic Analysis: High mineral and low flyash and soot.

XRF Analysis: Typical of fresh road sand impact and little impact from combustion sources.

Local Conditions: 1. General sanding of roads occurred.

2. Fire 1 1/2 miles to the north.

Conclusion: 1. No influence from Somerset Plant.

2. No significant contribution from Brayton Point Plant.

3. High TSP most likely caused by road sanding operations.

Date: 06/11/76 Site: North Main Street TSP: 175 ug/m^3

Wind Vector: 240°/12mph - shows possible influence from Brayton Point Plant, but no influence from Somerset Plant.

Optical Microscopic Analysis: High mineral (74 percent) and high soot (20 percent).

XRF Analysis: Typical of old road sand impact and little impact from high vanadium combustion source.

Local Conditions: Possible influence of brush fire on June 10, 1976, and Route 79 was being constructed near the site.

Other: This was a reported high sulfate day.

Conclusion: 1. No influence from Somerset Plant.

2. No significant contribution from Brayton Point Plant.

3. High TSP most likely caused by high sulfate, re-entrainment of road dust, a local brush fire, and the construction of Route 79.

Date: 04/09/76 Site: North Main Street TSP: 213 ug/m^3

Wind Vector: 030°/12mph

Conclusion: No influence from Brayton Point or Somerset Plants.

Date: 04/15/76 Site: Plymouth Avenue TSP: 153 ug/m^3

Wind Vector: 230°/8mph

Conclusion: No influence from Brayton Point or Somerset Plants.

Date: 02/09/76 Site: Plymouth Avenue TSP: 468 ug/m^3

Wind Vector: 340°/5

Conclusion: No influence from Brayton Point or Somerset Plants.

Date: 02/12/77 Site: Plymouth Avenue TSP: 173 ug/m^3

Wind Vector: 280°/10mph

Conclusion: No influence from Brayton Point or Somerset Plants.

Date: 02/21/77 Site: North Main Street TSP: 150 ug/m^3

Wind Vector: 210°/7mph

Conclusion: No influence from Brayton Point or Somerset Plants.

Date: 05/15/75 Site: North Main Street TSP: 185 ug/m^3

Wind Vector: 180°/8mph

Conclusion: No influence from Brayton Point or Somerset Plants.

Date: 05/21/75 Site: North Main Street TSP: 156 ug/m^3

Wind Vector: 150°/3mph

Conclusion: No influence from Brayton Point or Somerset Plants.

Date: 04/03/75 Site: North Main Street TSP: 160 ug/m^3

Wind Vector: 160°/5mph

Conclusion: No influence from Brayton Point or Somerset Plants.

Date: 04/12/75 Site: Plymouth Avenue TSP: 191 ug/m^3

Wind Vector: 300°/7mph - shows possible influence from Brayton Point Plant, but no influence from Somerset Plant.

Analysis: No special analysis conducted on the filter.

Local Conditions: Road sweeping conducted in the area.

Conclusion: 1. No influence from the Somerset Plant.

2. Most likely no significant contribution from Brayton Point Plant.

3. One of the causes of the exceedance could have been the street sweeping operation.

Date: 04/18/75 Site: North Main Street TSP: 177 ug/m^3

Wind Vector: 170°/8mph

Conclusion: No influence from Brayton Point or Somerset Plants.

NOTE: No evaluations were made of the Milliken Boulevard site because the site was influenced by several local sources; thus, no correlation to the power plant's emissions could be made (see Section III).

Section X

Conclusions

The following conclusions can be drawn:

(1) The particulate data collected and reported by ERT is valid. Sample collection and quality assurance procedures were acceptable to EPA, Region I. The data can be used for planning purposes.

(2) The site locations for the Swansea Marina, Sharp's Lot, Read Street, Central Fire Station and Globe Street sites conform to EPA Guidelines.

(3) While the North Main Street site conforms to EPA Guidelines, the data from 1973 to 1976 may be influenced by the construction of Route 79 in the vacinity of this site.

(4) Both the Plymouth Avenue and Milliken Boulevard sites are subject to re-entrainment of particulates due to the placement of the sampler in close proximity to major roadways. In addition, the Plymouth Avenue site is influenced by other local sources.

(5) Major fuel burning sources at the Brayton Point and Somerset Facility did not contribute significantly to the NAAQS exceedances which were studied.

(6) The most probable cause for the primary NAAQS violations at the Plymouth Avenue site was street sanding operations on the days of the violations.

