APPENDIX C

U.S. Environmental Protection Agency

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METHOD 108 - DETERMINATION OF PARTICULATE AND GASEOUS ARSENIC EMISSION FROM NONFERROUS SMELTERS

1. Applicability and Principle

1.1 Applicability. This method applies to the determination of inorganic arsenic (As) emissions from nonferrous smelters and other sources as specified in the regulations.

1.2 Principle. Particulate and gaseous As emissions are withdrawn isokinetically from the source and collected on a glass mat filter and in water. The collected As is then analyzed by means of atomic absorption spectrophotometry.

2. Apparatus

2.1 Sampling Train. A schematic of the sampling train is shown in Figure 4.2.1 ; it is similar to the Method 5* train of 40 CRF 60, Appendix A. The sampling train consists of the following components:

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* Note: This and all subsequent references to other methods refer to the Methods in 40 CFR 60, Appendix A.

2.1.1 Probe Nozzle, Probe Liner, Pitot Tube, Differential Pressure Gauge, Filter Holder, Filter Heating System, Metering System, Barometer, and Gas Density Determination Equipment. Same as Method 5, sections 2.1.1 to 2.1.6 and 2.1.8 to 2.1.10, respectively.

2.1.2 Impingers. Six impingers connected in series with leak-free ground-glass fittings or any similar leak-free non-contaminating fittings. For the first, third, fourth, fifth and sixth impingers, use the Greenburg-Smith design, modified by replacing the tip with a 1.3-cm-ID (0.5 in.) glass tube extending to about 1.3 cm (0.5 in.) from the bottom of the flask. for the second impinger, use the Greenburg-Smith design with the standard tip. The tester may use modifications (e.g., flexible connections between the impingers, materials other than glass, or flexible vacuum lines to connect the filter holder to the condenser), subject to the approval of the Administrator.

Place a thermometer, capable of measuring temperature to within $1^{o}C$ ($2^{o}F$), at the outlet of the sixth impinger for monitoring purposes.

2.2 Sample Recovery. The following items are needed:

2.2.1 Probe-Liner and Probe-Nozzle Brushes, Petri Dishes, Graduated Cylinder and/or Balance, Plastic Storage Containers, Rubber Policeman, and Funnel. Same as Method 5, sections 2.2.1 and 2.2.4 to 2.2.8, respectively.

2.2.2 Wash Bottles. Polyethylene (2).

2.2.3 Sample Storage Containers. Chemically resistant, polyethylene or polypropylene for glassware washes, 500- or 1000-ml.

2.3 Analysis. The following equipment is needed:

2.3.1 Spectrophotometer. Equipped with an electrodeless discharge lamp and a background corrector to measure absorbance at 193.7 nm. For measuring samples having less than 10 μg As/ml, use a vapor generator accessory.

2.3.2 Recorder. To match the output of the spectrophotometer.

2.3.3 Beakers. 150-ml.

2.3.4 Volumetric Flasks. Glass, 50-, 100-, 200-, 500-, and 1000-ml; and polypropylene, 50-ml.

2.3.5 Erlenmeyer Flasks, 250 ml.

2.3.6 Balance. To measure within 0.5 g

2.3.7 Volumetric Pipets. 1-, 2-, 3-, 5-, 8-, and 10-ml.

2.3.8 PARR Acid Digestion Bomb

2.3.9 Oven.

2.3.10 Hot Plate.

3. Reagents

Unless otherwise specified, use ACS reagent grade (or equivalent) chemicals throughout.

3.1 Sampling. The reagents used in sampling are as follows:

3.1.1 Filters, Silica Gel, Crushed Ice, and Stopcock Grease. Same as Method 5, sections 3.1.1, 3.1.2, 3.1.4, 3.1.5, respectively.

3.1.2 Water. Deionized distilled to meet ASTM Specification D 1193-74, Type 3. When high concentrations of organic matter are not expected to be present, the analyst may omit the $KMnO_4$ test for oxidizable organic matter.

3.1.3 Hydrogen Peroxide (H_2O_2), 10 Percent (W/V). Dilute 294 ml of 30 percent H_2O_2 to 1 liter with deionized distilled water.

3.2 Sample Recovery. 0.1 N sodium hydroxide (NaOH) is required. Dissolve 4.00 g of NaOH in about 500 ml of deionized distilled water in a 1-liter volumetric flask. Then, dilute to exactly 1.0 liter with deionized distilled water.

3.3 Analysis. The reagents needed for analysis are as follows:

3.3.1 Water. Same as 3.1.2.

3.3.2 Sodium Hydroxide, 0.1 N Same as 3.2.

3.3.3 Sodium Borohydride ($NaBH_4$), 5 Percent (W/V). Dissolve 5.00 g of $NaBH_4$ in about 500 ml of 0.1 N NaOH in a 1-liter volumetric flask. Then, dilute to exactly 1.0 liter with 0.1 N NaOH.

3.3.4 Hydrochloric Acid (HCl), Concentrated.

3.3.5 Potassium Iodide (KI), 30 Percent (W/V). Dissolve 300 g of KI in 500 ml of deionized distilled water in a 1-liter volumetric flask. Then, dilute to exactly 1.0 liter with deionized distilled water.

3.3.6 Sodium Hydroxide, 1.0 N. Dissolve 40.00 g of NaOH in about 500 ml of deionized distilled water in a 1-liter volumetric flask. Then, dilute to exactly 1.0 liter with deionized distilled water.

3.3.7 Phenolphthalein. Dissolve 0.05 g of phenolphthalein in 50 ml of 90 percent ethanol and 50 ml of deionized distilled water.

3.3.8 Nitric Acid (HNO_3), Concentrated.

3.3.9 Nitric Acid, 0.8 N. Dilute 52 ml of concentrated HNO_3 to

exactly 1.0 liter with deionized distilled water.

3.3.10 Nitric Acid, 50 Percent (V/V). Add 50 ml concentrated HNO_3 to 50 ml deionized distilled water.

3.3.11 Stock Arsenic Standard, 1 mg As/ml. Dissolve 1.3203 g of primary standard grade As_2O_3 in 20 ml of 0.1 N NaOH. Neutralize with concentrated HNO_3. Dilute to 1.0 liter with deionized distilled water.

3.3.12 Arsenic Working Solution, 1.0 μg As/ml. Pipet exactly 1.0 ml of stock As standard into an acid-cleaned, appropriately labeled 1-liter volumetric flask containing about 500 ml of deionized distilled water and 5 ml of concentrated HNO_3. Dilute to exactly 1.0 liter with dionized distilled water.

3.3.13 Hydrofluoric Acid, Concentrated.

3.3.14 Air. Suitable quality for atomic absorption analysis.

3.3.15 Acetylene. Suitable quality for atomic absorption analysis.

3.3.16 Filter. Paper filters, Whatman No. 41 or equivalent.

4. Procedure

4.1 Sampling. Because of the complexity of this method, testers must be trained and experienced with the test procedures in order to obtain reliable results.

4.1.1 Pretest Preparation. Follow the general procedure given in Method 5, section 4.1.1, except the filter need not be weighed.

4.1.2 Preliminary Determinations. Follow the general procedure given in Method 5, Section 4.1.2, except select the nozzle size to maintain isokinetic sampling rates below 28 liters/min (1.0 cfm).

4.1.3 Preparation of Collection Train. Follow the general procedure given in Method 5, section 4.1.3, except prepare the impingers as follows:

Place 150 ml of deionized distilled water in each of the first two impingers and 200 ml of 10 percent H_2O_2 in the third, fourth, and fifth impingers. Weigh and record the weight of each impinger and liquid. Transfer approximately 200 to 300 g of preweighed silica gel from its container to the sixth impinger. Set up the train as shown in Figure 108-1.

4.1.4 Leak-Check Procedures. Follow the leak-check procedures given in Method 5, sections 4.1.4.1 (Pretest Leak-Check), 4.1.4.2 (Leak-Checks During Sample Run), and 4.1.4.3 (Post-Test Leak-Check).

4.1.5 Arsenic Train Operation. Follow the general procedure given

in Method 5, section 4.1.5, except maintain a temperature of 110° to $135^{o}C$ (230° to $275^{o}F$) around the filter and maintain isokinetic sampling flow rates below 28 liters/min (1.0 cfm). For each run, record the data required on a data sheet such as the one shown in Figure 108-2.

4.1.6 Calculation of Percent Isokinetic. Same as Method 5, section 4.1.6.

4.2 Sample Recovery. Begin proper cleanup procedure as soon as the probe is removed from the stack at the end of the sampling period.

Allow the probe to cool. when it can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent loosing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling because a vacuum would form in the filter holder.

Before moving the sampling train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Use either ground-glass stoppers, plastic caps, or serum caps to close these openings.

Transfer the probe and filter-impinger assembly to a cleanup area that is clean and protected from the wind so that the chances of contaminating or losing the sample is minimized.

Inspect the train before and during disassembly and note any abnormal conditions. Treat the sample as follows:

4.2.1 Container No. 1 (Filter). Carefully remove the filter from the filter holder and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, fold the particulate cake inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers that adhere to the filter holder gasket by using a dry Nylon* bristle brush and/or a sharp-edged blade. Seal the container.

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* Mention of trade names or specific products does not consitute endorsement by the Environmental Protection Agency.

4.2.2 Container No. 2 (Probe). Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with 0.1 N NaOH and placing the wash in a plastic storage container. Measure and record to the nearest ml the total volume of solution in Container No. 2. Perform the rinsing with 0.1 N NaOH as follows:

Carefully remove the probe nozzle and rinse the inside surface with 0.1 N NaOH from a wash bottle. Brush with a Nylon bristle brush and rinse until the rinse shows no visible particles, after which make a final rinse of the inside surface.

Brush and rinse the inside parts of the Swagelok fitting with 0.1 N NaOH in a similar way until no visible particles remain.

Rinse the proble liner with 0.1 N NaOH. While squirting 0.1 N NaOH into the upper end of the probe, tilt and rotate the probe so that all inside surfaces will be wetted with the rinse solution. Let the 0.1 N NaOH drain from the lower end into the sample container. The tester may use a funnel (glass or polyethylene) to aid in transferring the liquid washes to the container. Follow the wash with a probe brush. Holding the probe in an inclined position, insert 0.1 NNaOH into the upper end as the probe brush is being moved with a twisting action through the probe,. Hold the sample container underneath the lower end of the probe, and catch any liquid and particulate matter brushed from the probe. Run the wash through the probe three times or more until no visible particulate matter is carried out with the rinse or until none remians in the probe liner on visual inspection. With stainless steel or metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevice in which particulate matter can be entrapped. Rinse the brush with 0.1 N NaOH, and quantitatively collect these washings in the sample container. After the brushing, make a final rinse of the probe as described above.

It is recommended that two people clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

After ensuring that all joints have been wiped clean of silicone grease, brush and rinse with 0.1 NN NaOH the inside of the front half of the filter holder. Brush and rinse each surface three times or more if needed to

remove visible particulate. Make a final rinse of the brush and filter holder. Carefully brush and rinse out the glass cyclone, also (if applicable). After all washings and particulate matter have been collected in the sample container, tighten the lid so that liquid will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to clearly identify its contents.

Rinse the glassware a final time with deionized distilled water to remove residual NaOH before reassembling. Do not save the rinse water.

4.2.3 Container No. 3 (Silica Gel). Note the color of the indicating silica gel to determine whether it has been completely spent and make a notation of its condition. Transfer the silica gel from the sixth impinger to its original container and seal. The tester may use as aids a funnel to pour the silica gel and a rubber policeman to remove the silica gel from the impinger. It is not necessary to remove the small amount of particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, the tester may follow the procedure for Container No. 3 in section 4.5 (Analysis).

4.2.4 Container No. 4 (Arsenic Sample). Clean each of the first two impingers and connecting glassware in the following manner:

1. Wipe the impinger ball joints free of silicone grease and cap the joints.

2. Weigh the impinger and liquid to within $\pm$ 0.5 g. Record in the log the weight of liquid along with a notation of any color or film observed in the impinger catch. The weight of liquid is needed along with the silica gel data to calculate the stack gas moisture content.

