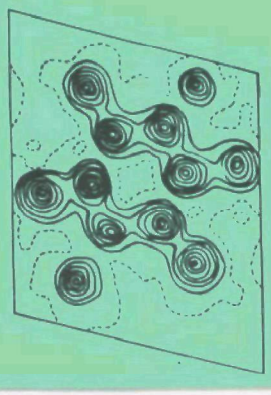
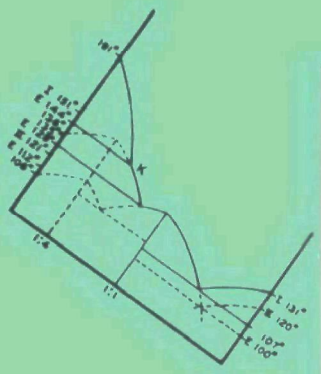
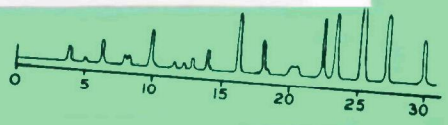
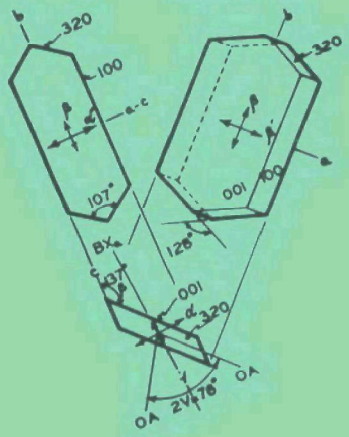
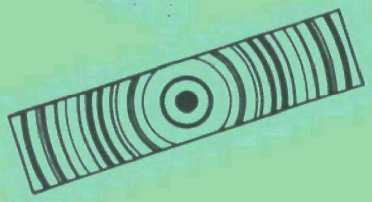




# Asbestos in the Water Supplies of the Ten Regional Cities



walter c. mccrone associates, inc.

Dr. R. J. Carton
Environmental Protection Agency
Office of Toxic Substances
Washington, D. C. 20460

Contract 68-01-2690

# Asbestos in the Water Supplies of the Ten Regional Cities

Date: 2 March 1976

MA Number: MA 4200

Copy 3 of 8

walter c. mccrone associates, inc.
2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616

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Asbestos in the Water Supplies of the Ten Regional Cities


Summary

As part of a program to determine the impact of point and non-point sources on waterborne levels of asbestos, samples of raw and finished water from the ten cities housing regional headquarters of the Environmental Protection Agency have been examined. These cities are Boston, New York, Philadelphia, Atlanta, Chicago, Dallas, Kansas City, Denver, San Francisco and Seattle.

The results of this examination show that while New York, Chicago, Dallas, Kansas City and Denver are essentially free of asbestos, San Francisco and Seattle may have detectable levels of asbestos in their water supplies and Boston, Philadelphia and Atlanta have ~~significant~~ higher asbestos levels.

## Introduction

The Office of Toxic Substances of the Environmental Protection Agency has sponsored a nationwide survey to determine the impact of point and non-point sources on waterborne levels of asbestos. This survey covers both natural sites, in which asbestos bearing rocks are prevalent, and man-made sources. Additionally, it provides for sampling water supplies in a number of cities and towns. This report records the results of the analysis of water from the ten major regional cities, headquarters of the EPA regional offices.

## Sampling and Analysis Methods

Aliquots of the water were vacuum filtered through 47 mm dia Millipore 0.45 μ m pore size filters. This filter was then prepared for examination on the transmission electron microscope by the direct transfer method. Nylon support grids were used to minimize background signals during X-ray analysis in EMMA-4, the combined electron microscope microanalyzer. Wherever practicable samples for analysis were filtered directly on site. Exceptions to this were the cities of Chicago, Denver and Seattle.

## Results

The data for the ten cities are summarized in Table 1.

Appendices 1 - 10, numbered to correspond to the EPA region number, each contain the relevant trip reports describing the sampling locations and conditions, the individual sample summaries and data print outs and a brief discussion of the results.

## Conclusion

~~Significant~~ asbestos levels have been found in the water supplies of Boston, up to 7.5 million fibers per liter (f.p.l.); Philadelphia, up to 240 million f.p.l.; and Atlanta, up to 12 million f.p.l. The potential exists for asbestos contamination in the water of San Francisco and Seattle. No evidence was found of asbestos in the water supplies or sources of New York, Chicago, Dallas and Kansas City. A few fibers observed in one of the Denver water sources might be attributable to background or contamination and are not regarded as significant.

Table 1

Asbestos in the water supplies of the Ten Regional Cities

| | City | Source | Supply | Comment |
|---|---|---|---|---|
| 1 | Boston | chrysotile, $7.5 \times 10^6$ | chrysotile, $11 \times 10^6$<br>amphibole, $1.8 \times 10^6$ | Anomalous results |
| 2 | New York | none detected | none detected | |
| 3 | Philadelphia | chrysotile, up to $240 \times 10^6$ | chrysotile, up to $130 \times 10^6$ | |
| 4 | Atlanta | chrysotile $8.4 \times 10^6$ | chrysotile, $12 \times 10^6$ | |
| 5 | Chicago | none detected | none detected | |
| 6 | Dallas | none detected | none detected | |
| 7 | Kansas City | none detected | none detected | |
| 8 | Denver | possible background contamination - believed "clean" | | |
| 9 | San Francisco | chrysotile<br>amphibole | none detected | |
| 10 | Seattle | chrysotile | ~~none detected~~ | |

## Decoding Sample Numbers

The sample numbers used are a 20 digit format and may be decoded as follows.

| | | |
|---|---|---|
| digit 1 | Location type | A = Accessory minerals<br>C = Regional city<br>G = General products<br>M = Mining and Milling<br>N = Natural sites<br>P = Pipe plants<br>R = Paper plants<br>S = Sheet plants<br>T = Roffing and Tile<br>V = Textiles |
| digits 2,3,4,5 | Date code | e.g. 0312 = March 12 |
| digits 6,7,8,9 | Time code | e.g. 1350 = 1:30 p.m. for grab sample<br>0600 = 6 hrs for integrated sample |
| digit 10 | Location relative to plant | U = upstream<br>D = downstream |
| digit 11 | Position relative to plant as origin | e.g. U1, U2, U3 = upstream locations; higher number = further from plant |
| digit 12 | Sample type | W = water A = air |
| digit 13 | Sample type | G = grab I = integrated |
| digit 14 | Filter number | 3 filters taken at ea point for water samples |
| digit 15 | Analyst code | S or blank = McCrone<br>M = Murchio |
| digits 16-20 | Comment codes | Only 16 used so far - R = rerun |

Appendix 1. City of Boston

The city of Boston water supply was sampled on two occasions- July 25, 1975 and October 17, 1975. On each visit one sample of raw water and one sample of finished water was collected at the Western reservoir, one of the reservoirs along the distribution system from the main reservoir situated in central Massachusetts.

The results of the analyses for asbestiform minerals are tabulated; sample descriptions and computer printouts are attached.

The results for the 7.25.75 samples are anomalous. The detection of amphibole in the finished water only is not at present understood. The amphibole type present could be amosite or crocidolite. (Na is not readily detectable by the EDXRA (energy dispersive x-ray analysis) system and some crocidolite standards have failed to give a detectable peak.) The possibility of amphibole contamination, such as from a gasket or insulation cannot be entirely ruled out. The possibility of amphibole from AC pipe is doubtful in the absence of chrysotile, the predominant asbestos mineral in AC pipe compositions. Duplicate analyses from a second filter set taken on July 25, 1975, will be run in an effort to clear up this anomoly. These repeat analyses will be the subject of a supplementary report.

MA code C1

Location: City of Boston

Date visited: 25 July 1975

Personnel contacted: Edward Tyler (617) 872-4388 (near Framingham, Mass.)

McCrone Personnel: R. Putscher
S. Bětty

Site description: Boston's water supply comes from a main reservoir in central Mass. The location at Weston, just west of Boston was one of the smaller overflow reservoirs, located along the large "tube" going to the city. One sample of raw water and one sample of finished water was collected.

MA code C1

Location: City of Boston

Date visited: 17 October 1975

Personnel contacted: Edward Tyler (617) 872-4388 (near Framingham, Mass)
Guy Foss

McCrone Personnel: R. Putscher
M. Palenik

Site description: Boston's water supply comes from a main reservoir in central Mass. The location at Weston, just west of Boston was one of the smaller overflow reservoirs, located along the large "tube" going to the city. One sample of raw water and one sample of finished water was collected.

City of Boston

| Sample | Date sampled | Asbestos type* | Fibers/litre† | Comment |
|---|---|---|---|---|
| Western Reservoir Raw | 7-25-76 | A | BDL | Detection limit |
| | | C | $1.8 \times 10^6$ | $.25 \times 10^6$ fpl |
| Western Reservoir Finished | " | A | BDL | Detection limit |
| | | C | BDL | $.25 \times 10^6$ fpl |
| Western Reservoir Raw | 10-17-76 | A | BDL | Detection limit |
| | | C | $7.5 \times 10^6$ | $.25 \times 10^6$ fpl |
| " " Finished | " | A | BDL | Detection limit |
| | | | $11 \times 10^6$ | $.25 \times 10^6$ fpl |

* C = chrysotile
A = asbestiform amphibole

† BDL = below detection limit

Varying types of organic residues are present as well as diatomaceous and other remains. Inorganics noted are generally quite small chunky types. Organic and a few inorganic fibers are evident. Most of the inorganic particles appear to be mainly silicon.

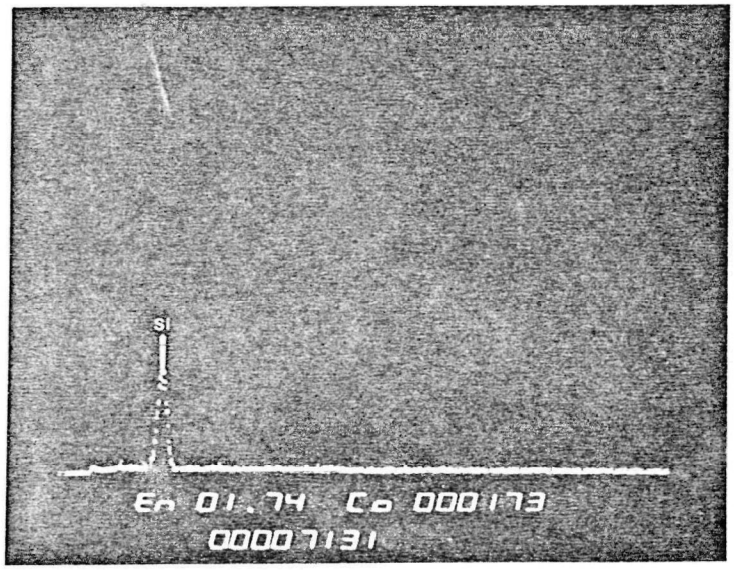



Figure 1 Probe of shardlike inorganic fiber.

SAMPLE :C107250935U1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 45.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 11.000 MG PER LITER
PH = 7.4

LIMIT OF DETECTION = 0.28E+06

SAMPLE :C107250935U1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10+-6
VOLUME FILTERED : 45.0 ML
GRID SQUARES COUNTED . 40
TOTAL SUSPENDED SOLIDS: 11.000 MG PER LITER
PH = 7.4

LIMIT OF DETECTION = 0.28E+06

Organic residues of varying types, diatomaceous remains and agglomerated areas are all present. Very small platy inorganics to quite large blocky particles evident. Varying types of organic fibers are present as well as some inorganic fibers. Amphibole asbestiform material is present.

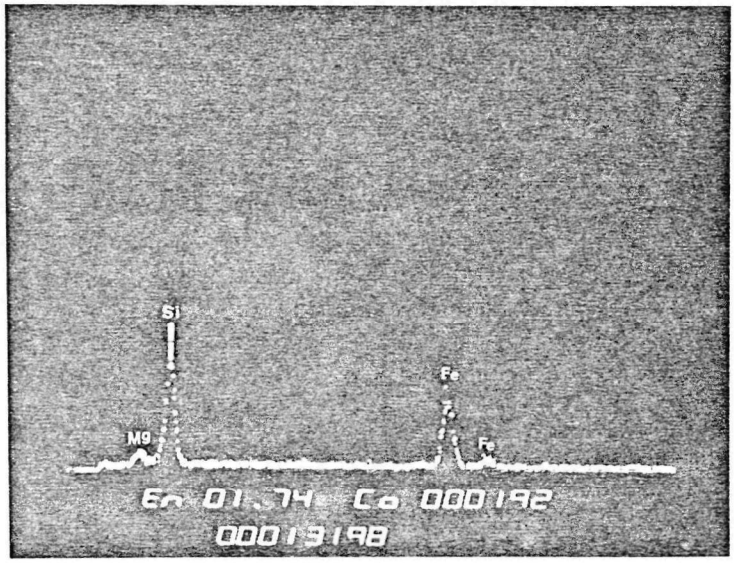



Figure 1 Probe of amphibole fiber.

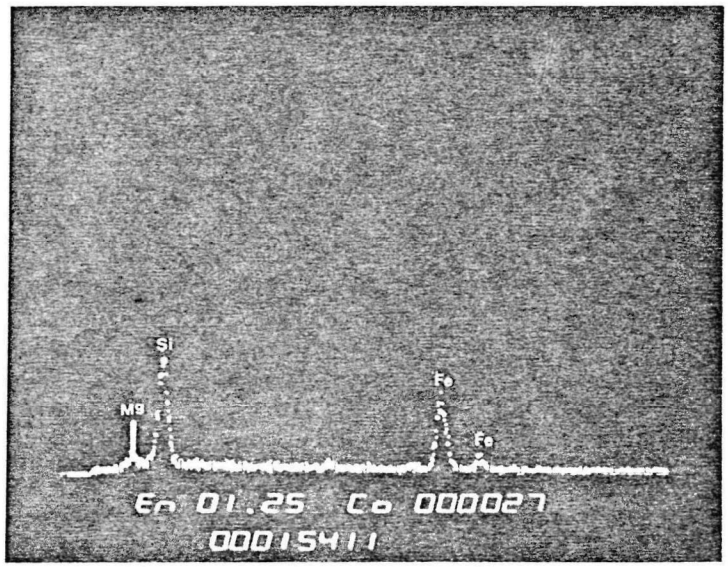



Figure 2 Probe of amphibole fiber.

SAMPLE :C107250930D1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.18E+07
FIBER CONCENTRATION BY MASS/PER LITER : 26.801 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.3

DESCRIPTIVE STATISTICS

NO. OBS. = 7

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.53659E+01 | 0.41573E+02 | 0.64477E+01 | 0.24370E+01 |
| 2 | WIDTH | 0.37176E+00 | 0.17905E+00 | 0.42315E+00 | 0.15993E+00 |
| 3 | ASPECT RATIO | 0.21435E+02 | 0.53455E+03 | 0.23120E+02 | 0.87387E+01 |
| 4 | MASS | 0.15232E+02 | 0.15427E+04 | 0.39277E+02 | 0.14845E+02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.12197E+01 | -0.91779E-01 | 0.18962E+02 | 0.80690E+00 | 0.18155E+02 |
| 2 | 0.13589E+01 | 0.24606E+00 | 0 12911E+01 | 0.10090E+00 | 0.11902E+01 |
| 3 | 0.81022E+00 | -0.12054E+01 | 0.63333E+02 | 0.24000E+01 | 0.60933E+02 |
| 4 | 0.16197E+01 | 0.79559E+00 | 0.10430E+03 | 0.39000E-01 | 0.10426E+03 |

SAMPLE :C107250930D1WG2 (AMPHIBOLE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 18.9623 | 1.2911 | 14.6875 | 104.3020 |
| 2 | 0.8069 | 0.1210 | 6.6667 | 0.0390 |
| 3 | 0.9683 | 0.4035 | 2.4000 | 0.5201 |
| 4 | 2.0173 | 0.3631 | 5.5556 | 0.8777 |
| 5 | 2.7031 | 0.2017 | 13.4000 | 0.3630 |
| 6 | 7.6656 | 0.1210 | 63.3333 | 0.3706 |
| 7 | 4.4380 | 0.1009 | 44.0000 | 0.1490 |

SAMPLE :C10725093OD1WG2

DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 0 | 0.00 | 0.00 |
| 0.5 | 1.0 | 2 | 28.57 | 28.57 |
| 1.0 | 1.5 | 0 | 0.00 | 28.57 |
| 1.5 | 2.0 | 0 | 0.00 | 28.57 |
| 2.0 | 2.5 | 1 | 14.29 | 42.86 |
| 2.5 | 3.0 | 1 | 14.29 | 57.14 |
| 3.0 | 3.5 | 0 | 0.00 | 57.14 |
| 3.5 | 4.0 | 0 | 0.00 | 57.14 |
| 4.0 | 4.5 | 1 | 14.29 | 71.43 |
| 4.5 | 5.0 | 0 | 0.00 | 71.43 |
| 5.0 | 5.5 | 0 | 0.00 | 71.43 |
| 5.5 | 6.0 | 0 | 0.00 | 71.43 |
| 6.0 | 6.5 | 0 | 0.00 | 71.43 |
| 6.5 | 7.0 | 0 | 0.00 | 71.43 |
| 7.0 | 7.5 | 0 | 0.00 | 71.43 |
| 7.5 | 8.0 | 1 | 14.29 | 85.71 |
| 8.0 | 8.5 | 0 | 0.00 | 85.71 |
| 8.5 | 9.0 | 0 | 0.00 | 85.71 |
| 9.0 | 9.5 | 0 | 0.00 | 85.71 |
| 9.5 | 10.0 | 0 | 0.00 | 85.71 |
| 10.0 | 10.5 | 0 | 0.00 | 85.71 |
| 10.5 | 11.0 | 0 | 0.00 | 85.71 |
| 11.0 | 11.5 | 0 | 0.00 | 85.71 |
| 11.5 | 12.0 | 0 | 0.00 | 85.71 |
| 12.0 | 12.5 | 0 | 0.00 | 85.71 |
| 12.5 | 13.0 | 0 | 0.00 | 85.71 |
| 13.0 | 13.5 | 0 | 0.00 | 85.71 |
| 13.5 | 14.0 | 0 | 0.00 | 85.71 |
| 14.0 | 14.5 | 0 | 0.00 | 85.71 |
| 14.5 | 15.0 | 0 | 0.00 | 85.71 |
| 15.0 | 15.5 | 0 | 0.00 | 85.71 |
| 15.5 | 16.0 | 0 | 0.00 | 85.71 |
| 16.0 | 16.5 | 0 | 0.00 | 85.71 |
| 16.5 | 17.0 | 0 | 0.00 | 85.71 |
| 17.0 | 17.5 | 0 | 0.00 | 85.71 |
| 17.5 | 18.0 | 0 | 0.00 | 85.71 |
| 18.0 | 18.5 | 0 | 0.00 | 85.71 |
| 18.5 | 19.0 | 1 | 14.29 | 100.00 |

DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 0 | 0.00 | 0.00 |
| 0.1 | 0.2 | 3 | 42.86 | 42.86 |
| 0.2 | 0.3 | 1 | 14.29 | 57.14 |
| 0.3 | 0.4 | 1 | 14.29 | 71.43 |

| | | | | |
|---|---|---|---|---|
| 0.4 | 0.5 | 1 | 14.29 | 85.71 |
| 0.5 | 0.6 | 0 | 0.00 | 85.71 |
| 0.6 | 0.7 | 0 | 0.00 | 85.71 |
| 0.7 | 0.8 | 0 | 0.00 | 85.71 |
| 0.8 | 0.9 | 0 | 0.00 | 85.71 |
| 0.9 | 1.0 | 0 | 0.00 | 85.71 |
| 1.0 | 1.1 | 0 | 0.00 | 85.71 |
| 1.1 | 1.2 | 0 | 0.00 | 85.71 |
| 1.2 | 1.3 | 1 | 14.29 | 100.00 |

DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 3 | 42.86 | 42.86 |
| 10 | 20 | 2 | 28.57 | 71.43 |
| 20 | 30 | 0 | 0.00 | 71.43 |
| 30 | 40 | 0 | 0.00 | 71.43 |
| 40 | 50 | 1 | 14.29 | 85.71 |
| 50 | 60 | 0 | 0.00 | 85.71 |
| 60 | 70 | 1 | 14.29 | 100.00 |
| 70 | 80 | 0 | 0.00 | 100.00 |
| 80 | 90 | 0 | 0.00 | 100.00 |
| 90 | 100 | 0 | 0.00 | 100.00 |
| 100 | 110 | 0 | 0.00 | 100.00 |
| 110 | 120 | 0 | 0.00 | 100.00 |
| 120 | 130 | 0 | 0.00 | 100.00 |
| 130 | 140 | 0 | 0.00 | 100.00 |
| 140 | 150 | 0 | 0.00 | 100.00 |
| 150 | 160 | 0 | 0.00 | 100.00 |
| 160 | 170 | 0 | 0.00 | 100.00 |
| 170 | 180 | 0 | 0.00 | 100.00 |
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0.00 | 100.00 |
| * OVER 200 | | 0 | 0.00 | 100.00 |

SAMPLE :C107250930D1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.3

LIMIT OF DETECTION = 0.25E+06

Generally organics predominate; varying organic residues are present as well as a general filmy type which is quite common. Diatoms and fragments noted as well as generally small to moderately sized inorganic particles. Inorganic particles include chrysotile, generally in fibril bundles.

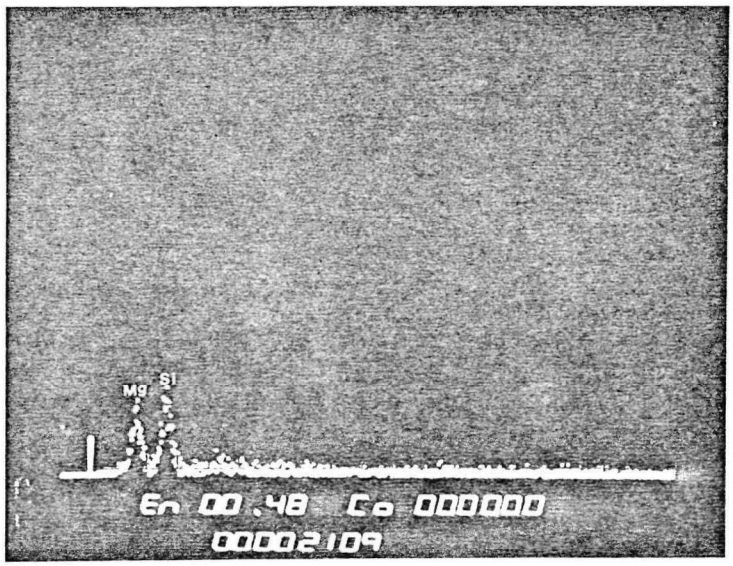



Figure 1 Probe of chrysotile.

SAMPLE :C110170835U1WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
/OLUME FILTERED : 40.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

LIMIT OF DETECTION = 0.31E+06

SAMPLE :C110170835U1WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.75E+07
FIBER CONCENTRATION BY MASS, PER LITER : 1.431 GRAMS*10↑-6
VOLUME FILTERED : 40.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

DESCRIPTIVE STATISTICS

NO. OBS. = 24

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.29519E+01 | 0.18320E+02 | 0.42802E+01 | 0.87369E+00 |
| 2 | WIDTH | 0.76800E-01 | 0.56183E-02 | 0.74955E-01 | 0.15300E-01 |
| 3 | ASPECT RATIO | 0.39722E+02 | 0.32285E+04 | 0.56820E+02 | 0.11598E+02 |
| 4 | MASS | 0.18982E+00 | 0.29009E+00 | 0.53860E+00 | 0.10994E+00 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.18103E+01 | 0.22484E+01 | 0.15735E+02 | 0.80700E-01 | 0.15654E+02 |
| 2 | 0.13462E+01 | 0.48991E+00 | 0.28240E+00 | 0.20200E-01 | 0.26220E+00 |
| 3 | 0.25858E+01 | 0.68358E+01 | 0.26000E+03 | 0.40000E+01 | 0.25600E+03 |
| 4 | 0.34307E+01 | 0.11630E+02 | 0.25164E+01 | 0.10000E-03 | 0.25163E+01 |

SAMPLE :C110170835U1WG3 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 2.2997 | 0.0807 | 28.5000 | 0.0344 |
| 2 | 7.2622 | 0.2017 | 36.0000 | 0.6797 |
| 3 | 0.8876 | 0.2017 | 4.4000 | 0.0831 |
| 4 | 15.7347 | 0.0605 | 260.0000 | 0.1325 |
| 5 | 0.3631 | 0.0282 | 12.8571 | 0.0007 |
| 6 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 7 | 0.2017 | 0.0282 | 7.1429 | 0.0004 |
| 8 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 9 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 10 | 8.8760 | 0.2017 | 44.0000 | 0.8308 |
| 11 | 2.2997 | 0.1614 | 14.2500 | 0.1378 |
| 12 | 0.6052 | 0.0807 | 7.5000 | 0.0091 |
| 13 | 3.8328 | 0.0282 | 135 7143 | 0.0070 |
| 14 | 1.2911 | 0.0282 | 45.7143 | 0.0024 |
| 15 | 3.6311 | 0.1009 | 36.0000 | 0.0850 |
| 16 | 1.4928 | 0.0605 | 24.6667 | 0.0126 |
| 17 | 3.7118 | 0.0403 | 92.0000 | 0.0139 |
| 18 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 19 | 0.8876 | 0.0403 | 22.0000 | 0.0033 |
| 20 | 0.1614 | 0.0282 | 5.7143 | 0.0003 |
| 21 | 13.7174 | 0.2824 | 48.5714 | 2.5164 |
| 22 | 2.1383 | 0 0282 | 75 7143 | 0.0039 |
| 23 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 24 | 0.0807 | 0.0202 | 4.0000 | 0.0001 |

SAMPLE :C110170835U1WG3

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 9 | 37.50 | 37.50 |
| 0.5 | 1.0 | 3 | 12.50 | 50.00 |
| 1.0 | 1.5 | 2 | 8.33 | 58.33 |
| 1.5 | 2.0 | 0 | 0.00 | 58.33 |
| 2.0 | 2.5 | 3 | 12.50 | 70.83 |
| 2.5 | 3.0 | 0 | 0.00 | 70.83 |
| 3.0 | 3.5 | 0 | 0.00 | 70.83 |
| 3.5 | 4.0 | 3 | 12.50 | 83.33 |
| 4.0 | 4.5 | 0 | 0.00 | 83.33 |
| 4.5 | 5.0 | 0 | 0.00 | 83.33 |
| 5.0 | 5.5 | 0 | 0.00 | 83.33 |
| 5.5 | 6.0 | 0 | 0.00 | 83.33 |
| 6.0 | 6.5 | 0 | 0.00 | 83.33 |
| 6.5 | 7.0 | 0 | 0.00 | 83.33 |
| 7.0 | 7.5 | 1 | 4.17 | 87.50 |
| 7.5 | 8.0 | 0 | 0.00 | 87.50 |
| 8.0 | 8.5 | 0 | 0.00 | 87.50 |
| 8.5 | 9.0 | 1 | 4.17 | 91.67 |
| 9.0 | 9.5 | 0 | 0.00 | 91.67 |
| 9.5 | 10.0 | 0 | 0.00 | 91.67 |
| 10.0 | 10.5 | 0 | 0.00 | 91.67 |
| 10.5 | 11.0 | 0 | 0.00 | 91.67 |
| 11.0 | 11.5 | 0 | 0.00 | 91.67 |
| 11.5 | 12.0 | 0 | 0.00 | 91.67 |
| 12.0 | 12.5 | 0 | 0.00 | 91.67 |
| 12.5 | 13.0 | 0 | 0.00 | 91.67 |
| 13.0 | 13.5 | 0 | 0.00 | 91.67 |
| 13.5 | 14.0 | 1 | 4.17 | 95.83 |
| 14.0 | 14.5 | 0 | 0.00 | 95.83 |
| 14.5 | 15.0 | 0 | 0.00 | 95.83 |
| 15.0 | 15.5 | 0 | 0.00 | 95.83 |
| 15.5 | 16.0 | 1 | 4.17 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 18 | 75.00 | 75.00 |
| 0.1 | 0.2 | 2 | 8.33 | 83.33 |
| 0.2 | 0.3 | 4 | 16.67 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | NUMBER | PERCENT | CUMULATIVE |
|---|---|---|---|

| | | | | PERCENT |
|---|---|---|---|---|
| 3 | 10 | 8 | 33.33 | 33.33 |
| 10 | 20 | 4 | 16.67 | 50.00 |
| 20 | 30 | 3 | 12.50 | 62.50 |
| 30 | 40 | 2 | 8.33 | 70.83 |
| 40 | 50 | 3 | 12.50 | 83.33 |
| 50 | 60 | 0 | 0.00 | 83.33 |
| 60 | 70 | 0 | 0.00 | 83.33 |
| 70 | 80 | 1 | 4.17 | 87.50 |
| 80 | 90 | 0 | 0.00 | 87.50 |
| 90 | 100 | 1 | 4.17 | 91.67 |
| 100 | 110 | 0 | 0.00 | 91.67 |
| 110 | 120 | 0 | 0.00 | 91.67 |
| 120 | 130 | 0 | 0.00 | 91.67 |
| 130 | 140 | 1 | 4.17 | 95.83 |
| 140 | 150 | 0 | 0.00 | 95.83 |
| 150 | 160 | 0 | 0.00 | 95.83 |
| 160 | 170 | 0 | 0.00 | 95.83 |
| 170 | 180 | 0 | 0.00 | 95.83 |
| 180 | 190 | 0 | 0.00 | 95.83 |
| 190 | 200 | 0 | 0.00 | 95.83 |
| * OVER | 200 | 1 | 4.17 | 100.00 |

Generally moderately loaded, although some areas are heavy; this is due principally to organic residues of varying types and sizes. Diatomaceous remains, organic fibers, and agglomerated areas are noted with some of the organic fibers being quite large. The inorganic particles are generally small to moderate in size with a wide range of morphologies. Chrysotile was detected.

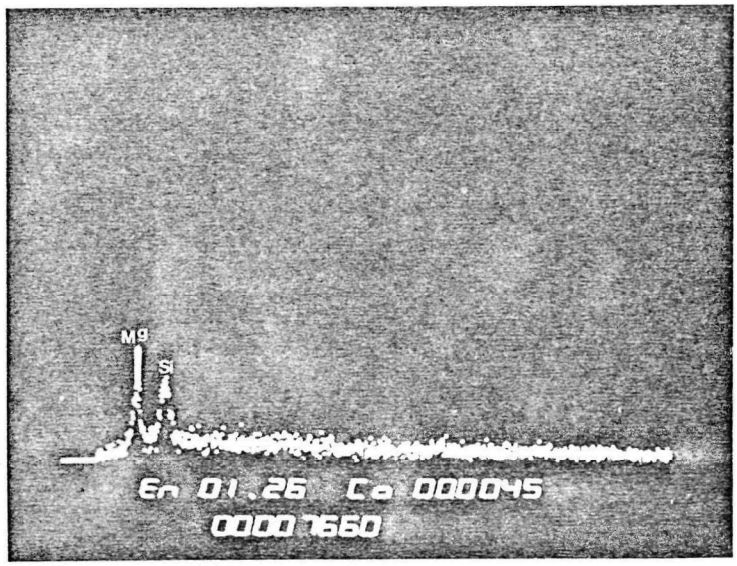



Figure 1 Probe of chrysotile fiber.