(7) The most probable cause for the secondary TSP violations at the Plymouth site are street sanding and cleaning operations.

(8) The most probable causes for the secondary TSP violations at the North Main Street site are the construction activities related to Route 79 in the vicinity of the site, road dust re-entrainment, a brush fire on June 10, 1976, and elevated regional sulfate levels.

(9) Based upon seven exceedances studied and other data, Brayton Point and Somerset power plants did not significantly contribute to the recorded exceedances.

Appendix A

MICROSCOPIC ANALYSIS

METHOD

Sample Preparation

After an initial visual inspection to determine the general filter characteristics, a representative area is chosen for microscopic analysis. This portion of the filter is examined under reflected light (~150X) and the general load characteristics noted for later reference to insure the integrity of the transfer process.

A representative fraction of the particulate matter is then removed from the filter and transferred to a glass microscopic slide using a dry transfer technique.

The particulate matter is then immersed in oil of a known index of refraction and slide prepared for subsequent microscopic analysis.

Sample Analysis

The microscopic slide is then methodically scanned in a fixed pattern under transmitted polarized light (~600X). A representative number (100-200) of particles are identified, sized and categorized in order of encounter. Because of the limitations of optical microscopy particles with diameters less than 2μm cannot be identified with any certainty, therefore are not included in subsequent calculations. The particle diameters are measured to the nearest μm. Martin's diameter is used for larger particles and Feret's diameter is used for the smaller particles.

Calculations

The weight percentage for each category is calculated from the number of particles observed (ni), the mean particle size (Vi), and the density ($\int$ i). The calculations are based on an assumed spherical geometry for most categories. (A cylindrical geometry is assumed for some biological material.)

PHOTOMICROGRAPHS

Two black and white photomicrographs are taken of each microscopic slide using Type 55 Polaroid film.

Photomicrographs A shows the typical loading, size and category distribution under a magnification of approximately 600X with slightly crossed polars (~X75) for the subject filter.

Photomicrographs B shows some noteworthy feature of the subject filter in a photographic format selected to best illustrate the particular case.

Definitions:

Mineral - transparent to translucent, colorless, red, yellow, occasionally green, angular, cleaved, rounded, often birefringent.

Fly ash - vitreous transparent colorless, red, yellow, greenish, orange, and brown, spherical to equant irregular.

Soot - opaque, dull to vitreous luster, black to very slightly colored (reflected light) tubular, elongate, spherical, irregular, angular, lacy, frothy.

Biological - transparent to translucent, colorless, green, red, brown, yellow, spherical, equant, symmetrical, elongate, occ. textured.

Densities[1] - used in the weight % calculations are as follows:

Mineral - 2.65 to 2.9, with 2.8 being used most often
Fly ash - 2.1, all cases
Soot - 1.1, all cases
Biological - 0.9, all cases

[1] from standard tables

MICROSCOPIC ANALYSIS DATA SHEET

Filter Identification		Filter Data	
Network/Station	Fall River/Plymouth Avenue	Filter Media	Glass fiber
Filter No.	105689	Loading ($\mu g/cm^2$)	2163.1
Date	2/9/76	TSP ($\mu g/m^3$)	468

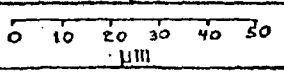
COMMENTS

Filter analyzed at client's request. Violation of primary standard.

PHOTOMICROGRAPHS

A

B



Analysis			Microscopist's Comments
CATETORY	W%	S(µm)	
Mineral	87.8	12.0	- Particulate matter, chiefly quartz, very angula
Fly Ash	5.05	8.13	- Poorly sinked (low temp.)
Soot	4.55	7.63	- Fine grained, flaky
Biological	2.59	18.5	- Few stray fibers (vegetable)
			- Occasional very large min grains

BY Donald G. McCloon (2/15/77)

MICROSCOPIC EVALUATION OF HI-VOL FILTER

NEW ENGLAND POWER COMPANY,

FALL RIVER NETWORK

New England Power Company (NEPCO) has requested that the Hi-Vol filter monitored at the Plymouth Avenue station on December 5, 1978 be examined by optical microscopy. The filter, number 136228, recorded total suspended particulate (TSP) concentrations of 422 $\mu g/m^3$.