3. Rotate and agitate each impinger, using the impinger contents as a rinse solution

4. Transfer the liquid to Container No. 4. Remove the outlet ball-joint cap, and drain the contents through this opening. Do not separate the impinger parts (inner and outer tubes) while transferring their contents to the cylinder.

5. (Note: In steps 5 and 6 below, measure and record the total amount of 0.1 N NaOH used for rinsing.) Pour approximately 30 ml of 0.1 NaOH

into each of the first two impingers and agitate the impingers. Drain the 0.1 N NaOH through the outlet arm of each impinger into Container No. 4. Repeat this operation a second time; inspect the impingers for any abnormal conditions.

6. Wipe the ball joints of the glassware connecting the impingers and the back half of the filter holder free of silicone grease, and rinse each piece of glassware twice with 0.1 N NaOH; transfer this rinse into Container No. 4. (Do not rinse or brush the glass-fritted filter support.) Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to clearly identify its contents.

4.2.5 Container No. 5 (SO_2 Impinger Sample). Because of the large quantity of liquid involved, the tester may place the solutions from the third, fourth, and fifth impingers in separate containers. However, the tester may recombine them at the time of analysis in order to reduce the number of analyses required. Clean the impingers according to the six-step procedure described under Container No. 4 using deionized distilled water instead 0.1 N NaOH as the rinsing liquid.

4.2.6 Blanks. Save a portion of the 0.1 NaOH used for cleanup as a blank. Take 200 ml of this solution directly from the wash bottle being used and place it in a plastic sample container labeled "NaOH blank." Also save samples of the deionized distilled water an 10 percent H_2O_2, and place in separate containers labeled "H_2O blank" and "H_2O_2 blank," respectively.

4.3 Arsenic Sample Prepartion.

4.3.1 Container No. 1 (Filter). Place the filter and loose particulate matter in a 150-ml beaker. Also, add the filtered material from Container No. 2 (see section 4.3.3). Add 50 ml of 0.1 N NaOH. Then stir and warm on a hot plate at low heat (do not boil) for about 15 min. Filter the solution through the Watman No. 41 filter paper. Wash with hot water and catch the filtrate in a clean 150-ml beaker. Boil the filtrate and evaporate to dryness. Cool, add 5 ml of 50 percent HNO_3, and then warm and stir. Allow to cool. Transfer to a 50-ml volumetric flask, dilute to volume with deionized distilled water, and mix well.

If there are any solids retained by the filter, place the filter in a PARR acid digestion bomb and add 5 ml each of concentrated HNO_3 and HF acids. Seal the bomb and heat it in an oven at 150°C for 5 hours.

Remove the bomb from the oven and allow it to cool. Quantitatively transfer the content of the bomb to a 50-ml polypropylene volumetric flask and diulte to exactly 50 ml with deionized distilled water.

4.3.2 Container No. 4 (Arsenic Impinger Sample).

Note: Prior to analysis, check the liquid level in Containers NO. 2 and NO. 4; confirm as to whether or not leakage occurred during transport on the analysis sheet. If a noticeable amount of leakage occurred, either void the sample or take steps, subject to the approval of the Administrator, to adjust the final results.

Transfer the contents of Container No. 4 to a 500-ml volumetric flask and dilute to exactly 500 ml with deionized distilled water. Pipet 50 ml of the solution into a 150-ml beaker. Add 10 ml of concentrated HNO_3, bring to a boil, and evaporate to dryness. Allow to cool, add 5 ml of 50 percent HNO_3, and then warm and stir. Allow the solution to cool, transfer to a 50-ml volumetric flask, dilute to volume with dionized distilled water, and mix well.

4.3.3 Container No. 2 (Probe Wash). See note in 4.3.2 above. Filter (using Whatman No. 41) the contents of Container No. 2 into a 200-ml volumetric flask. Combine the filtered material with the contents of Container No. 1 (Filter).

Dilute the filtrate to exactly 200 ml with dionized distilled water. Then pipet 50 ml into a 150-ml beaker. Add 10 ml of concentrated HNO_3, bring to a boil, and evaporate to dryness. Allow to cool, add 5 ml of 50 percent HNO_3, and then warm and stir. Allow the solution to cool, transfer to a 50--mll volumetric flak, dilute to volume with deionized distilled water, and mix well.

4.3.4 Filter Blank. Determine a filter blank using two filters from each lot of filters used in the sampling train. Cut each filter into strips and treat each filter individually as directed in section 4.3.1, beginning with the sentence, "Add 50 ml of 0.1 N NaOH."

4.3.5 0.1 N NaOH and Water Blanks. Treat separately 50 ml of 0.1 N NaOH and 50 ml deionized distilled water, as directed under section 4.3.2, beginning with the sentence, "Pipet 50 ml of the solution into a 150-ml beaker."

4.4 Spectrophotometer Preparation. Turn on the power; set the wavelength, slit width, and lamp current; and adjust the background corrector as instructed by the manufacturer's manual for the particular atomic

absorption spectrophotometer. Adjust the burner and flame characteristic as necessary.

4.5 Analysis.

4.5.1 Arsenic Determination. Prepare standard solutions as directed under section 5.1 and measure their absorbances against 0.8 N HNO_3. Then, determine the absorbances of the filter blank and each sample using 0.8 N HNO_3 as a reference. If the sample concentration falls outside the range of the calibration curve, make an appropriate dilution with 0.8 N HNO_3 so that the final concentration falls within the range of the curve. Determine the As concentration in the filter blank (i.e., the average of the two blank values from each lot). Next, using the appropriate standard curve, determine the As concentration in each sample fraction.

4.5.1.1 Arsenic Determination at Low Concentration. The lower limit of flame atomic absorption spectrophotometry is 10 μg As/ml. If the As concentration is a lower level, use the vapor generator, which is available as an accessory component. Follow the manufacturer's instructions in the use of such equipment. Place a sample containing between 0 and 5 μg of As in the reaction tube and dilute to 15 ml with deionized distilled water. Since there is some trial and error involved in this procedure, it may be necessary to screen the samples by conventional atomic absorption until an approximate concentration is determined. After determining the approximate concentration, adjust the volume of the sample accordingly, Pipet 15 ml of concentrated HCl into each tube. Add 1 ml of 30 percent KI solution. Place the reaction tube into a 50°C water bath for 5 min. Cool to room temperature. Connect the reaction tube to the vapor generator assembly. When the instrument response has returned to baseline, inject 5.0 ml of 5 percent $NaBH_4$ and integrate the resulting spectrophotometer signal over a 30-second time period.

4.5.1.2 Mandatory Check for Matrix Effects on the Arsenic Results. Since the analysis for As by atomic absorption is sensitive to the chemical composition and to the physical properties (viscosity, pH) of the sample (matrix effects), check (mandatory) at least one sample from each source using the "Method of Additions."

Three acceptable "Method of Additions" procedures are described in the "General Procedure Section" of the Perkin Elmer Corporation Manual (Citation 2 in section 7). If the results of the Method of Additions procedure on the source sample do not agree to within 5 percent of the value

obtained by the routine atomic absorption analysis, then reanlyze all samples from the source using the Method of Additions procedure.

4.5.2 Container No. 5. (So_2 Impinger Sample). Observe the level of liquid in Container No. 5 and confirm whether any sample was lost during shipping. Note any loss of liquid on the analytical data sheet. If a noticeable amount of leakage occurred, either void the sample or use methods subject to the approval of the Administrator, to adjust the final results.

Transfer the contents of the container(s) No. 5 to 1-liter volumetric flask and dilute to exactly 1.0 liter with deionized distilled water. Pipet 10 ml of this solution into a 250-ml Erlenmeyer flask and add two to four drops of phenolphthalein indicator. Titrate the sample to a faint pink endpoint using 1 N NaOH. Repeat and average the titration volumes. Run a blank with each series of samples.

4.5.3 Container No. 3 (Silica Gel). The tester may conduct this step in the field. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g; record this weight.

5. Calibration

Maintain a laboratory log of all calibrations.

5.1 Standard Solutions. Pipet 1, 3, 5, 8, and 10 ml of the 1.0-mg As/ml stock solution into separate 100-ml volumetric flasks, each containing 5 ml of concentrated HNO_3. Dilute to the mark with deioniized distilled water. If the low-level procedure is used, pipet 1, 2, 3, and 5 ml of 1.0 μg As/ml standard solution into the separate flasks. Then treat them in the same manner as the sample (section 4.3.4).

Check these absorbances frequently against 0.8 N HNO_3 (reagent blank) during the analysis to insure that base-line drift has not occurred. Prepare a standard curve of absorbance versus concentration. (Note: For instruments equipped with direct concentration readout devices, preparation of a standard curve will not be necessary.) In all cases, follow calibration and operational procedures in the manufacturer's instruction manual.

5.2 Sampling Train Calibration. Calibrate the sampling train components according to the indicated sections of Method 5: Probe Nozzle (section 5.1), Pitot Tube Assembly (section 5.2), Metering System (section 5.3), Probe Heater (section 5.4), Temperature Gauges (section 5.5), Leak Check of Metering System (section 5.6), and Barometer (section 5.7).

5.3 1 N Sodium Hydroxide Solution. Standardize the NaOH titrant against 25 ml off standard 1.0 N H_2SO_4.

6. Calculations

6.1 Nomenclature

B_{ws} = Water in the gas stream, proportion by volume.

C_a = Concentration of A_s as read from the standard curve, µg/ml.

C_{SO2} = Concentration of SO_2, percent of volume.

C_s = Arsenic concentration in stack gas, dry basis, converted to standard conditions, g/dscm (g/dscf).

E_a = Arsenic mass emission rate, g/hr.

F_d = Dilution factor (equals 1 if the sample has not been diluted).

I = Percent of isokinetic sampling.

M_{bi} = Total mass of all six impingers and contents before sampling, g.

M_{fi} = Total mass of all six impingers and contents after sampling, g.

M_n = Total mass of As collected in a specific part of the sampling train, µg

M_{SO2} = Mass of SO_2 collected in the sampling train, g.

M_t = Total mass of A_s collected in the sampling train, µg.

N = Normality of NaOH titrant, meq/ml.

T_m = Absolute average dry gas meter temperature (see Figure 108-2), ^oK (^oR).

V_a = Volume of sample aliquot titrated, ml.

V_m = Volume of gas sample as measured by the dry gas meter, dcm(dcf).

$V_{m(std)}$ = Volume of gas sample as measured by the dry gas meter correlated to standard conditions, scm(scf).

V_{soln} = Total volume of solution in which the SO_2 is contained, liter.

V_{SO2} = Volume of SO_2 collected in the sampling train, dscm(dscf).

V_t = Volume of NaOH titrant used for the sample (average of replicate titrations), ml.

V_{tb} = Volume of NaOH titrant used for the blank, ml.

V_{tot} = Volume of gas sampled corrected to standard conditions, dscm(dscf).

$V_{w(std)}$ = Volume of water vapor collected in the sampling train, corrected to standard conditions, scm(scf).

ΔH = Average pressure differential across the orifice meter (see Figure 108-2), mm H_2O (in. H_2O).

6.2 Calculate the volume of SO_2 gas collected by the sampling train.

$$V_{SO2} = K_1 (V_t - V_{tb}) N (V_{soln}/V_a) \qquad \text{Eq. 108-1}$$

Where:

K_1 = $1.203 \times 10^{-5} m^3$/meq. for metric units.

K_1 = 4.248×10^{-4} ft^3/mdq. for English units.