SAMPLE :C110170840D1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.11E+08
FIBER CONCENTRATION BY MASS, PER LITER : 35.850 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

DESCRIPTIVE STATISTICS

NO. OBS. = 42

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.96301E+01 | 0.12391E+03 | 0.11131E+02 | 0.17176E+01 |
| 2 | WIDTH | 0.20393E+00 | 0.21723E-01 | 0.14739E+00 | 0.22742E-01 |
| 3 | ASPECT RATIO | 0.48318E+02 | 0.17694E+04 | 0.42064E+02 | 0.64906E+01 |
| 4 | MASS | 0.33957E+01 | 0.94232E+02 | 0.97073E+01 | 0.14979E+01 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.20834E+01 | 0.47633E+01 | 0.52449E+02 | 0.36310E+00 | 0.52086E+02 |
| 2 | 0.15321E+01 | 0 17256E+01 | 0.64550E+00 | 0.40000E-02 | 0.64150E+00 |
| 3 | 0.14814E+01 | 0.18773E+01 | 0.18000E+03 | 0.15714E+01 | 0.17843E+03 |
| 4 | 0.37165E+01 | 0.13566E+02 | 0.50268E+02 | 0.00000E+00 | 0.50268E+02 |

SAMPLE :C110170840D1WG2 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 15.3312 | 0.1210 | 126.6667 | 0.5166 |
| 2 | 1.4928 | 0.2421 | 6.1667 | 0.2012 |
| 3 | 3.3890 | 0.0807 | 42.0000 | 0.0508 |
| 4 | 0.3631 | 0.0807 | 4.5000 | 0.0054 |
| 5 | 6.0518 | 0.2421 | 25.0000 | 0.8156 |
| 6 | 52.4490 | 0.6455 | 81.2500 | 50.2680 |
| 7 | 4.8414 | 0.1210 | 40.0000 | 0.1631 |
| 8 | 24.2072 | 0.4035 | 60.0000 | 9.0627 |
| 9 | 3.1469 | 0.1210 | 26.0000 | 0.1060 |
| 10 | 6.4553 | 0.1210 | 53.3333 | 0.2175 |
| 11 | 18.1554 | 0.4841 | 37.5000 | 9.7878 |
| 12 | 4.3573 | 0.1816 | 24.0000 | 0.3303 |
| 13 | 12.1036 | 0.2421 | 50.0000 | 1.6313 |
| 14 | 2.7435 | 0.1614 | 17.0000 | 0.1643 |
| 15 | 7.6656 | 0.3228 | 23.7500 | 1.8367 |
| 16 | 20.9796 | 0.1614 | 130.0000 | 1.2567 |
| 17 | 10.4898 | 0.1210 | 86.6667 | 0.3534 |
| 18 | 21.7865 | 0.3631 | 60.0000 | 6.6067 |
| 19 | 10.8932 | 0.1412 | 77.1429 | 0.4996 |
| 20 | 12.1036 | 0.2017 | 60.0000 | 1.1328 |
| 21 | 1.9769 | 0 0807 | 24.5000 | 0.0296 |
| 22 | 0.7666 | 0.1614 | 4.7500 | 0.0459 |
| 23 | 1.0490 | 0.1210 | 8.6667 | 0.0353 |
| 24 | 4.6397 | 0.1614 | 28.7500 | 0.2779 |
| 25 | 3.6311 | 0.1210 | 30.0000 | 0.1223 |
| 26 | 7.6656 | 0.2017 | 38.0000 | 0.7175 |
| 27 | 3.6311 | 0.0807 | 45.0000 | 0.0544 |
| 28 | 0.6859 | 0.0282 | 24.2857 | 0.0013 |
| 29 | 0.4438 | 0.2824 | 1.5714 | 0.0814 |
| 30 | 15.7347 | 0.1614 | 97.5000 | 0.9425 |
| 31 | 3.6311 | 0.1210 | 30.0000 | 0.1223 |
| 32 | 18.5589 | 0.5648 | 32.8571 | 13.6183 |
| 33 | 3.9942 | 0.1210 | 33.0000 | 0.1346 |
| 34 | 10.8932 | 0.2017 | 54.0000 | 1.0196 |
| 35 | 2.3400 | 0.1210 | 19.3333 | 0.0788 |
| 36 | 8.4725 | 0.2824 | 30.0000 | 1.5543 |
| 37 | 20.5761 | 0.1210 | 170.0000 | 0.6933 |
| 38 | 10.0863 | 0.1614 | 62.5000 | 0.6042 |
| 39 | 44.3799 | 0.6052 | 73.3333 | 37.3838 |
| 40 | 0.7262 | 0.0040 | 180.0000 | 0 0000 |
| 41 | 0.6052 | 0.1210 | 5.0000 | 0.0204 |
| 42 | 0.9683 | 0.1816 | 5.3333 | 0.0734 |

SAMPLE :C1101708 40D1WG2

DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 2 | 4.76 | 4.76 |
| 0.5 | 1.0 | 5 | 11.90 | 16.67 |
| 1.0 | 1.5 | 2 | 4.76 | 21.43 |
| 1.5 | 2.0 | 1 | 2.38 | 23.81 |
| 2.0 | 2.5 | 1 | 2.38 | 26.19 |
| 2.5 | 3.0 | 1 | 2.38 | 28.57 |
| 3.0 | 3.5 | 2 | 4.76 | 33.33 |
| 3.5 | 4.0 | 4 | 9.52 | 42.86 |
| 4.0 | 4.5 | 1 | 2.38 | 45.24 |
| 4.5 | 5.0 | 2 | 4.76 | 50.00 |
| 5.0 | 5.5 | 0 | 0.00 | 50.00 |
| 5.5 | 6.0 | 0 | 0.00 | 50.00 |
| 6.0 | 6.5 | 2 | 4.76 | 54.76 |
| 6.5 | 7.0 | 0 | 0.00 | 54.76 |
| 7.0 | 7.5 | 0 | 0.00 | 54.76 |
| 7.5 | 8.0 | 2 | 4.76 | 59.52 |
| 8.0 | 8.5 | 1 | 2.38 | 61.90 |
| 8.5 | 9.0 | 0 | 0.00 | 61.90 |
| 9.0 | 9.5 | 0 | 0.00 | 61.90 |
| 9.5 | 10.0 | 0 | 0.00 | 61.90 |
| 10.0 | 10.5 | 2 | 4.76 | 66.67 |
| 10.5 | 11.0 | 2 | 4.76 | 71.43 |
| 11.0 | 11.5 | 0 | 0.00 | 71.43 |
| 11.5 | 12.0 | 0 | 0.00 | 71.43 |
| 12.0 | 12.5 | 2 | 4.76 | 76.19 |
| 12.5 | 13.0 | 0 | 0.00 | 76.19 |
| 13.0 | 13.5 | 0 | 0.00 | 76.19 |
| 13.5 | 14.0 | 0 | 0.00 | 76.19 |
| 14.0 | 14.5 | 0 | 0.00 | 76.19 |
| 14.5 | 15.0 | 0 | 0.00 | 76.19 |
| 15.0 | 15.5 | 1 | 2.38 | 78.57 |
| 15.5 | 16.0 | 1 | 2.38 | 80.95 |
| 16.0 | 16.5 | 0 | 0.00 | 80.95 |
| 16.5 | 17.0 | 0 | 0.00 | 80.95 |
| 17.0 | 17.5 | 0 | 0.00 | 80.95 |
| 17.5 | 18.0 | 0 | 0.00 | 80.95 |
| 18.0 | 18.5 | 1 | 2.38 | 83.33 |
| 18.5 | 19.0 | 1 | 2.38 | 85.71 |
| 19.0 | 19.5 | 0 | 0.00 | 85.71 |
| 19.5 | 20.0 | 0 | 0.00 | 85.71 |
| 20.0 | 20.5 | 0 | 0.00 | 85.71 |
| 20.5 | 21.0 | 2 | 4.76 | 90.48 |
| 21.0 | 21.5 | 0 | 0.00 | 90.48 |
| 21.5 | 22.0 | 1 | 2.38 | 92.86 |
| 22.0 | 22.5 | 0 | 0.00 | 92.86 |
| 22.5 | 23.0 | 0 | 0.00 | 92.86 |
| 23.0 | 23.5 | 0 | 0.00 | 92.86 |
| 23.5 | 24.0 | 0 | 0.00 | 92.86 |
| 24.0 | 24.5 | 1 | 2.38 | 95.24 |
| 24.5 | 25.0 | 0 | 0.00 | 95.24 |
| 25.0 | 25.5 | 0 | 0.00 | 95.24 |

| | | | | |
|---|---|---|---|---|
| 25.5 | 26.0 | 0 | 0.00 | 95.24 |
| 26.0 | 26.5 | 0 | 0.00 | 95.24 |
| 26.5 | 27.0 | 0 | 0.00 | 95.24 |
| 27.0 | 27.5 | 0 | 0.00 | 95.24 |
| 27.5 | 28.0 | 0 | 0.00 | 95.24 |
| 28.0 | 28.5 | 0 | 0.00 | 95 24 |
| 28 5 | 29.0 | 0 | 0.00 | 95.24 |
| 29.0 | 29.5 | 0 | 0.00 | 95.24 |
| 29.5 | 30.0 | 0 | 0.00 | 95.24 |
| 30.0 | 30.5 | 0 | 0.00 | 95.24 |
| 30.5 | 31.0 | 0 | 0.00 | 95.24 |
| 31.0 | 31.5 | 0 | 0.00 | 95.24 |
| 31.5 | 32.0 | 0 | 0.00 | 95.24 |
| 32.0 | 32.5 | 0 | 0.00 | 95.24 |
| 32.5 | 33.0 | 0 | 0.00 | 95.24 |
| 33.0 | 33.5 | 0 | 0.00 | 95.24 |
| 33.5 | 34.0 | 0 | 0.00 | 95.24 |
| 34.0 | 34.5 | 0 | 0.00 | 95.24 |
| 34.5 | 35.0 | 0 | 0.00 | 95.24 |
| 35.0 | 35 5 | 0 | 0.00 | 95.24 |
| 35.5 | 36.0 | 0 | 0.00 | 95.24 |
| 36.0 | 36.5 | 0 | 0.00 | 95.24 |
| 36.5 | 37.0 | 0 | 0.00 | 95.24 |
| 37.0 | 37.5 | 0 | 0.00 | 95 24 |
| 37.5 | 38.0 | 0 | 0.00 | 95.24 |
| 38.0 | 38 5 | 0 | 0.00 | 95.24 |
| 38.5 | 39.0 | 0 | 0.00 | 95.24 |
| 39.0 | 39.5 | 0 | 0.00 | 95.24 |
| 39.5 | 40.0 | 0 | 0.00 | 95.24 |
| 40.0 | 40.5 | 0 | 0.00 | 95.24 |
| 40.5 | 41.0 | 0 | 0.00 | 95.24 |
| 41.0 | 41.5 | 0 | 0.00 | 95.24 |
| 41.5 | 42.0 | 0 | 0.00 | 95.24 |
| 42.0 | 42.5 | 0 | 0.00 | 95.24 |
| 42.5 | 43.0 | 0 | 0.00 | 95.24 |
| 43.0 | 43.5 | 0 | 0.00 | 95.24 |
| 43.5 | 44.0 | 0 | 0.00 | 95.24 |
| 44.0 | 44.5 | 1 | 2.38 | 97.62 |
| 44.5 | 45.0 | 0 | 0.00 | 97.62 |
| 45.0 | 45.5 | 0 | 0.00 | 97.62 |
| 45.5 | 46.0 | 0 | 0.00 | 97.62 |
| 46.0 | 46.5 | 0 | 0.00 | 97.62 |
| 46.5 | 47.0 | 0 | 0.00 | 97.62 |
| 47.0 | 47.5 | 0 | 0.00 | 97.62 |
| 47.5 | 48.0 | 0 | 0.00 | 97.62 |
| 48.0 | 48.5 | 0 | 0.00 | 97.62 |
| 48.5 | 49.0 | 0 | 0.00 | 97.62 |
| 49.0 | 49.5 | 0 | 0.00 | 97.62 |
| 49.5 | 50.0 | 0 | 0.00 | 97.62 |
| 50.0 | 50.5 | 0 | 0.00 | 97.62 |
| 50.5 | 51.0 | 0 | 0.00 | 97.62 |
| 51.0 | 51.5 | 0 | 0.00 | 97.62 |
| 51.5 | 52.0 | 0 | 0.00 | 97.62 |
| 52.0 | 52.5 | 1 | 2.38 | 100.00 |

DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 6 | 14.29 | 14.29 |
| 0.1 | 0.2 | 21 | 50.00 | 64.29 |
| 0.2 | 0.3 | 8 | 19.05 | 83.33 |
| 0.3 | 0.4 | 2 | 4.76 | 88.10 |
| 0.4 | 0.5 | 2 | 4.76 | 92.86 |
| 0.5 | 0.6 | 1 | 2.38 | 95.24 |
| 0.6 | 0.7 | 2 | 4.76 | 100.00 |

DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 7 | 16.67 | 16.67 |
| 10 | 20 | 2 | 4.76 | 21.43 |
| 20 | 30 | 10 | 23.81 | 45.24 |
| 30 | 40 | 5 | 11.90 | 57.14 |
| 40 | 50 | 3 | 7.14 | 64.29 |
| 50 | 60 | 5 | 11.90 | 76.19 |
| 60 | 70 | 1 | 2.38 | 78.57 |
| 70 | 80 | 2 | 4.76 | 83.33 |
| 80 | 90 | 2 | 4.76 | 88.10 |
| 90 | 100 | 1 | 2.38 | 90.48 |
| 100 | 110 | 0 | 0.00 | 90.48 |
| 110 | 120 | 0 | 0.00 | 90.48 |
| 120 | 130 | 2 | 4.76 | 95.24 |
| 130 | 140 | 0 | 0.00 | 95.24 |
| 140 | 150 | 0 | 0.00 | 95.24 |
| 150 | 160 | 0 | 0.00 | 95.24 |
| 160 | 170 | 1 | 2.38 | 97.62 |
| 170 | 180 | 1 | 2.38 | 100.00 |
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0.00 | 100.00 |
| * OVER 200 | | 0 | 0.00 | 100.00 |

SAMPLE :C110170840D1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
OLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

LIMIT OF DETECTION = 0.25E+06

Appendix 2. City of New York

The city of New York water supply was sampled on two occasions. August 11 and October 22, 1975. Raw water was sampled at the Hillview, Jerome Park and Central Park Reservoirs and finished water at the Hillview and Central Park Reservoirs. The sample locations are identified by the digit of the sample number as follows:

1. Central Park
2. Hillview Reservoir - Catskill
3. Jerome Park Reservoir
4. Hillview Reservoir - Delaware

No evidence of asbestiform minerals was detected in any of the samples analyzed. Sample descriptions and computer print outs are attached.

MA code C2

Location: New York City

Date visited: 11 August 1975

McCrone personnel: R. Putscher
M. Palenik

Site description: Water is obtained through two systems, (1) The higher level at Hillview in Yonkers comes from the Catskill-Delaware system and supplies enough natural pressure for any level. The lower level system is the Croton water system. All 3 reservoirs hold about 1 days supply or about 1 billion gallons each.

They treat water with some $CuSO_4$ for algae control and add chlorine to a level to maintain 0.8-1.0 ppm of free chlorine. They bring the pH up to 6.9 or 7.0 with NaOH and also fluoridate with hydrated fluosilicic acid.

Dust was sampled at Central Park with an air sample of 90 liters of air for 1/2 hr; also collected settled dust inside of station.

Total samples collected: 3 raw water
2 finished water
1 air sample
1 settled dust sample

Recommend analysis of all samples

Location: New York City

Date visited: 22 October 1975

McCrone personnel: R. Putscher
M. Palenik

Site description: Water is obtained through two systems, (1) The higher level at Hillview in Yonkers comes from the Catskill-Delaware system and supplies enough natural pressure for any level. The lower level system is the Croton water system. All 3 reservoirs hold about 1 days supply or about 1 billion gallons each.

They treat water with some $CuSO_4$ for algae control and add chlorine to a level to maintain 0.8-1.0 ppm of free chlorine. They bring the pH up to 6.9 or 7.0 with NaOH and also fluoridate with hydrated fluosilicic acid.

Sampling: 4 - U1 samples - represent inlet or raw water
3 - D1 samples represent treated or finished water

Total of 7 samples

C2 0811 1040 U1 WG2

Organic residues throughout. Diatomaceous and other remains present. Small to moderately sized, mainly blocky, inorganic material. Organic material of a fibrous nature is present as is some inorganic fibrous material (non-asbestiform).

SAMPLE :C208111040U1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 60.0 ML
GRID SQUARES COUNTED 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.21E+06

SAMPLE :C208111040U1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 60.0 ML
GRID SQUARES COUNTED . 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.21E+06

Substantial evidence of bacterial growth. Diatoms and their fragments, organic residues and agglomerated areas are common. Some organic fibers are present and inorganics consist mainly of small to moderately sized blocky material with some small platy material present. Loading was moderate to heavy due to the bacterial growth.

SAMPLE :C208111045D1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.13E+06

SAMPLE :C208111045D1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
'OLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED . 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.13E+06

Organic residues generally present as are diatomaceous remains. Small to moderate sized irregular blocky or chunky inorganic types present. Organic fibrous material is common. Material resembling the sporangia of fungi are present. Agglomeration of sample material is quite common. Fibrous inorganic material evident which generally shows a hexagonal diffraction array.

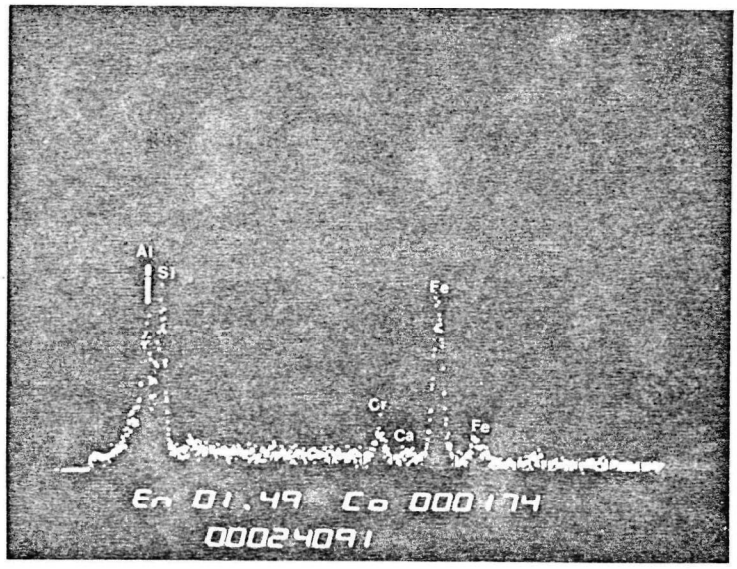



Figure 1 Probe of inorganic fiber.

SAMPLE :C208111000U2WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 35.0 ML
GRID SQUARES COUNTED . 40
TOTAL SUSPENDED SOLIDS: 11.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.36E+06

SAMPLE :C208111000U2WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 35.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 11.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.36E+06

Organic residues of various types generally present as are diatoms and fragments thereof. Remains are present which resemble the sporangia of fungi. Small to moderately sized blocky to chiplike material is present. Fibers of both organic and inorganic natures are evident. No asbestiform material was detected.

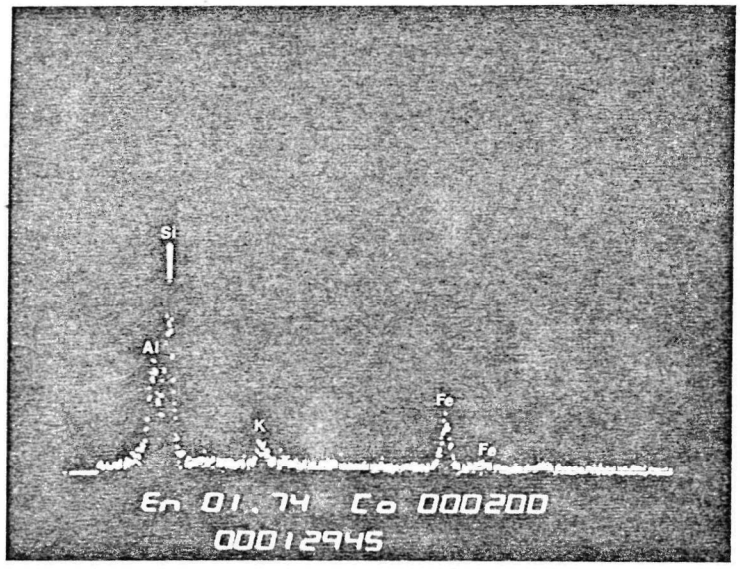



Figure 1 Probe of inorganic fiber.

SAMPLE :C208111010D2WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 70.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.18E+06

SAMPLE :C208111010D2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 70.0 ML
GRID SQUARES COUNTED : 41
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.18E+06

Whole diatoms and their fragments in addition to a large variety of organic residues are present. Agglomeration of sample material occurs quite frequently. Fibers of both an organic and inorganic nature were noted. Some remains are present which resemble the sporangia of fungi. Inorganic fibers are sparce and non-asbestiform.

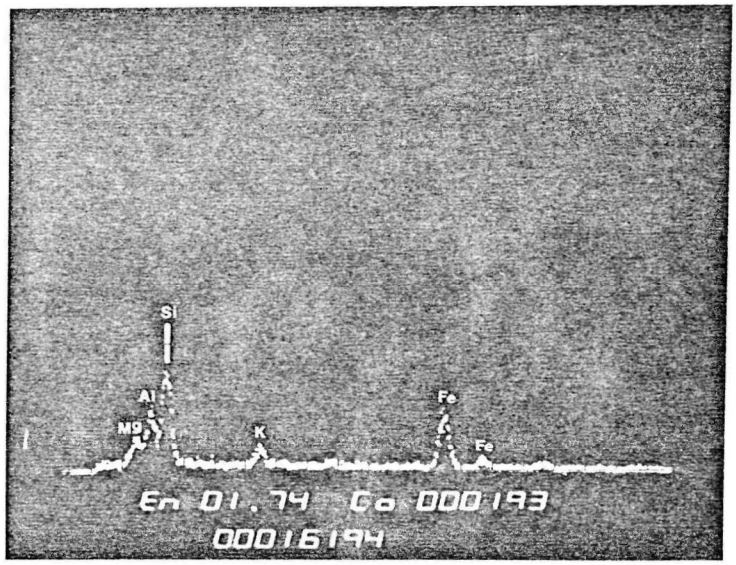



Figure 1 Probe of inorganic fiber.

SAMPLE :C208110945U3WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.00
FIBER CONCENTRATION BY MASS PER LITER : 0.000 GRAMS*10↑-6
'OLUME FILTERED : 70.0 ML
GRID SQUARES COUNTED . 40
TOTAL SUSPENDED SOLIDS: 11.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.18E+06

SAMPLE :C208110945U3WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
'OLUME FILTERED : 70.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 11.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.18E+06

C2 1022 1040 U1 WG3

Diatomaceous remains common. Organic residues prevalent, ranging in morphology from small filmy types to large irregular masses. Small to moderately sized inorganic material is present ranging from platy to blocky in shape. Fibers are present — mainly non-inorganic. No asbestiform material detected.

SAMPLE :C210221040U1WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.25E+06

SAMPLE :C210221040U1WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.25E+06

Large inorganic fibers of a network type are present. Much organic material is present from small blobs or films to large masses. Inorganics range from small platy to moderately sized blocky or chunky material. Diatomaceous remains are common. Some agglomeration of material noted. Fibers are present; no asbestiform material was detected.

SAMPLE :C210221045D1WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
/OLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.25E+06

SAMPLE :C210221045D1WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.25E+06

Organic residues of varying sizes common as are diatom fragments. Inorganic particles are present of small to moderate sizes and varying morphologies. Fibers of varying types are also present. No asbestiform material detected.

SAMPLE :C210220900U2WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED 40
TOTAL SUSPENDED SOLIDS: 4.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.25E+06

SAMPLE :C210220900U2WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 4.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.25E+06

Diatomaceous remains and organic residues prevalent. Areas of agglomeration noted. Small to moderately sized platy to chunky inorganic particulates are present. Fibers are present consisting mainly of organic types and remains. No asbestiform material detected.

SAMPLE :C210220910D2WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 6.7

LIMIT OF DETECTION = 0.25E+06

SAMPLE :C210220910D20G3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 6.7

LIMIT OF DETECTION = 0.25E+06

Quite heavily loaded. Much general organic residue of a filmy to networklike nature present. Diatomaceous remains prevalent. Small to moderately sized material with blocky to platy shapes, while the larger sizes are mainly from blocky type material. Fibers are present, mainly organic or remains. No asbestiform material detected.

SAMPLE :C210220945U3WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.25E+06

SAMPLE :C210220945U3WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.25E+06

Diatomaceous remains prevalent. Organic residues present as are some areas of agglomeration. Inorganics range to moderate sizes and from platy to irregular, blocky morphology. Fibers are present which are generally organic or some remains fragment. No asbestiform material detected.

C2 1022 0950 D3 WG3

Diatomaceous remains prevalent. Organic residues present as are some areas of agglomeration. Inorganics range to moderate sizes and from platy to the irregular blocky types in morphology. Fibers are present which are generally organic or some remain fragment. No asbestiform material detected.

SAMPLE :C210220950D3WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 6.5

LIMIT OF DETECTION = 0.25E+06

SAMPLE :C210220950D3WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 6.5

LIMIT OF DETECTION = 0.25E+06

Diatomaceous remains quite evident. Small to large blocky inorganics and generally small platy inorganics. Organic residues and areas of agglomeration are present. The fibers present in the sample are mainly organic or diatom fragments. Few inorganic fibers were present.

SAMPLE :C210220905U4WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.25E+06

SAMPLE :C210220905U4WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.25E+06

Appendix 3. City of Philadelphia

The City of Philadelphia water supply was sampled on two occasions - May 14, 1975 and October 27, 1975. On each visit samples of raw and finished water were obtained at the reservoirs at Queen's Lane, Belmont and Torresdale. Queen's Lane and Belmont reservoirs are supplied from the Schuylkill River; Torresdale reservoir is supplied from the Delaware River.

The results of the analyses for asbestiform minerals are tabulated: sample descriptions and computer print outs are attached. The low levels at Queen's Lane are interesting and point to an asbestos source intermediate between Queen's Lane and Belmont. The Wissahickon Creek enters the Schuylkill River just above Queen's Lane, but it is reported that mingling of the two streams occurs below the Queen's Lane intake. A sampling program to determine whether the Wissahickon Creek is the asbestos source and also to examine integrated samples taken at the Philadelphia plants is currently being discussed with EPA region 3 (Joe Friedel).

Company: City of Philadelphia - Regional City MA code C3

Date visited: 27 October 1975, 14 May 1975

Personnel contacted: Allen Hess, Superintendent (215) 686-1776 Ext. 47211

McCrone personnel: R. Putscher
M. Palenik

Site description: Philadelphia has 3 reservoirs - all were sampled for raw and finished water.

Reservoir no. 1 - Queens Lane Plant
Reservoir no. 2 - Belmont Plant Source of supply is the Schuylkill River

Reservoir no. 3 - Torresdale Plant Source of supply is the Delaware River

Sampling:

Three raw water samples - U1 -3
Three finished water samples - D1 -3

Total of six samples

Weather conditions: Fair and pleasant, about 70°F

Comments: Good cooperation

City of Philadelphia

| Sample | Date sampled | Asbestos type* | Fibers/litre† | Comment |
|---|---|---|---|---|
| Queen's Lane Raw | 5-14-75 | A | BDL | Detection limit |
| | | C | $40 \times 10^6$ | $1.6 \times 10^6$ fpl |
| Queen's Lane Finished | " | A | BDL | Detection limit |
| | | C | BDL | $.13 \times 10^6$ fpl |
| Belmont Raw | 5-14-75 | A | BDL | Detection limit |
| | | C | $25 \times 10^6$ | $.42 \times 10^6$ |
| | | A | BDL | Detection limit |
| | | C | $.75 \times 10^6$ | $.13 \times 10^6$ |
| Torresdale Raw | 5-14-75 | A | BDL | Detection limit $2.5 \times 10^6$ |
| | | C | BDL | Detection limit |
| Torresdale Finished | " | A | BDL | $2.5 \times 10^6$ |
| | | C | $17 \times 10^6$ | Detection limit $.46 \times 10^6$ |
| Queen's Lane Raw | 10-27-75 | A | BDL | Detection limit |
| | | C | BDL | $.13 \times 10^6$ |
| Queen's Lane Finished | " | A | BDL | Detection limit |
| | | C | BDL | $.1 \times 10^6$ |
| Belmont Raw | 10-27-75 | A | BDL | Detection limit |
| | | C | $240 \times 10^6$ | $5 \times 10^6$ |
| Belmont Finished | " | A | BDL | Detection limit |
| | | C | $130 \times 10^6$ | $2.5 \times 10^6$ |
| Torresdale Raw | 10-27-75 | A | BDL | Detection limit |
| | | C | $160 \times 10^6$ | $4.2 \times 10^6$ |
| Torresdale Finished | " | A | BDL | Detection limit |
| | | C | $170 \times 10^6$ | $.34 \times 10^6$ |

* C = chrysotile
A = asbestiform amphibole

† BDL - below detection limit

C3 0514 1400 U1 WG3

Large networklike organic fibers are present. Small platy to large blocky inorganics are present as are varying types of organic residues and fibers. Inorganic fibers noted including chrysotile. Agglomeration of sample material does take place. Chrysotile occurs in localized areas and not all fibers occurring in the areas are chrysotile fibers.

→ plant
U1 QL
U2 Belmont
U3 Foverdale

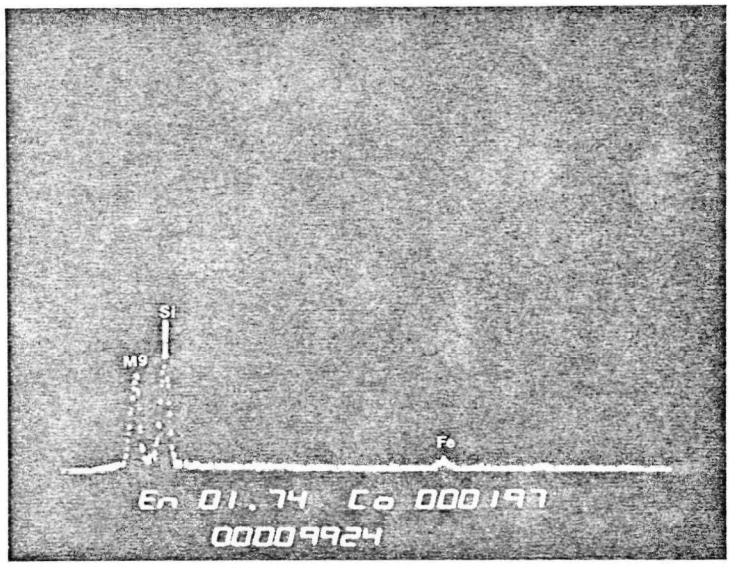



Figure 1 Probe of chrysotile fiber.

SAMPLE :C305141400U1WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 7.5 ML
GRID SQUARES COUNTED : 41
TOTAL SUSPENDED SOLIDS: 20.000 MG PER LITER
PH = 7.3

LIMIT OF DETECTION = 0.16E+07

SAMPLE :C30514140GU1WG3 (CHRYSOTILE)

Q. L.
Row

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.40E+08
FIBER CONCENTRATION BY MASS, PER LITER : 2.872 GRAMS+10+-6
VOLUME FILTERED : 7 5 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 20.000 MG PER LITER
PH = 7.3

DESCRIPTIVE STATISTICS

NO. OBS. = 24

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.16995E+01 | 0.11261E+01 | 0.10612E+01 | 0.21662E+00 |
| 2 | WIDTH | 0.96983E-01 | 0.86704E-02 | 0.93115E-01 | 0.19007E-01 |
| 3 | ASPECT RATIO | 0.33305E+02 | 0.83866E+03 | 0.28960E+02 | 0.59114E+01 |
| 4 | MASS | 0.71400E-01 | 0.34389E-01 | 0.18544E+00 | 0.37853E-01 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.13048E+01 | 0.10985E+01 | 0.48414E+01 | 0.28240E+00 | 0.45590E+01 |
| 2 | 0.16918E+01 | 0.25779E+01 | 0.40350E+00 | 0.20200E-01 | 0.38330E+00 |
| 3 | 0.12132E+01 | 0.11999E+01 | 0.12000E+03 | 0.11667E+01 | 0.11883E+03 |
| 4 | 0 38034E+01 | 0.14148E+02 | 0.90630E+00 | 0.12000E-02 | 0.90510E+00 |

SAMPLE :C305141400U1WG3 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 1.6138 | 0.2421 | 6.6667 | 0.2175 |
| 2 | 0.9279 | 0.1210 | 7.6667 | 0.0313 |
| 3 | 3.4294 | 0.0807 | 42.5000 | 0.0514 |
| 4 | 1.1700 | 0.0282 | 41.4286 | 0 0021 |
| 5 | 0.2824 | 0.2421 | 1.1667 | 0.0381 |
| 6 | 0.8069 | 0.0282 | 28.5714 | 0.0015 |
| 7 | 3.2276 | 0.0807 | 40.0000 | 0.0483 |
| 8 | 4.8414 | 0.0403 | 120.0000 | 0.0181 |
| 9 | 1.3314 | 0.1210 | 11.0000 | 0.0449 |
| 10 | 1.3314 | 0.1210 | 11.0000 | 0.0449 |
| 11 | 0.8876 | 0.0605 | 14.6667 | 0.0075 |
| 12 | 2.4207 | 0.0282 | 85.7143 | 0.0044 |
| 13 | 1.2104 | 0.0282 | 42.8571 | 0.0022 |
| 14 | 0.8876 | 0.1009 | 8.8000 | 0.0208 |
| 15 | 1.2507 | 0 0202 | 62.0000 | 0.0012 |
| 16 | 1.4121 | 0.0202 | 70.0000 | 0.0013 |
| 17 | 0.8876 | 0.1210 | 7.3333 | 0.0299 |
| 18 | 1.0490 | 0.0282 | 37.1429 | 0.0019 |
| 19 | 2.4207 | 0.4035 | 6.0000 | 0.9063 |
| 20 | 1.6138 | 0.0605 | 26.6667 | 0.0136 |
| 21 | 1.6945 | 0.0403 | 42.0000 | 0.0063 |
| 22 | 1.0490 | 0.0282 | 37 1429 | 0.0019 |
| 23 | 1.8155 | 0.2017 | 9 0000 | 0.1699 |
| 24 | 3.2276 | 0.0807 | 40.0000 | 0.0483 |

SAMPLE :C305141400U1WG3

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 1 | 4.17 | 4.17 |
| 0.5 | 1.0 | 5 | 20.83 | 25.00 |
| 1.0 | 1.5 | 8 | 33.33 | 58.33 |
| 1.5 | 2.0 | 4 | 16.67 | 75.00 |
| 2.0 | 2.5 | 2 | 8.33 | 83.33 |
| 2.5 | 3.0 | 0 | 0.00 | 83.33 |
| 3.0 | 3.5 | 3 | 12.50 | 95.83 |
| 3.5 | 4.0 | 0 | 0.00 | 95.83 |
| 4.0 | 4.5 | 0 | 0.00 | 95.83 |
| 4 5 | 5.0 | 1 | 4.17 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 15 | 62.50 | 62.50 |
| 0.1 | 0.2 | 5 | 20.83 | 83.33 |
| 0.2 | 0.3 | 3 | 12.50 | 95.83 |
| 0.3 | 0.4 | 0 | 0.00 | 95.83 |
| 0.4 | 0.5 | 1 | 4.17 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 7 | 29.17 | 29.17 |
| 10 | 20 | 3 | 12.50 | 41.67 |
| 20 | 30 | 2 | 8.33 | 50.00 |
| 30 | 40 | 4 | 16.67 | 66.67 |
| 40 | 50 | 4 | 16.67 | 83.33 |
| 50 | 60 | 0 | 0.00 | 83.33 |
| 60 | 70 | 2 | 8.33 | 91.67 |
| 70 | 80 | 0 | 0.00 | 91.67 |
| 80 | 90 | 1 | 4.17 | 95.83 |
| 90 | 100 | 0 | 0.00 | 95.83 |
| 100 | 110 | 0 | 0.00 | 95.83 |
| 110 | 120 | 1 | 4.17 | 100.00 |
| 120 | 130 | 0 | 0.00 | 100.00 |
| 130 | 140 | 0 | 0.00 | 100.00 |
| 140 | 150 | 0 | 0.00 | 100.00 |
| 150 | 160 | 0 | 0.00 | 100.00 |
| 160 | 170 | 0 | 0.00 | 100.00 |
| 170 | 180 | 0 | 0.00 | 100.00 |

| | | | | |
|---|---|---|---|---|
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0.00 | 100.00 |
| * OVER | 200 | 0 | 0.00 | 100.00 |

QL- Fin

C3 0514 1400 D1 WG2

General organic residues present of varying shapes. Small to moderately sized (mainly blocky) inorganics are present. Some inorganic fibers are present, but no asbestiform material was detected.

SAMPLE :C305141400D1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 8.000 MG PER LITER
PH = 7.9

LIMIT OF DETECTION = 0.13E+06

SAMPLE :C305141400D1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10+-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 8.000 MG PER LITER
PH = 7.9

LIMIT OF DETECTION = 0.13E+06

Belmont Row

Small to large blocky to chiplike inorganics with the platy types being in the smaller size ranges. Diatomaceous remains and various types of organic residues are extant. Chrysotile is present in localized "masses" and the overlaps make counting quite difficult. Large organic fibers are present as well as agglomerated areas.