The analysis was performed by transmitted light optical microscopy at approximately 200x. The samples were prepared by extracting particulates from the filter surface and mounting on glass slides. The analysis resulted in the following conclusions:

	MINERAL	FLY ASH	SOOT	BIOLOGICAL
Percent (%) by weight	84.5	10.1	5.4	Trace
Mean Size (micron)	12.1	8.4	7.1	Coarse

The results of the analysis show that the mineral fraction is predominantly responsible for the high weight of the filter. The biological matter is almost totally absent, though occasional bits of vegetable fiber (dead leaves, paper, etc.) are present. The photomicrographs enclosed show a typical overall view of the filter load, and of a piece of fiber. Both were taken at 600X in plane polarized light.

Definations:

1) Percent by weight - percentage of total particulate weight which is accounted for by particualtes of one type (mineral, biological, etc.); this weight percentage is proportional to the volume percentage of each particle class multiplied by the density of the particle class. This percent by weight is the same as the mass percent.

2) Mean size (in microns) - The average size of particles for each particle class in microns.

3) Mineral particulates - road dust, clay, feldspar, emissions from metal processing plants. These particulates are not identified separately in the analysis.

4) Biological materials - spores, pollens, grass cutting, insect parts, etc. These particulates are not identified separately in the analysis.

5) Flayash - usually a product of a higher temperature combustion process. It includes incineration emissions from homes, industry and power plants, etc. These particulates are not identified separately in the analysis.

6) Soot - Usually the product of a low temperature conbustion process. It includes emissions from automobile exhaust, dump incinerations, coal dust from coal piles, etc.

EBT 136228 | PPL 600X
Fall River | oil n = 1.628

UNIQUE FILTER
PARTICLE

EBT 136228 | PPL 600X
FALL RIVER | oil n = 1.628

Typical FILTER
COMPOSITION

(Minimal amount of soot or flyash

MICROSCOPIC ANALYSIS

METHOD

Sample Preparation

After an initial visual inspection to determine the general filter characteristics, a representative area is chosen for microscopic analysis. This portion of the filter is examined under reflected light (~150X) and the general load characteristics noted for later reference to insure the integrity of the transfer process.

A representative fraction of the particulate matter is then removed from the filter and transferred to a glass microscopic slide using a dry transfer technique.

The particulate matter is then immersed in oil of a known index of refraction and slide prepared for subsequent microscopic analysis.

Sample Analysis

The microscopic slide is then methodically scanned in a fixed pattern under transmitted polarized light (~600X). A representative number (100-200) of particles are identified, sized and categorized in order of encounter. Because of the limitations of optical microscopy particles with diameters less than 2μm cannot be identified with any certainty, therefore are not included in subsequent calculations. The particle diameters are measured to the nearest μm. Martin's diameter is used for larger particles and Feret's diameter is used for the smaller particles.

Calculations

The weight percentage for each category is calculated from the number of particles observed (ni), the mean particle size (Vi), and the density (ρi). The calculations are based on an assumed spherical geometry for most categories. (A cylindrical geometry is assumed for some biological material.)

PHOTOMICROGRAPHS

Two black and white photomicrographs are taken of each microscopic slide using Type 55 Polaroid film.

Photomicrographs A shows the typical loading, size and category distribution under a magnification of approximately 600X with slightly crossed polars (~X75) for the subject filter.

Photomicrographs B shows some noteworthy feature of the subject filter in a photographic format selected to best illustrate the particular case.

Definitions:

Mineral - transparent to translucent, colorless, red, yellow, occasionally green, angular, cleaved, rounded, often birefringent.

Fly ash - vitreous transparent colorless, red, yellow, greenish, orange, and brown, spherical to equant irregular.

Soot - opaque, dull to vitreous luster, black to very slightly colored (reflected light) tubular, elongate, spherical, irregular, angular, lacy, frothy.

Biological - transparent to translucent, colorless, green, red, brown, yellow, spherical, equant, symmetrical, elongate, occ. textured.

Densities[1] - used in the weight % calculations are as follows:

Mineral - 2.65 to 2.9, with 2.8 being used most often
Fly ash - 2.1, all cases
Soot - 1.1, all cases
Biological - 0.9, all cases

[1] from standard tables

MICROSCOPIC ANALYSIS DATA SHEET

Filter Identification		Filter Data	
Network/Station	Fall River/Plymouth Avenue	Filter Media	Glass Fiber
Filter No.	124016	Loading ($\mu g/cm^2$)	733
Date	6 - 11 - 76	TSP ($\mu g/m^3$)	146

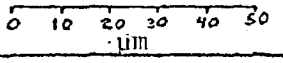
COMMENTS

Analysis performed at request of client. No violations of primary or secondary standard.