6.3 Calculate the sulfur dioxide concentration in the stack gas (dry basis adjusted to standard conditions) as follows:

$$C_{SO2} = \frac{V_{SO2}}{V_{m(std)} + V_{SO2}} \times 100 \qquad \text{Eq. 108-2}$$

6.4 Calculate the mass of sulfur dioxide collected by the sampling train.

$$M_{SO2} = K_2 (V_t - V_{tb}) N (V_{soln}/V_a) \qquad \text{Eq. 108.3}$$

Where:

K_2 = 0.032 g/meq.

6.5 Average dry gas meter temperatures (T_m) and average orifice pressure drop (ΔH). See data sheet (Figure 108-2).

6.6 Dry Gas Volume. Using data from this test, calculate $V_{m(std)}$ by using Eq. 5-1 of Method 5. If necessary, adjust the volume for leakages.

Then, add V_{SO2}.

$$V_{tot} = V_{m(std)} + V_{SO2} \qquad \text{Eq. 108-4}$$

6.7 Volume of water vapor.

$$V_{w(std)} = K_3 \, (M_{fi} - M_{bi} - M_{SO2}) \qquad \text{Eq. 108-5}$$

Where:

K_3 = 0.001334 m^3/g for metric units.
= 0.047012 ft^3/g for English units.

6.8 Moisture content.

$$B_{ws} = \frac{V_{w(std)}}{V_{tot} + V_{w(std)}} \qquad \text{Eq. 108-6}$$

6.9 Amount of As collected.

6.9.1 Calculate the amount of As collected in each part of sampling train, as follows:

$$M_n = C_a \, F_d \, V_{soln} \qquad \text{Eq. 108-7}$$

6.9.2 Calculate the total amount of As collected in the sampling train as follows:

$$M_t = M_n \text{ (filters)} + M_n \text{ (probe)} + M_n \text{ (impingers)} - M_n \text{ (filter blank)} - M_n \text{ (NaOH)} - M_n \text{ } (H_2O) \qquad \text{Eq. 108-8}$$

6.10 Calculate the As concentration in the stack gas (dry basis, adjusted to standard conditions) as follows:

$$C_s = K_4 \, (M_t/V_{m(std)} \qquad \text{Eq. 108-9}$$

Where:

$K_4 = 10^{-6}$ g/μg

6.11 Pollutant Mass Rate. Calculate the As mass emission rate using the following equation.

$$E_a = C_s Q_{sd} \qquad \text{Eq. 108-10}$$

The volumetric flow rate, Q_{sd}, should be calculated as indicated in Method 2.

6.12 Isokinetic Variation. Using data from this test, calculate I. Use Eq. 5-8 of Method 5, except substitute V_{tot} for $V_{m(std)}$.

6.13 Acceptable Results. Same as Method 5, section 6.12.

7. Bibliography

1. Same as Citations 1 through 9 of section 7 of Method 5.

2. Perkin Elmer Corporation. Analytical Methods for Atomic Absorption Spectrophotometry. Norwalk, Connecticut. September 1976.

3. Annual Book of ASTM Standards. Part 31; Water, Atmospheric Analysis. American Society for Testing and Materials. Philadelphia, PA. 1974. pp. 40-42.

APPENDIX D

Procedures for Processing and Analysis of PAH in Coke Oven Emissions from Kaiser Steel

Global Geochemistry Corporation

1.0 Samples expected

1.1 Connective tubes between section welded to oven port cover and remainder of sampling system - These are to be stainless steel tubing, disconnected and capped off for each sample. They will be about 10'-15' long.

1.2 Impingers, in series, first two water-filled, third dry - The center tubes will be removed and wrapped in clean foil, and the impingers stoppered as is, for shipping. One set for each sample. Protect from light during shipping.

2.0 Extraction procedure

Sample fractions are to be covered with foil or in opaque containers, with inert gas flush, during storage in freezer. Solvents used in extraction will be B&J glass distilled pesticide grade (low residue). Working bench area will be screened with amber plastic and light bulbs.

2.1 Connective tubes will be rinsed with dichloromethane by partial filling, capping, tilting several times, and draining into a beaker. This will be repeated until the washings are colorless, but at least three times.

2.2 Impinger contents will be transferred to a separatory funnel. The impingers and center tubes will be rinsed into the funnel, using a measured amount of dichloromethane in portions. The funnel is shaken well and the extract drawn. The rinsing and shaking is repeated with two more portions of solvent. The extracts and washings are combined over Na_2SO_4.

A separate portion of the water used for impingers is extracted in the same way.

For each liter of water, 100 ml dichloromethane will be used per extraction, i.e., 300 ml total.

Internal standard is added to the combined extracts at this point

3.0 Concentration of extracts

Bulk solvent is removed on a rotary evaporator in a water bath at not over 40°, stopping short of dryness. The residual volume should be just less than the final volume to which the solution is to be diluted (accurately). The object is a final solution with roughly five mg/ml solids concentration in dichloromethane. After the volume is made up to the mark in a volumetric flask, an aliquot is removed and evaporated on a tared disk in a nitrogen stream and weighed to determine yields. The remaining solution is stored in a vial or ampoule, sealed with a Teflon-lined septum. A split for SAI QA may be made at this point (see Section 4.3 also).

4.0 Gravity column cleanup chromatogram

4.1 Into a 10 min i.d. column with coarse sinter and Teflon stopcock, 6 g 120 mesh silica gel (activated at 120°) is slurry packed in pentane, cooling the column (by evaporation from a tissue wrapped around it and wet with acetone). This minimizes vapor gaps in the column. A cap of 3g sodium sulfate is added to the top. The column must not dry out before the chromatogram is complete.

4.2 A sample of the extract concentrate is taken. This is to be based on experience of expected PAH contents, but initially would be 5-10 mg. This is exchanged with pentane by adding 10 ml portions of pentane and evaporating over about 100 mg silica to small volume. Three to five portions of pentane are used. The final residue is rinsed onto the column with pentane.

4.3 The chromatogram is developed with four solvent steps:

1. 25 ml pentane
2. 10 ml 20% dichloromethane in pentane
3. 10 ml 50% " " " "
4. 10 ml 50% " " " methanol.

The column volume is approximately 8 cc. This is allowed for while collecting fractions. During the first chromatogram the graduated cylinder collector is observed for visible solvent changes, and a more precise estimate of the column volume.

The four fractions are evaporated in a nitrogen stream at not over 40° to 1.0 ml, then stored under nitrogen in the freezer. The principal constituents

of the fractions will be:

1. Aliphatics
2. Lower molecular weight PAH
3. Higher " " "
4. Polar materials

Fractions 2 and 3 are to be analyzed by HPLC, the others retained for future interest or in case of an incomplete or defective separation. Splits for SAI QA may also be made from these fractions.

5.0 HPLC Analysis

5.1 The column is a reverse phase partition column, C_{18} bonded to microparticle silica, 4 x 250 mm. The solvent system is a gradient from 60/40 acetonitrile/water to 100% acetonitrile, initial slope setting 1.5%/min. The flow rate is one ml/min, the injection sample volume one to ten µl, depending on concentration. Detectors are UV absorbance and fluorescence, in series. The absorbance is set routinely at 296 nm, but may be varied in certain instances to aid in identification of peaks. The fluorescence filters are narrow pass excitation at 360 nm and cut-off emission above 410 nm. Both detectors are recorded simultaneously.

5.2 Reference calibration is based initially on individual chromatograms of single compounds, and routinely interspersed chromatograms of multicomponent reference mixtures. The proposed calibration standards are the following, at minimum:

Phenathrene
Pyrene
Chrysene
Perylene
Benzo(a)pyrene
Benzo (ghi)perylene
Indeno (1,2,3, cd) pyrene
Coronene.

The internal standards (added in Section 2.2) are

9,10-Dimethylanthracene
9-Phenylanthracene
9,10-Diphenylanthracene

6.0 Peak Identification

Significant peaks not recognizable as present in the reference standard will be investigated by alternate methods for identification.

6.1 Stopped-flow examination of UV absorbance for maxima by manual wavelength variation allows checking against known reference spectra (published or measured). This is usually sufficient confirm a component already suspected to be present.

6.2 Collection of the fraction containing the unknown peak allows later determination of the full absorbance and/or the fluorescence spectrum, for comparison with reference compounds.

6.3 If not already run on GC/MS, the sample can be sent to SAI for that purpose, possibly allowing the component to be identified. Since the HPLC elution order is not the same as the GC retention sequence, it may be necessary in ambiguous cases to collect the HPLC fraction and run it separately by GC/MS.

There may be numerous minor constituents not identified. The decision on how many of these to track down and identify will be made in consultation with CARB advisors and with SAI, since at some point the returns are not worth further expense.

6.4 Identified peaks are quantified by comparing their areas to the areas of the known concentrations of reference compounds. A recovery factor based on the added internal standard nearest in elution order to the sample component is then applied; the amount of internal standard originally added to the sample is divided by the amount found in the HPLC analysis. This ratio is the multiplier used to correct for losses in concentration and chromatography steps.

7.0 Quality Assurance

7.1 Transmittal of sample splits to SAI provides for external QA. This should be done with 15% (or one in seven) of all samples.

7.2 Blank water extracts are carried through the same analytical procedure (10% of total).

7.3 The cleanup and HPLC analysis are duplicated on 15% (or one in seven) of all extracts.

7.4 The multicomponent reference is run first every day, then elution volumes and peak areas for each component are plotted on a control chart, to pinpoint developing problems. At least every tenth chromatogram will be this standard. It will also be rerun after any service on the instrument, such as a column change.

APPENDIX E

Gas chromatography/mass spectrometry protocols used by SAI Trace Organic Chemistry Laboratory.

Aliquots of samples received from Global Geochemistry Corporation were analyzed by combined gas chromatography mass spectrometry (GC/MS). Liquid extracts were spiked with an internal standard compound (deuterium-labeled phenanthrene) prior to analysis by gas chromatography mass spectrometry. A Finnigan model 4021 Quadrupole GC/MS system including an Incos data system was used for all analysis. Liquid samples (1 microliter) were injected into a 30-miter x 0.25-mm I.D. SE-54 fused silica open tubular gas chromatography column (J&W Scientific). A programmed GC oven rate of a 4 minute hold at 30°C followed by a 40°C/min temerature increase to 160°C and a 8°C/min temperature increase to 270°C was used for sample analysis. The detector system was a quadrupole mass spectrometer operated in the electron ionization mode at 70eV. The quadrupole mass filter was scanned from 35 to 475 atomic mass units in 0.95 seconds. A hold time of 0.05 seconds was used to stabilize the electronics prior to the next scan. Data were continuously acquired using a Finnigan Incos Data system, which writes time intensity mass spectral data to a magnetic disc. The mass spectrometer was operated under computer control during acquisition. Figures 3.3-7 through 3.3-9 show the total ionization chromatograms for each of the three samples that were analyzed.

Following analyses, the data files were searched for priority pollutant polynuclear aromatic hydrocarbons (PNA's). In addition to the quantitative data reduction used for priority pollutant PNA's, a survey analysis was performed on all significant GC peaks (i.e., signal to noise of greater than 10:1). The survey analysis was based upon a computerized library search of individual background subtracted, peak maxima scans for qualifying GC peaks. The library used for qualitative identification was a combined NIH/EPA National Bureau of Standards library which contains approximately 26,000 entries.

Tables 3.3-11 through 3.3-13 present the results of this survey analysis. As expected, a series of alkyl substituted PNA's were observed in addition to heterocyclic compounds containing nitrogen and sulfur moieties. Further investigation of the mass spectra of the nitrogen substituted identifications confirmed the presence of benzonitrile, isoquinoline and/or quinoline, acridine, carbazole and alkyl substituted pyridines. Ion specific searches for N-nitroso substituted amines were negative.