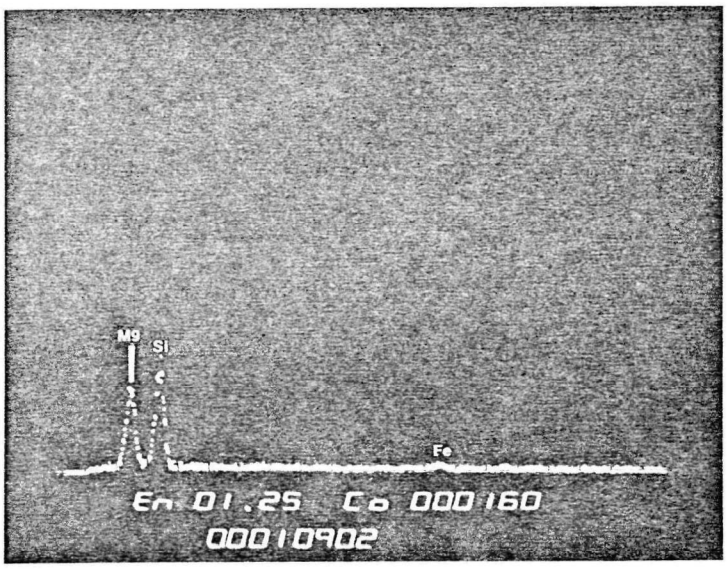



Figure 1 Probe of chrysotile fiber bundle.

SAMPLE :C305141430U2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 30.0 ML
GRID SQUARES COUNTED . 40
TOTAL SUSPENDED SOLIDS: 24.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.42E+06

SAMPLE :C305141430U2WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.25E+08
FIBER CONCENTRATION BY MASS, PER LITER : 34.298 GRAMS*10↑-6
VOLUME FILTERED : 30.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 24.000 MG PER LITER
PH = 7.2

DESCRIPTIVE STATISTICS

NO. OBS. = 60

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.40002E+01 | 0.19414E+02 | 0.44062E+01 | 0.56884E+00 |
| 2 | WIDTH | 0.12175E+00 | 0.30636E-01 | 0.17503E+00 | 0.22596E-01 |
| 3 | ASPECT RATIO | 0.71360E+02 | 0.61059E+04 | 0.78140E+02 | 0.10088E+02 |
| 4 | MASS | 0.13645E+01 | 0.34790E+02 | 0.58983E+01 | 0.76147E+00 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.25670E+01 | 0.69145E+01 | 0.21786E+02 | 0.64550E+00 | 0.21141E+02 |
| 2 | 0.23636E+01 | 0.56783E+01 | 0.80690E+00 | 0.40000E-02 | 0.80290E+00 |
| 3 | 0.29988E+01 | 0.12035E+02 | 0.49000E+03 | 0.30000E+01 | 0.48700E+03 |
| 4 | 0.49563E+01 | 0.23306E+02 | 0.32626E+02 | 0.10000E-03 | 0.32626E+02 |

SAMPLE :C305141430U2WG2 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 1.8155 | 0.1210 | 15.0000 | 0.0612 |
| 2 | 11.2967 | 0.2824 | 40.0000 | 2.0723 |
| 3 | 1.4524 | 0.4841 | 3.0000 | 0.7830 |
| 4 | 8.4725 | 0 2017 | 42.0000 | 0.7930 |
| 5 | 7.2622 | 0.2017 | 36.0000 | 0.6797 |
| 6 | 3.2276 | 0.0282 | 114.2857 | 0.0059 |
| 7 | 3.2276 | 0.4438 | 7.2727 | 1.4621 |
| 8 | 7.2622 | 0.1614 | 45.0000 | 0.4350 |
| 9 | 21.7865 | 0.8069 | 27.0000 | 32.6259 |
| 10 | 0.7666 | 0.0282 | 27.1429 | 0.0014 |
| 11 | 1.8559 | 0.0282 | 65.7143 | 0.0034 |
| 12 | 2.1383 | 0.0282 | 75.7143 | 0.0039 |
| 13 | 1.6542 | 0.0807 | 20.5000 | 0.0248 |
| 14 | 3.9538 | 0.0282 | 140.0000 | 0.0073 |
| 15 | 0.8876 | 0.0282 | 31.4286 | 0.0016 |
| 16 | 2.0576 | 0.0282 | 72.8571 | 0.0038 |
| 17 | 2.5418 | 0.0282 | 90.0000 | 0.0047 |
| 18 | 2.8645 | 0 0282 | 101.4286 | 0.0053 |
| 19 | 1.1700 | 0.0282 | 41.4286 | 0.0021 |
| 20 | 1.2507 | 0.0403 | 31.0000 | 0.0047 |
| 21 | 1.0490 | 0.0282 | 37.1429 | 0.0019 |
| 22 | 2.0576 | 0.0202 | 102.0000 | 0.0019 |
| 23 | 6.4553 | 0.0282 | 228.5714 | 0.0118 |
| 24 | 7.6656 | 0.0282 | 271.4286 | 0.0141 |
| 25 | 3.6311 | 0.0282 | 128.5714 | 0.0067 |
| 26 | 2.7435 | 0.0282 | 97.1429 | 0.0050 |
| 27 | 2.8645 | 0.2824 | 10.1429 | 0.5255 |
| 28 | 3.0259 | 0.0403 | 75.0000 | 0.0113 |
| 29 | 0.6859 | 0.0282 | 24.2857 | 0.0013 |
| 30 | 1.7752 | 0.0807 | 22.0000 | 0.0266 |
| 31 | 0.6455 | 0.0403 | 16.0000 | 0.0024 |
| 32 | 10.8932 | 0.2421 | 45.0000 | 1.4682 |
| 33 | 2.9856 | 0.2824 | 10.5714 | 0.5477 |
| 34 | 2.9856 | 0.0403 | 74.0000 | 0.0112 |
| 35 | 2.8645 | 0.2824 | 10.1429 | 0.5255 |
| 36 | 3.6311 | 0.0403 | 90.0000 | 0.0136 |
| 37 | 15.3312 | 0.3631 | 42.2222 | 4.6492 |
| 38 | 0.8069 | 0.1614 | 5.0000 | 0.0483 |
| 39 | 3.2276 | 0.0282 | 114.2857 | 0.0059 |
| 40 | 6.4553 | 0.1614 | 40.0000 | 0.3867 |
| 41 | 3.2276 | 0.4438 | 7.2727 | 1.4621 |
| 42 | 7.2622 | 0.1614 | 45.0000 | 0.4350 |
| 43 | 21.7865 | 0.8069 | 27.0000 | 32.6259 |
| 44 | 0.7666 | 0.0282 | 27.1429 | 0.0014 |
| 45 | 1.8559 | 0.0444 | 41.8182 | 0.0084 |
| 46 | 2.1383 | 0.0282 | 75.7143 | 0.0039 |
| 47 | 1.6542 | 0.0807 | 20.5000 | 0.0248 |
| 48 | 3.9538 | 0.0282 | 140.0000 | 0.0073 |
| 49 | 0.8876 | 0.0282 | 31.4286 | 0.0016 |
| 50 | 2.0576 | 0.0282 | 72.8571 | 0.0038 |
| 51 | 2.5418 | 0.0282 | 90.0000 | 0.0047 |

| | | | | |
|---|---|---|---|---|
| 52 | 2.8645 | 0.0282 | 101.4286 | 0.0053 |
| 53 | 3.1469 | 0.0282 | 111.4286 | 0.0058 |
| 54 | 3.7118 | 0.0282 | 131.4286 | 0.0068 |
| 55 | 0.9279 | 0.0403 | 23.0000 | 0.0035 |
| 56 | 1.3314 | 0.0403 | 33.0000 | 0.0050 |
| 57 | 1 1297 | 0.0403 | 28.0000 | 0.0042 |
| 58 | 1.9769 | 0 0040 | 490.0000 | 0.0001 |
| 59 | 2.0173 | 0.0202 | 100.0000 | 0.0019 |
| 60 | 6.0518 | 0.0282 | 214.2857 | 0.0111 |

SAMPLE :C305141430U2WG2

DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 0 | 0.00 | 0.00 |
| 0.5 | 1.0 | 8 | 13.33 | 13.33 |
| 1.0 | 1.5 | 6 | 10.00 | 23.33 |
| 1.5 | 2.0 | 7 | 11.67 | 35.00 |
| 2.0 | 2.5 | 6 | 10.00 | 45.00 |
| 2.5 | 3.0 | 9 | 15.00 | 60.00 |
| 3.0 | 3.5 | 6 | 10.00 | 70.00 |
| 3.5 | 4.0 | 5 | 8.33 | 78.33 |
| 4.0 | 4.5 | 0 | 0.00 | 78.33 |
| 4.5 | 5.0 | 0 | 0.00 | 78.33 |
| 5.0 | 5.5 | 0 | 0.00 | 78.33 |
| 5.5 | 6.0 | 0 | 0.00 | 78.33 |
| 6.0 | 6.5 | 3 | 5.00 | 83.33 |
| 6.5 | 7.0 | 0 | 0.00 | 83.33 |
| 7.0 | 7.5 | 3 | 5.00 | 88.33 |
| 7.5 | 8.0 | 1 | 1.67 | 90.00 |
| 8.0 | 8.5 | 1 | 1.67 | 91.67 |
| 8.5 | 9.0 | 0 | 0.00 | 91.67 |
| 9.0 | 9.5 | 0 | 0.00 | 91.67 |
| 9.5 | 10.0 | 0 | 0.00 | 91.67 |
| 10.0 | 10.5 | 0 | 0.00 | 91.67 |
| 10.5 | 11.0 | 1 | 1.67 | 93.33 |
| 11.0 | 11.5 | 1 | 1.67 | 95.00 |
| 11.5 | 12.0 | 0 | 0.00 | 95.00 |
| 12.0 | 12.5 | 0 | 0.00 | 95.00 |
| 12.5 | 13.0 | 0 | 0.00 | 95.00 |
| 13.0 | 13.5 | 0 | 0.00 | 95.00 |
| 13.5 | 14.0 | 0 | 0.00 | 95.00 |
| 14.0 | 14.5 | 0 | 0.00 | 95.00 |
| 14.5 | 15.0 | 0 | 0.00 | 95.00 |
| 15.0 | 15.5 | 1 | 1.67 | 96.67 |
| 15.5 | 16.0 | 0 | 0.00 | 96.67 |
| 16.0 | 16.5 | 0 | 0.00 | 96.67 |
| 16.5 | 17.0 | 0 | 0.00 | 96.67 |
| 17.0 | 17.5 | 0 | 0.00 | 96.67 |
| 17.5 | 18.0 | 0 | 0.00 | 96.67 |
| 18.0 | 18.5 | 0 | 0.00 | 96.67 |
| 18.5 | 19.0 | 0 | 0.00 | 96.67 |
| 19.0 | 19.5 | 0 | 0.00 | 96.67 |
| 19.5 | 20.0 | 0 | 0.00 | 96.67 |
| 20.0 | 20.5 | 0 | 0.00 | 96.67 |
| 20.5 | 21.0 | 0 | 0.00 | 96.67 |
| 21.0 | 21.5 | 0 | 0.00 | 96.67 |
| 21.5 | 22.0 | 2 | 3.33 | 100.00 |

DISTRIBUTION BY WIDTH

| WIDTH | NUMBER | PERCENT | CUMULATIVE |
|---|---|---|---|

| | | | | PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 42 | 70.00 | 70.00 |
| 0.1 | 0.2 | 5 | 8.33 | 78.33 |
| 0.2 | 0.3 | 7 | 11.67 | 90.00 |
| 0.3 | 0.4 | 1 | 1.67 | 91.67 |
| 0.4 | 0.5 | 3 | 5.00 | 96.67 |
| 0.5 | 0.6 | 0 | 0.00 | 96.67 |
| 0.6 | 0.7 | 0 | 0.00 | 96.67 |
| 0.7 | 0.8 | 0 | 0.00 | 96.67 |
| 0.8 | 0.9 | 2 | 3.33 | 100.00 |

DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 4 | 6.67 | 6.67 |
| 10 | 20 | 5 | 8.33 | 15.00 |
| 20 | 30 | 10 | 16.67 | 31.67 |
| 30 | 40 | 8 | 13.33 | 45.00 |
| 40 | 50 | 7 | 11.67 | 56.67 |
| 50 | 60 | 0 | 0.00 | 56.67 |
| 60 | 70 | 1 | 1.67 | 58.33 |
| 70 | 80 | 6 | 10.00 | 68.33 |
| 80 | 90 | 3 | 5.00 | 73.33 |
| 90 | 100 | 2 | 3.33 | 76.67 |
| 100 | 110 | 3 | 5.00 | 81.67 |
| 110 | 120 | 3 | 5.00 | 86.67 |
| 120 | 130 | 1 | 1.67 | 88.33 |
| 130 | 140 | 3 | 5.00 | 93.33 |
| 140 | 150 | 0 | 0.00 | 93.33 |
| 150 | 160 | 0 | 0.00 | 93.33 |
| 160 | 170 | 0 | 0.00 | 93.33 |
| 170 | 180 | 0 | 0.00 | 93.33 |
| 180 | 190 | 0 | 0.00 | 93.33 |
| 190 | 200 | 0 | 0.00 | 93.33 |
| * OVER 200 | | 4 | 6.67 | 100.00 |

Belmont - Fir

C3 0514 1430 D2 WG2

Small platy inorganics to moderate blocky types present. Little other material noted. Some fine filmy organic residues detected. Occasional chrysotile fibrils or fibers noted.

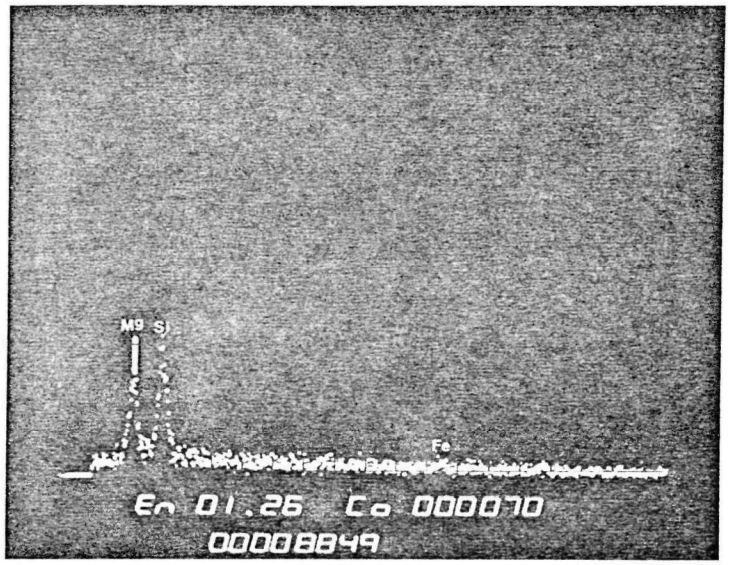



Figure 1 Probe of small chrysotile fiber.

SAMPLE :C305141430D2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 8.000 MG PER LITER
PH = 7.8

LIMIT OF DETECTION = 0.13E+06

SAMPLE : C3051141430D2WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.75E+06
FIBER CONCENTRATION BY MASS, PER LITER : 0.007 GRAMS*10↑-6
OLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 8.000 MG PER LITER
PH = 7.8

DESCRIPTIVE STATISTICS

NO. OBS. = 6

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.14659E+01 | 0.32272E+00 | 0.56808E+00 | 0.23192E+00 |
| 2 | WIDTH | 0.44350E-01 | 0.47620E-03 | 0.21822E-01 | 0.89088E-02 |
| 3 | ASPECT RATIO | 0.34746E+02 | 0.79767E+02 | 0.89312E+01 | 0.36462E+01 |
| 4 | MASS | 0.97500E-02 | 0.12250E-03 | 0.11068E-01 | 0.45185E-02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.59439E-01 | -0.18096E+01 | 0.22593E+01 | 0.76660E+00 | 0.14927E+01 |
| 2 | 0.63414E+00 | -0.15166E+01 | 0.80700E-01 | 0.28200E-01 | 0.52500E-01 |
| 3 | 0.23455E-01 | -0.17536E+01 | 0.47143E+02 | 0.23000E+02 | 0.24143E+02 |
| 4 | 0.63016E+00 | -0.16050E+01 | 0.27800E-01 | 0.14000E-02 | 0.26400E-01 |

SAMPLE :C305141430D2WG2 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 1.8559 | 0.0807 | 23.0000 | 0.0278 |
| 2 | 0.7666 | 0.0282 | 27.1429 | 0.0014 |
| 3 | 2.2593 | 0.0605 | 37.3333 | 0.0190 |
| 4 | 0.9279 | 0.0282 | 32.8571 | 0.0017 |
| 5 | 1.6542 | 0.0403 | 41.0000 | 0.0062 |
| 6 | 1.3314 | 0.0282 | 47.1429 | 0.0024 |

SAMPLE :C305141430D2WG2

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 0 | 0.00 | 0.00 |
| 0.5 | 1.0 | 2 | 33.33 | 33.33 |
| 1.0 | 1.5 | 1 | 16.67 | 50.00 |
| 1.5 | 2.0 | 2 | 33.33 | 83.33 |
| 2 0 | 2.5 | 1 | 16.67 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 6 | 100.00 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 0 | 0.00 | 0.00 |
| 10 | 20 | 0 | 0.00 | 0.00 |
| 20 | 30 | 2 | 33.33 | 33.33 |
| 30 | 40 | 2 | 33.33 | 66.67 |
| 40 | 50 | 2 | 33.33 | 100.00 |
| 50 | 60 | 0 | 0.00 | 100.00 |
| 60 | 70 | 0 | 0.00 | 100.00 |
| 70 | 80 | 0 | 0.00 | 100.00 |
| 80 | 90 | 0 | 0.00 | 100.00 |
| 90 | 100 | 0 | 0.00 | 100.00 |
| 100 | 110 | 0 | 0.00 | 100.00 |
| 110 | 120 | 0 | 0.00 | 100.00 |
| 120 | 130 | 0 | 0.00 | 100.00 |
| 130 | 140 | 0 | 0.00 | 100.00 |
| 140 | 150 | 0 | 0.00 | 100.00 |
| 150 | 160 | 0 | 0.00 | 100.00 |
| 160 | 170 | 0 | 0.00 | 100.00 |
| 170 | 180 | 0 | 0.00 | 100.00 |
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0.00 | 100.00 |
| * OVER 200 | | 0 | 0.00 | 100.00 |

C3 0514 1530 U3 WG3 — Torrendale Rm

Large organic fibers of a network type are present as well as diatomaceous remains. Generally small platy and small to quite large blocky inorganics are present. Some agglomeration is noted. Some inorganic fibers evident, however, these yield hexagonal diffraction patterns. No asbestiform material detected.

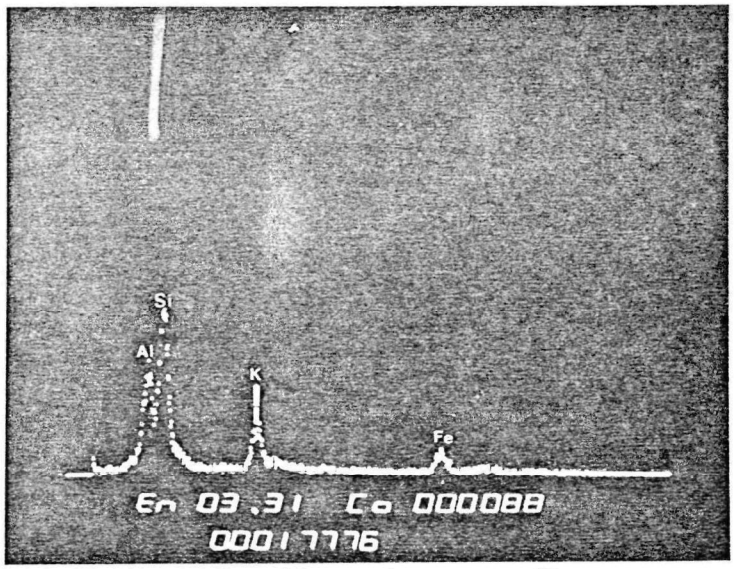



Figure 1 Probe of large inorganic fiber.

SAMPLE :C305141530U3WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 5.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 74.000 MG PER LITER
PH = 7.0

LIMIT OF DETECTION = 0.25E+07

SAMPLE :C305141530U3WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 5.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 74.000 MG PER LITER
PH = 7.0

LIMIT OF DETECTION = 0.25E+07

C3 0514 1530 D3 WG2 Torrendale Fur

Very small platy and blocky inorganics. Some large chunky inorganics present. Some light organic residues noted. Chrysotile is present and occurs in groups and also as single fibrils.

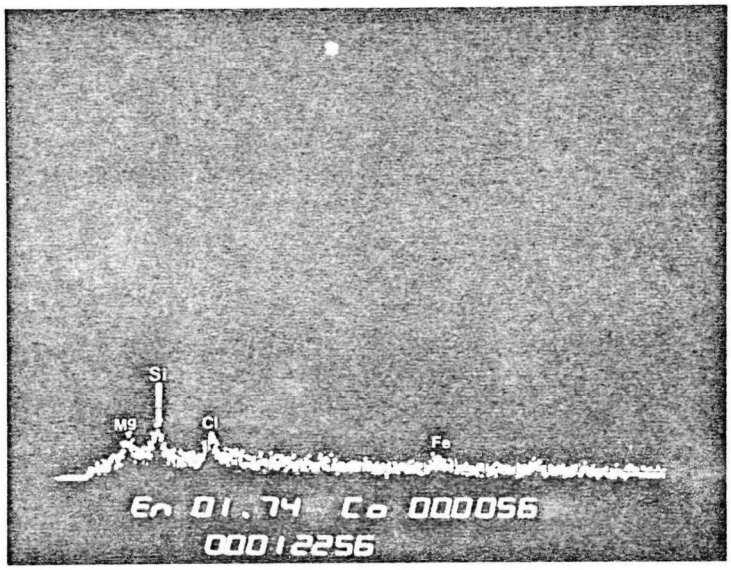



Figure 1 Probe of small chrysotile fibril. Chlorine is from organic residue.

SAMPLE :C305141530D3WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
/OLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 11
TOTAL SUSPENDED SOLIDS: 7.000 MG PER LITER
PH = 7.9

LIMIT OF DETECTION = 0.46E+06

SAMPLE :C305141530D3WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.17E+08
FIBER CONCENTRATION BY MASS, PER LITER : 0.581 GRAMS*10↑-6
/OLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 11
TOTAL SUSPENDED SOLIDS: 7.000 MG PER LITER
PH = 7.9

DESCRIPTIVE STATISTICS

NO. OBS. = 37

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.26312E+01 | 0.15963E+02 | 0.39953E+01 | 0.65683E+00 |
| 2 | WIDTH | 0.67251E-01 | 0.60494E-02 | 0.77778E-01 | 0.12787E-01 |
| 3 | ASPECT RATIO | 0.73852E+02 | 0.14858E+05 | 0.12189E+03 | 0.20039E+02 |
| 4 | MASS | 0.34365E-01 | 0.35962E-02 | 0.59969E-01 | 0.98588E-02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.26256E+01 | 0.75304E+01 | 0.19769E+02 | 0.12100E+00 | 0.19648E+02 |
| 2 | 0.19061E+01 | 0.22954E+01 | 0.28240E+00 | 0.40000E-02 | 0.27840E+00 |
| 3 | 0.23230E+01 | 0.45057E+01 | 0.49000E+03 | 0.14286E+01 | 0.48857E+03 |
| 4 | 0.23525E+01 | 0.58676E+01 | 0.28120E+00 | 0.00000E+00 | 0.28120E+00 |

SAMPLE :C305141530D3WG2 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 1.5331 | 0.2824 | 5.4286 | 0.2812 |
| 2 | 0.4035 | 0.2824 | 1.4286 | 0.0740 |
| 3 | 3.8328 | 0.0605 | 63.3333 | 0.0323 |
| 4 | 0.1210 | 0.0202 | 6.0000 | 0.0001 |
| 5 | 0.9279 | 0.0403 | 23.0000 | 0.0035 |
| 6 | 6.4553 | 0.0807 | 80.0000 | 0.0967 |
| 7 | 0.5245 | 0.0403 | 13.0000 | 0.0020 |
| 8 | 8.0691 | 0.0605 | 133.3333 | 0.0680 |
| 9 | 4.8414 | 0.0403 | 120.0000 | 0.0181 |
| 10 | 3.6311 | 0.0403 | 90.0000 | 0.0136 |
| 11 | 19.7692 | 0.0403 | 490.0000 | 0.0740 |
| 12 | 4.0345 | 0.1210 | 33.3333 | 0.1359 |
| 13 | 4.7608 | 0.0403 | 118.0000 | 0.0178 |
| 14 | 0.9279 | 0.0403 | 23.0000 | 0.0035 |
| 15 | 0.2824 | 0.0040 | 70.0000 | 0.0000 |
| 16 | 2.9452 | 0.0605 | 48.6667 | 0.0248 |
| 17 | 1.2104 | 0.2017 | 6.0000 | 0.1133 |
| 18 | 1.8155 | 0.2017 | 9.0000 | 0.1699 |
| 19 | 0.6455 | 0.0282 | 22.8571 | 0.0012 |
| 20 | 2.8645 | 0.0282 | 101.4286 | 0.0053 |
| 21 | 6.4553 | 0.0282 | 228.5714 | 0.0118 |
| 22 | 1.5331 | 0.0040 | 380.0000 | 0.0001 |
| 23 | 0.2421 | 0.0403 | 6.0000 | 0.0009 |
| 24 | 0.2017 | 0.0282 | 7.1429 | 0.0004 |
| 25 | 0.5245 | 0.0403 | 13.0000 | 0.0020 |
| 26 | 0.4035 | 0.0282 | 14.2857 | 0.0007 |
| 27 | 0.3631 | 0.0202 | 18.0000 | 0.0003 |
| 28 | 0.3228 | 0.0202 | 16.0000 | 0.0003 |
| 29 | 1.7349 | 0.0282 | 61.4286 | 0.0032 |
| 30 | 0.3228 | 0.0202 | 16.0000 | 0.0003 |
| 31 | 0.2824 | 0.0403 | 7.0000 | 0.0011 |
| 32 | 0.4438 | 0.0282 | 15.7143 | 0.0008 |
| 33 | 12.9105 | 0.0282 | 457.1429 | 0.0237 |
| 34 | 0.4035 | 0.2824 | 1.4286 | 0.0740 |
| 35 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 36 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 37 | 1.0490 | 0.0807 | 13.0000 | 0.0157 |

SAMPLE :C305141530D3WG2

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 14 | 37.84 | 37.84 |
| 0.5 | 1.0 | 5 | 13.51 | 51.35 |
| 1.0 | 1.5 | 2 | 5.41 | 56.76 |
| 1.5 | 2.0 | 4 | 10.81 | 67.57 |
| 2.0 | 2.5 | 0 | 0.00 | 67.57 |
| 2.5 | 3.0 | 2 | 5.41 | 72.97 |
| 3.0 | 3.5 | 0 | 0.00 | 72.97 |
| 3.5 | 4.0 | 2 | 5.41 | 78.38 |
| 4.0 | 4.5 | 1 | 2.70 | 81.08 |
| 4.5 | 5.0 | 2 | 5.41 | 86.49 |
| 5.0 | 5.5 | 0 | 0.00 | 86.49 |
| 5.5 | 6.0 | 0 | 0.00 | 86.49 |
| 6.0 | 6.5 | 2 | 5.41 | 91.89 |
| 6.5 | 7.0 | 0 | 0.00 | 91.89 |
| 7.0 | 7.5 | 0 | 0.00 | 91.89 |
| 7.5 | 8.0 | 0 | 0.00 | 91.89 |
| 8.0 | 8.5 | 1 | 2.70 | 94.59 |
| 8.5 | 9.0 | 0 | 0.00 | 94.59 |
| 9.0 | 9.5 | 0 | 0.00 | 94.59 |
| 9.5 | 10 0 | 0 | 0.00 | 94.59 |
| 10.0 | 10.5 | 0 | 0.00 | 94.59 |
| 10.5 | 11.0 | 0 | 0.00 | 94.59 |
| 11.0 | 11.5 | 0 | 0.00 | 94.59 |
| 11.5 | 12.0 | 0 | 0.00 | 94.59 |
| 12.0 | 12.5 | 0 | 0.00 | 94.59 |
| 12.5 | 13.0 | 1 | 2.70 | 97.30 |
| 13.0 | 13.5 | 0 | 0.00 | 97.30 |
| 13.5 | 14.0 | 0 | 0.00 | 97.30 |
| 14.0 | 14.5 | 0 | 0.00 | 97.30 |
| 14.5 | 15.0 | 0 | 0.00 | 97.30 |
| 15.0 | 15.5 | 0 | 0.00 | 97.30 |
| 15.5 | 16.0 | 0 | 0.00 | 97.30 |
| 16.0 | 16.5 | 0 | 0.00 | 97.30 |
| 16.5 | 17.0 | 0 | 0.00 | 97.30 |
| 17.0 | 17.5 | 0 | 0.00 | 97.30 |
| 17.5 | 18.0 | 0 | 0.00 | 97.30 |
| 18.0 | 18.5 | 0 | 0.00 | 97.30 |
| 18.5 | 19.0 | 0 | 0.00 | 97.30 |
| 19.0 | 19.5 | 0 | 0.00 | 97.30 |
| 19.5 | 20.0 | 1 | 2.70 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 31 | 83.78 | 83.78 |
| 0.1 | 0.2 | 1 | 2.70 | 86.49 |

| | | | | |
|---|---|---|---|---|
| 0.2 | 0.3 | 5 | 13.51 | 100.00 |

DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 10 | 27.03 | 27.03 |
| 10 | 20 | 9 | 24.32 | 51.35 |
| 20 | 30 | 3 | 8.11 | 59.46 |
| 30 | 40 | 1 | 2.70 | 62.16 |
| 40 | 50 | 1 | 2.70 | 64.86 |
| 50 | 60 | 0 | 0.00 | 64.86 |
| 60 | 70 | 3 | 8.11 | 72.97 |
| 70 | 80 | 1 | 2.70 | 75.68 |
| 80 | 90 | 1 | 2.70 | 78.38 |
| 90 | 100 | 0 | 0.00 | 78.38 |
| 100 | 110 | 1 | 2.70 | 81.08 |
| 110 | 120 | 2 | 5.41 | 86.49 |
| 120 | 130 | 0 | 0.00 | 86.49 |
| 130 | 140 | 1 | 2.70 | 89.19 |
| 140 | 150 | 0 | 0.00 | 89.19 |
| 150 | 160 | 0 | 0.00 | 89.19 |
| 160 | 170 | 0 | 0.00 | 89.19 |
| 170 | 180 | 0 | 0.00 | 89.19 |
| 180 | 190 | 0 | 0.00 | 89.19 |
| 190 | 200 | 0 | 0.00 | 89.19 |
| * OVER 200 | | 4 | 10.81 | 100.00 |

Moderate to heavy loading due mainly to general presence of an organic residue. Varying types of residues are present. Inorganics range from small to moderate sizes and consist of particles ranging from platy to irregularly shaped blocky types. Diatomaceous remains present and fairly common. Agglomeration of material does take place. No asbestiform material detected.

SAMPLE :C310270810U1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 7.6

LIMIT OF DETECTION = 0.13E+06

SAMPLE :C310270810U1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 7.6

LIMIT OF DETECTION = 0.13E+06

Very light loading. Some small material present which consists mainly of organic residues, although some chunky inorganics are present as well.

SAMPLE :C310270815D1WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 50
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.6

LIMIT OF DETECTION = 0.10E+06

SAMPLE :C310270815D1WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED 50
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.6

LIMIT OF DETECTION = 0.10E+06

Small to moderate or smaller large-sized particulates of varying morphologies, organic residues of varying types (generally small) and some diatomaceous remains are present. Inorganic fibers are present, including chrysotile. Some large organic fibers noted.

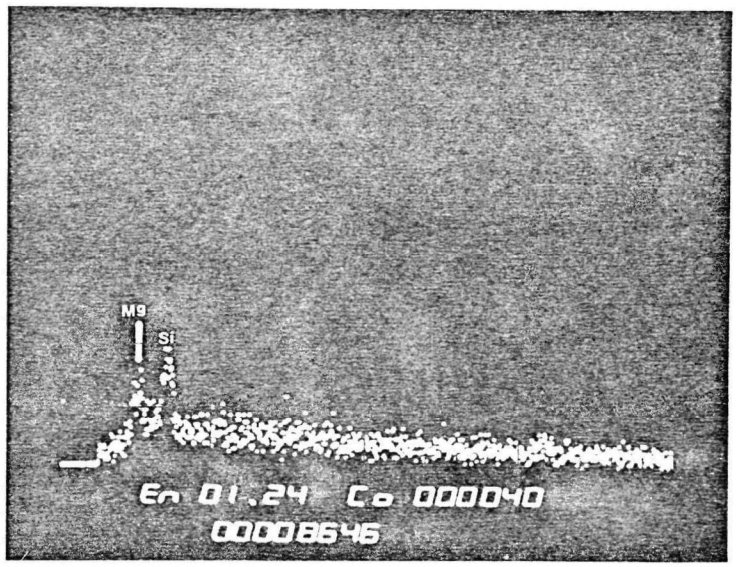



Figure 1 Probe of chrysotile fibril.