PHOTOMICROGRAPHS

A

B



Analysis			Microscopist's Comments
CATETORY	W%	S(µm)	Particulate matter well sorted and free from
Mineral	74.4	13.0	adhering substances. Mineral category mostly
Fly Ash	4.7	9.2	natural in origin. Biological loading typical
Soot	19.9	12.5	for late spring.
Biological	1.1	8.7	Photomicrograph B: Unusually large mineral
			and soot particles (560X, Polars X 75°).

BY Donald F. Mulhern (4/1/77)

MICROSCOPIC ANALYSIS DATA SHEET

Filter Identification		Filter Data	
Network/Station	Fall River/N. Main	Filter Media	Glass Fiber
Filter No.	117916	Loading ($\mu g/cm^2$)	1061
Date	4 - 9 - 76	TSP ($\mu g/m^3$)	213

COMMENTS

Violation of Secondary Standard

PHOTOMICROGRAPHS

A

B

0 10 20 30 40 50
μm

Analysis			Microscopist's Comments
CATETORY	W%	S(μm)	Particulate matter well sorted and free from
Mineral	87.0	17.0	adhering substances. Mineral category mostly
Fly Ash	3.8	8.1	natural in origin. Biological loading typical
Soot	7.3	11.6	for early spring.
Biological	1.9	13.2	Photomicrograph B: Unusually large mineral
			particles (560X, Polars X 75°)

BY [illegible]

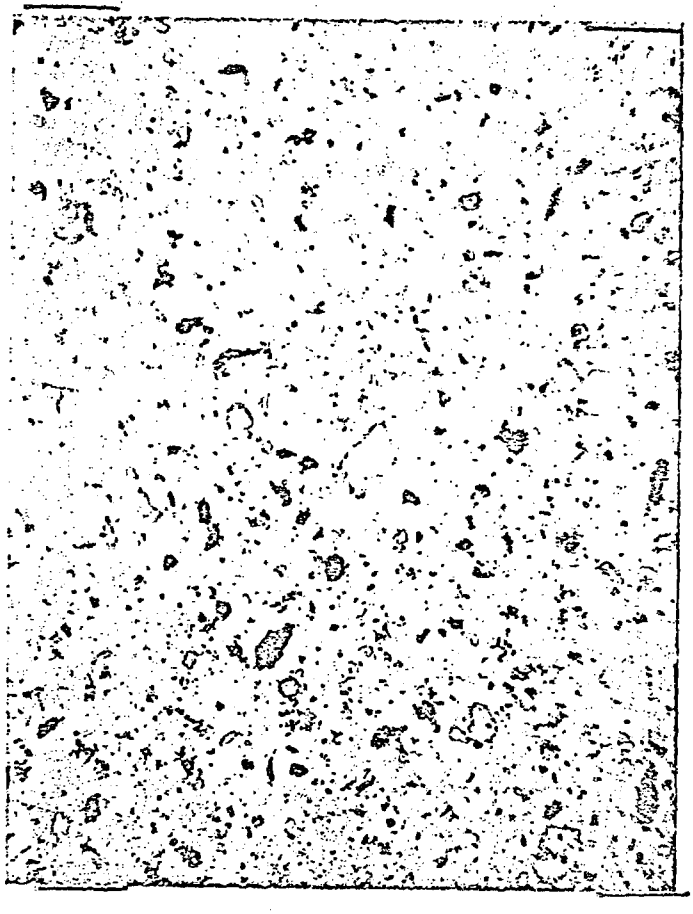
MICROSCOPIC ANALYSIS DATA SHEET

Filter Identification		Filter Data	
Network/Station	Fall River/Plymouth Avenue	Filter Media	Glass Fiber
Filter No.	117929	Loading ($\mu g/cm^2$)	652
Date	4 - 15 - 76	TSP ($\mu g/m^3$)	153

COMMENTS: Violation of Secondary Standard.