APPENDIX F

Detailed Fiber and Mass Concentration Data - Johns Manville

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: A10B

Manville
D-2 Baghouse
7/23 @ 3:47 -
6:33

TOTAL AREA SCANNED = 18300.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 2.570000 CUBIC METERS
TOTAL FIBERS COUNTED = 26.0 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		23.0	2.0	25.0
PERCENT TOTAL FIBERS		88.462%	7.692%	96.154%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		1.4956E+06	1.3005E+05	1.6257E+06
(FIBERS PER CUB METER OF AIR)		5.8196E+05	5.0605E+04	6.3256E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.7281E+06	1.4181E+07	1.5909E+07
(SQ CM PER CUB METER OF AIR)		6.7240E+05	5.5179E+06	6.1903E+06
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		2.8405E+05	9.8715E+06	1.0156E+07
(PGRAMS PER CUB METER OF AIR)		1.1052E+05	3.8410E+06	3.9516E+06
LENGTH (MICRONS)	MEAN	1.6696	44.3333	6.5923
	STD DEV	0.9411	39.9694	19.2589
	MEAN LOG	0.3268	3.3012	0.6700
	GEOM MN	1.3865	27.1442	1.9542
	COEF VAR	0.9031	1.8088	2.2544
DIAMETER (MICRONS)	MEAN	0.1983	0.7500	0.2619
	STD DEV	0.1050	0.5612	0.2778
	MEAN LOG	-1.7368	-0.6675	-1.6134
	GEOM MN	0.1761	0.5130	0.1992
	COEF VAR	0.6094	1.5768	0.9125
AREA (SQ MIC)	MEAN	1.1554	104.7368	13.1071
	STD DEV	0.9690	76.5366	42.0935
	MEAN LOG	-0.1900	3.7924	0.2695
	GEOM MN	0.8269	44.3610	1.3093
	COEF VAR	1.3499	4.7319	4.0405
VOLUME (CUB MIC)	MEAN	0.0730	24.1981	2.8567
	STD DEV	0.1090	18.2077	9.8828
	MEAN LOG	-3.3884	1.7246	-2.7985
	GEOM MN	0.0338	5.6103	0.0609
	COEF VAR	2.4700	12.5883	7.9909

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A10B

Manville
D-2 Baghouse
7/23 @ 3:47 -
6:33

TOTAL AREA SCANNED = 18300.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 2.570000 CUBIC METERS
TOTAL FIBERS COUNTED = 26.0 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		25.0	1.0	0.0	0.0	0.0	26.0
PERCENT TOTAL FIBERS		96.154%	3.846%	0.000%	0.000%	0.000%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		1.6257E+06	6.5027E+04	0.0000E+00	0.0000E+00	0.0000E+00	1.6907E+06
(FIBERS PER CUB METER OF AIR)		6.3256E+05	2.5302E+04	0.0000E+00	0.0000E+00	0.0000E+00	6.5786E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.5909E+07	6.3840E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
(SQ CM PER CUB METER OF AIR)		6.1903E+06	2.4841E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		1.0156E+07	2.2983E+02				
(PGRAMS PER CUB METER OF AIR)		3.9516E+06	8.9426E+01				
LENGTH (MICRONS)	MEAN	6.5923	0.6000	0.0000	0.0000	0.0000	6.3704
	STD DEV	19.2589	0.0000	0.0000	0.0000	0.0000	18.9328
	MEAN LOG	0.6700	-0.5108	0.0000	0.0000	0.0000	0.6262
	GEOM MN	1.9542	0.6000	0.0000	0.0000	0.0000	1.8706
	COEF VAR	2.2544	0.0000	0.0000	0.0000	0.0000	2.2518
DIAMETER (MICRONS)	MEAN	0.2619	0.0500	0.0000	0.0000	0.0000	0.2541
	STD DEV	0.2778	0.0000	0.0000	0.0000	0.0000	0.2755
	MEAN LOG	-1.6134	-2.9957	0.0000	0.0000	0.0000	-1.6646
	GEOM MN	0.1992	0.0500	0.0000	0.0000	0.0000	0.1893
	COEF VAR	0.9125	0.0000	0.0000	0.0000	0.0000	0.9892
AREA (SQ MIC)	MEAN	13.1071	0.0982	0.0000	0.0000	0.0000	12.6253
	STD DEV	42.0935	0.0000	0.0000	0.0000	0.0000	41.3797
	MEAN LOG	0.2695	-2.3210	0.0000	0.0000	0.0000	0.1735
	GEOM MN	1.3093	0.0982	0.0000	0.0000	0.0000	1.1895
	COEF VAR	4.0405	0.0000	0.0000	0.0000	0.0000	4.2643
VOLUME (CUB MIC)	MEAN	2.8567	0.0012	0.0000	0.0000	0.0000	2.7509
	STD DEV	9.8828	0.0000	0.0000	0.0000	0.0000	9.7131
	MEAN LOG	-2.7985	-6.7439	0.0000	0.0000	0.0000	-2.9446
	GEOM MN	0.0609	0.0012	0.0000	0.0000	0.0000	0.0526
	COEF VAR	7.9909	0.0000	0.0000	0.0000	0.0000	8.7798

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: A10A

Manville
D-2 Baghouse
7/23 @ 3:47 -
6:33

TOTAL AREA SCANNED = 18300.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 2.570000 CUBIC METERS
TOTAL FIBERS COUNTED = 19.5 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		13.0	4.5	17.5
PERCENT TOTAL FIBERS		66.667%	23.077%	89.744%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		8.4536E+05	2.9262E+05	1.1380E+06
(FIBERS PER CUB METER OF AIR)		3.2893E+05	1.1386E+05	4.4279E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.5585E+06	1.5970E+07	1.7529E+07
(SQ CM PER CUB METER OF AIR)		6.0643E+05	6.2141E+06	6.8206E+06
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		4.7881E+05	8.5356E+06	9.0144E+06
(PGRAMS PER CUB METER OF AIR)		1.8631E+05	3.3213E+06	3.5076E+06
LENGTH (MICRONS)	MEAN	1.6077	30.2857	11.6450
	STD DEV	0.8508	19.2852	17.8254
	MEAN LOG	0.3430	3.1226	1.3159
	GEOM MN	1.4092	22.7047	3.7280
	COEF VAR	0.6617	1.3045	3.3615
DIAMETER (MICRONS)	MEAN	0.2608	0.7571	0.4345
	STD DEV	0.2046	0.5261	0.4244
	MEAN LOG	-1.5813	-0.4436	-1.1831
	GEOM MN	0.2057	0.6417	0.3063
	COEF VAR	0.9211	0.6882	1.2637
AREA (SQ MIC)	MEAN	1.8436	62.0128	22.9028
	STD DEV	2.5553	43.2570	38.5068
	MEAN LOG	-0.0116	3.8551	1.3417
	GEOM MN	0.9885	47.2344	3.8257
	COEF VAR	1.7962	1.2130	6.9722
VOLUME (CUB MIC)	MEAN	0.2178	11.5880	4.1974
	STD DEV	0.4685	9.6330	7.8760
	MEAN LOG	-3.0611	1.9937	-1.2919
	GEOM MN	0.0468	7.3427	0.2747
	COEF VAR	4.0979	1.9114	15.7316

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: A10TEM

Manville
D-2 Baghouse
7/23 @ 3:47 -
6:33

TOTAL AREA SCANNED = 96875.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF TEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 2.573000 CUBIC METERS
TOTAL FIBERS COUNTED = 106.5 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		88.0	4.0	92.0
PERCENT TOTAL FIBERS		82.629%	3.756%	86.385%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		1.0810E+06	4.9135E+04	1.1301E+06
(FIBERS PER CUB METER OF AIR)		4.2012E+05	1.9097E+04	4.3922E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		7.6395E+05	9.7370E+05	1.7377E+06
(SQ CM PER CUB METER OF AIR)		2.9691E+05	3.7843E+05	6.7534E+05
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		8.5506E+04	4.1677E+05	5.0228E+05
(PGRAMS PER CUB METER OF AIR)		3.3232E+04	1.6198E+05	1.9521E+05
LENGTH (MICRONS)	MEAN	1.5633	14.8400	2.2621
	STD DEV	1.1476	7.6277	3.6193
	MEAN LOG	0.1921	2.5992	0.3188
	GEOM MN	1.2118	13.4529	1.3755
	COEF VAR	1.0539	0.5044	1.4301
DIAMETER (MICRONS)	MEAN	0.1176	0.4300	0.1340
	STD DEV	0.0669	0.3280	0.1215
	MEAN LOG	-2.3103	-1.1254	-2.2480
	GEOM MN	0.0992	0.3245	0.1056
	COEF VAR	0.8361	1.0875	0.9534
AREA (SQ MIC)	MEAN	0.7052	22.0736	1.8298
	STD DEV	0.8218	20.4266	6.7355
	MEAN LOG	-0.9243	2.6350	-0.7370
	GEOM MN	0.3968	13.9436	0.4786
	COEF VAR	2.1005	1.5968	2.9580
VOLUME (CUB MIC)	MEAN	0.0301	3.4793	0.2117
	STD DEV	0.0558	3.8957	1.1811
	MEAN LOG	-4.6701	0.1069	-4.4187
	GEOM MN	0.0094	1.1128	0.0120
	COEF VAR	4.3401	4.1845	6.2770

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A10A

Manville
D-2 Baghouse
7/23 @ 3:47 -
6:33

TOTAL AREA SCANNED = 18300.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 2.570000 CUBIC METERS
TOTAL FIBERS COUNTED = 19.5 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		17.5	2.0	0.0	0.0	0.0	19.5
PERCENT TOTAL FIBERS		89.744%	10.256%	0.000%	0.000%	0.000%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		1.1380E+06	1.3005E+05	0.0000E+00	0.0000E+00	0.0000E+00	1.2680E+06
(FIBERS PER CUB METER OF AIR)		4.4279E+05	5.0605E+04	0.0000E+00	0.0000E+00	0.0000E+00	4.9340E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.7529E+07	3.3963E+04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
(SQ CM PER CUB METER OF AIR)		6.8206E+06	1.3215E+04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		9.0144E+06	2.9877E+03				
(PGRAMS PER CUB METER OF AIR)		3.5076E+06	1.1625E+03				
LENGTH (MICRONS)	MEAN	11.6450	0.6000	0.0000	0.0000	0.0000	10.6409
	STD DEV	17.8254	0.0000	0.0000	0.0000	0.0000	17.2899
	MEAN LOG	1.3159	-0.5108	0.0000	0.0000	0.0000	1.1498
	GEOM MN	3.7280	0.6000	0.0000	0.0000	0.0000	3.1576
	COEF VAR	3.3615	0.0000	0.0000	0.0000	0.0000	3.4784
DIAMETER (MICRONS)	MEAN	0.4345	0.1250	0.0000	0.0000	0.0000	0.4064
	STD DEV	0.4244	0.0250	0.0000	0.0000	0.0000	0.4144
	MEAN LOG	-1.1831	-2.0999	0.0000	0.0000	0.0000	-1.2665
	GEOM MN	0.3063	0.1225	0.0000	0.0000	0.0000	0.2818
	COEF VAR	1.2637	0.2247	0.0000	0.0000	0.0000	1.2810
AREA (SQ MIC)	MEAN	22.9028	0.2611	0.0000	0.0000	0.0000	20.8445
	STD DEV	38.5068	0.0569	0.0000	0.0000	0.0000	37.2874
	MEAN LOG	1.3417	-1.3670	0.0000	0.0000	0.0000	1.0955
	GEOM MN	3.8257	0.2549	0.0000	0.0000	0.0000	2.9907
	COEF VAR	6.9722	0.2481	0.0000	0.0000	0.0000	7.3987
VOLUME (CUB MIC)	MEAN	4.1974	0.0077	0.0000	0.0000	0.0000	3.8165
	STD DEV	7.8760	0.0029	0.0000	0.0000	0.0000	7.6055
	MEAN LOG	-1.2919	-4.9521	0.0000	0.0000	0.0000	-1.6247
	GEOM MN	0.2747	0.0071	0.0000	0.0000	0.0000	0.1970
	COEF VAR	15.7316	0.5000	0.0000	0.0000	0.0000	16.9486

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A10TEM

TOTAL AREA SCANNED = 96875.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF TEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 2.573000 CUBIC METERS
TOTAL FIBERS COUNTED = 106.5 FIBERS