SAMPLE :C310270S25U2WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 20.0 ML
GRID SQUARES COUNTED : 5
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.6

LIMIT OF DETECTION = 0.50E+07

SAMPLE :C310270825U2WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.24E+09
FIBER CONCENTRATION BY MASS, PER LITER : 2.575 GRAMS*10+-6
VOLUME FILTERED : 20.0 ML
GRID SQUARES COUNTED : 5
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.6

DESCRIPTIVE STATISTICS

NO. OBS. = 47

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.25306E+01 | 0.14194E+02 | 0.37675E+01 | 0.54955E+00 |
| 2 | WIDTH | 0.37138E-01 | 0.64238E-03 | 0.25345E-01 | 0.36970E-02 |
| 3 | ASPECT RATIO | 0.16011E+03 | 0.32317E+06 | 0.56848E+03 | 0.82922E+02 |
| 4 | MASS | 0.10902E-01 | 0.96168E-03 | 0.31011E-01 | 0.45234E-02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.24505E+01 | 0.56619E+01 | 0.16945E+02 | 0.16140E+00 | 0.16784E+02 |
| 2 | 0.27134E+01 | 0.10119E+02 | 0.16140E+00 | 0.40000E-02 | 0.15740E+00 |
| 3 | 0.60540E+01 | 0.36859E+02 | 0.39000E+04 | 0.57143E+01 | 0.38943E+04 |
| 4 | 0.51948E+01 | 0.28578E+02 | 0.20300E+00 | 0.00000E+00 | 0.20300E+00 |

SAMPLE :C310270825U2WG3 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 4.0345 | 0.0282 | 142.8571 | 0.0074 |
| 2 | 0.5245 | 0.0605 | 8.6667 | 0.0044 |
| 3 | 0.4841 | 0.0202 | 24.0000 | 0.0005 |
| 4 | 16.9450 | 0.0403 | 420.0000 | 0.0634 |
| 5 | 15.7347 | 0.0040 | 3900.0000 | 0.0006 |
| 6 | 3.5100 | 0.0807 | 43.5000 | 0.0526 |
| 7 | 1.2911 | 0.0282 | 45.7143 | 0.0024 |
| 8 | 8.8760 | 0.0282 | 314.2857 | 0.0163 |
| 9 | 0.5245 | 0.0282 | 18.5714 | 0.0010 |
| 10 | 0.3631 | 0.0403 | 9.0000 | 0.0014 |
| 11 | 1.7349 | 0.0040 | 430.0000 | 0.0001 |
| 12 | 0.5648 | 0.0605 | 9.3333 | 0.0048 |
| 13 | 1.3314 | 0.0282 | 47.1429 | 0.0024 |
| 14 | 0.8876 | 0.0202 | 44.0000 | 0.0008 |
| 15 | 0.4841 | 0.0040 | 120.0000 | 0.0000 |
| 16 | 0.4035 | 0.0282 | 14.2857 | 0.0007 |
| 17 | 0.7666 | 0.0807 | 9.5000 | 0.0115 |
| 18 | 0.5245 | 0.0403 | 13.0000 | 0.0020 |
| 19 | 1.8962 | 0.0282 | 67.1429 | 0.0035 |
| 20 | 3.3890 | 0.1614 | 21.0000 | 0.2030 |
| 21 | 1.8962 | 0.0403 | 47.0000 | 0.0071 |
| 22 | 2.3400 | 0.0282 | 82.8571 | 0.0043 |
| 23 | 1.1700 | 0.0605 | 19.3333 | 0.0099 |
| 24 | 4.3573 | 0.0282 | 154.2857 | 0.0080 |
| 25 | 1.8962 | 0.0403 | 47.0000 | 0.0071 |
| 26 | 2.5821 | 0.0282 | 91.4286 | 0.0047 |
| 27 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 28 | 0.1614 | 0.0282 | 5.7143 | 0.0003 |
| 29 | 0.6455 | 0.0807 | 8.0000 | 0.0097 |
| 30 | 5.6484 | 0.0282 | 200.0000 | 0.0104 |
| 31 | 0.8876 | 0.0282 | 31.4286 | 0.0016 |
| 32 | 0.6859 | 0.0403 | 17.0000 | 0.0026 |
| 33 | 0.7262 | 0.0605 | 12.0000 | 0.0061 |
| 34 | 0.3631 | 0.0282 | 12.8571 | 0.0007 |
| 35 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 36 | 0.7262 | 0.0202 | 36.0000 | 0.0007 |
| 37 | 0.5648 | 0.0282 | 20.0000 | 0.0010 |
| 38 | 1.2911 | 0.0282 | 45.7143 | 0.0024 |
| 39 | 0.6052 | 0.0403 | 15.0000 | 0.0023 |
| 40 | 1.6945 | 0.0403 | 42.0000 | 0.0063 |
| 41 | 0.3631 | 0.0282 | 12.8571 | 0.0007 |
| 42 | 0.8473 | 0.0282 | 30.0000 | 0.0016 |
| 43 | 0.4438 | 0.0282 | 15.7143 | 0.0008 |
| 44 | 11.2967 | 0.0282 | 400.0000 | 0.0207 |
| 45 | 6.0518 | 0.0282 | 214.2857 | 0.0111 |
| 46 | 6.4553 | 0.0282 | 228.5714 | 0.0118 |
| 47 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |

SAMPLE :C310270825U2WG3

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 11 | 23.40 | 23.40 |
| 0.5 | 1.0 | 14 | 29 79 | 53.19 |
| 1.0 | 1.5 | 4 | 8.51 | 61.70 |
| 1.5 | 2.0 | 5 | 10.64 | 72.34 |
| 2.0 | 2.5 | 1 | 2.13 | 74.47 |
| 2.5 | 3.0 | 1 | 2.13 | 76.60 |
| 3.0 | 3.5 | 1 | 2.13 | 78.72 |
| 3.5 | 4.0 | 1 | 2.13 | 80.85 |
| 4.0 | 4.5 | 2 | 4.26 | 85.11 |
| 4.5 | 5.0 | 0 | 0.00 | 85.11 |
| 5.0 | 5.5 | 0 | 0.00 | 85.11 |
| 5.5 | 6.0 | 1 | 2.13 | 87.23 |
| 6.0 | 6.5 | 2 | 4.26 | 91.49 |
| 6.5 | 7.0 | 0 | 0.00 | 91.49 |
| 7.0 | 7.5 | 0 | 0.00 | 91.49 |
| 7.5 | 8.0 | 0 | 0.00 | 91.49 |
| 8.0 | 8.5 | 0 | 0.00 | 91.49 |
| 8.5 | 9.0 | 1 | 2.13 | 93.62 |
| 9.0 | 9.5 | 0 | 0.00 | 93.62 |
| 9.5 | 10.0 | 0 | 0.00 | 93.62 |
| 10.0 | 10.5 | 0 | 0.00 | 93.62 |
| 10.5 | 11.0 | 0 | 0.00 | 93.62 |
| 11.0 | 11.5 | 1 | 2.13 | 95.74 |
| 11.5 | 12.0 | 0 | 0.00 | 95.74 |
| 12.0 | 12.5 | 0 | 0.00 | 95.74 |
| 12.5 | 13.0 | 0 | 0.00 | 95.74 |
| 13.0 | 13.5 | 0 | 0.00 | 95.74 |
| 13.5 | 14.0 | 0 | 0.00 | 95.74 |
| 14.0 | 14.5 | 0 | 0.00 | 95.74 |
| 14.5 | 15.0 | 0 | 0.00 | 95.74 |
| 15.0 | 15.5 | 0 | 0.00 | 95.74 |
| 15.5 | 16.0 | 1 | 2.13 | 97.87 |
| 16.0 | 16.5 | 0 | 0.00 | 97.87 |
| 16.5 | 17.0 | 1 | 2.13 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 46 | 97.87 | 97.87 |
| 0.1 | 0.2 | 1 | 2.13 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 8 | 17.02 | 17.02 |
| 10 | 20 | 12 | 25.53 | 42 55 |
| 20 | 30 | 3 | 6.38 | 48.94 |
| 30 | 40 | 2 | 4.26 | 53.19 |
| 40 | 50 | 8 | 17.02 | 70.21 |
| 50 | 60 | 0 | 0.00 | 70.21 |
| 60 | 70 | 1 | 2.13 | 72.34 |
| 70 | 80 | 0 | 0.00 | 72.34 |
| 80 | 90 | 1 | 2.13 | 74.47 |
| 90 | 100 | 1 | 2.13 | 76.60 |
| 100 | 110 | 0 | 0.00 | 76.60 |
| 110 | 120 | 1 | 2.13 | 78.72 |
| 120 | 130 | 0 | 0.00 | 78.72 |
| 130 | 140 | 0 | 0.00 | 78.72 |
| 140 | 150 | 1 | 2.13 | 80.85 |
| 150 | 160 | 1 | 2.13 | 82.98 |
| 160 | 170 | 0 | 0.00 | 82.98 |
| 170 | 180 | 0 | 0.00 | 82.98 |
| 180 | 190 | 0 | 0.00 | 82.98 |
| 190 | 200 | 1 | 2.13 | 85.11 |
| * OVER 200 | | 7 | 14.89 | 100.00 |

Light to moderately light loading. Organic residues of varying types, generally small inorganic particulates, and some small diatom fragments present. Some agglomeration occurs due to an organic residue. Inorganic fibers are present, including chrysotile.

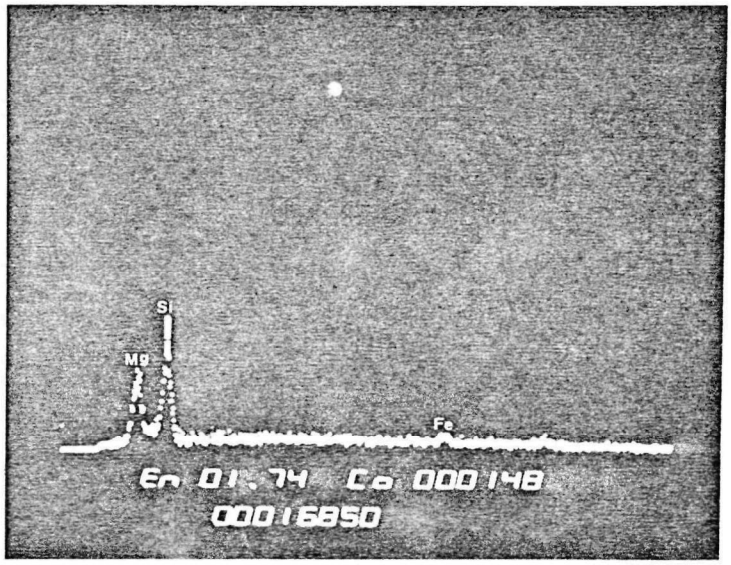



Figure 1 Probe of chrysotile bundle.

SAMPLE :C310270830D2WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
/OLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 2
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.5

LIMIT OF DETECTION = 0.25E+07

SAMPLE :C310270830D2WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.13E+09
FIBER CONCENTRATION BY MASS, PER LITER : 3.443 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 2
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.5

DESCRIPTIVE STATISTICS

NO. OBS. = 53

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.18011E+01 | 0.72080E+01 | 0.26848E+01 | 0.36878E+00 |
| 2 | WIDTH | 0.52262E-01 | 0.31117E-02 | 0.55783E-01 | 0.76624E-02 |
| 3 | ASPECT RATIO | 0.63031E+02 | 0.18112E+05 | 0.13458E+03 | 0.18486E+02 |
| 4 | MASS | 0.25834E-01 | 0.92769E-02 | 0.96316E-01 | 0.13230E-01 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.27946E+01 | 0.77962E+01 | 0.12507E+02 | 0.12100E+00 | 0.12386E+02 |
| 2 | 0.35135E+01 | 0.15631E+02 | 0.36310E+00 | 0.40000E-02 | 0.35910E+00 |
| 3 | 0.38805E+01 | 0.16622E+02 | 0.81000E+03 | 0.40000E+01 | 0.80600E+03 |
| 4 | 0.61133E+01 | 0.38532E+02 | 0.68510E+00 | 0.10000E-03 | 0.68500E+00 |

SAMPLE :C310270830D2WG3 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 2.2593 | 0.3631 | 6.2222 | 0.6851 |
| 2 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |
| 3 | 0.9279 | 0.0282 | 32.8571 | 0.0017 |
| 4 | 4.1152 | 0.0403 | 102.0000 | 0.0154 |
| 5 | 3.1469 | 0.0282 | 111.4286 | 0.0058 |
| 6 | 1.4928 | 0.0282 | 52.8571 | 0.0027 |
| 7 | 1.6542 | 0.0282 | 58.5714 | 0.0030 |
| 8 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |
| 9 | 3.2680 | 0.0040 | 810.0000 | 0.0001 |
| 10 | 1.2507 | 0.1009 | 12.4000 | 0.0293 |
| 11 | 5.2449 | 0.1210 | 43.3333 | 0.1767 |
| 12 | 12.5071 | 0.0403 | 310.0000 | 0.0468 |
| 13 | 9.2794 | 0.0282 | 328.5714 | 0.0170 |
| 14 | 0.7262 | 0.1210 | 6.0000 | 0.0245 |
| 15 | 3.3890 | 0.0282 | 120.0000 | 0.0062 |
| 16 | 0.4841 | 0.0403 | 12.0000 | 0.0018 |
| 17 | 0.1210 | 0.0282 | 4.2857 | 0.0002 |
| 18 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 19 | 0.2017 | 0.0282 | 7.1429 | 0.0004 |
| 20 | 0.5245 | 0.0202 | 26.0000 | 0.0005 |
| 21 | 1.6138 | 0.0282 | 57.1429 | 0.0030 |
| 22 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |
| 23 | 0.3631 | 0.0282 | 12.8571 | 0.0007 |
| 24 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 25 | 0.2824 | 0.0282 | 10.0000 | 0.0005 |
| 26 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 27 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 28 | 3.8328 | 0.0282 | 135.7143 | 0.0070 |
| 29 | 0.8876 | 0.0282 | 31.4286 | 0.0016 |
| 30 | 12.5071 | 0.0282 | 442.8571 | 0.0229 |
| 31 | 1.0490 | 0.0282 | 37.1429 | 0.0019 |
| 32 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |
| 33 | 0.3631 | 0.0605 | 6.0000 | 0.0031 |
| 34 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 35 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 36 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 37. | 0.3228 | 0.0403 | 8.0000 | 0.0012 |
| 38 | 0.8473 | 0.1210 | 7.0000 | 0.0285 |
| 39 | 0.1614 | 0.0282 | 5.7143 | 0.0003 |
| 40 | 0.1614 | 0.0403 | 4.0000 | 0.0006 |
| 41 | 3.2680 | 0.0807 | 40.5000 | 0.0489 |
| 42 | 0.8069 | 0.0282 | 28.5714 | 0.0015 |
| 43 | 1.5735 | 0.1210 | 13.0000 | 0.0530 |
| 44 | 1.4928 | 0.0282 | 52.8571 | 0.0027 |
| 45 | 1.1700 | 0.1412 | 8.2857 | 0.0537 |
| 46 | 1.0893 | 0.1009 | 10.8000 | 0.0255 |
| 47 | 1.2507 | 0.1210 | 10.3333 | 0.0421 |
| 48 | 0.8876 | 0.1210 | 7.3333 | 0.0299 |
| 49 | 2.9049 | 0.0282 | 102.8571 | 0.0053 |
| 50 | 0.1614 | 0.0282 | 5.7143 | 0.0003 |
| 51 | 1.6542 | 0.0282 | 58.5714 | 0.0030 |

| | | | | |
|---|---|---|---|---|
| 52 | 0.4035 | 0.0282 | 14.2857 | 0.0007 |
| 53 | 1.8559 | 0.0403 | 46.0000 | 0.0069 |

SAMPLE :C310270830D2WG3

## DISTPIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 22 | 41.51 | 41.51 |
| 0.5 | 1.0 | 7 | 13.21 | 54.72 |
| 1.0 | 1.5 | 7 | 13.21 | 67.92 |
| 1.5 | 2.0 | 5 | 9.43 | 77.36 |
| 2.0 | 2.5 | 1 | 1.89 | 79.25 |
| 2.5 | 3.0 | 1 | 1.89 | 81.13 |
| 3.0 | 3.5 | 4 | 7 55 | 88.68 |
| 3.5 | 4.0 | 1 | 1.89 | 90.57 |
| 4.0 | 4.5 | 1 | 1.89 | 92.45 |
| 4.5 | 5.0 | 0 | 0.00 | 92.45 |
| 5.0 | 5.5 | 1 | 1.89 | 94.34 |
| 5.5 | 6.0 | 0 | 0.00 | 94.34 |
| 6.0 | 6.5 | 0 | 0.00 | 94.34 |
| 6.5 | 7.0 | 0 | 0.00 | 94.34 |
| 7.0 | 7.5 | 0 | 0.00 | 94.34 |
| 7.5 | 8.0 | 0 | 0.00 | 94.34 |
| 8.0 | 8.5 | 0 | 0.00 | 94.34 |
| 8.5 | 9.0 | 0 | 0.00 | 94.34 |
| 9.0 | 9.5 | 1 | 1.89 | 96.23 |
| 9.5 | 10.0 | 0 | 0.00 | 96.23 |
| 10.0 | 10.5 | 0 | 0.00 | 96.23 |
| 10.5 | 11.0 | 0 | 0.00 | 96.23 |
| 11.0 | 11.5 | 0 | 0.00 | 96.23 |
| 11.5 | 12.0 | 0 | 0.00 | 96.23 |
| 12.0 | 12.5 | 0 | 0.00 | 96.23 |
| 12.5 | 13.0 | 2 | 3.77 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 43 | 81.13 | 81.13 |
| 0.1 | 0.2 | 9 | 16.98 | 98.11 |
| 0.2 | 0.3 | 0 | 0.00 | 98.11 |
| 0.3 | 0.4 | 1 | 1.89 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 16 | 30.19 | 30.19 |
| 10 | 20 | 15 | 28.30 | 58.49 |
| 20 | 30 | 2 | 3.77 | 62.26 |

| | | | | |
|---|---|---|---|---|
| 30 | 40 | 3 | 5.66 | 67.92 |
| 40 | 50 | 3 | 5.66 | 73.58 |
| 50 | 60 | 5 | 9 43 | 83.02 |
| 60 | 70 | 0 | 0.00 | 83.02 |
| 70 | 80 | 0 | 0.00 | 83.02 |
| 80 | 90 | 0 | 0.00 | 83.02 |
| 90 | 100 | 0 | 0.00 | 83.02 |
| 100 | 110 | 2 | 3.77 | 86.79 |
| 110 | 120 | 2 | 3.77 | 90.57 |
| 120 | 130 | 0 | 0.00 | 90.57 |
| 130 | 140 | 1 | 1.89 | 92.45 |
| 140 | 150 | 0 | 0.00 | 92.45 |
| 150 | 160 | 0 | 0.00 | 92.45 |
| 160 | 170 | 0 | 0.00 | 92.45 |
| 170 | 180 | 0 | 0.00 | 92.45 |
| 180 | 190 | 0 | 0.00 | 92.45 |
| 190 | 200 | 0 | 0.00 | 92.45 |
| * OVER 200 | | 4 | 7.55 | 100.00 |

Small to moderately sized material. Platy to chunky inorganics, organic residues, diatomaceous remains and agglomerated areas are present. Inorganic fibers noted — including chrysotile.

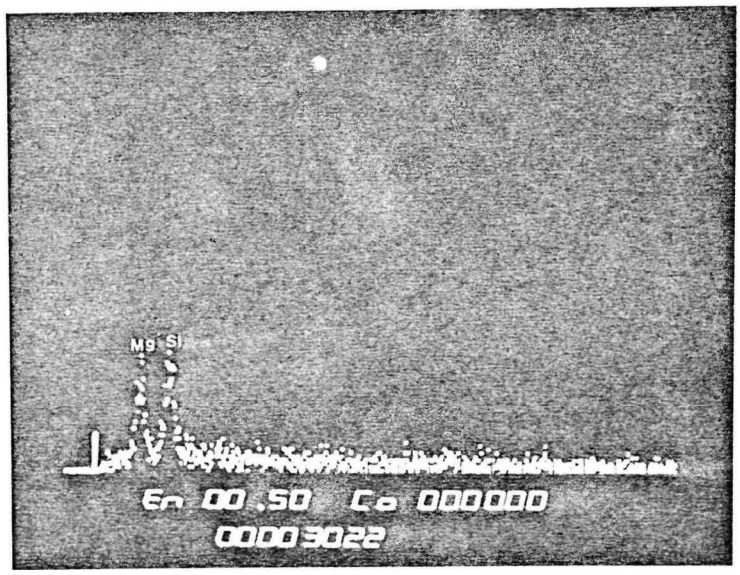



Figure 1 Probe of chrysotile fibril.

SAMPLE :C310270910U3WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 20.0 ML
GRID SQUARES COUNTED : 6
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 7.5

LIMIT OF DETECTION = 0.42E+07

SAMPLE :C310270910U3WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.16E+09
FIBER CONCENTRATION BY MASS,PER LITER : 3.631 GRAMS*10↑-6
VOLUME FILTERED : 20.0 ML
GRID SQUARES COUNTED : 6
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 7.5

DESCRIPTIVE STATISTICS

NO. OBS. = 39

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.30031E+01 | 0.14762E+02 | 0.38421E+01 | 0.61523E+00 |
| 2 | WIDTH | 0.44454E-01 | 0.12055E-02 | 0.34720E-01 | 0.55597E-02 |
| 3 | ASPECT RATIO | 0.85209E+02 | 0.12976E+05 | 0.11391E+03 | 0.18241E+02 |
| 4 | MASS | 0.22221E-01 | 0.20392E-02 | 0.45157E-01 | 0.72309E-02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.21624E+01 | 0.44293E+01 | 0.16542E+02 | 0.12100E+00 | 0.16421E+02 |
| 2 | 0.18262E+01 | 0.24232E+01 | 0.16140E+00 | 0.40000E-02 | 0.15740E+00 |
| 3 | 0.23050E+01 | 0.56784E+01 | 0.55714E+03 | 0.45000E+01 | 0.55264E+03 |
| 4 | 0.30914E+01 | 0.10140E+02 | 0.23110E+00 | 0.00000E+00 | 0.23110E+00 |

SAMPLE :C310270910U3WG3 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 1.9769 | 0.1210 | 16.3333 | 0.0666 |
| 2 | 2.1786 | 0.0605 | 36.0000 | 0.0184 |
| 3 | 2.6224 | 0.0605 | 43.3333 | 0.0221 |
| 4 | 7.6656 | 0.0282 | 271.4286 | 0.0141 |
| 5 | 9.2794 | 0.0282 | 328.5714 | 0.0170 |
| 6 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 7 | 0.2824 | 0.0282 | 10.0000 | 0.0005 |
| 8 | 0.3631 | 0.0807 | 4.5000 | 0.0054 |
| 9 | 3.8328 | 0.0282 | 135.7143 | 0.0070 |
| 10 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |
| 11 | 5.2449 | 0.0282 | 185.7143 | 0.0096 |
| 12 | 0.9279 | 0.0282 | 32.8571 | 0.0017 |
| 13 | 1.4524 | 0.0282 | 51.4286 | 0.0027 |
| 14 | 16.5416 | 0.0605 | 273.3333 | 0.1393 |
| 15 | 0.4035 | 0.0040 | 100.0000 | 0.0006 |
| 16 | 0.7262 | 0.0202 | 36.0000 | 0.0007 |
| 17 | 0.8473 | 0.0202 | 42.0000 | 0.0008 |
| 18 | 1.6542 | 0.0282 | 58.5714 | 0.0030 |
| 19 | 2.3804 | 0.0403 | 59.0000 | 0.0089 |
| 20 | 2.5418 | 0.0403 | 63.0000 | 0.0095 |
| 21 | 0.4035 | 0.0282 | 14.2857 | 0.0007 |
| 22 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 23 | 0.9683 | 0.0282 | 34.2857 | 0.0018 |
| 24 | 1.4524 | 0.0282 | 51.4286 | 0.0027 |
| 25 | 1.3717 | 0.0282 | 48.5714 | 0.0025 |
| 26 | 2.9452 | 0.0282 | 104.2857 | 0.0054 |
| 27 | 3.9538 | 0.0282 | 140.0000 | 0.0073 |
| 28 | 4.8414 | 0.0403 | 120.0000 | 0.0181 |
| 29 | 6.8587 | 0.1210 | 56.6667 | 0.2311 |
| 30 | 1.8559 | 0.1210 | 15.3333 | 0.0625 |
| 31 | 2.5418 | 0.1009 | 25.2000 | 0.0595 |
| 32 | 1.5735 | 0.1614 | 9.7500 | 0.0943 |
| 33 | 7.2622 | 0.0282 | 257.1429 | 0.0133 |
| 34 | 15.7347 | 0.0282 | 557.1429 | 0.0289 |
| 35 | 1.6542 | 0.0403 | 41.0000 | 0.0062 |
| 36 | 1.0490 | 0.0282 | 37.1429 | 0.0019 |
| 37 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 38 | 0.1614 | 0.0282 | 5.7143 | 0.0003 |
| 39 | 0.1210 | 0.0202 | 6.0000 | 0.0001 |

SAMPLE :C310270910U3WG3

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 10 | 25.64 | 25.64 |
| 0.5 | 1.0 | 4 | 10.26 | 35.90 |
| 1.0 | 1.5 | 4 | 10.26 | 46.15 |
| 1.5 | 2.0 | 5 | 12.82 | 58.97 |
| 2.0 | 2.5 | 2 | 5.13 | 64.10 |
| 2.5 | 3.0 | 4 | 10.26 | 74.36 |
| 3.0 | 3.5 | 0 | 0.00 | 74.36 |
| 3.5 | 4.0 | 2 | 5.13 | 79.49 |
| 4.0 | 4.5 | 0 | 0.00 | 79.49 |
| 4.5 | 5.0 | 1 | 2.56 | 82.05 |
| 5.0 | 5.5 | 1 | 2.56 | 84.62 |
| 5.5 | 6.0 | 0 | 0.00 | 84.62 |
| 6.0 | 6.5 | 0 | 0.00 | 84.62 |
| 6.5 | 7.0 | 1 | 2.56 | 87.18 |
| 7.0 | 7.5 | 1 | 2.56 | 89.74 |
| 7.5 | 8.0 | 1 | 2.56 | 92.31 |
| 8.0 | 8.5 | 0 | 0.00 | 92.31 |
| 8.5 | 9.0 | 0 | 0.00 | 92.31 |
| 9.0 | 9.5 | 1 | 2.56 | 94.87 |
| 9.5 | 10.0 | 0 | 0.00 | 94.87 |
| 10.0 | 10.5 | 0 | 0.00 | 94.87 |
| 10.5 | 11.0 | 0 | 0.00 | 94.87 |
| 11.0 | 11.5 | 0 | 0.00 | 94.87 |
| 11.5 | 12.0 | 0 | 0.00 | 94.87 |
| 12.0 | 12.5 | 0 | 0.00 | 94.87 |
| 12.5 | 13.0 | 0 | 0.00 | 94.87 |
| 13.0 | 13.5 | 0 | 0.00 | 94.87 |
| 13.5 | 14.0 | 0 | 0.00 | 94.87 |
| 14.0 | 14.5 | 0 | 0.00 | 94.87 |
| 14.5 | 15.0 | 0 | 0.00 | 94.87 |
| 15.0 | 15.5 | 0 | 0.00 | 94.87 |
| 15.5 | 16.0 | 1 | 2.56 | 97.44 |
| 16.0 | 16.5 | 0 | 0.00 | 97.44 |
| 16.5 | 17.0 | 1 | 2.56 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 34 | 87.18 | 87.18 |
| 0.1 | 0.2 | 5 | 12.82 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 5 | 12.82 | 12.82 |
| 10 | 20 | 7 | 17.95 | 30.77 |
| 20 | 30 | 1 | 2.56 | 33.33 |
| 30 | 40 | 5 | 12.82 | 46.15 |
| 40 | 50 | 4 | 10.26 | 56.41 |
| 50 | 60 | 5 | 12.82 | 69.23 |
| 60 | 70 | 1 | 2.56 | 71.79 |
| 70 | 80 | 0 | 0.00 | 71.79 |
| 80 | 90 | 0 | 0.00 | 71.79 |
| 90 | 100 | 1 | 2.56 | 74.36 |
| 100 | 110 | 1 | 2.56 | 76.92 |
| 110 | 120 | 1 | 2.56 | 79.49 |
| 120 | 130 | 0 | 0.00 | 79.49 |
| 130 | 140 | 2 | 5.13 | 84.62 |
| 140 | 150 | 0 | 0.00 | 84.62 |
| 150 | 160 | 0 | 0.00 | 84.62 |
| 160 | 170 | 0 | 0.00 | 84.62 |
| 170 | 180 | 0 | 0.00 | 84.62 |
| 180 | 190 | 1 | 2.56 | 87.18 |
| 190 | 200 | 0 | 0.00 | 87.18 |
| * OVER 200 | | 5 | 12.82 | 100.00 |

A light to moderately light loading. Material is generally small and mainly organic residues. Small platy to blocky particles and small agglomerated masses are present as are some small diatom fragments. Fibers are present — chrysotile among them.

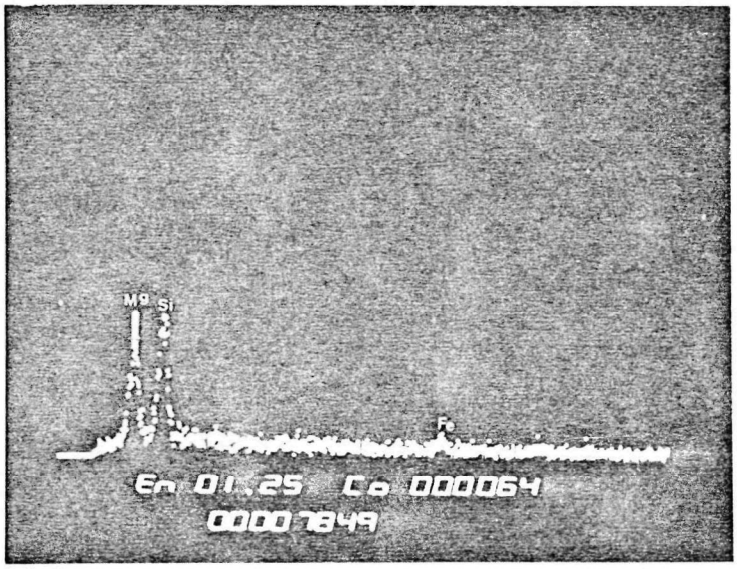



Figure 1 Probe of chrysotile fibril.

SAMPLE :C310270970D3WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 15
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.3

LIMIT OF DETECTION = 0.34E+06

SAMPLE :C310270920D3WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.17E+09
FIBER CONCENTRATION BY MASS/PER LITER : 3.214 GRAMS*10↑-6
'OLUME FILTERED : 10.0 ML
GRID SQUARES COUNTED . 15
TOTAL SUSPENDED SOLIDS: 1.000 MG PER LITER
PH = 7.3

DESCRIPTIVE STATISTICS

NO. OBS. = 51

| VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|
| 1 LENGTH | 0.30742E+01 | 0.12141E+02 | 0.34844E+01 | 0.48791E+00 |
| 2 WIDTH | 0.49178E-01 | 0.18955E-02 | 0.43538E-01 | 0.60965E-02 |
| 3 ASPECT RATIO | 0.11685E+03 | 0.49498E+05 | 0.22248E+03 | 0.31154E+02 |
| 4 MASS | 0.18812E-01 | 0.10769E-02 | 0.32816E-01 | 0.45951E-02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.16708E+01 | 0.24397E+01 | 0.14121E+02 | 0.20170E+00 | 0.13919E+02 |
| 2 | 0.31870E+01 | 0.13669E+02 | 0.28240E+00 | 0.40000E-02 | 0.27840E+00 |
| 3 | 0.47779E+01 | 0.26470E+02 | 0.15000E+04 | 0.30000E+01 | 0.14970E+04 |
| 4 | 0.26413E+01 | 0.65220E+01 | 0.15540E+00 | 0.00000E+00 | 0.15540E+00 |

SAMPLE :C31027@920D3WG3 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 7.2622 | 0.0605 | 120.0000 | 0.0612 |
| 2 | 5.6484 | 0 0403 | 140.0000 | 0.0211 |
| 3 | 1.5735 | 0.0282 | 55.7143 | 0.0029 |
| 4 | 0.4841 | 0.0202 | 24.0000 | 0.0005 |
| 5 | 0.6455 | 0.0202 | 32.0000 | 0.0006 |
| 6 | 0.5245 | 0.0282 | 18.5714 | 0.0010 |
| 7 | 6.0518 | 0.0282 | 214.2857 | 0.0111 |
| 8 | 14.1209 | 0.0605 | 233.3333 | 0.1189 |
| 9 | 3.4294 | 0.1210 | 28.3333 | 0.1156 |
| 10 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |
| 11 | 5.2449 | 0.0282 | 185.7143 | 0.0096 |
| 12 | 0.8473 | 0.2824 | 3.0000 | 0.1554 |
| 13 | 6.0518 | 0.0040 | 1500.0000 | 0.0002 |
| 14 | 1.2507 | 0.1210 | 10.3333 | 0.0421 |
| 15 | 1.6138 | 0.0605 | 26.6667 | 0.0136 |
| 16 | 0.8473 | 0.1009 | 8.4000 | 0.0198 |
| 17 | 3.4697 | 0.0282 | 122.8571 | 0.0064 |
| 18 | 0.3631 | 0.0282 | 12.8571 | 0.0007 |
| 19 | 1.1297 | 0.0282 | 40.0000 | 0.0021 |
| 20 | 13.3140 | 0.0282 | 471.4286 | 0.0244 |
| 21 | 5.2449 | 0.0282 | 185.7143 | 0.0096 |
| 22 | 2.5014 | 0.0282 | 88.5714 | 0.0046 |
| 23 | 0.4841 | 0.0807 | 6.0000 | 0.0073 |
| 24 | 0.4841 | 0.0605 | 8.0000 | 0.0041 |
| 25 | 1.4928 | 0.0403 | 37.0000 | 0.0056 |
| 26 | 0.6859 | 0.0040 | 170.0000 | 0.0000 |
| 27 | 1.1700 | 0.1009 | 11.6000 | 0.0274 |
| 28 | 0.2421 | 0.0403 | 6.0000 | 0.0009 |
| 29 | 0.2017 | 0.0605 | 3.3333 | 0.0017 |
| 30 | 1.0893 | 0.0403 | 27.0000 | 0.0041 |
| 31 | 0.2824 | 0.0605 | 4.6667 | 0.0024 |
| 32 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |
| 33 | 3.9538 | 0.0282 | 140.0000 | 0.0073 |
| 34 | 6.0518 | 0.0282 | 214.2857 | 0.0111 |
| 35 | 7.2622 | 0.0282 | 257.1429 | 0.0133 |
| 36 | 4.8414 | 0.0282 | 171.4286 | 0.0089 |
| 37 | 0.8473 | 0.0282 | 30.0000 | 0.0016 |
| 38 | 0.6455 | 0.0605 | 10.6667 | 0.0054 |
| 39 | 6.8587 | 0.0282 | 242.8571 | 0.0126 |
| 40 | 0 8069 | 0.0282 | 28.5714 | 0.0015 |
| 41 | 6.0518 | 0.0282 | 214.2857 | 0.0111 |
| 42 | 0.4841 | 0.0282 | 17.1429 | 0.0009 |
| 43 | 3.6714 | 0.1009 | 36.4000 | 0.0859 |
| 44 | 1.5735 | 0.0807 | 19.5000 | 0.0236 |
| 45 | 13.7174 | 0.0403 | 340.0000 | 0.0514 |
| 46 | 1.0893 | 0.0403 | 27.0000 | 0.0041 |
| 47 | 4.8414 | 0.0282 | 171.4286 | 0.0089 |
| 48 | 2.5418 | 0.0403 | 63.0000 | 0.0095 |
| 49 | 0.4438 | 0.0040 | 110.0000 | 0.0000 |
| 50 | 0.8473 | 0.0807 | 10.5000 | 0.0127 |
| 51 | 1.5331 | 0.0605 | 25.3333 | 0.0129 |

SAMPLE :C310270920D3WG3

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 11 | 21.57 | 21.57 |
| 0.5 | 1.0 | 9 | 17.65 | 39.22 |
| 1.0 | 1.5 | 6 | 11.76 | 50.98 |
| 1.5 | 2.0 | 4 | 7.84 | 58.82 |
| 2.0 | 2.5 | 0 | 0.00 | 58.82 |
| 2.5 | 3.0 | 2 | 3.92 | 62.75 |
| 3.0 | 3.5 | 2 | 3.92 | 66.67 |
| 3.5 | 4.0 | 2 | 3.92 | 70.59 |
| 4.0 | 4.5 | 0 | 0.00 | 70.59 |
| 4.5 | 5.0 | 2 | 3.92 | 74.51 |
| 5.0 | 5.5 | 2 | 3.92 | 78.43 |
| 5.5 | 6.0 | 1 | 1.96 | 80.39 |
| 6.0 | 6.5 | 4 | 7.84 | 88.24 |
| 6.5 | 7.0 | 1 | 1.96 | 90.20 |
| 7.0 | 7.5 | 2 | 3.92 | 94.12 |
| 7.5 | 8.0 | 0 | 0.00 | 94.12 |
| 8.0 | 8.5 | 0 | 0.00 | 94.12 |
| 8.5 | 9.0 | 0 | 0.00 | 94.12 |
| 9.0 | 9.5 | 0 | 0.00 | 94.12 |
| 9.5 | 10.0 | 0 | 0.00 | 94.12 |
| 10.0 | 10.5 | 0 | 0.00 | 94.12 |
| 10.5 | 11.0 | 0 | 0.00 | 94.12 |
| 11.0 | 11.5 | 0 | 0.00 | 94.12 |
| 11.5 | 12.0 | 0 | 0.00 | 94.12 |
| 12.0 | 12.5 | 0 | 0.00 | 94.12 |
| 12.5 | 13.0 | 0 | 0.00 | 94.12 |
| 13.0 | 13.5 | 1 | 1.96 | 96.08 |
| 13.5 | 14.0 | 1 | 1.96 | 98.04 |
| 14.0 | 14.5 | 1 | 1.96 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 45 | 88.24 | 88.24 |
| 0.1 | 0.2 | 5 | 9.80 | 98.04 |
| 0.2 | 0.3 | 1 | 1.96 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 7 | 13.73 | 13.73 |

| | | | | |
|---|---|---|---|---|
| 10 | 20 | 10 | 19.61 | 33.33 |
| 20 | 30 | 8 | 15.69 | 49.02 |
| 30 | 40 | 4 | 7.84 | 56.86 |
| 40 | 50 | 0 | 0.00 | 56.86 |
| 50 | 60 | 1 | 1.96 | 58.82 |
| 60 | 70 | 1 | 1.96 | 60.78 |
| 70 | 80 | 0 | 0.00 | 60.78 |
| 80 | 90 | 1 | 1.96 | 62.75 |
| 90 | 100 | 0 | 0.00 | 62.75 |
| 100 | 110 | 1 | 1.96 | 64.71 |
| 110 | 120 | 1 | 1.96 | 66.67 |
| 120 | 130 | 1 | 1.96 | 68.63 |
| 130 | 140 | 2 | 3.92 | 72.55 |
| 140 | 150 | 0 | 0.00 | 72.55 |
| 150 | 160 | 0 | 0.00 | 72.55 |
| 160 | 170 | 1 | 1.96 | 74.51 |
| 170 | 180 | 2 | 3.92 | 78.43 |
| 180 | 190 | 2 | 3.92 | 82.35 |
| 190 | 200 | 0 | 0.00 | 82.35 |
| * OVER 200 | | 9 | 17.65 | 100.00 |

Appendix 4. City of Atlanta

The city of Atlanta water supply was sampled on two occasions, April 3, 1975 and November 28, 1975. On each visit a sample of the raw water and a sample of the finished water was obtained from the Atlanta water works quality control center located in Northwest Atlanta. On the 3 April visit an additional sample was taken from a faucet in the Holiday Inn, I-20 E.