PHOTOMICROGRAPHS

A



B

0 10 20 30 40 50
μm

Analysis			Microscopist's Comments
CATETORY	W%	S(μm)	Particulate matter well sorted and free from adhering substances. Mineral category mostly natural in origin. Biological loading typical for early spring.
Mineral	75.9	9.6	
Fly Ash	4.5	6.1	
Soot	19.0	9.4	
Biological	0.5	7.7	Photomicrograph B: Unusually large soot particles (560X, Polars x 75°)

BY [signature]

MICROSCOPIC ANALYSIS DATA SHEET

Filter Identification		Filter Data	
[redacted]work/Station	Fall River/ Plymouth Avenue	Filter Media	Glass Fiber
Filter No.	105688	Loading ($\mu g/cm^2$)	850
Date	2 - 12 - 76	TSP ($\mu g/m^3$).	173

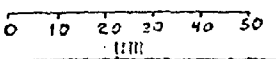
COMMENTS

Violation of Secondary Standard.

PHOTOMICROGRAPHS

A

B



CATETORY	Analysis W%	S(um)	Microscopist's Comments
Mineral	67.2	10.4	Particles well sorted and free from adhering substances. Mineral category mostly natural in origin. No biological particles observed (typical of winter season).
Fl[redacted]sh	6.3	9.0	
Soot	26.5	10.5	
Biological	0	X	Photomicrograph B: Unusually large mineral particle (560X, Polars X 75°)

BY Donald J. Mullan (11/17)

MICROSCOPIC ANALYSIS DATA SHEET

Filter Identification		Filter Data	
[redacted]work/Station	Fall River/No. Main	Filter Media	Glass Fiber
Filter No.	123940	Loading ($\mu g/cm^2$)	820
Date	6 - 11 - 76	TSP ($\mu g/m^3$)	175

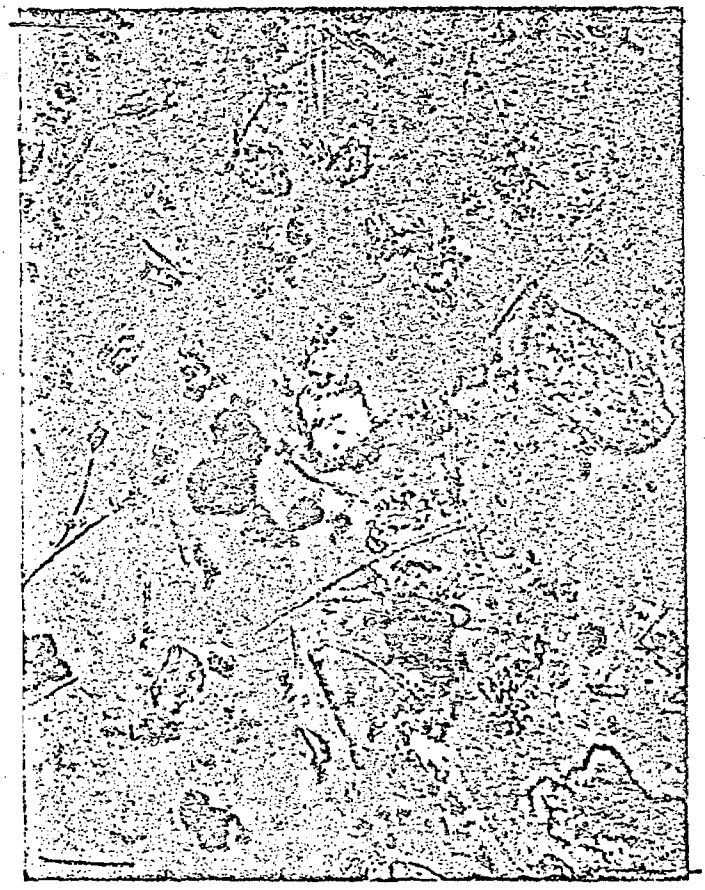
COMMENTS

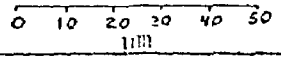
Violation of Secondary Standard

PHOTOMICROGRAPHS

A

B





Analysis			Microscopist's Comments
CATETORY	W%	S(μm)	Particulate matter well sorted and free from adhering substances. Mineral category mostly
Mineral	72.1	10.0	
Fly Ash	12.1	8.4	natural in origin. Biological loading typical
Soot	11.3	8.4	for late spring.
Biological	4.4	10.5	Photomicrograph B: Large soot and mineral
			particles (560X, Polars X75°)

BY Donald F. Mulhern (6/11/76)

Appendix B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: August 30, 1977

UBJECT: Evaluation of Eastern Analytical Laboratories, Inc.