Manville
D-2 Baghouse
7/23 @ 3:47 -
6:33

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		92.0	10.5	4.0	0.0	0.0	106.5
PERCENT TOTAL FIBERS		86.385%	9.859%	3.756%	0.000%	0.000%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		1.1301E+06	1.2898E+05	4.9135E+04	0.0000E+00	0.0000E+00	1.3082E+06
(FIBERS PER CUB METER OF AIR)		4.3922E+05	5.0129E+04	1.9097E+04	0.0000E+00	0.0000E+00	5.0845E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.7377E+06	1.0024E+05	1.4169E+04	0.0000E+00	0.0000E+00	0.0000E+00
(SQ CM PER CUB METER OF AIR)		6.7534E+05	3.8958E+04	5.5067E+03	0.0000E+00	0.0000E+00	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		5.0228E+05	8.8639E+03				
(PGRAMS PER CUB METER OF AIR)		1.9521E+05	3.4449E+03				
LENGTH (MICRONS)	MEAN	2.2621	2.5182	1.7000	0.0000	0.0000	2.2673
	STD DEV	3.6193	3.2178	0.5385	0.0000	0.0000	3.5181
	MEAN LOG	0.3188	0.3873	0.4616	0.0000	0.0000	0.3309
	GEOM MN	1.3755	1.4731	1.5866	0.0000	0.0000	1.3922
	COEF VAR	1.4301	1.6174	0.4943	0.0000	0.0000	1.4191
DIAMETER (MICRONS)	MEAN	0.1340	0.1182	0.0525	0.0000	0.0000	0.1295
	STD DEV	0.1215	0.0321	0.0286	0.0000	0.0000	0.1146
	MEAN LOG	-2.2480	-2.1659	-3.0779	0.0000	0.0000	-2.2699
	GEOM MN	0.1056	0.1147	0.0461	0.0000	0.0000	0.1033
	COEF VAR	0.9534	0.2640	0.6385	0.0000	0.0000	0.9218
AREA (SQ MIC)	MEAN	1.8298	0.9132	0.2884	0.0000	0.0000	1.6821
	STD DEV	6.7355	1.0528	0.2072	0.0000	0.0000	6.2803
	MEAN LOG	-0.7370	-0.5778	-1.4539	0.0000	0.0000	-0.7471
	GEOM MN	0.4786	0.5611	0.2337	0.0000	0.0000	0.4737
	COEF VAR	2.9580	1.5507	0.8393	0.0000	0.0000	2.7640
VOLUME (CUB MIC)	MEAN	0.2117	0.0262	0.0050	0.0000	0.0000	0.1856
	STD DEV	1.1811	0.0295	0.0062	0.0000	0.0000	1.0996
	MEAN LOG	-4.4187	-4.1859	-5.9357	0.0000	0.0000	-4.4506
	GEOM MN	0.0120	0.0152	0.0026	0.0000	0.0000	0.0117
	COEF VAR	6.2770	1.7908	1.8076	0.0000	0.0000	5.7284

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: A9B

Manville
D-2 Baghouse
7/23 @ 2:00 - 3:30

TOTAL AREA SCANNED = 30744.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 1.500000 CUBIC METERS
TOTAL FIBERS COUNTED = 22.0 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		14.5	7.5	22.0
PERCENT TOTAL FIBERS		65.909%	34.091%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		5.6125E+05	2.9030E+05	8.5155E+05
(FIBERS PER CUB METER OF AIR)		3.7417E+05	1.9353E+05	5.6770E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.9374E+06	7.1501E+06	9.0875E+06
(SQ CM PER CUB METER OF AIR)		1.2916E+06	4.7668E+06	6.0584E+06
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		5.2062E+05	1.9863E+06	2.5069E+06
(PGRAMS PER CUB METER OF AIR)		3.4708E+05	1.3242E+06	1.6713E+06
LENGTH (MICRONS)	MEAN	2.8500	22.9500	10.5808
	STD DEV	1.3652	32.7860	22.5877
	MEAN LOG	0.8894	2.6431	1.5639
	GEOM MN	2.4336	14.0562	4.7773
	COEF VAR	0.8527	1.2704	2.0185
DIAMETER (MICRONS)	MEAN	0.3250	0.4400	0.3692
	STD DEV	0.1630	0.0890	0.1481
	MEAN LOG	-1.2742	-0.8376	-1.1063
	GEOM MN	0.2797	0.4328	0.3308
	COEF VAR	0.7835	0.2007	0.6716
AREA (SQ MIC)	MEAN	3.6192	30.5834	13.9901
	STD DEV	2.7467	40.7245	28.5414
	MEAN LOG	0.8205	2.9694	1.6470
	GEOM MN	2.2716	19.4808	5.1914
	COEF VAR	2.0491	1.2767	3.2862
VOLUME (CUB MIC)	MEAN	0.3749	3.2299	1.4730
	STD DEV	0.3808	4.0270	2.8733
	MEAN LOG	-1.9006	0.7264	-0.8902
	GEOM MN	0.1495	2.0675	0.4106
	COEF VAR	4.3226	1.4084	5.7578

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A9B

Manville
D-2 Baghouse
7/23 @ 2:00-
3:30

TOTAL AREA SCANNED = 30744.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION = 1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 1.500000 CUBIC METERS
TOTAL FIBERS COUNTED = 22.0 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		22.0	0.0	0.0	0.0	0.0	22.0
PERCENT TOTAL FIBERS		100.000%	0.000%	0.000%	0.000%	0.000%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		8.5155E+05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	8.5155E+05
(FIBERS PER CUB METER OF AIR)		5.6770E+05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.6770E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		9.0875E+06	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
(SQ CM PER CUB METER OF AIR)		6.0584E+06	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		2.5069E+06	0.0000E+00				
(PGRAMS PER CUB METER OF AIR)		1.6713E+06	0.0000E+00				
LENGTH (MICRONS)	MEAN	10.5808	0.0000	0.0000	0.0000	0.0000	10.5808
	STD DEV	22.5877	0.0000	0.0000	0.0000	0.0000	22.5877
	MEAN LOG	1.5639	0.0000	0.0000	0.0000	0.0000	1.5639
	GEOM MN	4.7773	0.0000	0.0000	0.0000	0.0000	4.7773
	COEF VAR	2.0185	0.0000	0.0000	0.0000	0.0000	2.0185
DIAMETER (MICRONS)	MEAN	0.3692	0.0000	0.0000	0.0000	0.0000	0.3692
	STD DEV	0.1481	0.0000	0.0000	0.0000	0.0000	0.1481
	MEAN LOG	-1.1063	0.0000	0.0000	0.0000	0.0000	-1.1063
	GEOM MN	0.3308	0.0000	0.0000	0.0000	0.0000	0.3308
	COEF VAR	0.6716	0.0000	0.0000	0.0000	0.0000	0.6716
AREA (SQ MIC)	MEAN	13.9901	0.0000	0.0000	0.0000	0.0000	13.9901
	STD DEV	28.5414	0.0000	0.0000	0.0000	0.0000	28.5414
	MEAN LOG	1.6470	0.0000	0.0000	0.0000	0.0000	1.6470
	GEOM MN	5.1914	0.0000	0.0000	0.0000	0.0000	5.1914
	COEF VAR	3.2862	0.0000	0.0000	0.0000	0.0000	3.2862
VOLUME (CUB MIC)	MEAN	1.4730	0.0000	0.0000	0.0000	0.0000	1.4730
	STD DEV	2.8733	0.0000	0.0000	0.0000	0.0000	2.8733
	MEAN LOG	-0.8902	0.0000	0.0000	0.0000	0.0000	-0.8902
	GEOM MN	0.4106	0.0000	0.0000	0.0000	0.0000	0.4106
	COEF VAR	5.7578	0.0000	0.0000	0.0000	0.0000	5.7578

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A9A

Manville
D-2 Baghouse
7/23 @ 2:00 -
3:30

TOTAL AREA SCANNED = 25620.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 1.500000 CUBIC METERS
TOTAL FIBERS COUNTED = 21.5 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		19.5	2.0	0.0	0.0	0.0	21.5
PERCENT TOTAL FIBERS		90.698%	9.302%	0.000%	0.000%	0.000%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		9.0574E+05	9.2896E+04	0.0000E+00	0.0000E+00	0.0000E+00	9.9863E+05
(FIBERS PER CUB METER OF AIR)		6.0383E+05	6.1931E+04	0.0000E+00	0.0000E+00	0.0000E+00	6.6576E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.8762E+07	2.1013E+05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
(SQ CM PER CUB METER OF AIR)		1.2508E+07	1.4008E+05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		6.8002E+06	6.9057E+04				
(PGRAMS PER CUB METER OF AIR)		4.5335E+06	4.6038E+04				
LENGTH (MICRONS)	MEAN	20.4435	1.5500	0.0000	0.0000	0.0000	18.9320
	STD DEV	61.6628	0.9500	0.0000	0.0000	0.0000	59.3671
	MEAN LOG	1.5111	0.2027	0.0000	0.0000	0.0000	1.4064
	GEOM MN	4.5318	1.2247	0.0000	0.0000	0.0000	4.0814
	COEF VAR	2.7047	1.0412	0.0000	0.0000	0.0000	2.7465
DIAMETER (MICRONS)	MEAN	0.3787	0.3090	0.0000	0.0000	0.0000	0.3724
	STD DEV	0.3091	0.2000	0.0000	0.0000	0.0000	0.3025
	MEAN LOG	-1.2548	-1.4979	0.0000	0.0000	0.0000	-1.2742
	GEOM MN	0.2851	0.2236	0.0000	0.0000	0.0000	0.2796
	COEF VAR	1.1362	1.2361	0.0000	0.0000	0.0000	1.1503
AREA (SQ MIC)	MEAN	31.3795	2.2619	0.0000	0.0000	0.0000	29.0501
	STD DEV	96.2564	2.0577	0.0000	0.0000	0.0000	92.6650
	MEAN LOG	1.4468	-0.0627	0.0000	0.0000	0.0000	1.3260
	GEOM MN	4.2495	0.9392	0.0000	0.0000	0.0000	3.7661
	COEF VAR	5.0173	3.5993	0.0000	0.0000	0.0000	5.1797
VOLUME (CUB MIC)	MEAN	4.1547	0.2478	0.0000	0.0000	0.0000	3.8422
	STD DEV	12.1022	0.2431	0.0000	0.0000	0.0000	11.6565
	MEAN LOG	-1.2400	-3.0346	0.0000	0.0000	0.0000	-1.3836
	GEOM MN	0.2894	0.0481	0.0000	0.0000	0.0000	0.2507
	COEF VAR	10.3934	9.2062	0.0000	0.0000	0.0000	10.8558

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: A9A

Manville
D-2 Baghouse
7/23 @ 2:00 -
3:30

TOTAL AREA SCANNED = 25620.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 1.500000 CUBIC METERS
TOTAL FIBERS COUNTED = 21.5 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		15.0	4.5	19.5
PERCENT TOTAL FIBERS		69.767%	20.930%	90.698%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		6.9672E+05	2.0902E+05	9.0574E+05
(FIBERS PER CUB METER OF AIR)		4.6448E+05	1.3934E+05	6.0383E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.6414E+06	1.7120E+07	1.8762E+07
(SQ CM PER CUB METER OF AIR)		1.0943E+06	1.1413E+07	1.2508E+07
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		3.8184E+05	6.4184E+06	6.8002E+06
(PGRAMS PER CUB METER OF AIR)		2.5456E+05	4.2789E+06	4.5335E+06
LENGTH (MICRONS)	MEAN	2.5750	61.2857	20.4435
	STD DEV	1.0674	100.4628	61.6628
	MEAN LOG	0.8484	3.0259	1.5111
	GEOM MN	2.3359	20.6118	4.5318
	COEF VAR	0.5924	2.8855	2.7047
DIAMETER (MICRONS)	MEAN	0.2506	0.6714	0.3787
	STD DEV	0.1659	0.3574	0.3091
	MEAN LOG	-1.5833	-0.5038	-1.2548
	GEOM MN	0.2053	0.6042	0.2851
	COEF VAR	0.8724	0.5341	1.1362
AREA (SQ MIC)	MEAN	2.2794	97.8943	31.3795
	STD DEV	1.9650	155.1596	96.2564
	MEAN LOG	0.4611	3.6998	1.4468
	GEOM MN	1.5858	40.4406	4.2495
	COEF VAR	1.4599	2.3111	5.0173
VOLUME (CUB MIC)	MEAN	0.2002	13.1936	4.1547
	STD DEV	0.2782	19.0687	12.1022
	MEAN LOG	-2.5598	1.7767	-1.2400
	GEOM MN	0.0773	5.9100	0.2894
	COEF VAR	3.3286	2.3499	10.3934