The results of the analyses for asbestiform material are presently available for the samples taken in April only. The results of the November samples will be the subject of a supplementary report shortly to be issued. The data for the samples taken on April 3 are presented in tabular form. The relevant sample descriptions and computer print outs are attached.

The Water Quality Control Center is located in Northwest Atlanta; the motel at which the tap water was sampled is located to the East of the city. It is possible that the water supply to the faucet sampled does not come from the main Atlanta system although the motel claimed that it was Atlanta water.

City of Atlanta

| Sample | Date sampled | Asbestos type* | Fibers/litre† | Comment |
|---|---|---|---|---|
| Water Q.C. Center | 4-3-75 | A | BDL | Detection limit |
| Raw water | | C | $8.4 \times 10^6$ | $2.1 \times 10^6$ fpl |
| Water Q.C. Center | 4-3-75 | A | BDL | Detection limit |
| Finished water | | C | $12 \times 10^6$ | $.25 \times 10^6$ fpl |
| Tap water | 4-3-75 | A | BDL | Detection limit |
| | | C | BDL | $0.13 \times 10^6$ |

* C = chrysotile
A = asbestiform amphibole

† BDL = below detection limit

Site type: Regional city water supply. MA code C4

Location: Atlanta, Georgia

Company: Atlanta Water Department
Quality Control Center
2630 Ridgewood Road, NW
Atlanta, Georgia

Date visited: 11/28/75

Personnel contacted: Richard Reece, Director
Neal Spivey, Chemist
Atlanta Water Works general information 658-6573
Bill Bush, Director 658-6581

McCrone personnel: R.E. Stevens
M. Palenik

Site description: Atlanta draws its water from the Chattahoochee River which rises in the hills of White County and flows south to join the Apalachiocola and from thence into the Gulf of Mexico.

Sampling: The following samples were obtained

U1 Atlanta raw (Chattahoochee River)
D1 Atlanta finished

Quality Control center located in northwest Atlanta on east bank of Chattahoochee.

Weather conditions: 11/28 clear, cold.

Comments: Chattahoochee River several feet lower than in April. Flow rate 11,300 cfs (7300 million gallons/day). Average for 1974, 3100 m.g.d. = 4800 c.f.s. Sample for 1973.

Cooperation of water department personnel was very good.

Site type: Regional city water supply MA code C4

Location: Atlanta, Georgia

Company: Atlanta Water Department
Quality Control Center
2630 Ridgewood Road, NW
Atlanta, Georgia

Date visited: 4/3/75

Personnel contacted: Richard Reece, Director
Neal Spivey, Chemist
Atlanta Water Works general information 658-6573
Bill Bush, Director 658-6581

McCrone personnel: R.E. Stevens
R.E. Putscher

Site description: Atlanta draws its water from the Chattahoochee River which rises in the hills of White County and flows south to join the Apalachicola and from thence into the Gulf of Mexico.

Sampling: The following samples were obtained

U1 Atlanta raw Chattahoochee River
D1 Atlanta finished
D2 Atlanta tap water

Quality Control center located in northwest Atlanta on east bank of Chattahoochee.

Weather conditions: 4/3/75 - violent thunderstorm with tornado watch the previous evening. Clearing, sunny by afternoon.

Comments: Chattahoochee River rising due to torrential rains. Flow rate 11,300 cfs (7300 million gallons/day). Average for 1974 3100 m.g.d. = 4800 c.f.s. Same for 1973

Cooperation of water department personnel was very good.

Small to moderately large inorganics varying from platy to chiplike and blocky in morphology. Some large organic fibers noted. General low level of material present. Chrysotile was detected.

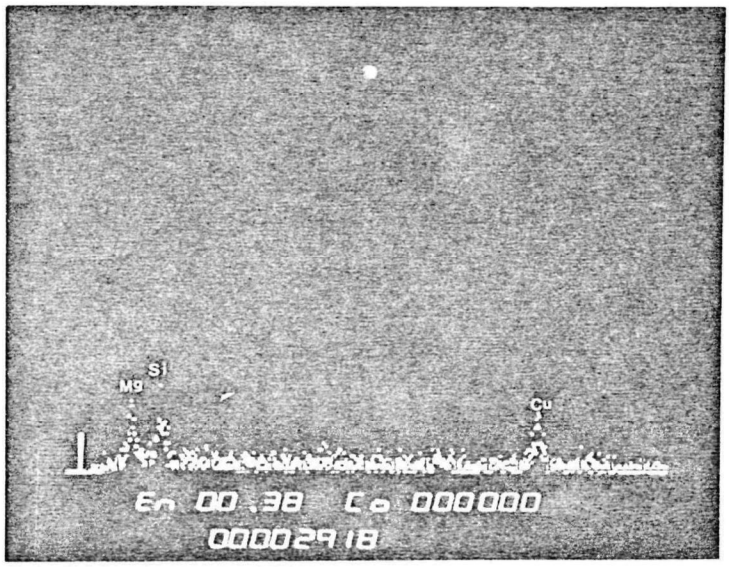



Figure 1 Probe of chrysotile fibril. Copper is background scatter.

SAMPLE :C404031100U1WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 6.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 48.000 MG PER LITER
PH = 7.3

LIMIT OF DETECTION = 0.21E+07

SAMPLE :C404031100U1WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.84E+07
FIBER CONCENTRATION BY MASS, PER LITER : 0.119 GRAMS*10↑-6
VOLUME FILTERED : 6.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 48.000 MG PER LITER
PH = 7.3

SAMPLE :C404031100U1WG3 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 3.3083 | 0.0807 | 41.0000 | 0.0495 |
| 2 | 0.7666 | 0.0605 | 12.6667 | 0.0065 |
| 3 | 0.2421 | 0.0202 | 12.0000 | 0.0002 |
| 4 | 0.2017 | 0.0282 | 7.1429 | 0.0004 |

Some light organic residues and small inorganic material noted. Chrysotile is present as fibrils and as small "groupings".

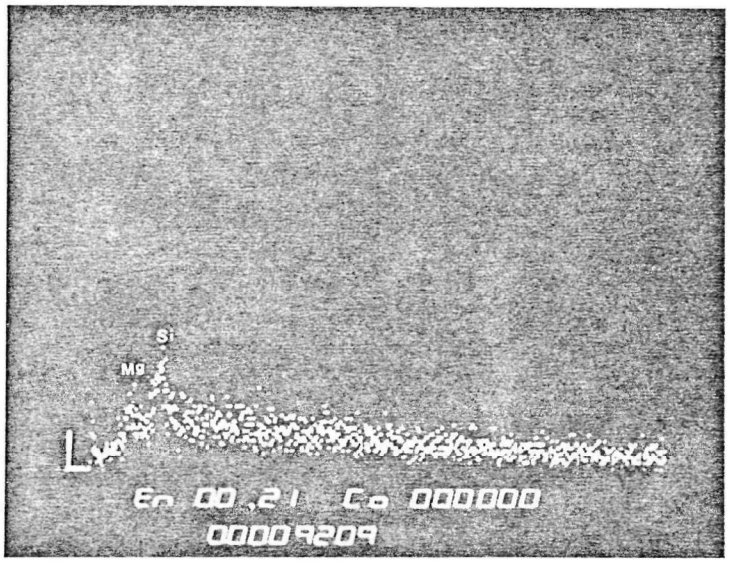



Figure 1 Probe of chrysotile fibril.

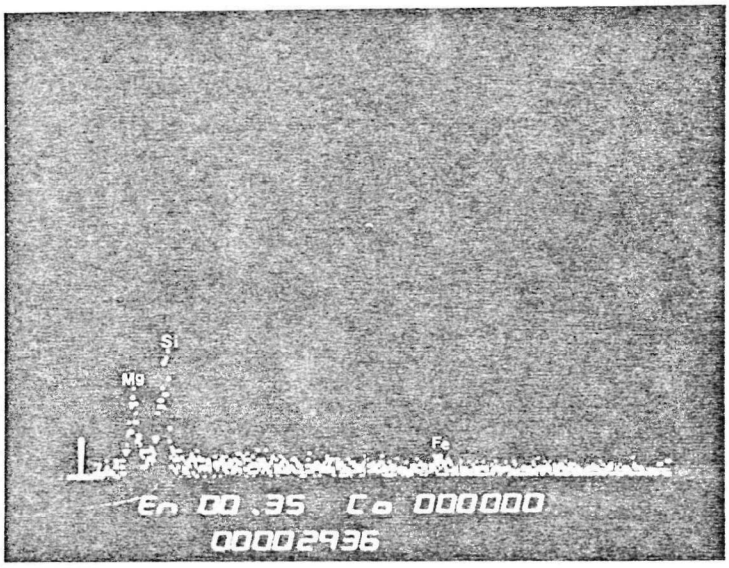



Figure 2 Probe of chrysotile fiber.

SAMPLE :C40403110OD1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
IBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 10.0 ML
GRID SQUARES COUNTED : 20
TOTAL SUSPENDED SOLIDS: 15.000 MG PER LITER
PH = 7.4

LIMIT OF DETECTION = 0.25E+07

SAMPLE :C404031100D1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.12E+08
FIBER CONCENTRATION BY MASS/PER LITER : 0.574 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20
TOTAL SUSPENDED SOLIDS: 15.000 MG PER LITER
PH = 7.4

DESCRIPTIVE STATISTICS

NO. OBS. = 46

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.14858E+01 | 0.18495E+01 | 0.13600E+01 | 0.20052E+00 |
| 2 | WIDTH | 0.82689E-01 | 0.71006E-02 | 0.84265E-01 | 0.12424E-01 |
| 3 | ASPECT RATIO | 0.31731E+02 | 0.13331E+04 | 0.36511E+02 | 0.53833E+01 |
| 4 | MASS | 0.49611E-01 | 0.13049E-01 | 0.11423E+00 | 0.16843E-01 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.13550E+01 | 0.86568E+00 | 0.52449E+01 | 0.24210E+00 | 0.50028E+01 |
| 2 | 0.14362E+01 | 0.72933E+00 | 0.28240E+00 | 0.20200E-01 | 0.26220E+00 |
| 3 | 0.19773E+01 | 0.36730E+01 | 0.17143E+03 | 0.18571E+01 | 0.16957E+03 |
| 4 | 0.43260E+01 | 0.21586E+02 | 0.71050E+00 | 0.20000E-03 | 0.71030E+00 |

SAMPLE :C404031100D1WG2 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 1.7349 | 0.0282 | 61.4286 | 0.0032 |
| 2 | 0.2824 | 0.0282 | 10.0000 | 0.0005 |
| 3 | 4.0345 | 0.0403 | 100.0000 | 0.0151 |
| 4 | 3.8732 | 0.2824 | 13.7143 | 0.7105 |
| 5 | 0.5245 | 0.2824 | 1.8571 | 0.0962 |
| 6 | 0.2824 | 0.0202 | 14.0000 | 0.0003 |
| 7 | 5.0432 | 0.0403 | 125.0000 | 0.0189 |
| 8 | 0.7666 | 0.0605 | 12.6667 | 0.0065 |
| 9 | 1.0490 | 0.2824 | 3.7143 | 0.1924 |
| 10 | 0.9279 | 0.0282 | 32.8571 | 0.0017 |
| 11 | 0.8473 | 0.2824 | 3.0000 | 0.1554 |
| 12 | 2.1383 | 0.0807 | 26.5000 | 0.0320 |
| 13 | 0.5245 | 0.0282 | 18.5714 | 0.0010 |
| 14 | 5.2449 | 0.0807 | 65.0000 | 0.0785 |
| 15 | 1.9769 | 0.1210 | 16.3333 | 0.0566 |
| 16 | 2.1383 | 0.1614 | 13.2500 | 0.1281 |
| 17 | 1.4524 | 0.0282 | 51.4286 | 0.0027 |
| 18 | 1.1297 | 0.0403 | 28.0000 | 0.0042 |
| 19 | 0.7666 | 0.0403 | 19.0000 | 0.0029 |
| 20 | 0.5245 | 0.0403 | 13.0000 | 0.0020 |
| 21 | 0.4841 | 0.1210 | 4.0000 | 0.0163 |
| 22 | 0.9279 | 0.0282 | 32.8571 | 0.0017 |
| 23 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 24 | 1.5331 | 0.0282 | 54.2857 | 0.0028 |
| 25 | 0.5648 | 0.0605 | 9.3333 | 0.0048 |
| 26 | 0.3631 | 0.0807 | 4.5000 | 0.0054 |
| 27 | 3.1873 | 0.1210 | 26.3333 | 0.1074 |
| 28 | 2.7435 | 0.1009 | 27.2000 | 0.0642 |
| 29 | 1.4524 | 0.0202 | 72.0000 | 0.0014 |
| 30 | 0.8473 | 0.0202 | 42.0000 | 0.0008 |
| 31 | 0.2421 | 0.0202 | 12.0000 | 0.0002 |
| 32 | 1.2507 | 0.2824 | 4.4286 | 0.2294 |
| 33 | 1.1297 | 0.0807 | 14.0000 | 0.0169 |
| 34 | 2.2593 | 0.1210 | 18.6667 | 0.0761 |
| 35 | 1.1700 | 0.2017 | 5.8000 | 0.1095 |
| 36 | 0.4841 | 0.0202 | 24.0000 | 0.0005 |
| 37 | 0.4841 | 0.0202 | 24.0000 | 0.0005 |
| 38 | 3.2276 | 0.0282 | 114.2857 | 0.0059 |
| 39 | 1.0490 | 0.2017 | 5.2000 | 0.0982 |
| 40 | 0.6052 | 0.0605 | 10.0000 | 0.0051 |
| 41 | 4.8414 | 0.0282 | 171.4286 | 0.0089 |
| 42 | 2.4207 | 0.0282 | 85.7143 | 0.0044 |
| 43 | 0.7262 | 0.0282 | 25.7143 | 0.0013 |
| 44 | 0.2421 | 0.0282 | 8.5714 | 0.0004 |
| 45 | 0.3228 | 0.0282 | 11.4286 | 0.0006 |
| 46 | 0.2824 | 0.0202 | 14.0000 | 0.0003 |

SAMPLE .C40403110OD1WG2

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 11 | 23.91 | 23.91 |
| 0.5 | 1.0 | 12 | 26.09 | 50.00 |
| 1.0 | 1.5 | 8 | 17.39 | 67.39 |
| 1.5 | 2.0 | 3 | 6.52 | 73.91 |
| 2.0 | 2.5 | 4 | 8.70 | 82.61 |
| 2.5 | 3.0 | 1 | 2.17 | 84.78 |
| 3.0 | 3.5 | 2 | 4.35 | 89.13 |
| 3.5 | 4.0 | 1 | 2.17 | 91.30 |
| 4.0 | 4.5 | 1 | 2.17 | 93.48 |
| 4.5 | 5.0 | 1 | 2.17 | 95.65 |
| 5.0 | 5.5 | 2 | 4.35 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 33 | 71.74 | 71.74 |
| 0.1 | 0.2 | 6 | 13.04 | 84.78 |
| 0.2 | 0.3 | 7 | 15.22 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 13 | 28.26 | 28.26 |
| 10 | 20 | 13 | 28.26 | 56.52 |
| 20 | 30 | 7 | 15.22 | 71.74 |
| 30 | 40 | 2 | 4.35 | 76.09 |
| 40 | 50 | 1 | 2.17 | 78.26 |
| 50 | 60 | 2 | 4.35 | 82.61 |
| 60 | 70 | 2 | 4.35 | 86.96 |
| 70 | 80 | 1 | 2.17 | 89.13 |
| 80 | 90 | 1 | 2.17 | 91.30 |
| 90 | 100 | 1 | 2.17 | 93.48 |
| 100 | 110 | 0 | 0.00 | 93.48 |
| 110 | 120 | 1 | 2.17 | 95.65 |
| 120 | 130 | 1 | 2.17 | 97.83 |
| 130 | 140 | 0 | 0.00 | 97.83 |
| 140 | 150 | 0 | 0.00 | 97.83 |
| 150 | 160 | 0 | 0.00 | 97.83 |
| 160 | 170 | 0 | 0.00 | 97.83 |
| 170 | 180 | 1 | 2.17 | 100.00 |
| 180 | 190 | 0 | 0.00 | 100.00 |

| | | | | |
|---|---|---|---|---|
| 190 | 200 | 0 | 0.00 | 100.00 |
| * OVER | 200 | 0 | 0.00 | 100.00 |

C4 0403 1000 D2 WG2

Very clean sample. Some small inorganics and occasional small organic residues present.

SAMPLE :C404031000D2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.6

LIMIT OF DETECTION = 0.13E+06

SAMPLE :C404031000D2WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.6

LIMIT OF DETECTION = 0.13E+06

Appendix 5. City of Chicago

The city of Chicago water supply was sampled by City of Chicago personnel on March 27, 1975 and samples of the raw and finished water were brought the same day to the Chicago laboratories of Walter C. McCrone Associates, Inc., where they were immediately filtered.

Chicago draws its water from Lake Michigan via a series of offshore cribs located approximately 1 mile out in the lake. The samples brought to McCrone Associates were identified as "Raw Crib " (U1), and "Outlets" (D1), the latter being finished water sampled at the outlet to the city distribution system.

No evidence of asbestiform minerals was detected in either the raw or the finished water. The sample descriptions and computer outputs are attached.

C5 0327 U1 WG2

Sample heavily loaded with much present in the way of chunky and platy inorganics, diatom fragments and organic residues. Fibrous material (73:1 aspect ratio) is present, consisting mainly of various non-asbestiform silicates, diatom fragments and organic tubules. No evidence was found for identification of any of the fibrous phase to be an asbestos mineral.

FROM TAPE # 3 8 28 75

SAMPLE :C50327XXXXUIWG2 (CHRYSOTILE)

C50327XXXXUIWG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75
SAMPLE C50327XXXXUIWG2 ·(CHRYSOTILE)
C50327XXXXUIWG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75

SAMPLE :C59327XXXXU1WG2 '(AMPHIBOLE)

C50327XXXXU1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75
SAMPLE :C50327XXXXU1WG2 `(AMPHIBOLE)
C50327XXXXU1WG2 BELOW DETECTION LIMITS

C5 0327 D1 WG2

Small platy and sharply fractured inorganic material with little organic material present. No asbestiform material detected. Light to fair loading.

FROM THPE # 3 8 28 75
SAMPLE C50327XXXXD1WG2 (CHRYSOTILE)
C50327XXXXD1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75
SAMPLE :C50327XXXXD1WG2 '(CHRYSOTILE)
C50327XXXXD1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75
SAMPLE :C50327XXXXD1WG2 (AMPHIBOLE)
C50327XXXXD1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75

SAMPLE :C50327XXXXD1WG2 (AMPHIBOLE)

C50327XXXXD1WG2 BELOW DETECTION LIMITS

Appendix 6. City of Dallas

Samples of the city of Dallas water supply were obtained from EPA Region 6 personnel (F. Warren Norris, Jr., Water Division), and were filtered at McCrone Associates on receipt during March 1975. The samples were identified by EPA codes as 10841 - Raw water; and 10842 - Finished water. These were recoded in the McCrone Associates' code used in this program as C603XXXXXX U1WG2 and C603XXXXXX D1WG2.

No evidence of asbestiform minerals was detected in either sample. Sample descriptions and computer printouts are attached.

C6 U1 WG2 (10841)

Large (>10 $\mu$m) agglomerated inorganics and large areas of organic residues. Much inorganic matter, ranging from platy or blocky submicrometer sizes to large, chunky or irregularly-shaped materials. Inorganics proved to be various silicon compounds (Fe, K, Mg, Al silicates, perhaps) or high iron-containing compounds.

FROM TAPE # 3 8 28 75

SAMPLE :C603XXXXXXU1WG2 (CHRYSOTILE)

C603XXXXXXU1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75

SAMPLE :C603XXXXXXU1WG2 (CHRYSOTILE)

C603XXXXXXU1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75

SAMPLE C603XXXXXXU1WG2 .(AMPHIBOLE)

C603XXXXXXU1WG2 BELOW DETECTION LIMITS

FROM TWPE # 3 8 28 75
SAMPLE C603XXXXXU1WG2 (AMPHIBOLE)
C603XXXXXU1WG2 BELOW DETECTION LIMITS

C6 D1 WG2 (10842)

Some filmy organic residues were noted. There is very little material present in this sample. The only inorganics present are small ($< 0.3\ \mu m$) and blocky in appearance; they show Fe and Ni when probed.

FROM TAPE # 3 8 28 75

SAMPLE .C603XXXXXXD1WG2 ·(CHRYSOTILE)

C603XXXXXXD1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75

SAMPLE :C603XXXXXXD1WG2 .(CHRYSOTILE)

C603XXXXXXD1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75
SAMPLE .C603XXXXXXD1WG2 (AMPHIBOLE)
C603XXXXXXD1WG2 BELOW DETECTION LIMITS

FROM TAPE # 3 8 28 75

SAMPLE .C603XXXXXD1WG2 .(AMPHIBOLE)

C603XXXXXXD1WG2 BELOW DETECTION LIMITS

Appendix 7. Kansas City

The Kansas City water supply was sampled on September 17, 1975. Three water treatment plants were visited - those of Johnson County, Kansas, Water District No. 1; Kansas City, Kansas and Kansas City, Missouri. At each plant samples of both raw and finished water were obtained.

The samples are identified as follows:

| | |
|---|---|
| U1 | Johnson County - raw water |
| D1 | Johnson County - finished water |
| U2 | Kansas City, Missouri - raw water |
| D2 | Kansas City, Missouri - finished water |
| U3 | Kansas City, Kansas - raw water |
| D3 | Kansas City, Kansas - finsihed water |

No evidence of asbestiform minerals was detected in any of the six samples. Sample descriptions and computer printouts are attached.

Site type: Regional City MA code C7

Location: Kansas City and vicinity

Date visited: 17 September 1975

Personnel contacted: Bennet Kwan - Johnson County, Kansas (913) 722-3000
Kermit Mangum - Kansas City, Kansas (913) 371-3500 or 4220
Dale McMurtrey - Kansas City, Missouri (816) 274-1461

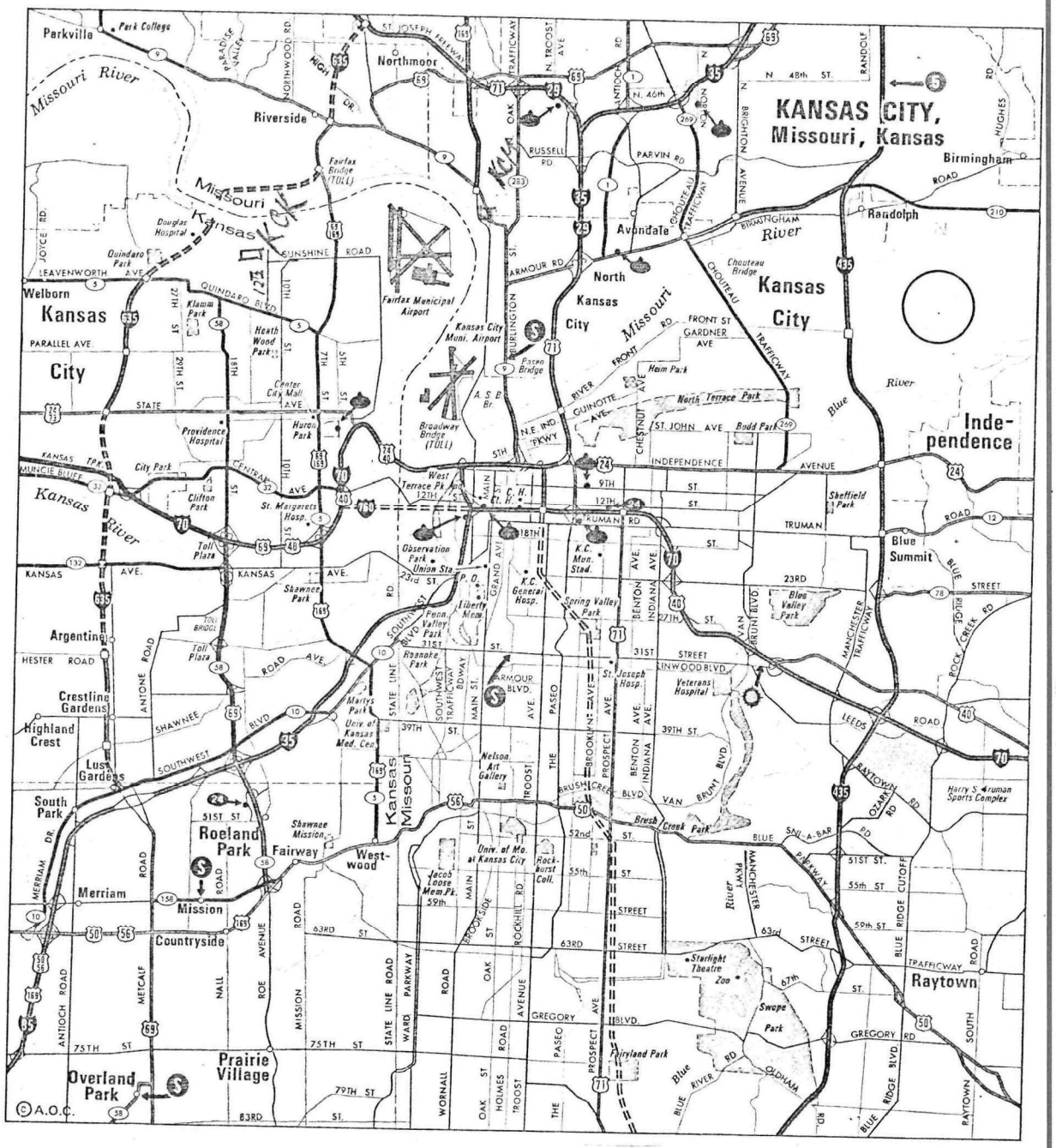
McCrone personnel: M. Palenik
H. Humecki

Site description: Metropolitan Kansas City has three water treatment plants serving Kansas City, Kansas, Johnson County, Kansas, and Kansas City, Missouri.

The Johnson County plant supplies water to purchasers in the communities neighboring Kansas City, Kansas on the south. Water from the Kansas River seeps into 21 wells located along the shore. It is pumped from these wells into the water treatment plant for processing. Samples were obtained from the Kansas River at the wells and also from the treated water tap at the plant.

Both Kansas City, Kansas and Kansas City, Missouri draw water from the Missouri River near treatment plants just a few miles from each other. Raw and finished water were obtained from these plants.

Recommend analysis of all samples.




walter c. mccrone associates, inc.

C7 0917 1130 U1 WG2

Small to massive inorganics in all forms. Agglomeration of material quite common. Organic residues of varying types present as are organic fibers ranging to the quite large. Diatomaceous remains are present. Loading is on the heavy side.

SAMPLE :C709171130U1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 3.0 ML
GRID SQUARES COUNTED : 80
TOTAL SUSPENDED SOLIDS: 118.000 MG PER LITER
PH = 8.1

LIMIT OF DETECTION = 0.21E+07

SAMPLE ·C709171130U1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED . 3.1 ML
GRID SQUARES COUNTED : 31
TOTAL SUSPENDED SOLIDS. 128.000 MG PER LITER
PH = · 7.2

LIMIT OF DETECTION = 0.20E+07

Organic fibrous residues present and some small inorganic particulates. Little material present otherwise. No asbestiform material detected.

SAMPLE :C709171115D1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0 00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
OLUME FILTERED : 26.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.0

LIMIT OF DETECTION = 0.48E+06

SAMPLE :C709171115D1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10+-6
VOLUME FILTERED : 26.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.0

LIMIT OF DETECTION = 0.48E+06

C7 0917 1305 U2 WG3

Small to quite large inorganics of varying shapes with the larger sizes being more of a chunky nature. Some large organic fibers are present. Organic residues are present and agglomeration of material is quite common. Some diatoms and their fragments noted, but little in the way of fibrous inorganic material detected. There were some small organic fibers present.

SAMPLE :C709171305U2WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 1.1 ML
GRID SQUARES COUNTED : 80
TOTAL SUSPENDED SOLIDS: 400.000 MG PER LITER
PH = 8.0

LIMIT OF DETECTION = 0.57E+07

SAMPLE :C709171305U2WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10**-6
VOLUME FILTERED : 1.1 ML
GRID SQUARES COUNTED : 80
TOTAL SUSPENDED SOLIDS: 400.000 MG PER LITER
PH = 8.0

LIMIT OF DETECTION = 0.57E+07

C7 0917 1310 D2 WG2

Very little matter present. Occasional organic or bacterial residues or chunky particulates are the only materials noted.

SAMPLE :C709171310D2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS/PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 31.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 9.0

LIMIT OF DETECTION = 0.41E+06

SAMPLE :C709171310D2WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 31.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 9.0

LIMIT OF DETECTION = 0.41E+06

C7 0917 1230 U3 WG2

Agglomeration common. Varying types of organics present with the inorganics ranging from the small platy types to large massive forms. Organic fibers present ranging from long ultra-thin types to large irregular network types. No asbestiform material detected.

SAMPLE :C709171230U3WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 3.0 ML
GRID SQUARES COUNTED . 80
TOTAL SUSPENDED SOLIDS: 118.000 MG PER LITER
PH = 8.1

LIMIT OF DETECTION = 0.21E+07

Very lightly loaded with occasional chunky inorganic particulates and an occasional organic residue. The only material consistently present is an agglomerated material consisting of spherically appearing material ~30 nanometers in size and of a crystalline nature containing aluminum, silicon, chlorine, calcium and phosphorous. No asbestiform material detected.

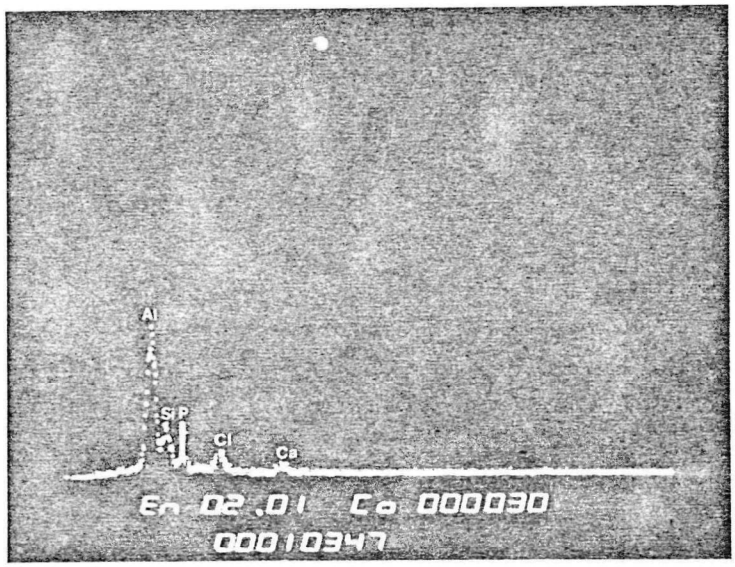



Figure 1 Probe of agglomerated spheroidal material.