FROM: Warren H. Oldaker
Chief, Analytical Quality Control, S&A Division, Region I

TO: Alan Oi
Environmental Engineer, Air Section, S&A Division

At your request, a review was conducted on August 10, 1977 of the analytical procedures and supportive equipment used by this commercial laboratory to develop the data in the report entitled, "Microscopic Evaluation of Hi-Vol Filter, New England Power Company, Fall River Network". Mr. Don Muldoon of the Environmental Research Associates (prime contractor) and Mr. John Menzie of the New England Power Company accompanied us during this on-site evaluation.

The optical sizing, using Feret's diameter and Martin's diameter, follow those generally accepted techniques described in the McCrone Particle Atlas. The "dry-transfer" technique developed by Eastern consists of pressing the exposed side of the filter on a glass slide, mounting in oil with a known index of refraction (η= 1.628) and examining under transmitted polarized light. Selection of representative fields and particles is highly subjective and depends heavily upon the expertise of the analyst.

It is important to note that the analyst did not attempt to categorize or enumerate particles (single or aggregate) less than 2 μm which is a limitation of optical microscopy.

Particulate densities used in the calculation of percent weight for each class were tabular values for the specific category (mineral, fly ash, soot, biological).

The laboratory is well equipped with plane and polarized light optical microscopes; scanning electron microscope (SEM); X-ray microprobe; electronic particle sizing (Coulter); and supportive photomicrographic equipment. The optical microscopy is performed by an analyst who is a minerologist-geologist by training and experience. The SEM is operated by Mr. Robert MacDonald, President of the Eastern Analytical Laboratories, Inc. This laboratory has had extensive experience with the analysis (both SEM and optical) of Hi-volume ambient air filters and appears highly qualified for this kind of analysis.

EPA Form 1320-6 (Rev. 3-76)

The general consensus of qualified opinion is that optical microscopy has the advantage of particulate color identification and "points the finger" towards the general nature of the particle class. Additional weight of evidence is needed to further the concepts of quantitation and representativeness. Such evidence may include X-ray microprobe or fluorescence analysis of selected particles; SEM particle sizing; and microdensitometer mapping for particulate distribution on the filter surface. If additional work is contemplated, additional considerations should also include particulate collections on membranes other than glass fiber filter types.

cc:
Tom Devine, Chief
Air Branch, A&HM Div., Reg. I

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
600 Washington St., Boston 02111

DAVID STANDLEY
COMMISSIONER

August 8, 1977

Mr. Al Oi
Surveillance and Analysis Division
Environmental Protection Agency
60 Westview Street
Lexington, Massachusetts 02173

Dear Sir:

Per your letter of August 4, 1977, I have requested that Mr. Vallon of this staff perform certain statistical analysis of Sulfur Dioxide and Total Suspended Particulates levels. Description of the work performed along with pertinent conclusions is presented below:

The 24 hour TSP (Total Suspended Particulates) data was correlated with the daily averages of continuous SO_2 (Sulfur Dioxide) data at the Plymouth Ave., Fall River, Mass. site from April 1975 to September 1976 (number of cases=169). Using the S.P.S.S. computer package (Statistical Package for the Social Sciences), the simple statistical correlation between the two pollutants, TSP and SO_2, was found to be r = .31. This simple correlation indicates a weak positive linear relationship between these pollutants with a confidence coefficient of .999 (This confidence coefficient indicates that the correlation computed could only be theoretically due to chance less than one in a thousand).

This correlation suggests that combustion of sulfur containing fossil fuels was not strongly associated with particulate concentration levels at this site during the period of this analysis.

If you intend to use this analysis as part of a technical support document, the Division requests prior notification of such use as well as an opportunity to review implications arising from their use.

Sincerely,

William A. Simmons

William A. Simmons
Chief
Air Quality Surveillance Branch

S/ct

cc: Mr. Donovan
Mr. Donaldson

August 4, 1977

Mr. William Simmons, Chief
Air Quality Surveillance Branch
Division of Air and Hazardous Materials
600 Washington Street, Room 320
Boston, MA 02111

Dear Mr. Simmons:

On July 15, 1977, I met with Ron Vallon of your staff. At this time, I requested copies of correlation studies he was presently working on. These studies dealt with the TSP, SO_2, and wind direction data collected at the Brayton Point monitoring network during the years 1975 to 1976. At the same time, I requested his interpretation of the results of these studies. It is my intention to include this information in the Technical Support Document for Chapter 494 in Southeastern Massachusetts specifically for the Brayton Point Power Plant.

I wish to thank you and your staff for aiding me in this project.

Sincerely yours,

Allen W. Oi
Environmental Engineer

AWOi:cb:8/8/77