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: A9TEM

Manville
D-2 Baghouse
7/23 @ 2:00 -
3:30

TOTAL AREA SCANNED = 93744.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF TEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 1.497000 CUBIC METERS
TOTAL FIBERS COUNTED = 70.5 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		61.5	6.0	67.5
PERCENT TOTAL FIBERS		87.234%	8.511%	95.745%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		7.8069E+05	7.6165E+04	8.5685E+05
(FIBERS PER CUB METER OF AIR)		5.2150E+05	5.0878E+04	5.7238E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		8.1259E+05	4.1121E+05	1.2238E+06
(SQ CM PER CUB METER OF AIR)		5.4281E+05	2.7469E+05	8.1750E+05
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		1.2081E+05	5.9226E+04	1.8004E+05
(PGRAMS PER CUB METER OF AIR)		8.0702E+04	3.9563E+04	1.2027E+05
LENGTH (MICRONS)	MEAN	1.7484	10.7333	2.8715
	STD DEV	1.1409	5.7341	3.7522
	MEAN LOG	0.3149	2.2653	0.5587
	GEOM MN	1.3702	9.6339	1.7485
	COEF VAR	1.0958	0.5413	1.6075
DIAMETER (MICRONS)	MEAN	0.1525	0.1989	0.1583
	STD DEV	0.0953	0.1088	0.0983
	MEAN LOG	-2.0788	-1.7869	-2.0423
	GEOM MN	0.1251	0.1675	0.1297
	COEF VAR	0.9164	0.8453	0.9213
AREA (SQ MIC)	MEAN	1.0669	5.9241	1.6741
	STD DEV	1.1922	2.8170	2.1945
	MEAN LOG	-0.5659	1.6349	-0.2908
	GEOM MN	0.5679	5.1288	0.7477
	COEF VAR	2.4620	0.8037	3.0012
VOLUME (CUB MIC)	MEAN	0.0612	0.3494	0.0972
	STD DEV	0.1034	0.3280	0.1786
	MEAN LOG	-4.0842	-1.5500	-3.7675
	GEOM MN	0.0168	0.2122	0.0231
	COEF VAR	5.3300	2.0593	6.0932

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A9TEM

TOTAL AREA SCANNED =.93744.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF TEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 1.497000 CUBIC METERS
TOTAL FIBERS COUNTED = 70.5 FIBERS

Manville
D-2 Baghouse
7/23 @ 2:00 -
3:30

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		67.5	3.0	0.0	0.0	0.0	70.5
PERCENT TOTAL FIBERS		95.745%	4.255%	0.000%	0.000%	0.000%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		8.5685E+05	3.8082E+04	0.0000E+00	0.0000E+00	0.0000E+00	8.9494E+05
(FIBERS PER CUB METER OF AIR)		5.7238E+05	2.5439E+04	0.0000E+00	0.0000E+00	0.0000E+00	5.9782E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		1.2238E+06	7.5772E+04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
(SQ CM PER CUB METER OF AIR)		8.1750E+05	5.0616E+04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		1.8004E+05	1.7826E+04				
(PGRAMS PER CUB METER OF AIR)		1.2027E+05	1.1908E+04				
LENGTH (MICRONS)	MEAN	2.8715	1.9667	0.0000	0.0000	0.0000	2.8353
	STD DEV	3.7522	0.8179	0.0000	0.0000	0.0000	3.6843
	MEAN LOG	0.5587	0.5802	0.0000	0.0000	0.0000	0.5596
	GEOM MN	1.7485	1.7863	0.0000	0.0000	0.0000	1.7500
	COEF VAR	1.6075	0.5693	0.0000	0.0000	0.0000	1.5686
DIAMETER (MICRONS)	MEAN	0.1583	0.2667	0.0000	0.0000	0.0000	0.1627
	STD DEV	0.0983	0.0943	0.0000	0.0000	0.0000	0.1004
	MEAN LOG	-2.0423	-1.3784	0.0000	0.0000	0.0000	-2.0158
	GEOM MN	0.1297	0.2520	0.0000	0.0000	0.0000	0.1332
	COEF VAR	0.9213	0.3865	0.0000	0.0000	0.0000	0.9274
AREA (SQ MIC)	MEAN	1.6741	1.9897	0.0000	0.0000	0.0000	1.6867
	STD DEV	2.1945	1.4550	0.0000	0.0000	0.0000	2.1707
	MEAN LOG	-0.2908	0.4169	0.0000	0.0000	0.0000	-0.2625
	GEOM MN	0.7477	1.5172	0.0000	0.0000	0.0000	0.7691
	COEF VAR	3.0012	1.0775	0.0000	0.0000	0.0000	2.9489
VOLUME (CUB MIC)	MEAN	0.0972	0.1560	0.0000	0.0000	0.0000	0.0996
	STD DEV	0.1786	0.1567	0.0000	0.0000	0.0000	0.1781
	MEAN LOG	-3.7675	-2.4182	0.0000	0.0000	0.0000	-3.7135
	GEOM MN	0.0231	0.0891	0.0000	0.0000	0.0000	0.0244
	COEF VAR	6.0932	1.8669	0.0000	0.0000	0.0000	6.0223

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: A8B

Manville
(downwind)

TOTAL AREA SCANNED = 6975.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION = 1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.330000 CUBIC METERS
TOTAL FIBERS COUNTED = 4.0 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		2.0	0.0	2.0
PERCENT TOTAL FIBERS		50.000%	0.000%	50.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		3.4122E+05	0.0000E+00	3.4122E+05
(FIBERS PER CUB METER OF AIR)		1.0247E+05	0.0000E+00	1.0247E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		4.9766E+04	0.0000E+00	4.9766E+04
(SQ CM PER CUB METER OF AIR)		1.4945E+04	0.0000E+00	1.4945E+04
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		2.2889E+03	0.0000E+00	2.2889E+03
(PGRAMS PER CUB METER OF AIR)		6.8736E+02	0.0000E+00	6.8736E+02
LENGTH (MICRONS)	MEAN	0.6000	0.0000	0.6000
	STD DEV	0.1000	0.0000	0.1000
	MEAN LOG	-0.5249	0.0000	-0.5249
	GEOM MN	0.5916	0.0000	0.5916
	COEF VAR	0.1832	0.0000	0.1832
D METER (M MICRONS)	MEAN	0.0750	0.0000	0.0750
	STD DEV	0.0150	0.0000	0.0150
	MEAN LOG	-2.6107	0.0000	-2.6107
	GEOM MN	0.0735	0.0000	0.0735
	COEF VAR	0.2247	0.0000	0.2247
AREA (SQ MIC)	MEAN	0.1458	0.0000	0.1458
	STD DEV	0.0082	0.0000	0.0082
	MEAN LOG	-1.9268	0.0000	-1.9268
	GEOM MN	0.1456	0.0000	0.1456
	COEF VAR	0.0582	0.0000	0.0582
VOLUME (CUB MIC)	MEAN	0.0026	0.0000	0.0026
	STD DEV	0.0006	0.0000	0.0006
	MEAN LOG	-5.9878	0.0000	-5.9878
	GEOM MN	0.0025	0.0000	0.0025
	COEF VAR	0.2677	0.0000	0.2677

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A8B

Manville
(downwind)

TOTAL AREA SCANNED = 6975.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.330000 CUBIC METERS
TOTAL FIBERS COUNTED = 4.0 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		2.0	0.0	2.0	0.0	0.0	4.0
PERCENT TOTAL FIBERS		50.000%	0.000%	50.000%	0.000%	0.000%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		3.4122E+05	0.0000E+00	3.4122E+05	0.0000E+00	0.0000E+00	6.8244E+05
(FIBERS PER CUB METER OF AIR)		1.0247E+05	0.0000E+00	1.0247E+05	0.0000E+00	0.0000E+00	2.0494E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		4.9766E+04	0.0000E+00	3.8832E+04	0.0000E+00	0.0000E+00	0.0000E+00
(SQ CM PER CUB METER OF AIR)		1.4945E+04	0.0000E+00	1.1661E+04	0.0000E+00	0.0000E+00	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		2.2889E+03	0.0000E+00				
(PGRAMS PER CUB METER OF AIR)		6.8736E+02	0.0000E+00				
LENGTH (MICRONS)	MEAN	0.6000	0.0000	0.5000	0.0000	0.0000	0.5500
	STD DEV	0.1000	0.0000	0.1000	0.0000	0.0000	0.1118
	MEAN LOG	-0.5249	0.0000	-0.7136	0.0000	0.0000	-0.6192
	GEOM MN	0.5916	0.0000	0.4899	0.0000	0.0000	0.5384
	COEF VAR	0.1832	0.0000	0.2247	0.0000	0.0000	0.2322
DIAMETER (MICRONS)	MEAN	0.0750	0.0000	0.0650	0.0000	0.0000	0.0700
	STD DEV	0.0150	0.0000	0.0150	0.0000	0.0000	0.0158
	MEAN LOG	-2.6107	0.0000	-2.7607	0.0000	0.0000	-2.6657
	GEOM MN	0.0735	0.0000	0.0632	0.0000	0.0000	0.0682
	COEF VAR	0.2247	0.0000	0.2649	0.0000	0.0000	0.2610
AREA (SQ MIC)	MEAN	0.1458	0.0000	0.1138	0.0000	0.0000	0.1298
	STD DEV	0.0082	0.0000	0.0470	0.0000	0.0000	0.0374
	MEAN LOG	-1.9268	0.0000	-2.2670	0.0000	0.0000	-2.0969
	GEOM MN	0.1456	0.0000	0.1036	0.0000	0.0000	0.1228
	COEF VAR	0.0582	0.0000	0.5522	0.0000	0.0000	0.4285
VOLUME (CUB MIC)	MEAN	0.0026	0.0000	0.0019	0.0000	0.0000	0.0022
	STD DEV	0.0006	0.0000	0.0011	0.0000	0.0000	0.0010
	MEAN LOG	-5.9878	0.0000	-6.4766	0.0000	0.0000	-6.2322
	GEOM MN	0.0025	0.0000	0.0015	0.0000	0.0000	0.0020
	COEF VAR	0.2677	0.0000	0.9596	0.0000	0.0000	0.7515

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: AGA

Manville
(downwind)