SAMPLE :C709171235D3WG2 ·(CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 23.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7 2

LIMIT OF DETECTION = 0.55E+06

SAMPLE :C709171235D3WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS/PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 23.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.55E+06

Appendix 8. City of Denver

The city of Denver water supply was sampled on two occasions, 26 February 1975 and 15 September 1975. Samples were taken at both the Marston and the Moffat plants and are identified as follows.

| | | |
|---|---|---|
| On 26 February | Marston | U1 = Raw water (Conduit 20 in lab) |
| | | D1 = Finished water (Conduit 30 in lab) |
| | Moffat | U2 = Raw water at intake overflow valve |
| | | D2 = Finished water at hose to turbidimeter |
| On 15 September | Marston | U1 = Raw water |
| | | D1 = Finished blend |
| | Moffat | U2 = Raw water |
| | 1100 | D2 = Finished No. 3 |
| | 1110 | D2 = Finished No. 2 |

The results of the analyses for asbestiform material indicate that there is probably no asbestos contamination problem at Denver. It should be noted that one analyst identified possible amphibole fibers both in the raw and in the finished water of Marston on February 26, but at levels which could be background contamination during sampling or sample preparation; 2 fibers were found in the raw sample and 1 in the finished sample. Again at Marston, on the second visit, chrysotile was observed but again at possible contamination levels - 3 fibers in 40 grid squares. We believe, therefore, that the Denver water supply system is free of asbestos.

Site type: Regional City MA code C8

Location: Denver

Date visited: 15 September 1975, 26 February 1975

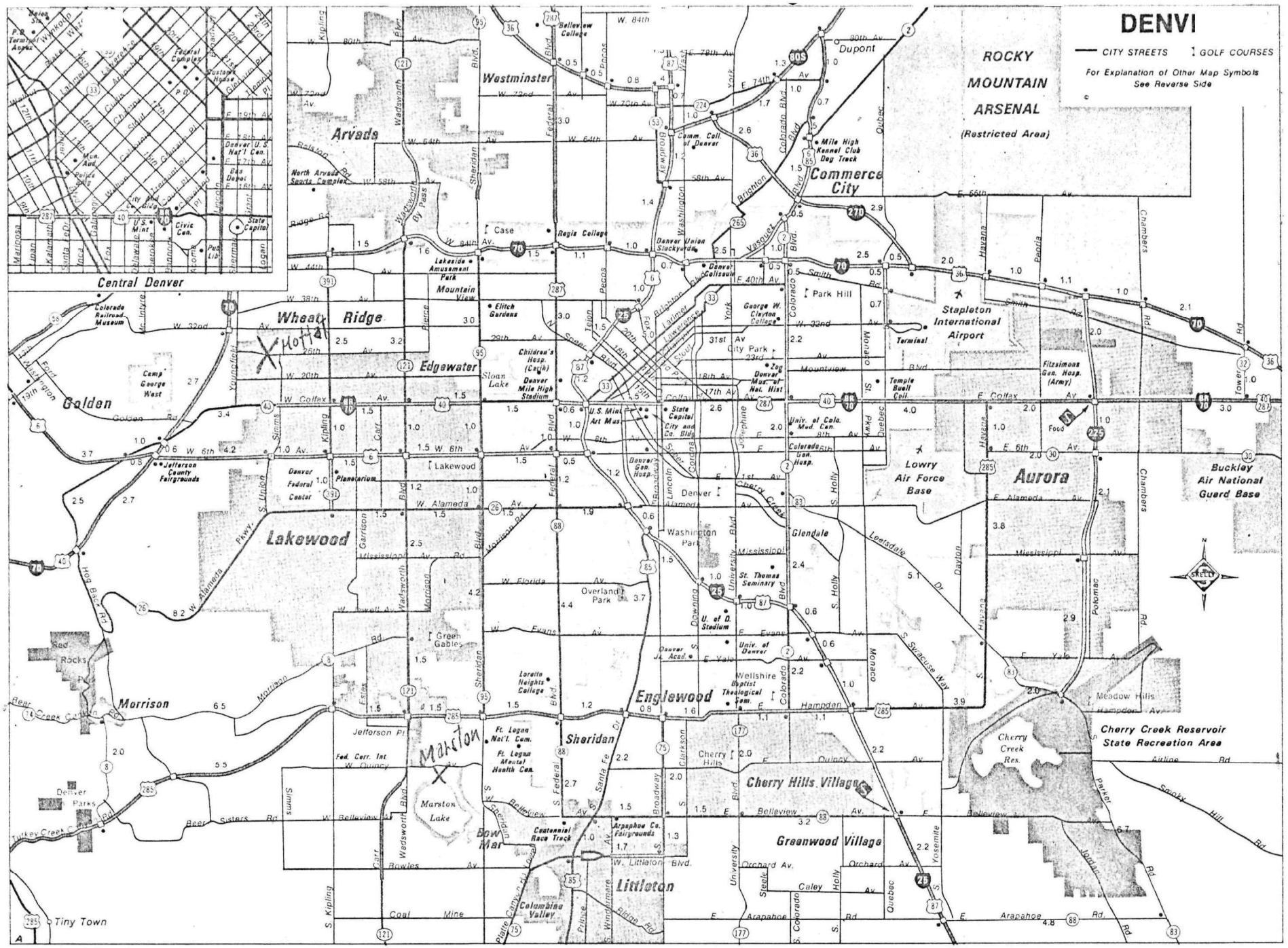
McCrone personnel: H. Humecki
M. Palenik

Site description: Denver has two water treatment plants located at Moffat (N.W. Denver) and at Marston (S.W. Denver). The incoming water to each plant was sampled in addition to the finished water. Grab samples were taken in each case.

Raw water was obtained from the laboratory raw-water tap at Moffat, and finished water from conduits 2 and 3.

Raw water from the Marston plant was taken at the pumphouse, and finished water from the plant laboratory treated water tap.

Recommend analysis of all samples.


DENVI
CITY STREETS
GOLF COURSES
For Explanation of Other Map Symbols See Reverse Side
ROCKY MOUNTAIN ARSENAL
(Restricted Area)
Central Denver
Westminster
Arvada
Commerce City
Wheat Ridge
Edgewater
Golden
Lakewood
Morrison
Englewood
Sheridan
Littleton
Greenwood Village
Cherry Hills Village
Aurora
Stapleton International Airport
Lowry Air Force Base
Buckley Air National Guard Base
Cherry Creek Reservoir State Recreation Area
Denver Parks
Tiny Town
Marston
Hotta

Large, thick organic residues appear to be part of a network. Whole diatoms and fragments thereof were detected. Very small (<0.05 $\mu$m) spherically appearing material in the form of agglomerates. Large, chunky inorganics in the larger size ranges (1 to 10 $\mu$m) are present. Also detected platy and more chunky or blocky inorganics in the range below 2 $\mu$m. Inorganic fibers are present and appear to be of two basic types — thick with a small aspect ratio or thin with a large aspect ratio — neither of which is an asbestos type, but appear to be types of clays. Elementally they contain Fe, Ca, Si, Mg and Al. The fibers appear only occassionally.

SAMPLE :C802261145U1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0 00
FIBER CONCENTRATION BY MASS/PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED . 100.0 ML
GRID SQUARES COUNTED : 20
TOTAL SUSPENDED SOLIDS. 12.000 MG PER LITER
PH = 7.7

SAMPLE :C802261145U1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.7

SAMPLE :C80226114 5U1WG2M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.22E+06
FIBER CONCENTRATION BY MASS,PER LITER : 0.491 GRAMS*10↑-6
OLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 10.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.7

SAMPLE :C80226114 5U1WG2M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 10.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.7

Larger organic residues and small (< 0.05 μm) spheroids are present, as in C8 0226 1145 U1 WG2. In fact, the spheroids are more prevalent. A heavier overall organic filming is present. Inorganics are less prevalent than in C8 0226 1145 U1 WG2, and are generally smaller with most material in the < 1.5 μm size range. Small, dense (< 0.2 μm) spherical or nearly spherical inorganics are present. Platy inorganics are at a minimum, as is any evidence of diatomaceous residues. The small, dense inorganics appear to consist of mainly iron, with some silicon present, while the very small (< 0.05 μm) material in agglomerates is probably organic.

SAMPLE :C802261130D1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER . 0.000 GRAMS*10↑-6
VOLUME FILTERED . 100.0 ML
GRID SQUARES COUNTED 20.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.6

SAMPLE :C80226113OD1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS/PER LITER : 0.000 GRAMS*10↑-6
/OLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.6

SAMPLE :C80226113OD1WG2M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0 56E+05
FIBER CONCENTRATION BY MASS, PER LITER . 0.599 GRAMS*10+-6
VOLUME FILTERED . 100.0 ML
GRID SQUARES COUNTED . 20.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.6

SAMPLE :C802261130D1WG2M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED . 20.
TOTAL SUSPENDED SOLIDS. 12.000 MG PER LITER
PH = 7.6

C8 0226 1400 U2 WG2

Diatoms and diatom fragments. Large particles and aggregates of smaller particles. Heavy organic filming.

SAMPLE :C80226140OU3WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.00
FIBER CONCENTRATION BY MASS PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED . 20.
TOTAL SUSPENDED SOLIDS: 17.000 MG PER LITER
PH = 7.6

SAMPLE : C80226140OU2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 17.000 MG PER LITER
PH = 7.6

SAMPLE ·C80226140OU2WG2M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS·PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 10.
TOTAL SUSPENDED SOLIDS· 17.000 MG PER LITER
PH = 7.6

SAMPLE .C80226140OU2WG2M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10**-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 10.
TOTAL SUSPENDED SOLIDS: 17.000 MG PER LITER
PH = 7.6

C8 0226 1355 D2 WG2

Lightly loaded. Some very "light" organic residues. Mainly blocky or ragged chunks and fibers of inorganics from the multimicrometer sizes down through the submicrometer sizes. The material appears to be various silicates containing Fe and Mg.

SAMPLE :C80226135SD2WG2 (CHRYSOTILE)

FIBER CONCENTPATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS/PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.7

SAMPLE :C802261355D2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED . 20.
TOTAL SUSPENDED SOLIDS. 12.000 MG PER LITER
PH = 7.7

SAMPLE :C802261335D2WG2M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.7

SAMPLE :C80226133SD2WG2M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS.PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 12.000 MG PER LITER
PH = 7.7

Diatoms and their fragments are present as well as what could be sporangia of fungi. Varying organic residues noted and agglomeration of material is common. Varying organic fibers also noted. Inorganics are generally blocky and range to moderately large sizes. Some small agglomerated spherical material is present as are a few inorganic nonasbestiform fibers and a few chrysotile fibers.

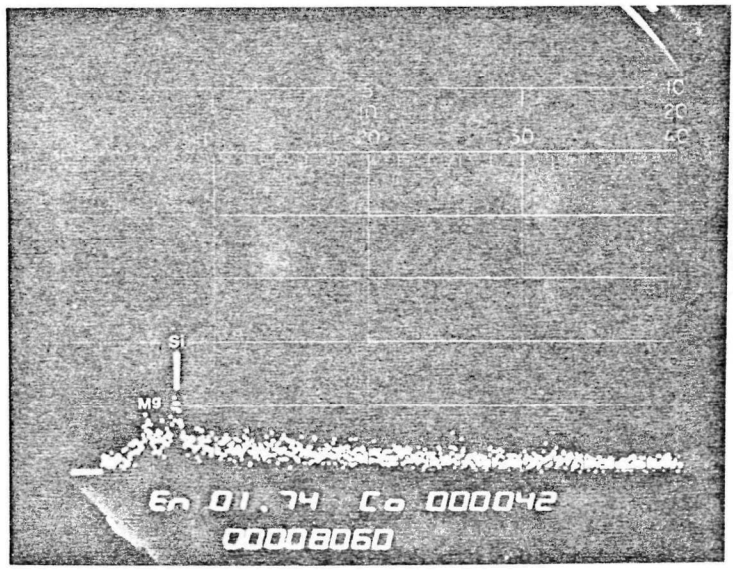



Figure 1 Probe of chrysotile fibril.

SAMPLE :C809151025U1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.15E+07
FIBER CONCENTRATION BY MASS,PER LITER : 0.648 GRAMS*10↑-6
VOLUME FILTERED : 25.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.9

SAMPLE :C809151025U1WG2 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 0.7262 | 0.0282 | 25.7143 | 0.0013 |
| 2 | 3.8732 | 0.2824 | 13.7143 | 0.7105 |
| 3 | 3.1469 | 0.2824 | 11.1429 | 0.5773 |

SAMPLE :C809151025U1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS.PER LITER : 0.000 GRAMS*10↑-6
/OLUME FILTERED : 25.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.50E+06

Small diatom fragments, organic residues and small to moderately sized blocky inorganic particulates are present.

SAMPLE :C8091510 3OD1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
/OLUME FILTERED : 24.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.27E+06

SAMPLE :C809151030D1WC2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
'OLUME FILTERED : 24.0 ML
GRID SQUARES COUNTED 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.52E+06

C8 0915 1105 U2 WG2

Small to moderately sized inorganics present ranging from platy to blocky in form. Some diatomaceous remains noted. Some organic residues and small agglomerated areas present.

SAMPLE :C809151105U2WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
'OLUME FILTERED : 25.0 ML
GRID SQUARES COUNTED . 42
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.48E+06

SAMPLE :C809J51105U2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 25.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0 000 MG PER LITER
PH = 6.8

LIMIT OF DETECTION = 0.50E+06

Small filmy flakes of organic residues and occasional small chunky inorganic particulates present.

SAMPLE :C809151110D2WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0 000 GRAMS*10↑-6
VOLUME FILTERED : 25.0 ML
GRID SQUARES COUNTED . 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.7

LIMIT OF DETECTION = 0.50E+06

SAMPLE :C809151110D2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 25.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.7

LIMIT OF DETECTION = 0.50E+06

C8 0915 1100 D2 WG2

Some organic residues and generally small blocky inorganic material present. Some small diatom fragments noted.

Appendix 9. City of San Francisco

The San Francisco Water System is extremely complex, deriving its main feed from the Yosemite Mountains some 100-150 miles east of the city. From the Yosemites the water is fed via tunnels and pipes (The Hetch-Hetchy aqueduct) to a number of holding reservoirs which are also fed by local run off. The map accompanying the trip report of 5 March shows, in part, the complexity of the system. A "short narrative" (some 22 pages and 16 pages of Appendices) describing the San Francisco water supply system is available from the San Francisco Water Department.

The water system was sampled on two occasions, 5 March 1975 and September 10 and 12, 1975 when the following samples were taken.

March 5

U1 Alameda East Portal ("Terminus" of the Hetch-Hetchy aqueduct). This water has been chlorinated and is regarded as "finished" water. No treatment other than chlorination is applied.

U2 Calaveras Reservoir - Surface water sampled approximately 50 yards from boathouse

U3 San Antonio reservoir - Surface water sampled at boathouse

U4 Lower Crystal Springs Reservoir - Surface water sampled at shore line - rock samples also collected - bedrock extremely friable.

U5 San Andreas Reservoir - Faucet on side of chlorination plant - "raw water"

D5 San Andreas filtration plant, outlet no. 1, "finished" water

U6 Pilarcitos Reservoir - Surface water

| | | |
|---|---|---|
| September 10 | U1 | Alameda East Portal ("Terminus" of the Hetch-Hetchy aqueduct). This water has been chlorinated and is regarded as "finished" water. No treatment other than chlorination is applied. |
| | U2 | Calaveras Reservoir |
| | U3 | San Antonio reservoir |
| | D3 | Sunol filtration - San Antonio treated |
| | U4 | Crystal Springs - "raw water" |
| | D4 | Crystal Springs finished - chlorination only |
| | U5 | San Andreas Reservoir |
| | D5 | San Andreas filtration plant, outlet no. 1, "finished" water |
| | D8 | San Francisco tap water - Airport Holiday Inn |
| September 12 | U7 | Mocassin reservoir - about 100 miles east of San Francisco |

During analysis of the first batch of samples it became apparent that sample preparation problems were being experienced. The data reported for these samples, therefore, is generally that obtained by Murchio and is identifiable by the letter 'M' on the end of the sample code. The sample descriptions, however, were not prepared by Murchio and thus although qualitatively reflecting the sample do not accurately reflect sample loadings.

Sampling during the second visit was carried out by a different sampling team and also under a different guide, thus there are some differences in location at the reservoirs sampled. The most noticeable difference in results between the two samplings is in the Lower Crystal Springs Reservoir samples where $620 \times 10^6$ chrysotile fibers were found on the first visit and none on the second visit. We believe this may be explained by the

different locations at which the samples were taken. It was noted in the trip report for the first visit that the bedrock adjacent to the sampling location is extremely friable and that samples of this rock were taken. These samples did indeed turn out to have a large serpentine content (determined by light microscopy) and the rock could be powdered between the fingers. It is therefore not surprising that the chrysotile content of the first sample is high. It might also not be unexpected that a sampling point some miles distant from the first should show a completely different picture. This highlights the problem of trying to characterize a system as complex as that of San Francisco which could well merit a major study of its own. An additional explanation of differences between the March and September samples may be found in the San Francisco Water Department booklet which , in talking of the Crystal Springs, San Andreas, Pilarcitos section says .... "Historically this has been a problem water due to high turbidity during the winter months ..." thus seasonal variation may also be a factor.

We believe the San Francisco situation may best be summarized as follows:

1) Water from the Hetch-Hetchy aqueduct entering the San Francisco water system (at Alameda East Portal) is free of asbestos.

2) The potential for contamination of the San Francisco water system by asbestos - both serpentine and amphibole - exists due to natural sources in certain of the holding reservoirs, principally Crystal Springs and Calaveras and to a lesser extent San Antonio and San Andreas.

3) These natural sources may be isolated rock outcrops whose total impact on a large reservoir (e.g. Crystal Springs holds $22,580 \times 10^6$ gallons) may not be significant.

4) No evidence has been found of asbestos in any of the finished waters examined.

City of San Francisco

| Location | Date sampled | Asbestos type | Fibers/ liter | Comment |
|---|---|---|---|---|
| Alameda E. Portal (raw/finished) | 3- 5-75 | A | BDL | detection limit |
| | | C | BDL | $0.22 \times 10^6$ |
| Calaveras Reservoir (raw) | 3- 5-75 | A | $45 \times 10^6$ | |
| | | C | $240 \times 10^6$ | |
| San Antonio Reservoir (raw) | 3- 5-75 | A | $.56 \times 10^6$ | Only 1 particle of ea type found - possible background contamination. |
| | | C | $.56 \times 10^6$ | |
| Crystal Springs Reservoir (raw) | 3- 5-75 | A | $18 \times 10^6$ | $71 \times 10^6$ ) samples |
| | | C | $620 \times 10^6$ | $1.7 \times 10^6$ ) re-run |
| San Andreas Reservoir (raw) | 3- 5-75 | A | $4.1 \times 10^6$ | detection limit |
| | | C | BDL | $0.51 \times 10^6$ |
| San Andreas Outlet no. 1 (finished) | 3- 5-75 | A | BDL | detection limit |
| | | C | BDL | $0.05 \times 10^6$ |
| Pilarcitos Reservoir (raw) | 3- 5-75 | A | BDL | detection limit |
| | | C | BDL | $2.5 \times 10^6$ |
| Alameda E. Portal | 9-10-75 | A | BDL | detection limit |
| | | C | BDL | $0.43 \times 10^6$ |

| | | | | |
|---|---|---|---|---|
| Calaveras Reservoir | 9-10-75 | A | BDL | detection limit |
| | | C | $2.6 \times 10^6$ | $0.66 \times 10^6$ |
| San Antonio Reservoir (raw) | 9-10-75 | A | BDL | detection limit |
| | | C | BDL | $0.55 \times 10^6$ |
| SUNOL filtration (San Antonio finished) | 9-10-75 | A | BDL | detection limit |
| | | C | BDL | $0.31 \times 10^6$ |
| Crystal Springs Reservoir (raw) | 9-10-75 | A | BDL | detection limit |
| | | C | BDL | $0.48 \times 10^6$ |
| Crystal Springs Reservoir (finished) | 9-10-75 | A | BDL | detection limit |
| | | C | BDL | $0.52 \times 10^6$ |
| San Andreas Reservoir | 9-10-75 | A | BDL | detection limit |
| | | C | BDL | $0.52 \times 10^6$ |
| San Andreas Outlet no. 1 | 9-10-75 | A | BDL | detection limit |
| | | C | BDL | $0.55 \times 10^6$ |
| Mocassin Reservoir (raw) | 12-10-75 | A | BDL | detection limit |
| | | C | $1.6 \times 10^6$ | $0.55 \times 10^6$ |
| San Francisco tap water | 9-10-75 | A | BDL | detection limit |
| | | C | BDL | $0.32 \times 10^6$ |

Site type: Regional City MA Code C9

Location: San Francisco

Company: San Francisco Water Dept.
1000 El Camino Real
Millbrae
San Francisco

Date Visited: 5th March 1975

Personnel contacted: H. Tracy
M. Camerina
S. Leonard

McCrone Personnel· I.M. Stewart

Site description: The San Francisco Water Supply system is extremely complex, deriving water from several sources, as far distant as the Hetch-Hetchy reservoir in the Yosemites. There are several local holding reservoirs which derive their supplies partly from local sources and partly from the Hetch-Hetchy aqueduct. Part of the system is shown in the attached map.

S.F.W.D. provided an engineer and transport to visit the major sources: this assistance is gratefully acknowledged.

The following samples were taken:

U1 Alameda East Portal ("Terminus" of the Hetch-Hetchy aqueduct). This water has been chlorinated and is regarded as "finished" water. No treatment other than chlorination is applied.

U2 Calaveras Reservoir - Surface water sampled approximately 50 yards from boathouse

U3 San Antonio reservoir-Surface water sampled at boathouse

U4 Lower Crystal Springs Reservoir - Surface water sampled at shore line - rock samples also collected - bedrock extremely friable.

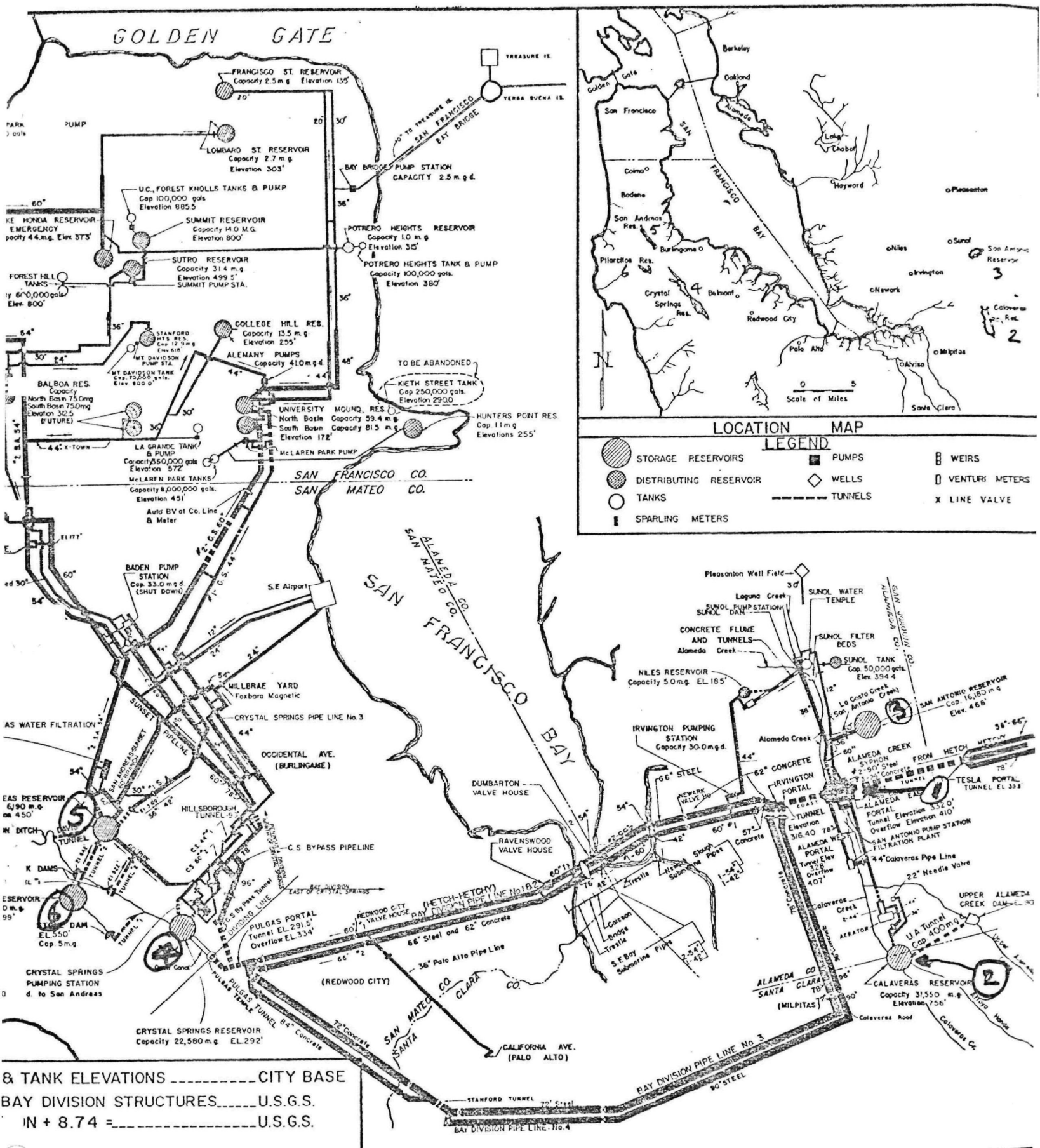
U5 San Andreas Reservoir - faucet on side of chlorination plant - "raw" water.

D5 San Andreas filtration plant, outlet no. 1 "finished" water.

U6 Pilarcitos Reservoir-Surface water.

Weather conditions during sampling were overcast with occasional rain showers.

Recommend analysis of all samples.




& TANK ELEVATIONS _____ CITY BASE
BAY DIVISION STRUCTURES _____ U.S.G.S.
IN + 8.74 = _____ U.S.G.S.

# DIAGRAM OF SYSTEM

SUPERSEDES: X-838-B
ORIGINAL: January 1949
REVISED: JULY 1973

SAN FRANCISCO WATER DEPARTMENT

X-838-C

Site type: Regional City MA Code C9

Location: San Francisco

Company: San Francisco Water Dept.
1000 El Camino Real
Millbrae
San Francisco

Date visited: 10, 12 September 1975;

Personnel contacted: H. Tracy
M. Camerina
S. Leonard

McCrone personnel: H. Humecki
M. Palenik

Site description: The San Francisco Water Supply system is extremely complex, deriving water from several sources, as far distant as the Hetch-Hetchy reservoir in the Yosemites. There are several local holding reservoirs which derive their supplies partly from local sources and partly from the Hetch-Hetchy aqueduct. Part of the system is shown in the attached map.

S.F.W.D. provided an engineer and transport to visit the major sources: this assistance is gratefully acknowledged.

The following samples were taken:

D8 San Francisco tap water - Airport Holiday Inn

U1 Alameda East Portal ("Terminus" of the Hetch-Hetchy aqueduct). This water has been chlorinated and is regarded as "finished" water. No treatment other than chlorination is applied.

U2 Calaveras Reservoir

U3 San Antonio reservoir

D3 Sunol filtration - San Antonio treated

U4 Crystal Springs - "raw"

D4 Crystal Springs "finished" - chlorination only

U5 San Andreas Reservoir

D5 San Andreas filtration plant, outlet no. 1 "finished" water

U7 Mocassin reservoir - about 100 miles east of San Francisco

Weather conditions during sampling were clear and dry.

Recommend analysis of all samples.

C9 0305 0950 U1 WG2

Irregular, filmy residues present throughout the sample. Diatomaceous remains are also present in small fragments. Blocky, irregular inorganics (usually $>0.5\ \mu m$ in size) were detected. Very small, regular crystals ($<0.05\ \mu m$) are well dispersed, never agglomerated. These appear to be potassium silicates.

SAMPLE :C90395095OU1WG3M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER 0.00
FIBER CONCENTRATION BY MASS,PER LITER 0.000 GRAMS*10+-6
VOLUME FILTERED . 22.0 ML
GRID SQUARES COUNTED . 20.
TOTAL SUSPENDED SOLIDS: 11.000 MG PER LITER
PH = 8.9

SAMPLE ;C9030509 50U1WG3M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.00
FIBER CONCENTRATION BY MASS PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED 22 0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 11.000 MG PER LITER
PH = 8.9

Light loading. Some "light" organic residues are present, as are platy inorganics in the multimicrometer size ranges. Also present are smaller chunky inorganics and an occassional spheroidal particle. Small fairly regular well-dispersed inorganic particles which contain K, Si, Fe and Al. Only an infrequent inorganic fiber was noted. No asbestiform material was detected.

Very few organics present. Sample consists mainly of platy to irregularly shaped or chiplike inorganic particles.

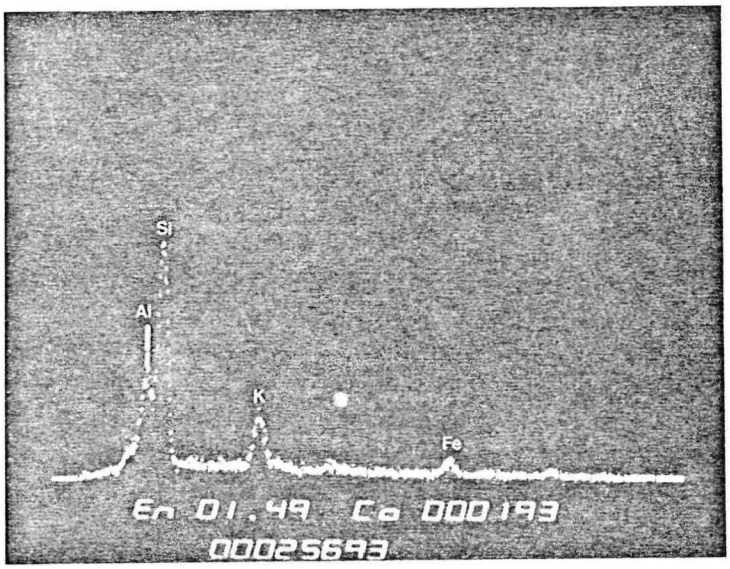



Figure 1 Probe of platy inorganic.

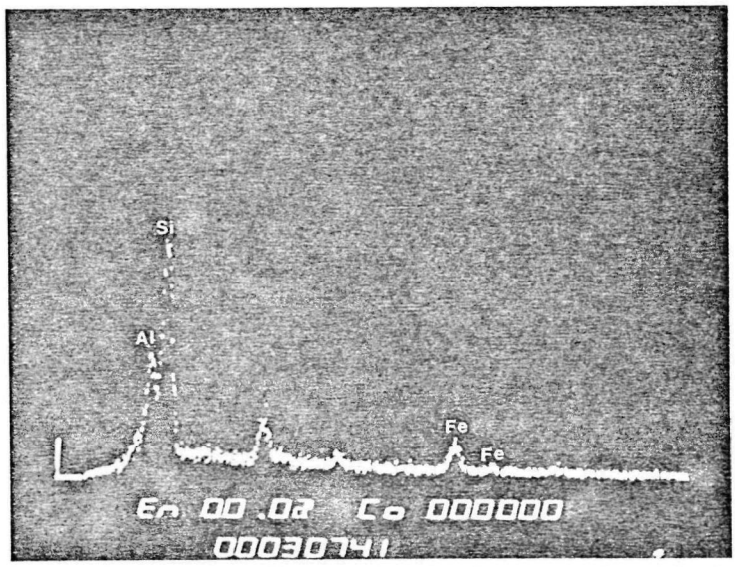



Figure 2 Probe of ragged-edged, irregular blocky particle.

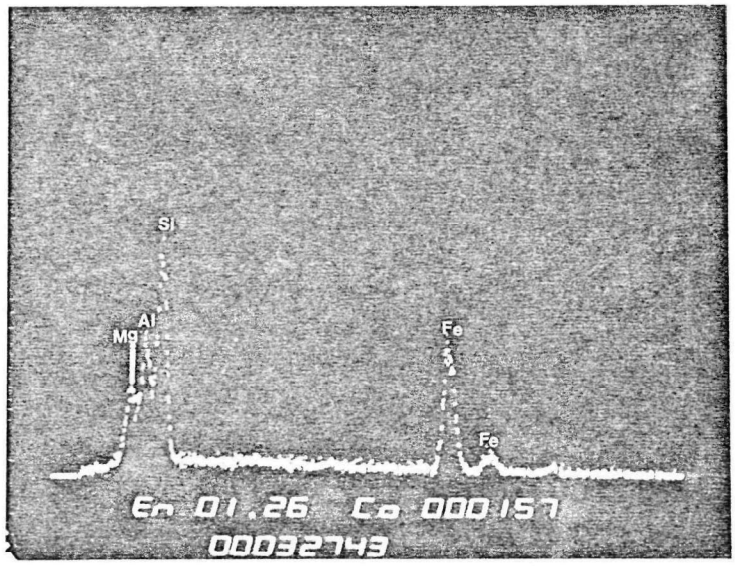


Figure 3 Probe of regular-edged blocky inorganic.

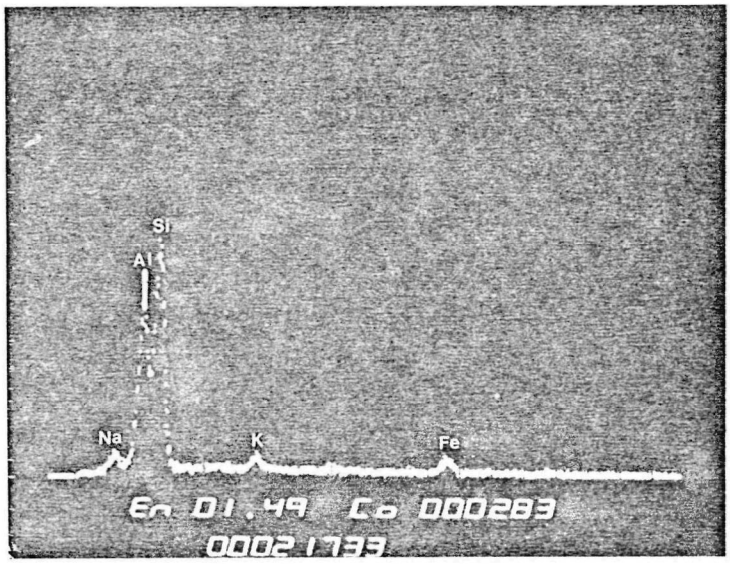


Figure 4 Probe of irregular chip.