TOTAL AREA SCANNED = 6975.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.330000 CUBIC METERS
TOTAL FIBERS COUNTED = 6.0 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		2.0	0.0	2.0
PERCENT TOTAL FIBERS		33.333%	0.000%	33.333%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		3.4122E+05	0.0000E+00	3.4122E+05
(FIBERS PER CUB METER OF AIR)		1.0247E+05	0.0000E+00	1.0247E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		3.8939E+04	0.0000E+00	3.8939E+04
(SQ CM PER CUB METER OF AIR)		1.1693E+04	0.0000E+00	1.1693E+04
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		1.5573E+03	0.0000E+00	1.5573E+03
(PGRAMS PER CUB METER OF AIR)		4.6766E+02	0.0000E+00	4.6766E+02
LENGTH (MICRONS)	MEAN	0.6500	0.0000	0.6500
	STD DEV	0.0500	0.0000	0.0500
	MEAN LOG	-0.4338	0.0000	-0.4338
	GEOM MN	0.6481	0.0000	0.6481
	COEF VAR	0.0801	0.0000	0.0801
DIAMETER (MICRONS)	MEAN	0.0550	0.0000	0.0550
	STD DEV	0.0250	0.0000	0.0250
	MEAN LOG	-3.0161	0.0000	-3.0161
	GEOM MN	0.0490	0.0000	0.0490
	COEF VAR	0.6330	0.0000	0.6330
AREA (SQ MIC)	MEAN	0.1141	0.0000	0.1141
	STD DEV	0.0467	0.0000	0.0467
	MEAN LOG	-2.2623	0.0000	-2.2623
	GEOM MN	0.1041	0.0000	0.1041
	COEF VAR	0.5450	0.0000	0.5450
VOLUME (CUB MIC)	MEAN	0.0018	0.0000	0.0018
	STD DEV	0.0013	0.0000	0.0013
	MEAN LOG	-6.7076	0.0000	-6.7076
	GEOM MN	0.0012	0.0000	0.0012
	COEF VAR	1.4689	0.0000	1.4689

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: ABA

Manville
(downwind)

TOTAL AREA SCANNED = 6975.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.330000 CUBIC METERS
TOTAL FIBERS COUNTED = 6.0 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		2.0	0.0	2.0	0.0	2.0	6.0
PERCENT TOTAL FIBERS		33.333%	0.000%	33.333%	0.000%	33.333%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		3.4122E+05	0.0000E+00	3.4122E+05	0.0000E+00	3.4122E+05	1.0237E+06
(FIBERS PER CUB METER OF AIR)		1.0247E+05	0.0000E+00	1.0247E+05	0.0000E+00	1.0247E+05	3.0740E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		3.8939E+04	0.0000E+00	4.8909E+04	0.0000E+00	2.2844E+05	0.0000E+00
(SQ CM PER CUB METER OF AIR)		1.1693E+04	0.0000E+00	1.4687E+04	0.0000E+00	6.8600E+04	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		1.5573E+03	0.0000E+00				
(PGRAMS PER CUB METER OF AIR)		4.6766E+02	0.0000E+00				
LENGTH (MICRONS)	MEAN	0.6500	0.0000	0.5500	0.0000	1.0500	0.7500
	STD DEV	0.0500	0.0000	0.0500	0.0000	0.4500	0.3403
	MEAN LOG	-0.4338	0.0000	-0.6020	0.0000	-0.0527	-0.3628
	GEOM MN	0.6481	0.0000	0.5477	0.0000	0.9487	0.6957
	COEF VAR	0.0801	0.0000	0.0954	0.0000	0.5811	0.4292
DIAMETER (MICRONS)	MEAN	0.0550	0.0000	0.0750	0.0000	0.1900	0.1067
	STD DEV	0.0250	0.0000	0.0250	0.0000	0.0100	0.0632
	MEAN LOG	-3.0161	0.0000	-2.6492	0.0000	-1.6621	-2.4425
	GEOM MN	0.0490	0.0000	0.0707	0.0000	0.1897	0.0869
	COEF VAR	0.6330	0.0000	0.4142	0.0000	0.0541	0.9530
AREA (SQ MIC)	MEAN	0.1141	0.0000	0.1433	0.0000	0.6695	0.3090
	STD DEV	0.0467	0.0000	0.0609	0.0000	0.2297	0.2910
	MEAN LOG	-2.2623	0.0000	-2.0420	0.0000	-0.4639	-1.5894
	GEOM MN	0.1041	0.0000	0.1298	0.0000	0.6289	0.2041
	COEF VAR	0.5450	0.0000	0.5736	0.0000	0.4298	1.4674
VOLUME (CUB MIC)	MEAN	0.0018	0.0000	0.0028	0.0000	0.0285	0.0110
	STD DEV	0.0013	0.0000	0.0019	0.0000	0.0097	0.0136
	MEAN LOG	-6.7076	0.0000	-6.1419	0.0000	-3.6185	-5.4893
	GEOM MN	0.0012	0.0000	0.0022	0.0000	0.0268	0.0041
	COEF VAR	1.4689	0.0000	1.1909	0.0000	0.4230	3.5899

FIBER AND MASS CONCENTRATION
ASBESTOS DETAIL

SAI SAMPLE ID: A8TEM

Manville
(downwind)

TOTAL AREA SCANNED = 96875.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF TEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.330000 CUBIC METERS
TOTAL FIBERS COUNTED = 16.0 FIBERS

		<= 5 MICRON	> 5 MICRON	ALL CHRYSOTILE
FIBER COUNT (FIBERS)		5.0	0.0	5.0
PERCENT TOTAL FIBERS		31.250%	0.000%	31.250%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		6.1419E+04	0.0000E+00	6.1419E+04
(FIBERS PER CUB METER OF AIR)		1.8444E+04	0.0000E+00	1.8444E+04
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		7.9111E+03	0.0000E+00	7.9111E+03
(SQ CM PER CUB METER OF AIR)		2.3757E+03	0.0000E+00	2.3757E+03
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		3.3324E+02	0.0000E+00	3.3324E+02
(PGRAMS PER CUB METER OF AIR)		1.0007E+02	0.0000E+00	1.0007E+02
LENGTH (MICRONS)	MEAN	0.7100	0.0000	0.7100
	STD DEV	0.3878	0.0000	0.3878
	MEAN LOG	-0.4954	0.0000	-0.4954
	GEOM MN	0.6093	0.0000	0.6093
	COEF VAR	0.7604	0.0000	0.7604
DIAMETER (MICRONS)	MEAN	0.0520	0.0000	0.0520
	STD DEV	0.0264	0.0000	0.0264
	MEAN LOG	-3.0850	0.0000	-3.0850
	GEOM MN	0.0457	0.0000	0.0457
	COEF VAR	0.6749	0.0000	0.6749
AREA (SQ MIC)	MEAN	0.1288	0.0000	0.1288
	STD DEV	0.0974	0.0000	0.0974
	MEAN LOG	-2.3994	0.0000	-2.3994
	GEOM MN	0.0916	0.0000	0.0916
	COEF VAR	1.3465	0.0000	1.3465
VOLUME (CUB MIC)	MEAN	0.0021	0.0000	0.0021
	STD DEV	0.0023	0.0000	0.0023
	MEAN LOG	-6.9069	0.0000	-6.9069
	GEOM MN	0.0010	0.0000	0.0010
	COEF VAR	2.6587	0.0000	2.6587

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A8TEM

Manville
(downwind)

TOTAL AREA SCANNED = 96875.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION = 1.00000 PARTS
AREA OF TEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.330000 CUBIC METERS
TOTAL FIBERS COUNTED = 16.0 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		5.0	1.0	9.0	0.0	1.0	16.0
PERCENT TOTAL FIBERS		31.250%	6.250%	56.250%	0.000%	6.250%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		6.1419E+04	1.2284E+04	1.1055E+05	0.0000E+00	1.2284E+04	1.9654E+05
(FIBERS PER CUB METER OF AIR)		1.8444E+04	3.6889E+03	3.3200E+04	0.0000E+00	3.6889E+03	5.9022E+04
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		7.9111E+03	8.0269E+02	6.8622E+04	0.0000E+00	1.1751E+03	0.0000E+00
(SQ CM PER CUB METER OF AIR)		2.3757E+03	2.4105E+02	2.0607E+04	0.0000E+00	3.5288E+02	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		3.3324E+02	2.3155E+01				
(PGRAMS PER CUB METER OF AIR)		1.0007E+02	6.9533E+00				
LENGTH (MICRONS)	MEAN	0.7100	0.5000	1.2444	0.0000	0.4000	0.9781
	STD DEV	0.3878	0.0000	2.0330	0.0000	0.0000	1.5751
	MEAN LOG	-0.4954	-0.6931	-0.3833	0.0000	-0.9163	-0.4710
	GEOM MN	0.6093	0.5000	0.6816	0.0000	0.4000	0.6244
	COEF VAR	0.7604	0.0000	1.3583	0.0000	0.0000	1.0766
DIAMETER (MICRONS)	MEAN	0.0520	0.0400	0.0867	0.0000	0.0700	0.0719
	STD DEV	0.0264	0.0000	0.0639	0.0000	0.0000	0.0532
	MEAN LOG	-3.0850	-3.2189	-2.7013	0.0000	-2.6593	-2.8509
	GEOM MN	0.0457	0.0400	0.0671	0.0000	0.0700	0.0578
	COEF VAR	0.6749	0.0000	1.0295	0.0000	0.0000	0.8903
AREA (SQ MIC)	MEAN	0.1288	0.0653	0.6207	0.0000	0.0957	0.3995
	STD DEV	0.0974	0.0000	1.3629	0.0000	0.0000	1.0540
	MEAN LOG	-2.3904	-2.7281	-1.8811	0.0000	-2.3469	-2.1223
	GEOM MN	0.0916	0.0653	0.1524	0.0000	0.0957	0.1198
	COEF VAR	1.3465	0.0000	3.1426	0.0000	0.0000	2.3270
VOLUME (CUB MIC)	MEAN	0.0021	0.0006	0.0277	0.0000	0.0015	0.0164
	STD DEV	0.0023	0.0000	0.0682	0.0000	0.0000	0.0527
	MEAN LOG	-6.9069	-7.3725	-6.0274	0.0000	-6.4764	-6.4144
	GEOM MN	0.0010	0.0006	0.0024	0.0000	0.0015	0.0016
	COEF VAR	2.6587	0.0000	6.9467	0.0000	0.0000	4.9161

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A7B

Manville
(upwind)

TOTAL AREA SCANNED = 6975.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.816000 CUBIC METERS
TOTAL FIBERS COUNTED = 7.0 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		0.0	0.0	3.0	0.0	4.0	7.0
PERCENT TOTAL FIBERS		0.000%	0.000%	42.857%	0.000%	57.143%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		0.0000E+00	0.0000E+00	5.1183E+05	0.0000E+00	6.8244E+05	1.1943E+06
(FIBERS PER CUB METER OF AIR)		0.0000E+00	0.0000E+00	1.3413E+05	0.0000E+00	1.7884E+05	3.1296E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		0.0000E+00	0.0000E+00	1.0929E+05	0.0000E+00	2.6866E+05	0.0000E+00
(SQ CM PER CUB METER OF AIR)		0.0000E+00	0.0000E+00	2.8639E+04	0.0000E+00	7.0404E+04	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		0.0000E+00	0.0000E+00				
(PGRAMS PER CUB METER OF AIR)		0.0000E+00	0.0000E+00				
LENGTH (MICRONS)	MEAN	0.0000	0.0000	0.6667	0.0000	0.7750	0.7286
	STD DEV	0.0000	0.0000	0.2055	0.0000	0.2487	0.2373
	MEAN LOG	0.0000	0.0000	-0.4594	0.0000	-0.2990	-0.3678
	GEOM MN	0.0000	0.0000	0.6316	0.0000	0.7416	0.6923
	COEF VAR	0.0000	0.0000	0.4035	0.0000	0.3297	0.3761
DIAMETER (MICRONS)	MEAN	0.0000	0.0000	0.0867	0.0000	0.1375	0.1157
	STD DEV	0.0000	0.0000	0.0492	0.0000	0.0415	0.0515
	MEAN LOG	0.0000	0.0000	-2.6431	0.0000	-2.0279	-2.2916
	GEOM MN	0.0000	0.0000	0.0711	0.0000	0.1316	0.1011
	COEF VAR	0.0000	0.0000	0.9392	0.0000	0.3403	0.7757
AREA (SQ MIC)	MEAN	0.0000	0.0000	0.2135	0.0000	0.3937	0.3165
	STD DEV	0.0000	0.0000	0.1341	0.0000	0.2478	0.2253
	MEAN LOG	0.0000	0.0000	-1.8972	0.0000	-1.0955	-1.4391
	GEOM MN	0.0000	0.0000	0.1500	0.0000	0.3344	0.2372
	COEF VAR	0.0000	0.0000	1.6299	0.0000	0.7158	1.3426
VOLUME (CUB MIC)	MEAN	0.0000	0.0000	0.0057	0.0000	0.0146	0.0108
	STD DEV	0.0000	0.0000	0.0050	0.0000	0.0135	0.0116
	MEAN LOG	0.0000	0.0000	-5.9873	0.0000	-4.5964	-5.1925
	GEOM MN	0.0000	0.0000	0.0025	0.0000	0.0101	0.0056
	COEF VAR	0.0000	0.0000	3.9420	0.0000	1.2700	3.0434