SAMPLE : C9030510 25U2WG3MR (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.45E+08
FIBER CONCENTRATION BY MASS PER LITER : 39 019 GRAMS*10↑-6
OLUME FILTERED . 1.0 ML
GRID SQUARES COUNTED : 10
TOTAL SUSPENDED SOLIDS: 37 000 MG PER LITER
PH = 7 6

SAMPLE :C9030510 25U2WG3MP (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.24E+09
FIBER CONCENTRATION BY MASS, PER LITER : 1.405 GRAMS*10+-6
VOLUME FILTERED . 1.0 ML
GRID SQUARES COUNTED : 10.
TOTAL SUSPENDED SOLIDS: 37 000 MG PER LITER
PH = 7.6

DESCRIPTIVE STATISTICS

NO. OBS = 21

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.98095E+00 | 0.11146E+01 | 0.10558E+01 | 0.23038E+00 |
| 2 | WIDTH | 0 35238E-01 | 0.25619E-03 | 0.16006E-01 | 0.34928E-02 |
| 3 | ASPECT RATIO | 0.27905E+02 | 0.79890E+03 | 0.28265E+02 | 0.61679E+01 |
| 4 | MASS | 0.59619E-02 | 0.35119E-03 | 0.18740E-01 | 0.40894E-02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.12918E+01 | 0.43698E+00 | 0.38000E+01 | 0.20000E+00 | 0.36000E+01 |
| 2 | 0.31989E+01 | 0 98412E+01 | 0.10000E+00 | 0.30000E-01 | 0 70000E-01 |
| 3 | 0.12010E+01 | 0 12405E+00 | 0.10000E+03 | 0.66667E+01 | 0.93333E+02 |
| 4 | 0 38938E+01 | 0.13987E+02 | 0.87400E-01 | 0.40000E-03 | 0 87000E-01 |

SAMPLE C9030510 25U2WG3MP (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 3.0000 | 0.0300 | 100.0000 | 0.0062 |
| 2 | 0.4000 | 0.0500 | 8.0000 | 0.0023 |
| 3 | 3.8000 | 0.1000 | 38.0000 | 0.0874 |
| 4 | 2.0000 | 0.0300 | 66.6667 | 0.0041 |
| 5 | 0.4000 | 0.0300 | 13 3333 | 0.0008 |
| 6 | 1.0000 | 0 0300 | 33.3333 | 0.0021 |
| 7 | 0 4000 | 0.0300 | 13.3333 | 0.0008 |
| 8 | 0 2000 | 0.0300 | 6.6667 | 0 0004 |
| 9 | 1.8000 | 0.0300 | 60.0000 | 0.0037 |
| 10 | 2.5000 | 0.0300 | 83 3333 | 0.0052 |
| 11 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 12 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 13 | 0 6000 | 0.0300 | 20.0000 | 0.0012 |
| 14 | 0.2000 | 0.0300 | 6 6667 | 0.0004 |
| 15 | 1.6000 | 0.0300 | 53.3333 | 0.0033 |
| 16 | 0.5000 | 0.0500 | 10.0000 | 0.0029 |
| 17 | 0.2000 | 0.0300 | 6.6667 | 0 0004 |
| 18 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 19 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 20 | 0.2000 | 0 0300 | 6.6667 | 0 0004 |
| 21 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |

SAMPLE :C9030510 25U2WG3MR

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 12 | 57.14 | 57.14 |
| 0.5 | 1.0 | 3 | 14.29 | 71.43 |
| 1.0 | 1.5 | 0 | 0.00 | 71.43 |
| 1.5 | 2.0 | 3 | 14.29 | 85.71 |
| 2.0 | 2.5 | 1 | 4.76 | 90.48 |
| 2.5 | 3.0 | 1 | 4.76 | 95.24 |
| 3.0 | 3.5 | 0 | 0.00 | 95.24 |
| 3.5 | 4.0 | 1 | 4.76 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 21 | 100.00 | 100.00 |
| 0.1 | 0.2 | 0 | 0.00 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 8 | 38.10 | 38.10 |
| 10 | 20 | 6 | 28.57 | 66.67 |
| 20 | 30 | 0 | 0.00 | 66.67 |
| 30 | 40 | 2 | 9.52 | 76.19 |
| 40 | 50 | 0 | 0.00 | 76.19 |
| 50 | 60 | 2 | 9.52 | 85.71 |
| 60 | 70 | 1 | 4.76 | 90.48 |
| 70 | 80 | 0 | 0.00 | 90.48 |
| 80 | 90 | 1 | 4.76 | 95.24 |
| 90 | 100 | 1 | 4.76 | 100.00 |
| 100 | 110 | 0 | 0.00 | 100.00 |
| 110 | 120 | 0 | 0.00 | 100.00 |
| 120 | 130 | 0 | 0.00 | 100.00 |
| 130 | 140 | 0 | 0.00 | 100.00 |
| 140 | 150 | 0 | 0.00 | 100.00 |
| 150 | 160 | 0 | 0.00 | 100.00 |
| 160 | 170 | 0 | 0.00 | 100.00 |
| 170 | 180 | 0 | 0.00 | 100.00 |
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0.00 | 100.00 |
| * OVER 200 | | 0 | 0.00 | 100.00 |

C9 0305 1105 U3 WG2

Very light loading. Irregularly shaped organic residues are prevalent throughout the sample. The small potassium silicates are present in this sample also, as are the blocky type of inorganics in the small size ranges — but none in any large sizes. Most of the material is under 2 $\mu$m in size. No asbestiform material was detected.

SAMPLE :C903051105U3WG3M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0 56E+06
FIBER CONCENTRATION BY MASS PER LITER . 0.333 GRAMS*10↑-6
VOLUME FILTERED : 10.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 6.000 MG PER LITER
PH = 8 0

SAMPLE :C9030511 05U3WG3M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.56E+06
FIBER CONCENTRATION BY MASS, PER LITER : 0.013 GRAMS*10↑-6
VOLUME FILTERED . 10.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 6 000 MG PER LITER
PH = 8.0

Light loading. Large organic fibers present with widths of up to 5 $\mu$m. Their physical appearance is very similar to paper fibers, but these appear to be part of a network of some sort. Some light, overall filming is present in areas of the sample. Small blocky and platy silicates are present in sizes < 0.5 $\mu$m. No really large inorganics were detected.

SAMPLE : C903051215U4WG3M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.18E+08
FIBER CONCENTRATION BY MASS, PER LITER : 6.744 GRAMS*10↑-6
VOLUME FILTERED : 26.0 ML
GRID SQUARES COUNTED 5.
TOTAL SUSPENDED SOLIDS: 4.000 MG PER LITER
PH = 7.6

DESCRIPTIVE STATISTICS

NO. OBS. = 6

| VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|
| 1 LENGTH | 0.21417E+01 | 0.23804E+01 | 0.15429E+01 | 0.62987E+00 |
| 2 WIDTH | 0.21667E+00 | 0.13667E-01 | 0.11690E+00 | 0.47726E-01 |
| 3 ASPECT RATIO | 0.13917E+02 | 0.31604E+03 | 0 17778E+02 | 0.72577E+01 |
| 4 MASS | 0.38417E+00 | 0.15817E+00 | 0.39771E+00 | 0.16236E+00 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.82575E+00 | -0.82052E+00 | 0.50000E+01 | 0.60000E+00 | 0.44000E+01 |
| 2 | 0.37090E+00 | -0.16181E+01 | 0.40000E+00 | 0.10000E+00 | 0.30000E+00 |
| 3 | 0.13272E+01 | -0.14043E+00 | 0.50000E+02 | 0.50000E+01 | 0.45000E+02 |
| 4 | 0 66099E+00 | -0.14384E+01 | 0.10560E+01 | 0.19800E-01 | 0.10362E+01 |

SAMPLE .C903051215U4WG3M (AMPHIBOLE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 2.2500 | 0.3000 | 7.5000 | 0.6682 |
| 2 | 0.6000 | 0.1000 | 6.0000 | 0.0198 |
| 3 | 2.0000 | 0.2000 | 10.0000 | 0 2640 |
| 4 | 1 0000 | 0.2000 | 5.0000 | 0.1320 |
| 5 | 5 0000 | 0.1000 | 50.0000 | 0.1650 |
| 6 | 2.0000 | 0.4000 | 5 0000 | 1.0560 |

SAMPLE C903051215U4WG3M

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 0 | 0.00 | 0.00 |
| 0.5 | 1.0 | 2 | 33.33 | 33.33 |
| 1.0 | 1.5 | 0 | 0.00 | 33.33 |
| 1.5 | 2.0 | 2 | 33.33 | 66.57 |
| 2.0 | 2.5 | 1 | 16.67 | 83.33 |
| 2.5 | 3.0 | 0 | 0.00 | 83.33 |
| 3.0 | 3.5 | 0 | 0.00 | 83.33 |
| 3.5 | 4.0 | 0 | 0.00 | 83.33 |
| 4.0 | 4.5 | 0 | 0 00 | 83.33 |
| 4.5 | 5.0 | 1 | 16.67 | 100.00 |
| 5.0 | 5.5 | 0 | 0.00 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 2 | 33.33 | 33.33 |
| 0.1 | 0.2 | 2 | 33.33 | 66.67 |
| 0.2 | 0.3 | 1 | 16.67 | 83.33 |
| 0.3 | 0.4 | 1 | 16.67 | 100.00 |
| 0.4 | 0.5 | 0 | 0.00 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 5 | 83.33 | 83.33 |
| 10 | 20 | 0 | 0.00 | 83.33 |
| 20 | 30 | 0 | 0.00 | 83.33 |
| 30 | 40 | 0 | 0.00 | 83.33 |
| 40 | 50 | 1 | 16.67 | 100.00 |
| 50 | 60 | 0 | 0.00 | 100.00 |
| 60 | 70 | 0 | 0.00 | 100.00 |
| 70 | 80 | 0 | 0.00 | 100.00 |
| 80 | 90 | 0 | 0.00 | 100.00 |
| 90 | 100 | 0 | 0.00 | 100 00 |
| 100 | 110 | 0 | 0.00 | 100 00 |
| 110 | 120 | 0 | 0.00 | 100.00 |
| 120 | 130 | 0 | 0.00 | 100.00 |
| 130 | 140 | 0 | 0.00 | 100.00 |
| 140 | 150 | 0 | 0.00 | 100 00 |
| 150 | 160 | 0 | 0.00 | 100 00 |
| 160 | 170 | 0 | 0.00 | 100.00 |

| | | | | |
|---|---|---|---|---|
| 170 | 180 | 0 | 0 00 | 100.00 |
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0 00 | 100.00 |
| * OVER | 200 | 0 | 0.00 | 100 00 |

SAMPLE :C90305121SU4WG3M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.62E+09
FIBER CONCENTRATION BY MASS, PER LITER : 211.737 GRAMS*10+-6
VOLUME FILTERED : 26.0 ML
GRID SQUARES COUNTED : 5.
TOTAL SUSPENDED SOLIDS: 4.000 MG PER LITER
PH = 7.6

DESCRIPTIVE STATISTICS

NO. OBS. = 211

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.14746E+01 | 0.36536E+01 | 0.19114E+01 | 0.13159E+00 |
| 2 | WIDTH | 0.73270E-01 | 0.19622E-01 | 0.14008E+00 | 0.96434E-02 |
| 3 | ASPECT RATIO | 0.29566E+02 | 0.13172E+04 | 0.36293E+02 | 0.24985E+01 |
| 4 | MASS | 0.34300E+00 | 0.63561E+01 | 0.25211E+01 | 0.17356E+00 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.32216E+01 | 0.13482E+02 | 0.13000E+02 | 0.10900E+00 | 0.12900E+02 |
| 2 | 0.60693E+01 | 0.46083E+02 | 0.14000E+01 | 0.30000E-01 | 0.13700E+01 |
| 3 | 0.37074E+01 | 0.17613E+02 | 0.26667E+03 | 0.33333E+01 | 0.26333E+03 |
| 4 | 0.10326E+02 | 0 11609E+03 | 0 31556E+02 | 0.20000E-03 | 0.31556E+02 |

SAMPLE :C9030512150U4WG3M (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 2.0000 | 0.0500 | 40.0000 | 0.0115 |
| 2 | 1.0000 | 0.2000 | 5.0000 | 0.0920 |
| 3 | 2.0000 | 0.1000 | 20.0000 | 0.0460 |
| 4 | 13.0000 | 0.4000 | 32.5000 | 4.7840 |
| 5 | 0.4000 | 0.1000 | 4.0000 | 0.0092 |
| 6 | 1.3000 | 0.0500 | 26.0000 | 0.0075 |
| 7 | 0.7000 | 0.0300 | 23.3333 | 0.0014 |
| 8 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 9 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 10 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 11 | 0.4000 | 0.0500 | 8.0000 | 0.0023 |
| 12 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 13 | 1.6000 | 0.0300 | 53.3333 | 0.0033 |
| 14 | 1.4000 | 0.0500 | 28.0000 | 0.0081 |
| 15 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 16 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 17 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 18 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 19 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 20 | 1.4000 | 0.0300 | 46.6667 | 0.0029 |
| 21 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 22 | 2.0000 | 0.0300 | 66.6667 | 0.0041 |
| 23 | 4.0000 | 0.0300 | 133.3333 | 0.0083 |
| 24 | 3.0000 | 0.0300 | 100.0000 | 0.0062 |
| 25 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 26 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 27 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 28 | 3.0000 | 0.2000 | 15.0000 | 0.2760 |
| 29 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 30 | 1.5000 | 0.3000 | 5.0000 | 0.3105 |
| 31 | 2.0000 | 0.0300 | 66.6667 | 0.0041 |
| 32 | 3.0000 | 0.0300 | 100.0000 | 0.0062 |
| 33 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 34 | 1.2000 | 0.0300 | 40.0000 | 0.0025 |
| 35 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 36 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 37 | 3.0000 | 0.0500 | 60.0000 | 0.0173 |
| 38 | 2.5000 | 0.1000 | 25.0000 | 0.0575 |
| 39 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 40 | 0.2500 | 0.0300 | 8.3333 | 0.0005 |
| 41 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 42 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 43 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 44 | 1.2000 | 0.0300 | 40.0000 | 0.0025 |
| 45 | 0.5000 | 0.0500 | 10.0000 | 0.0029 |
| 46 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 47 | 1.2000 | 0.0300 | 40.0000 | 0.0025 |
| 48 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 49 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 50 | 1.6000 | 0.2000 | 8.0000 | 0.1472 |
| 51 | 0.4000 | 0.0500 | 8.0000 | 0.0023 |

| | | | | |
|---|---|---|---|---|
| 52 | 1 6000 | 0 1000 | 16.0000 | 0.0368 |
| 53 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 54 | 1.0000 | 0.1000 | 10.0000 | 0.0230 |
| 55 | 5.5000 | 0.2000 | 27.5000 | 0 5060 |
| 56 | 0 8000 | 0 0300 | 26.6667 | 0.0017 |
| 57 | 0.2000 | 0 0300 | 6 6667 | 0.0004 |
| 58 | 4.0000 | 0 0500 | 80.0000 | 0 0230 |
| 59 | 0.4000 | 0.0300 | 13.3333 | 0.0000 |
| 60 | 0.8000 | 0.0300 | 26.6667 | 0.0017 |
| 61 | 0.6000 | 0 0300 | 20.0000 | 0.0012 |
| 62 | 0 2000 | 0.0300 | 6.6667 | 0.0004 |
| 63 | 1 0000 | 0.0300 | 33.3333 | 0.0021 |
| 64 | 1.2000 | 0 0300 | 40.0000 | 0 0025 |
| 65 | 1 2000 | 0 0300. | 40.0000 | 0.0025 |
| 66 | 2.8000 | 0.0000 | 46.6667 | 0.0232 |
| 67 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 68 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 69 | 1.0000 | 0.0300 | 33 3333 | 0.0021 |
| 70 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 71 | 1.0000 | 0.0300 | 33 3333 | 0.0021 |
| 72 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 73 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 74 | 0 5000 | 0.0300 | 16.6667 | 0.0010 |
| 75 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 76 | 0.5000 | 0 0300 | 16.6667 | 0.0010 |
| 77 | 0.8000 | 0.0500 | 16.0000 | 0.0046 |
| 78 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 79 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 80 | 0 4000 | 0.0300 | 13.3333 | 0.0008 |
| 81 | 0.4000 | 0.0300 | 13.3333 | 0 0008 |
| 82 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 83 | 3.0000 | 0.0300 | 100.0000 | 0.0062 |
| 84 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 85 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 86 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 87 | 1.5000 | 0.0500 | 30.0000 | 0.0086 |
| 88 | 1.0000 | 0.1000 | 10.0000 | 0 0230 |
| 89 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 90 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 91 | 0.2000 | 0 0300 | 6.6667 | 0.0004 |
| 92 | 0.6000 | 0.0300 | 20.0000 | 0 0012 |
| 93 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 94 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 95 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 96 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 97 | 0 5000 | 0.0300 | 16.6667 | 0.0010 |
| 98 | 0.4000 | 0.0500 | 8.0000 | 0.0023 |
| 99 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 100 | 0 4000 | 0.0300 | 13 3333 | 0.0008 |
| 101 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 102 | 0 2000 | 0.0300 | 6.6667 | 0.0004 |
| 103 | 0.2000 | 0.0300 | 6.6667 | 0 0004 |
| 104 | 0.2000 | 0.0300 | 6.6667 | 0 0004 |
| 105 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 106 | 0.4000 | 0 0300 | 13.3333 | 0.0008 |
| 107 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 108 | 1.6000 | 0.0300 | 53.3333 | 0.0033 |
| 109 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 110 | 0 2000 | 0.0300 | 6.6667 | 0.0004 |
| 111 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |

| | | | | |
|---|---|---|---|---|
| 112 | 1.6000 | 0.2000 | 8.0000 | 0 1472 |
| 113 | 2.5000 | 0 0500 | 50.0000 | 0.0144 |
| 114 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 115 | 4.0000 | 0.0300 | 133.3333 | 0.0083 |
| 116 | 0.1000 | 0.0300 | 3.3333 | 0.0002 |
| 117 | 0.6000 | 0 0300 | 20.0000 | 0.0012 |
| 118 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 119 | 0.5000 | 0.0300 | 12.0000 | 0 0035 |
| 120 | 0.8000 | 0 0300 | 26.6667 | 0.0017 |
| 121 | 0.8000 | 0.0300 | 26 6667 | 0.0017 |
| 122 | 1 0000 | 0 0500 | 20.0000 | 0 0058 |
| 123 | 0.4000 | 0 0300 | 13 3333 | 0.0008 |
| 124 | 2.1000 | 0.0600 | 35.0000 | 0 0174 |
| 125 | 3.3000 | 0.1000 | 33.0000 | 0.0759 |
| 126 | 3.0000 | 0.0300 | 100.0000 | 0.0062 |
| 127 | 1.0000 | 0.3000 | 3.3333 | 0.2070 |
| 128 | 0.3000 | 0 0300 | 10.0000 | 0.0006 |
| 129 | 3.5000 | 0.1000 | 35.0000 | 0.0805 |
| 130 | 1.8000 | 0.0300 | 60.0000 | 0.0037 |
| 131 | 3.2000 | 0.0600 | 53.3333 | 0.0265 |
| 132 | 0.8000 | 0.0600 | 13.3333 | 0.0066 |
| 133 | 3 6000 | 0.1000 | 36.0000 | 0.0828 |
| 134 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 135 | 1.8000 | 0.0600 | 30.0000 | 0.0149 |
| 136 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 137 | 1.3000 | 0.0300 | 43.3333 | 0.0027 |
| 138 | 0.8000 | 0.0300 | 26.6667 | 0.0017 |
| 139 | 0.8000 | 0.0300 | 26.6667 | 0.0017 |
| 140 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 141 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 142 | 0 2000 | 0.0300 | 6.6667 | 0.0004 |
| 143 | 2.0000 | 0.0300 | 66.6667 | 0.0041 |
| 144 | 6.0000 | 0.3000 | 20 0000 | 1.2420 |
| 145 | 10.0000 | 0 6000 | 16.6667 | 8.2800 |
| 146 | 3.0000 | 0 1000 | 30.0000 | 0.0690 |
| 147 | 4.0000 | 0.1000 | 40.0000 | 0.0920 |
| 148 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 149 | 1.2000 | 0 0600 | 20.0000 | 0.0099 |
| 150 | 2.0000 | 0.0300 | 66.6667 | 0.0041 |
| 151 | 2.0000 | 0 0300 | 66 6667 | 0.0041 |
| 152 | 7.0000 | 1 4000 | 5.0000 | 31.5560 |
| 153 | 2.0000 | 0.0300 | 66.6667 | 0.0041 |
| 154 | 6.0000 | 0.0300 | 200.0000 | 0.0124 |
| 155 | 5.0000 | 0.4000 | 12.5000 | 1.8400 |
| 156 | 5.0000 | 0.4000 | 12.5000 | 1.8400 |
| 157 | 5.0000 | 0.4000 | 12.5000 | 1.8400 |
| 158 | 7.0000 | 1.0000 | 7.0000 | 16.1000 |
| 159 | 4.0000 | 0.1000 | 40.0000 | 0.0920 |
| 160 | 3.0000 | 0.0500 | 60.0000 | 0.0173 |
| 161 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 162 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 163 | 13 0000 | 0.0500 | 260.0000 | 0.0748 |
| 164 | 2.0000 | 0.0300 | 66 6667 | 0.0041 |
| 165 | 0.3000 | 0 0300 | 10.0000 | 0.0006 |
| 166 | 0 3000 | 0 0300 | 10 0000 | 0.0006 |
| 167 | 0.8000 | 0 0300 | 26.6667 | 0.0017 |
| 168 | 0.3000 | 0.0300 | 10 0000 | 0 0006 |
| 169 | 0 2000 | 0 0300 | 6.6667 | 0.0004 |
| 170 | 1.7000 | 0 1000 | 17.0000 | 0 0391 |
| 171 | 0 4000 | 0.0300 | 13.3333 | 0.0008 |

| | | | | |
|---|---|---|---|---|
| 172 | 3.5000 | 0 1000 | 35 0000 | 0.0805 |
| 173 | 1.0000 | 0 0300 | 33.3333 | 0.0021 |
| 174 | 2.0000 | 0.4000 | 5.0000 | 0.7360 |
| 175 | 3.0000 | 0.1000 | 30.0000 | 0.0690 |
| 176 | 4.0000 | 0 0300 | 133.3333 | 0.0083 |
| 177 | 1.4000 | 0.0300 | 46 6667 | 0.0029 |
| 178 | 0.4000 | 0 0300 | 13.3333 | 0.0008 |
| 179 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 180 | 0.3000 | 0.0300 | 10.0000 | 0 0006 |
| 181 | 0.6000 | 0.0300 | 20.0000 | 0 0012 |
| 182 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 183 | 4.0000 | 0.0300 | 133 3333 | 0 0083 |
| 184 | 0.6000 | 0.1000 | 6.0000 | 0.0138 |
| 185 | 0.9000 | 0.1000 | 9.0000 | 0.0207 |
| 186 | 2.6000 | 0 0500 | 52.0000 | 0.0149 |
| 187 | 2.4000 | 0 3000 | 8.0000 | 0.4968 |
| 188 | 1.0000 | 0.3000 | 3.3333 | 0.2070 |
| 189 | 1.0000 | 0 3000 | 3.3333 | 0.2070 |
| 190 | 0.7000 | 0 0300 | 23.3333 | 0 0014 |
| 191 | 1.3000 | 0 0300 | 43.3333 | 0 0027 |
| 192 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 193 | 1.8000 | 0.0300 | 60.0000 | 0.0037 |
| 194 | 2.0000 | 0 0300 | 66.6667 | 0.0041 |
| 195 | 0.5000 | 0.0300 | 16 6667 | 0.0010 |
| 196 | 0.5000 | 0 0300 | 16.6667 | 0.0010 |
| 197 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 198 | 8.0000 | 0.0300 | 266.6667 | 0.0166 |
| 199 | 4.0000 | 0.0300 | 133.3333 | 0.0083 |
| 200 | 0.3000 | 0 0300 | 10.0000 | 0.0006 |
| 201 | 0.2000 | 0 0300 | 6.6667 | 0.0004 |
| 202 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 203 | 0 6000 | 0.0300 | 20.0000 | 0.0012 |
| 204 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 205 | 0.7000 | 0.1000 | 7.0000 | 0.0161 |
| 206 | 0.6000 | 0 1000 | 6.0000 | 0.0138 |
| 207 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 208 | 1 0000 | 0.0300 | 33.3333 | 0.0021 |
| 209 | 0 6000 | 0.0300 | 20.0000 | 0.0012 |
| 210 | 0.4000 | 0.0500 | 8.0000 | 0.0023 |
| 211 | 1.2000 | 0.0600 | 20.0000 | 0.0099 |

SAMPLE :C903051215U4WG3M

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 78 | 36.97 | 36.97 |
| 0.5 | 1.0 | 58 | 27.49 | 64.45 |
| 1.0 | 1.5 | 15 | 7.11 | 71.56 |
| 1.5 | 2.0 | 20 | 9.48 | 81.04 |
| 2.0 | 2.5 | 4 | 1.90 | 82.94 |
| 2.5 | 3.0 | 11 | 5.21 | 88.15 |
| 3.0 | 3.5 | 4 | 1.90 | 90.05 |
| 3.5 | 4.0 | 9 | 4.27 | 94.31 |
| 4.0 | 4.5 | 0 | 0.00 | 94.31 |
| 4.5 | 5.0 | 3 | 1.42 | 95.73 |
| 5.0 | 5.5 | 1 | 0.47 | 96.21 |
| 5.5 | 6.0 | 2 | 0.95 | 97.16 |
| 6.0 | 6.5 | 0 | 0.00 | 97.16 |
| 6.5 | 7.0 | 2 | 0.95 | 98.10 |
| 7.0 | 7.5 | 0 | 0.00 | 98.10 |
| 7.5 | 8.0 | 1 | 0.47 | 98.58 |
| 8.0 | 8.5 | 0 | 0.00 | 98.58 |
| 8.5 | 9.0 | 0 | 0.00 | 98.58 |
| 9.0 | 9.5 | 0 | 0.00 | 98.58 |
| 9.5 | 10.0 | 1 | 0.47 | 99.05 |
| 10.0 | 10.5 | 0 | 0.00 | 99.05 |
| 10.5 | 11.0 | 0 | 0.00 | 99.05 |
| 11.0 | 11.5 | 0 | 0.00 | 99.05 |
| 11.5 | 12.0 | 0 | 0.00 | 99.05 |
| 12.0 | 12.5 | 0 | 0.00 | 99.05 |
| 12.5 | 13.0 | 2 | 0.95 | 100.00 |
| 13.0 | 13.5 | 0 | 0.00 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 192 | 91.00 | 91.00 |
| 0.1 | 0.2 | 5 | 2.37 | 93.36 |
| 0.2 | 0.3 | 6 | 2.84 | 96.21 |
| 0.3 | 0.4 | 5 | 2.37 | 98.58 |
| 0.4 | 0.5 | 0 | 0.00 | 98.58 |
| 0.5 | 0.6 | 1 | 0.47 | 99.05 |
| 0.6 | 0.7 | 0 | 0.00 | 99.05 |
| 0.7 | 0.8 | 0 | 0.00 | 99.05 |
| 0.8 | 0.9 | 0 | 0.00 | 99.05 |
| 0.9 | 1.0 | 0 | 0.00 | 99.05 |
| 1.0 | 1.1 | 1 | 0.47 | 99.53 |
| 1.1 | 1.2 | 0 | 0.00 | 99.53 |
| 1.2 | 1.3 | 0 | 0.00 | 99.53 |
| 1.3 | 1.4 | 0 | 0.00 | 99.53 |
| 1.4 | 1.5 | 1 | 0.47 | 100.00 |

DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBEP | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 60 | 28.44 | 28.44 |
| 10 | 20 | 69 | 32.70 | 61.14 |
| 20 | 30 | 17 | 8.06 | 69.19 |
| 30 | 40 | 30 | 14.22 | 83.41 |
| 40 | 50 | 6 | 2.84 | 86.26 |
| 50 | 60 | 8 | 3.79 | 90.05 |
| 60 | 70 | 8 | 3.79 | 93.84 |
| 70 | 80 | 1 | 0 47 | 94.31 |
| 80 | 90 | 0 | 0.00 | 94.31 |
| 90 | 100 | 4 | 1.90 | 96.21 |
| 100 | 110 | 0 | 0.00 | 96.21 |
| 110 | 120 | 0 | 0.00 | 96.21 |
| 120 | 130 | C | 0.00 | 96.21 |
| 130 | 140 | 5 | 2.37 | 98.58 |
| 140 | 150 | 0 | 0.00 | 98.58 |
| 150 | 160 | 0 | 0.00 | 98 58 |
| 160 | 170 | 0 | 0.00 | 98.58 |
| 170 | 180 | 0 | 0.00 | 98.58 |
| 180 | 190 | 0 | 0.00 | 98.58 |
| 190 | 200 | 1 | 0.47 | 99.05 |
| * OVER 200 | | 2 | 0.95 | 100.00 |

SAMPLE :C90305121 5U4WG3MR (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.17E+07
FIBER CONCENTRATION BY MASS, PER LITER : 0.341 GRAMS*10↑-6
VOLUME FILTERED . 26.0 ML
GRID SQUARES COUNTED . 5.
TOTAL SUSPENDED SOLIDS: 4.000 MG PER LITER
PH = 7.6

SAMPLE :C90305121 5U4WG3MR (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.71E+08
BER CONCENTRATION BY MASS, PER LITER : 1.385 GRAMS*10+-6
.OLUME FILTERED : 26.0 ML
GRID SQUARES COUNTED : 5.
TOTAL SUSPENDED SOLIDS: 4.000 MG PER LITER
PH = 7.6

DESCRIPTIVE STATISTICS

NO. OBS = 83

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.11711E+01 | 0.18874E+01 | 0.13738E+01 | 0.15080E+00 |
| 2 | WIDTH | 0.48795E-01 | 0.20083E-02 | 0.44814E-01 | 0.49190E-02 |
| 3 | ASPECT RATIO | 0.27243E+02 | 0.89899E+03 | 0.29983E+02 | 0.32911E+01 |
| 4 | MASS | 0.19369E-01 | 0.51659E-02 | 0.71874E-01 | 0.78892E-02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.31655E+01 | 0.11687E+02 | 0.85090E+01 | 0.20000E+00 | 0.83000E+01 |
| 2 | 0.43290E+01 | 0.20957E+02 | 0.30000E+00 | 0.30000E-01 | 0.27000E+00 |
| 3 | 0.32547E+01 | 0.13304E+02 | 0.20000E+03 | 0.60000E+01 | 0.19400E+03 |
| 4 | 0 54000E+01 | 0.29725E+02 | 0.49680E+00 | 0.40000E-03 | 0.49640E+00 |

SAMPLE :C903051215U4WG3MR (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 8.5000 | 0.1000 | 85.0000 | 0.1955 |
| 2 | 1.5000 | 0.0300 | 50.0000 | 0.0031 |
| 3 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 4 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 5 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 6 | 0.4000 | 0.0600 | 6.6667 | 0.0033 |
| 7 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 8 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 9 | 2.3000 | 0.0300 | 76.6667 | 0.0048 |
| 10 | 4.0000 | 0.0300 | 133.3333 | 0.0083 |
| 11 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 12 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 13 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 14 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 15 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 16 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 17 | 3.0000 | 0.1000 | 30.0000 | 0.0690 |
| 18 | 1.0000 | 0.1000 | 10.0000 | 0.0230 |
| 19 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 20 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 21 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 22 | 0.6000 | 0.0800 | 7.5000 | 0.0088 |
| 23 | 0.3000 | 0.0500 | 6.0000 | 0.0017 |
| 24 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 25 | 2.4000 | 0.0300 | 80.0000 | 0.0050 |
| 26 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 27 | 0.8000 | 0.0300 | 26.6667 | 0.0017 |
| 28 | 1.5900 | 0.0500 | 30.0000 | 0.0086 |
| 29 | 0.6000 | 0.0600 | 10.0000 | 0.0050 |
| 30 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 31 | 6.5000 | 0.0600 | 108.3333 | 0.0538 |
| 32 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 33 | 2.0000 | 0.1000 | 20.0000 | 0.0460 |
| 34 | 0.6000 | 0.0500 | 12.0000 | 0.0035 |
| 35 | 2.0000 | 0.0600 | 33.3333 | 0.0166 |
| 36 | 1.0000 | 0.0500 | 20.0000 | 0.0058 |
| 37 | 2.4000 | 0.3000 | 8.0000 | 0.4968 |
| 38 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 39 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 40 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 41 | 0.6000 | 0.0500 | 12.0000 | 0.0035 |
| 42 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 43 | 0.6000 | 0.0500 | 12.0000 | 0.0035 |
| 44 | 1.9000 | 0.3000 | 6.3333 | 0.3933 |
| 45 | 1.5000 | 0.0300 | 50.0000 | 0.0031 |
| 46 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 47 | 0.8000 | 0.0300 | 26.6667 | 0.0017 |
| 48 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 49 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 50 | 2.0000 | 0.0600 | 33.3333 | 0.0166 |
| 51 | 2.0000 | 0.0600 | 33.3333 | 0.0166 |

| | | | | |
|---|---|---|---|---|
| 52 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 53 | 1.5000 | 0.0300 | 50.0000 | 0.0031 |
| 54 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 55 | 0.8000 | 0.1000 | 8.0000 | 0.0184 |
| 56 | 0.5000 | 0.0300 | 16.6667 | 0.0010 |
| 57 | 0.6000 | 0.0500 | 12.0000 | 0.0035 |
| 58 | 0.3000 | 0.0300 | 10.0000 | 0.0006 |
| 59 | 1.6000 | 0.0300 | 53.3333 | 0.0033 |
| 60 | 0.8000 | 0.0500 | 16.0000 | 0.0046 |
| 61 | 2.0000 | 0.0300 | 66.6667 | 0.0041 |
| 62 | 2.2000 | 0.0500 | 44.0000 | 0.0126 |
| 63 | 0.3000 | 0.0500 | 6.0000 | 0.0017 |
| 64 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 65 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 66 | 0.5000 | 0.0500 | 10.0000 | 0.0029 |
| 67 | 2.8000 | 0.0500 | 56.0000 | 0.0161 |
| 68 | 1.2000 | 0.0500 | 24.0000 | 0.0069 |
| 69 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 70 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 71 | 0.5000 | 0.0500 | 10.0000 | 0.0029 |
| 72 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 73 | 1.5000 | 0.1000 | 15.0000 | 0.0345 |
| 74 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 75 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 76 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 77 | 1.5000 | 0.1000 | 15.0000 | 0.0345 |
| 78 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |
| 79 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 80 | 0.4000 | 0.0500 | 8.0000 | 0.0023 |
| 81 | 6.0000 | 0.0300 | 200.0000 | 0.0124 |
| 82 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 83 | 1.0000 | 0.0300 | 33.3333 | 0.0021 |

SAMPLE C90305121 5U4WG3MR

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 29 | 34.94 | 34.94 |
| 0.5 | 1.0 | 30 | 36.14 | 71.08 |
| 1.0 | 1.5 | 7 | 8.43 | 79.52 |
| 1 5 | 2.0 | 7 | 8 43 | 87.95 |
| 2.0 | 2.5 | 4 | 4 82 | 92.77 |
| 2.5 | 3.0 | 2 | 2.41 | 95.18 |
| 3.0 | 3.5 | 0 | 0.00 | 95.18 |
| 3.5 | 4.0 | 1 | 1.20 | 96.39 |
| 4.0 | 4.5 | 0 | 0.00 | 96.39 |
| 4.5 | 5.0 | 0 | 0.00 | 96.39 |
| 5.0 | 5 5 | 0 | 0.00 | 96.39 |
| 5.5 | 6.0 | 1 | 1.20 | 97 59 |
| 6.0 | 6.5 | 1 | 1.20 | 98.80 |
| 6.5 | 7.0 | 0 | 0.00 | 98.80 |
| 7.0 | 7.5 | 0 | 0.00 | 98.80 |
| 7.5 | 8.0 | 0 | 0.00 | 98 80 |
| 8.0 | 8.5 | 1 | 1.20 | 100.00 |
| 8.5 | 9.0 | 0 | 0.00 | 100 00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 81 | 97.59 | 97.59 |
| 0.1 | 0.2 | 0 | 0.00 | 97.59 |
| 0.2 | 0.3 | 2 | 2.41 | 100.00 |
| 0.3 | 0.4 | 0 | 0.00 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 20 | 24.10 | 24.10 |
| 10 | 20 | 34 | 40.96 | 65.06 |
| 20 | 30 | 5 | 6.02 | 71.08 |
| 30 | 40 | 11 | 13 25 | 84.34 |
| 40 | 50 | 4 | 4.82 | 89.16 |
| 50 | 60 | 2 | 2.41 | 91.57 |
| 60 | 70 | 1 | 1.20 | 92.77 |
| 70 | 80 | 2 | 2.41 | 95 18 |
| 80 | 90 | 1 | 1.20 | 96.39 |
| 90 | 100 | 0 | 0.00 | 96 39 |
| 100 | 110 | 1 | 1.20 | 97.59 |

| | | | | |
|---|---|---|---|---|
| 110 | 120 | 0 | 0.00 | 97.59 |
| 120 | 130 | 0 | 0.00 | 97.59 |
| 130 | 140 | 1 | 1.20 | 98.80 |
| 140 | 150 | 0 | 0.00 | 98.80 |
| 150 | 160 | 0 | 0.00 | 98.80 |
| 160 | 170 | 0 | 0.00 | 98.80 |
| 170 | 180 | 0 | 0.00 | 98.80 |
| 180 | 190 | 0 | 0.00 | 98.80 |
| 190 | 200 | 1 | 1.20 | 100.00 |
| * OVER | 200 | 0 | 0.00 | 100.00 |

C9 0305 1350 U5 WG2

Light material loading, but significant overall organic filming is present. Much small (<0.5 $\mu$m) blocky to platy inorganics present. Only very little material in the larger sizes (usually an irregular chunky inorganic). Very few fibers detected; none of them asbestiform material.

SAMPLE :C9030513 50U5WG3M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.41E+07
FIBER CONCENTRATION BY MASS PER LITER : 6.739 GRAMS*10↑-6
VOLUME FILTERED . 22.0 ML
GRID SQUARES COUNTED . 10.
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 7.5

DESCRIPTIVE STATISTICS

NO. OBS. = 8

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.15375E+01 | 0.11512E+01 | 0 10730E+01 | 0.37935E+00 |
| 2 | WIDTH | 0.28125E+00 | 0 94241E-01 | 0.30699E+00 | 0.10854E+00 |
| 3 | ASPECT RATIO | 0.71125E+01 | 0.14444E+02 | 0.38005E+01 | 0.13437E+01 |
| 4 | MASS | 0.16551E+01 | 0.15219E+02 | 0.39011E+01 | 0.13792E+01 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.76826E+00 | -0.12710E+01 | 0.34000E+01 | 0.60000E+00 | 0.28000E+01 |
| 2 | 0.15199E+01 | 0.80990E+00 | 0.10000E+01 | 0.10000E+00 | 0.90000E+00 |
| 3 | 0.95940E+00 | -0.45560E+00 | 0.15000E+02 | 0.34000E+01 | 0.11600E+02 |
| 4 | 0.17922E+01 | 0 15377E+01 | 0.11220E+02 | 0.19800E-01 | 0.11200E+02 |

SAMPLE :C90305135OU5WG3M (AMPHIBOLE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 0.6000 | 0 1000 | 6.0000 | 0.0198 |
| 2 | 1.0000 | 0.2000 | 5.0000 | 0.1320 |
| 3 | 3.0000 | 0.4000 | 7.5000 | 1.5840 |
| 4 | 1.5000 | 0.1000 | 15 0000 | 0.0495 |
| 5 | 1.2000 | 0 2000 | 6.0000 | 0.1584 |
| 6 | 1.0000 | 0 1000 | 10.0000 | 0.0330 |
| 7 | 0.6000 | 0.1500 | 4.0000 | 0.0445 |
| 8 | 3.4000 | 1.0000 | 3.4000 | 11.2200 |

SAMPLE .C9030513 50U5WG3M

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 0 | 0.00 | 0.00 |
| 0.5 | 1.0 | 4 | 50.00 | 50.00 |
| 1.0 | 1.5 | 2 | 25 00 | 75.00 |
| 1 5 | 2.0 | 0 | 0.00 | 75.00 |
| 2.0 | 2.5 | 0 | 0.00 | 75.00 |
| 2.5 | 3.0 | 1 | 12.50 | 87.50 |
| 3.0 | 3.5 | 1 | 12.50 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 3 | 37.50 | 37.50 |
| 0.1 | 0.2 | 3 | 37.50 | 75.00 |
| 0.2 | 0.3 | 0 | 0.00 | 75.00 |
| 0.3 | 0.4 | 1 | 12.50 | 87.50 |
| 0.4 | 0.5 | 0 | 0.00 | 87.50 |
| 0.5 | 0.6 | 0 | 0.00 | 87.50 |
| 0 6 | 0.7 | 0 | 0.00 | 87.50 |
| 0.7 | 0.8 | 0 | 0.00 | 87.50 |
| 0.8 | 0.9 | 0 | 0 00 | 87.50 |
| 0.9 | 1.0 | 0 | 0.00 | 87.50 |
| 1.0 | 1.1 | 1 | 12.50 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 7 | 87 50 | 87.50 |
| 10 | 20 | 1 | 12.50 | 100.00 |
| 20 | 30 | 0 | 0.00 | 100.00 |
| 30 | 40 | 0 | 0.00 | 100 00 |
| 40 | 50 | 0 | 0.00 | 100.00 |
| 50 | 60 | 0 | 0.00 | 100.00 |
| 60 | 70 | 0 | 0.00 | 100.00 |
| 70 | 80 | 0 | 0.00 | 100.00 |
| 80 | 90 | 0 | 0.00 | 100.00 |
| 90 | 100 | 0 | 0 00 | 100.00 |
| 100 | 110 | 0 | 0.00 | 100 00 |
| 110 | 120 | 0 | 0.00 | 100 00 |
| 120 | 130 | 0 | 0.00 | 100.00 |
| 130 | 140 | 0 | 0.00 | 100.00 |
| 140 | 150 | 0 | 0.00 | 100.00 |

| | | | | |
|---|---|---|---|---|
| 150 | 160 | 0 | 0.00 | 100.00 |
| 160 | 170 | 0 | 0.00 | 100.00 |
| 170 | 180 | 0 | 0.00 | 100.00 |
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0.00 | 100.00 |
| + OVER | 200 | 0 | 0.00 | 100.00 |

SAMPLE :C90305135OU5WG3M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
/OLUME FILTEPED · 22.0 ML
GRID SQUARES COUNTED : 10.
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 7.5

Very lightly loaded. Some "light" stringy organic residues are present. Generally small (< 2 $\mu$m), irregular inorganics are present. Platy and blocky inorganics in the submicrometer range were detected.

SAMPLE :C90305134OD5WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.00
FIBER CONCENTRATION BY MASS PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 3.000 MG PER LITER
PH = 7.5

SAMPLE :C903051340D5WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 3.000 MG PER LITER
PH = 7.5

Large, jagged inorganic material (>2 μm); moderately-sized, platy inorganics ( 0.6 to 3 μm); and small, blocky inorganics (< 0.1 μm) are present, along with some very light organic residues. Occassional small, thin (< 0.05 μm) fibers are present; however, these are non-defractive. Occassional perfectly circular, apparently spherical particles are also present. These appear to be organic in nature.

SAMPLE .C903051340D5WG3 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS/PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 3.000 MG PER LITER
PH = 7.5

SAMPLE :C903051340D5WG3 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.00
FIBER CONCENTRATION BY MASS PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 3.000 MG PER LITER
PH = 7.5

SAMPLE .C903051340D5WG3M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER.PER LITER : 0.00
FIBER CONCENTRATION BY MASS.PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED 100.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 3.000 MG PER LITER
PH = 7.5

SAMPLE :C90305134 0D5WG3M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER 0 00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10+-6
VOLUME FILTERED : 100.0 ML
GRID SQUARES COUNTED . 20.
TOTAL SUSPENDED SOLIDS: 3.000 MG PER LITER
PH = 7.5

C9 0305 1415 U6 WG2

Light to moderate loading. There are large organic fibers similar to those noted in C9 0305 1215 U4 WG2 and in this case, occassionally act as agglomeration centers for smaller sample material. Almost no organic filming noted in this sample, though organic residues are present. Some apparently spherical particulates show up infrequently. Both platy and blocky inorganics in the submicrometer range. Occassional organic tubules with a width generally less than 0.08 $\mu$m, whose sources are objects that look like sporangium of fungi. Some small diatom fragments are evident.

SAMPLE :C903051415U6WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 10.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 8.000 MG PER LITER
PH = 7.6

SAMPLE :C9030051415U6WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 10.0 ML
GRID SQUARES COUNTED : 20.
TOTAL SUSPENDED SOLIDS: 8.000 MG PER LITER
PH = 7.6

C9 0910 1140 U1 WG2

Agglomeration of material common. Organic residues present. Inorganics range to chunky multimicrometer particles. The overall sample loading is light. No asbestiform material detected.

SAMPLE : C909101140U1WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 29.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.43E+06

SAMPLE :C909101140U1WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 29.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.43E+06

Agglomeration of material common. Inorganics range from platy to blocky in morphology and to the multimicrometer sizes. Diatomaceous remains noted. Chrysotile is present, but no other type of asbestiform material was detected. There are nonasbestos inorganic and organic fibers present.

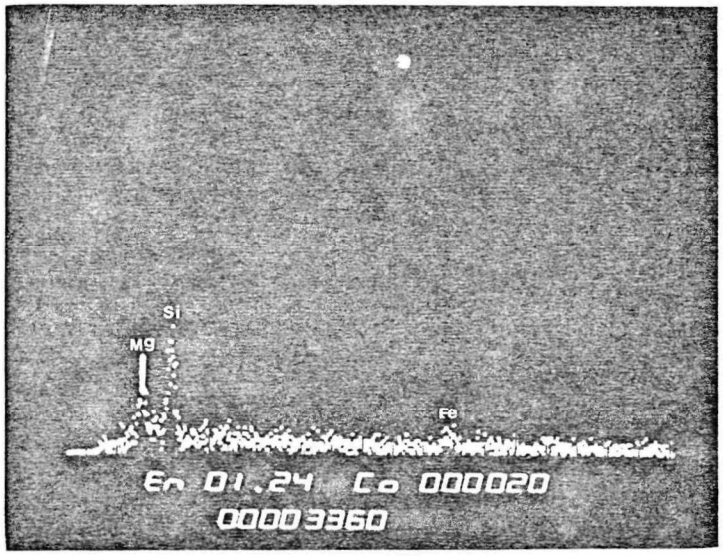



Figure 1 Probe of chrysotile fibril.

SAMPLE :C909101200U2WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.26E+07
FIBER CONCENTRATION BY MASS, PER LITER : 0.214 GRAMS*10↑-6
VOLUME FILTERED : 19.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.1

SAMPLE :C90910120 0U2WG2 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 2.3804 | 0.2421 | 9.8333 | 0.3208 |
| 2 | 0.6455 | 0.0282 | 22.8571 | 0.0012 |
| 3 | 0.2824 | 0.0282 | 10.0000 | 0.0005 |
| 4 | 0.9279 | 0.0282 | 32.8571 | 0.0017 |

SAMPLE :C90910120OU2WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 19.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.1

LIMIT OF DETECTION = 0.66E+06

Small platy to moderately large chunky inorganics. Organic residues present and agglomeration of sample material does occur. Some thin organic fibers and diatomaceous remains noted. No asbestiform material detected, although there are some inorganic fibers present.

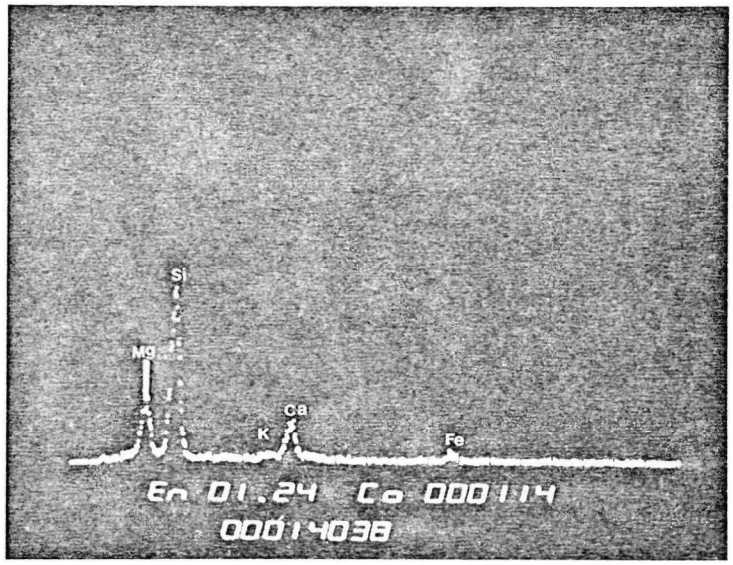



Figure 1 Probe of large crystalline non-asbestos fiber.

SAMPLE :C909101125U3WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 23.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.55E+06

SAMPLE :C909101125U3WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 23.0 ML
GRID SQUARES COUNTED . 39
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.56E+06

A fairly light loading on this sample. Organic residues of varying morphologies and some agglomerates noted. Inorganic particulates are generally small and chunky, although there is platy material present. No asbestiform material detected.

SAMPLE :C909101150D3WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 32.0 ML
GRID SQUARES COUNTED : 50
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 7.0

LIMIT OF DETECTION = 0.31E+06

SAMPLE :C909101150D3WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 32.0 ML
GRID SQUARES COUNTED : 50
TOTAL SUSPENDED SOLIDS: 2.000 MG PER LITER
PH = 7.0

LIMIT OF DETECTION = 0.31E+06

C9 0910 1020 U4 WG2

Organic residues of varying morphological characteristics present as well as diatomaceous remains, agglomerated areas, small platy to large chunky inorganic particulates. No asbestiform matter detected.

SAMPLE :C909101020U4WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 26.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0 48E+06

SAMPLE :C909G1020U4WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER PER LITER : 0.00
FIBER CONCENTRATION BY MASS PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 26.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.2

LIMIT OF DETECTION = 0.48E+06

C9 0910 1010 D4 WG2

Organic residues present and some small to moderately large chunky particles. Light loading evidenced, although the organic residues are quite common. No asbestiform material detected.

SAMPLE :C909101010D4WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 24.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.1

LIMIT OF DETECTION = 0.52E+06

SAMPLE :C909101010D4WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 24.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.1

LIMIT OF DETECTION = 0.52E+06

C9 0910 0910 U5 WG2

Filmy to ribbonlike organic residues are present with inorganics being small platy and small to moderately large chunky and blocky material. Diatomaceous remains noted as well as organic fibers.

SAMPLE :C909100910U5WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 24.0 ML
GRID SQUARES COUNTED : 39
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.54E+06

SAMPLE :C909100910U5WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATIOÑ BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 24.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.52E+06

C9 0910 0915 D5 WG2

Organic residues common. Agglomerated material small to moderately sized, platy and blocky inorganics and diatomaceous remains are present. Some fibers of organic nature noted, but no asbestiform material detected.

SAMPLE :C909100915D5WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 23.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.1

LIMIT OF DETECTION = 0.55E+06

SAMPLE :C909100915D5WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 23.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 7.1

LIMIT OF DETECTION = 0.55E+06

Diatomaceous remains present as are areas of agglomeration. Organic residues range from films to "fibers". Inorganics are present of varying morphologies to multimicrometer sizes. Inorganic fibers are present, including chrysotile, as well as organic fibers of different sizes.

SAMPLE :C909100905U7WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.16E+07
FIBER CONCENTRATION BY MASS, PER LITER : 0.004 GRAMS*10↑-6
VOLUME FILTERED : 23.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 8.5

SAMPLE :C909100905U7WG2 (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 1.4928 | 0.0282 | 52.8571 | 0.0027 |
| 2 | 0.6859 | 0.0202 | 34.0000 | 0.0006 |
| 3 | 1.8559 | 0.0282 | 65.7143 | 0.0034 |

SAMPLE :C909100905U7WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 23.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 8.5

LIMIT OF DETECTION = 0.55E+06

C9 0910 0800 D8 WG2

A quite lightly loaded sample showing organic residues and some, generally small and chunky, inorganic particles. No asbestiform material was detected.

SAMPLE :C909100800D8WG2 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.00
FIBER CONCENTRATION BY MASS, PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 31.0 ML
GRID SQUARES COUNTED : 50
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.32E+06

SAMPLE :C909100800D8WG2 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS/PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 31.0 ML
GRID SQUARES COUNTED : 50
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 6.9

LIMIT OF DETECTION = 0.32E+06

Appendix 10. City of Seattle

Only 1 sample from the city of Seattle has been examined. This sample came from the Tolt Reservoir and is therefore raw water. The only further treatment to which this water is subjected prior to passing into the distribution system is chlorination. The sample should therefore be representative also of the finished product.

The "pedigree" of the sample is as follows:

EPA Region 10 Drinking Water Programs Branch is actively conducting a survey program in their region which includes the Seattle water supply. Jack Murchio, a consultant on this project is also associated with the Seattle project and permission was received from EPA region 10 for the transfer of this sample from their project. The sample is part of a limited "round robin" series and had been analyzed by two other laboratories as well as by Murchio.

The data presented herein is that of both McCrone Associates and of Murchio, the latter identified by the final letter 'M'. The samples designated DM are duplicates run at McCrone Associates on the actual filter analyzed by Murchio. It will be noted that Murchio reports both amphibole and chrysotile fibers present at levels of $1.9 \times 10^6$ and $1.5 \times 10^6$, respectively, whereas McCrone finds both below the limit of detection. Attention is drawn, however, to the McCrone descriptions which mention poorly diffracting fibers resembling chrysotile but with elemental compositions rich in Al, Si, Ca, Fe and some Mg. A positive identification of these fibers has not been made and the possibility that they are a fine amphibole in the Tremolite-Actinolite series cannot be ruled out. We have examined Murchio's data and consider that his identification of the chrysotile is valid. We therefore believe that both chrysotile and amphibole asbestos are present in Tolt reservoir water.

For further information on the EPA Region 10 program

contact: Roy Jones, U.S.E.P.A.
Drinking Water Programs Branch
1200 6th Avenue
M/S 429
Seattle, Washington 98101 Phone: 206 442 1223

Diatoms and their fragments present. Much organic material from filmy to fibrous; generally small to moderately sized inorganic particulates. Some (very infrequent) small inorganic fibers detected resembling chrysotile, however they diffract poorly and probe shows Al, Si, Ca, Fe and some Mg present.

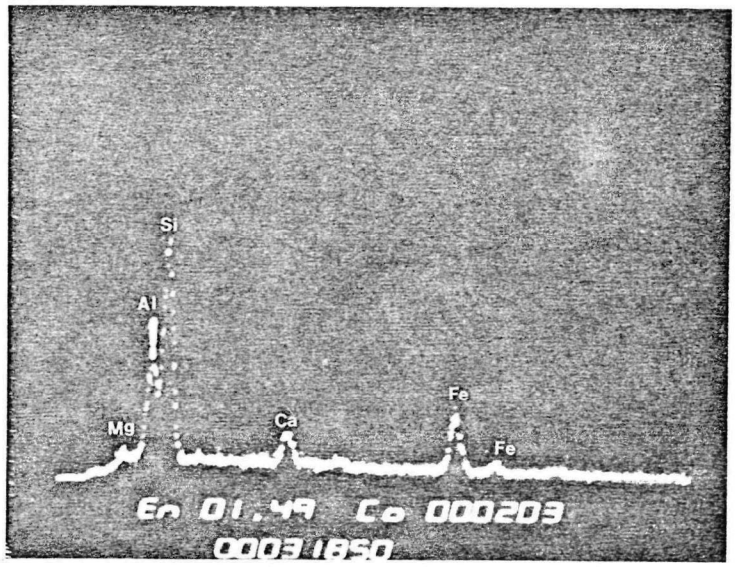



Figure 1 Probe of fiber resembling chrysotile.

SAMPLE :CX09081105 (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER/PER LITER : 0.00
FIBER CONCENTRATION BY MASS/PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

LIMIT OF DETECTION = 0.25E+06

SAMPLE :CX09081105 (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6,
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

LIMIT OF DETECTION = 0.25E+06

SAMPLE :CX09081105 M (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.19E+07
FIBER CONCENTRATION BY MASS, PER LITER : 1.210 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 20
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

DESCRIPTIVE STATISTICS

NO. OBS. = 19

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.14737E+01 | 0.80649E+00 | 0.89805E+00 | 0.20603E+00 |
| 2 | WIDTH | 0.22526E+00 | 0.34293E-01 | 0.18518E+00 | 0.42484E-01 |
| 3 | ASPECT RATIO | 0.80702E+01 | 0.25726E+02 | 0.50721E+01 | 0.11636E+01 |
| 4 | MASS | 0.63557E+00 | 0.14218E+01 | 0 11924E+01 | 0.27356E+00 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.64148E+00 | -0.69517E+00 | 0.35000E+01 | 0.40000E+00 | 0.31000E+01 |
| 2 | 0.11929E+01 | -0 19821E+00 | 0.60000E+00 | 0.80000E-01 | 0.52000E+00 |
| 3 | 0.16334E+01 | 0.17647E+01 | 0.22000E+02 | 0.30000E+01 | 0.19000E+02 |
| 4 | 0.18568E+01 | 0 20718E+01 | 0.41580E+01 | 0.12700E-01 | 0.41453E+01 |

SAMPLE :CX09081105 M (AMPHIBOLE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 0.6000 | 0.1000 | 6.0000 | 0.0198 |
| 2 | 3.0000 | 0.1500 | 20.0000 | 0.2227 |
| 3 | 0.6000 | 0.1000 | 6.0000 | 0.0198 |
| 4 | 0 4000 | 0.1000 | 4.0000 | 0.0132 |
| 5 | 1.2000 | 0.4000 | 3.0000 | 0.6336 |
| 6 | 0.6000 | 0.1000 | 6.0000 | 0.0198 |
| 7 | 1.2000 | 0.1000 | 12.0000 | 0.0396 |
| 8 | 1.2000 | 0.1500 | 8.0000 | 0.0891 |
| 9 | 0.6000 | 0.0800 | 7.5000 | 0.0127 |
| 10 | 2.4000 | 0.6000 | 4.0000 | 2.8512 |
| 11 | 1.4000 | 0.2000 | 7.0000 | 0 1848 |
| 12 | 0.5000 | 0 1000 | 5.0000 | 0.0165 |
| 13 | 1.6000 | 0.2000 | 8.0000 | 0.2112 |
| 14 | 3 5000 | 0.6000 | 5.8333 | 4.1580 |
| 15 | 2.2000 | 0.6000 | 3.6667 | 2.6136 |
| 16 | 1.0000 | 0.1000 | 10.0000 | 0.0330 |
| 17 | 2.2000 | 0.1000 | 22.0000 | 0.0726 |
| 18 | 2.2000 | 0.3000 | 7.3333 | 0.6534 |
| 19 | 1.6000 | 0.2000 | 8.0000 | 0.2112 |

SAMPLE :CX09081105 M

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 2 | 10.53 | 10.53 |
| 0.5 | 1.0 | 5 | 26.32 | 36.84 |
| 1.0 | 1.5 | 4 | 21.05 | 57.89 |
| 1.5 | 2.0 | 2 | 10.53 | 68.42 |
| 2.0 | 2.5 | 4 | 21.05 | 89.47 |
| 2.5 | 3.0 | 1 | 5.26 | 94.74 |
| 3.0 | 3.5 | 1 | 5.26 | 100.00 |
| 3.5 | 4.0 | 0 | 0.00 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 9 | 47.37 | 47 37 |
| 0.1 | 0.2 | 5 | 26.32 | 73.68 |
| 0.2 | 0.3 | 1 | 5.26 | 78.95 |
| 0.3 | 0.4 | 1 | 5.26 | 84.21 |
| 0.4 | 0.5 | 0 | 0.00 | 84.21 |
| 0.5 | 0.6 | 3 | 15.79 | 100.00 |
| 0.6 | 0.7 | 0 | 0.00 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 16 | 84.21 | 84.21 |
| 10 | 20 | 2 | 10.53 | 94.74 |
| 20 | 30 | 1 | 5.26 | 100.00 |
| 30 | 40 | 0 | 0.00 | 100.00 |
| 40 | 50 | 0 | 0.00 | 100.00 |
| 50 | 60 | 0 | 0.00 | 100.00 |
| 60 | 70 | 0 | 0.00 | 100.00 |
| 70 | 80 | 0 | 0.00 | 100.00 |
| 80 | 90 | 0 | 0.00 | 100.00 |
| 90 | 100 | 0 | 0.00 | 100.00 |
| 100 | 110 | 0 | 0.00 | 100.00 |
| 110 | 120 | 0 | 0.00 | 100.00 |
| 120 | 130 | 0 | 0.00 | 100.00 |
| 130 | 140 | 0 | 0.00 | 100.00 |
| 140 | 150 | 0 | 0.00 | 100.00 |
| 150 | 160 | 0 | 0.00 | 100.00 |
| 160 | 170 | 0 | 0.00 | 100.00 |
| 170 | 180 | 0 | 0.00 | 100.00 |

| | | | | |
|---|---|---|---|---|
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0.00 | 100.00 |
| * OVER | 200 | 0 | 0.00 | 100.00 |

SAMPLE :CX09081105 M (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER, PER LITER : 0.15E+07
FIBER CONCENTRATION BY MASS, PER LITER : 0.008 GRAMS*10+-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 20
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

DESCRIPTIVE STATISTICS

NO. OBS. = 15

| | VARIABLE | MEAN | VARIANCE | STANDARD DEVIATION | STANDARD ERROR |
|---|---|---|---|---|---|
| 1 | LENGTH | 0.74000E+00 | 0.18114E+00 | 0.42561E+00 | 0.10989E+00 |
| 2 | WIDTH | 0.50667E-01 | 0.59238E-03 | 0.24339E-01 | 0.62843E-02 |
| 3 | ASPECT RATIO | 0.17361E+02 | 0.19263E+03 | 0.13879E+02 | 0.35835E+01 |
| 4 | MASS | 0.55000E-02 | 0.43330E-04 | 0.65826E-02 | 0.16996E-02 |

| | SKEWNESS | KURTOSIS | MAX | MIN | RANGE |
|---|---|---|---|---|---|
| 1 | 0.11628E+01 | 0.50039E+00 | 0.18000E+01 | 0.20000E+00 | 0.16000E+01 |
| 2 | 0.93215E+00 | -0.40080E+00 | 0.10000E+00 | 0.30000E-01 | 0.70000E-01 |
| 3 | 0.18540E+01 | 0.31076E+01 | 0.60000E+02 | 0.50000E+01 | 0.55000E+02 |
| 4 | 0.15023E+01 | 0.80144E+00 | 0.22100E-01 | 0.40000E-03 | 0.21700E-01 |

SAMPLE :CX09081105 M (CHRYSOTILE)

| | LENGTH | WIDTH | ASPECT RATIO | MASS |
|---|---|---|---|---|
| 1 | 1.5000 | 0.0800 | 18.7500 | 0.0221 |
| 2 | 0.8000 | 0.1000 | 8.0000 | 0.0184 |
| 3 | 0.4000 | 0.0300 | 13.3333 | 0.0008 |
| 4 | 0.8000 | 0.0500 | 16.0000 | 0.0046 |
| 5 | 0.4000 | 0.0500 | 8.0000 | 0.0023 |
| 6 | 0.9000 | 0.0300 | 30.0000 | 0.0019 |
| 7 | 0.5000 | 0.0500 | 10.0000 | 0.0029 |
| 8 | 0.5000 | 0.0500 | 10.0000 | 0.0029 |
| 9 | 0.2000 | 0.0300 | 6.6667 | 0.0004 |
| 10 | 0.8000 | 0.0300 | 26.6667 | 0.0017 |
| 11 | 0.5000 | 0.0500 | 10.0000 | 0.0029 |
| 12 | 0.9000 | 0.0500 | 18.0000 | 0.0052 |
| 13 | 1.8000 | 0.0300 | 60.0000 | 0.0037 |
| 14 | 0.6000 | 0.0300 | 20.0000 | 0.0012 |
| 15 | 0.5000 | 0.1000 | 5.0000 | 0.0115 |

## DISTRIBUTION BY LENGTH

| LENGTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.5 | 7 | 46.67 | 46.67 |
| 0.5 | 1.0 | 6 | 40.00 | 86.67 |
| 1.0 | 1.5 | 1 | 6.67 | 93.33 |
| 1.5 | 2.0 | 1 | 6.67 | 100.00 |

## DISTRIBUTION BY WIDTH

| WIDTH | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 0.0 | 0.1 | 15 | 100.00 | 100.00 |
| 0.1 | 0.2 | 0 | 0.00 | 100.00 |

## DISTRIBUTION BY ASPECT RATIO

| ASPECT RATIO | | NUMBER | PERCENT | CUMULATIVE PERCENT |
|---|---|---|---|---|
| 3 | 10 | 7 | 46.67 | 46.67 |
| 10 | 20 | 5 | 33.33 | 80.00 |
| 20 | 30 | 2 | 13.33 | 93.33 |
| 30 | 40 | 0 | 0.00 | 93.33 |
| 40 | 50 | 0 | 0.00 | 93.33 |
| 50 | 60 | 1 | 6.67 | 100.00 |
| 60 | 70 | 0 | 0.00 | 100.00 |
| 70 | 80 | 0 | 0.00 | 100.00 |
| 80 | 90 | 0 | 0.00 | 100.00 |
| 90 | 100 | 0 | 0.00 | 100.00 |
| 100 | 110 | 0 | 0.00 | 100.00 |
| 110 | 120 | 0 | 0.00 | 100.00 |
| 120 | 130 | 0 | 0.00 | 100.00 |
| 130 | 140 | 0 | 0.00 | 100.00 |
| 140 | 150 | 0 | 0.00 | 100.00 |
| 150 | 160 | 0 | 0.00 | 100.00 |
| 160 | 170 | 0 | 0.00 | 100.00 |
| 170 | 180 | 0 | 0.00 | 100.00 |
| 180 | 190 | 0 | 0.00 | 100.00 |
| 190 | 200 | 0 | 0.00 | 100.00 |
| * OVER 200 | | 0 | 0.00 | 100.00 |

Much organic material present from fibrous forms to the blobs causing some agglomeration to occur. Diatomaceous remains present as well as what could be the sporangia of some fungi. Small to moderately sized inorganics are present of various shapes. Some few small, thin fibers, similar in morphology to chrysotile, are present, but they do not defract well, if at all, and the EDXRA yields Fe, Ca, Al, Si.

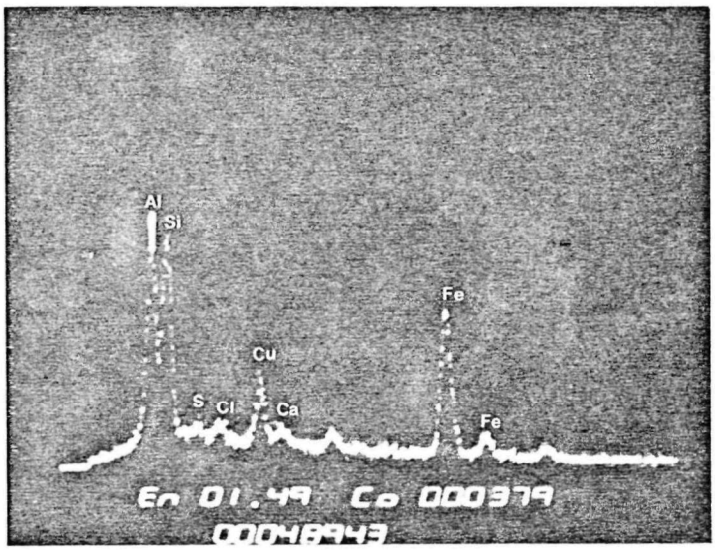



Figure 1 Probe of fiber similar to chrysotile. The S and Cl come from the organics in the sample.

SAMPLE :CX09081105 DN (CHRYSOTILE)

FIBER CONCENTRATION BY NUMBER,PER LITER : 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10↑-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 38
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

LIMIT OF DETECTION = 0.26E+06

SAMPLE .C2090811G3 DM (AMPHIBOLE)

FIBER CONCENTRATION BY NUMBER,PER LITER : . 0.00
FIBER CONCENTRATION BY MASS,PER LITER : 0.000 GRAMS*10+-6
VOLUME FILTERED : 50.0 ML
GRID SQUARES COUNTED : 40
TOTAL SUSPENDED SOLIDS: 0.000 MG PER LITER
PH = 0.0

LIMIT OF DETECTION = 0.25E+06