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A7A

Manville
(upwind)

TOTAL AREA SCANNED = 6975.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF SEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.816000 CUBIC METERS
TOTAL FIBERS COUNTED = 8.0 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		0.0	0.0	6.0	0.0	2.0	8.0
PERCENT TOTAL FIBERS		0.000%	0.000%	75.000%	0.000%	25.000%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		0.0000E+00	0.0000E+00	1.0237E+06	0.0000E+00	3.4122E+05	1.3649E+06
(FIBERS PER CUB METER OF AIR)		0.0000E+00	0.0000E+00	2.6825E+05	0.0000E+00	8.9418E+04	3.5767E+05
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		0.0000E+00	0.0000E+00	8.2979E+05	0.0000E+00	6.9678E+04	0.0000E+00
(SQ CM PER CUB METER OF AIR)		0.0000E+00	0.0000E+00	2.1745E+05	0.0000E+00	1.8259E+04	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		0.0000E+00	0.0000E+00				
(PGRAMS PER CUB METER OF AIR)		0.0000E+00	0.0000E+00				
LENGTH (MICRONS)	MEAN	0.0000	0.0000	1.2167	0.0000	0.6000	1.0625
	STD DEV	0.0000	0.0000	1.2562	0.0000	0.0000	1.1202
	MEAN LOG	0.0000	0.0000	-0.1446	0.0000	-0.5108	-0.2361
	GEOM MN	0.0000	0.0000	0.8654	0.0000	0.6000	0.7897
	COEF VAR	0.0000	0.0000	1.0628	0.0000	0.0000	0.9094
DIAMETER (MICRONS)	MEAN	0.0000	0.0000	0.1183	0.0000	0.1000	0.1137
	STD DEV	0.0000	0.0000	0.0878	0.0000	0.0000	0.0765
	MEAN LOG	0.0000	0.0000	-2.3573	0.0000	-2.3026	-2.3436
	GEOM MN	0.0000	0.0000	0.0947	0.0000	0.1000	0.0960
	COEF VAR	0.0000	0.0000	0.8857	0.0000	0.0000	0.7329
AREA (SQ MIC)	MEAN	0.0000	0.0000	0.8106	0.0000	0.2042	0.6590
	STD DEV	0.0000	0.0000	1.3903	0.0000	0.0000	1.2323
	MEAN LOG	0.0000	0.0000	-1.3005	0.0000	-1.5886	-1.3726
	GEOM MN	0.0000	0.0000	0.2724	0.0000	0.2042	0.2535
	COEF VAR	0.0000	0.0000	2.7116	0.0000	0.0000	2.1348
VOLUME (CUB MIC)	MEAN	0.0000	0.0000	0.0509	0.0000	0.0047	0.0393
	STD DEV	0.0000	0.0000	0.1038	0.0000	0.0000	0.0921
	MEAN LOG	0.0000	0.0000	-5.1008	0.0000	-5.3576	-5.1650
	GEOM MN	0.0000	0.0000	0.0061	0.0000	0.0047	0.0057
	COEF VAR	0.0000	0.0000	5.9117	0.0000	0.0000	4.3543

FIBER AND MASS CONCENTRATION
CUMULATIVE SUMMARY

SAI SAMPLE ID: A7TEM

Manville
(upwind)

TOTAL AREA SCANNED =125000.00 SQ MICRONS
TOTAL AREA OF FILTER = 11.900 SQ CM
TOTAL AREA ASHED = 11.900 SQ CM
ALIQUOT FRACTION =1.00000 PARTS
AREA OF TEM MEMBRANE = 11.90 SQ CM
TOTAL VOLUME OF AIR = 3.816000 CUBIC METERS
TOTAL FIBERS COUNTED = 13.0 FIBERS

		CHRYSOTILE	AMPHIBOLE	AMBIGUOUS	NO PATTERN	NON-ASBESTOS	ALL FIBERS
FIBER COUNT (FIBERS)		0.0	1.0	3.0	0.0	9.0	13.0
PERCENT TOTAL FIBERS		0.000%	7.692%	23.077%	0.000%	69.231%	100.000%
FIBER CONCENTRATION (FIBERS PER SQ CM OF FILTER)		0.0000E+00	9.5200E+03	2.8560E+04	0.0000E+00	8.5680E+04	1.2376E+05
(FIBERS PER CUB METER OF AIR)		0.0000E+00	2.4948E+03	7.4843E+03	0.0000E+00	2.2453E+04	3.2432E+04
TOTAL SURFACE AREA (SQ CM PER SQ CM OF FILTER)		0.0000E+00	6.6171E+03	9.0681E+03	0.0000E+00	4.7255E+04	0.0000E+00
(SQ CM PER CUB METER OF AIR)		0.0000E+00	1.7341E+03	2.3763E+03	0.0000E+00	1.2383E+04	0.0000E+00
MASS CONCENTRATION (PGRAMS PER SQ CM OF FILTER)		0.0000E+00	7.0658E+02				
(PGRAMS PER CUB METER OF AIR)		0.0000E+00	1.8516E+02				
LENGTH (MICRONS)	MEAN	0.0000	1.4000	0.6833	0.0000	1.4556	1.2731
	STD DEV	0.0000	0.0000	0.1312	0.0000	1.1383	1.0028
	MEAN LOG	0.0000	0.3365	-0.4013	0.0000	0.1005	0.0028
	GEOM MN	0.0000	1.4000	0.6694	0.0000	1.1057	1.0028
	COEF VAR	0.0000	0.0000	0.2312	0.0000	1.0748	0.9290
DIAMETER (MICRONS)	MEAN	0.0000	0.1500	0.1267	0.0000	0.1111	0.1177
	STD DEV	0.0000	0.0000	0.0525	0.0000	0.0314	0.0381
	MEAN LOG	0.0000	-1.8971	-2.1459	0.0000	-2.2444	-2.1950
	GEOM MN	0.0000	0.1500	0.1170	0.0000	0.1060	0.1114
	COEF VAR	0.0000	0.0000	0.4772	0.0000	0.3823	0.4073
AREA (SQ MIC)	MEAN	0.0000	0.6951	0.3175	0.0000	0.5515	0.5086
	STD DEV	0.0000	0.0000	0.1816	0.0000	0.4449	0.3963
	MEAN LOG	0.0000	-0.3637	-1.3161	0.0000	-0.9406	-0.9829
	GEOM MN	0.0000	0.6951	0.2682	0.0000	0.3904	0.3742
	COEF VAR	0.0000	0.0000	0.7940	0.0000	1.3653	1.2371
VOLUME (CUB MIC)	MEAN	0.0000	0.0247	0.0112	0.0000	0.0162	0.0157
	STD DEV	0.0000	0.0000	0.0100	0.0000	0.0152	0.0139
	MEAN LOG	0.0000	-3.6993	-4.9347	0.0000	-4.6300	-4.6287
	GEOM MN	0.0000	0.0247	0.0072	0.0000	0.0098	0.0098
	COEF VAR	0.0000	0.0000	1.5872	0.0000	2.0391	1.9259

APPENDIX G

Meteorology Summary Data for Study Sites

Period 1941-1970

Site: Johns Manville Stockton

Source: Weather Bureau

Meteorology

Direction

Daily Average	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Wind Speed (mph)	-	-	-	-	-	6.9	6.9	6.9	-	-	-	8.3	8.3	8.3	8.3	-
Direction (Percent)	-	-	-	-	-	1	20	3	-	-	-	3	33	19	20	-

Period: 1969-1973 Meteorology Site: RSR

Sourece: Whittier Station SCAQMD

Average Wind Direction: X

Start Time	S	SSW	SW	WSW	W	WNW	NW	NNW
	123	51	22	43	86	66	43	50
00	7.6	3.2	1.4	2.7	5.3	4.1	2.7	3.1
	115	51	27	38	69	68	40	48
01	7.1	3.2	1.7	2.4	4.3	4.2	2.5	3.0
	115	46	28	32	79	45	45	61
02	7.1	2.9	1.7	2.0	4.9	2.8	2.8	3.8
	96	46	38	29	56	55	33	56
03	6.0	2.9	2.4	1.8	3.5	3.4	2.0	3.5
	92	36	29	25	54	49	31	69
04	5.7	2.2	1.8	1.6	3.4	3.0	1.9	4.3
	86	45	28	19	47	37	40	51
05	5.3	2.8	1.7	1.2	2.9	2.3	2.5	3.2
	109	44	31	25	58	41	47	65
06	6.8	2.7	1.9	1.6	3.6	2.5	2.9	4.0
	145	60	40	34	71	48	37	75
07	9.0	3.7	2.5	2.1	4.4	3.0	2.3	4.7
	182	110	81	52	89	48	57	102
08	11.3	6.8	5.0	3.2	5.5	3.0	3.5	6.3
	257	189	98	102	117	52	65	84
09	16.0	11.8	6.1	6.3	7.3	3.2	4.0	5.2
	284	238	126	142	170	77	48	70
10	17.7	14.8	7.8	8.8	10.6	4.8	3.0	4.4
	276	286	182	168	154	78	53	53
11	17.2	17.8	11.3	10.5	9.6	4.9	3.3	3.3
	280	364	182	173	188	62	41	45
12	17.4	22.6	11.3	10.8	11.7	3.9	2.5	2.8
	245	403	191	230	170	59	40	39
13	15.2	25.0	11.9	14.3	10.6	3.7	2.5	2.4
	274	345	173	252	213	57	35	30
14	17.0	21.4	10.7	15.7	13.2	3.5	2.2	1.9
	257	313	165	285	232	61	49	21
15	16.0	19.4	10.2	17.7	14.4	3.8	3.0	1.3
	257	247	161	255	308	94	55	19
16	16.0	15.3	10.0	15.8	19.1	5.8	3.4	1.2
	235	182	156	244	346	130	67	17
17	14.6	11.3	9.7	15.2	21.5	8.1	4.2	1.1
	215	133	110	202	382	135	68	35
18	13.4	8.3	6.8	12.5	23.7	8.4	4.2	2.2
	186	116	77	138	350	136	59	30
19	11.6	7.2	4.8	8.6	21.7	8.4	3.7	1.9
	188	84	61	92	266	144	43	37
20	11.7	5.2	3.8	5.7	16.5	8.9	2.7	2.3
	157	64	40	84	199	102	55	29
21	9.7	4.0	2.5	5.2	12.4	6.3	3.4	1.8
	155	53	25	62	151	110	30	41
22	9.6	3.3	1.6	3.8	9.4	6.8	1.9	2.5
	127	53	32	53	103	79	44	49
23	7.9	3.3	2.0	3.3	6.4	4.9	2.7	3.0
	4456	3559	2103	2779	3958	1833	1125	1176
	11.5	9.2	5.4	7.2	10.2	4.7	2.9	3.0

Period: 1969-1973 Meteorology Site: RSR

Source: Whittier Station SCAQMD Average Wind Direction X

Start Time	N	NNE	NE	ENE	E	ESE	SE	SSE
00	99	111	162	216	202	105	101	130
	6.1	6.9	10.1	13.4	12.5	6.5	6.3	8.1
01	115	122	171	241	213	90	87	115
	7.1	7.6	10.6	15.0	13.2	5.6	5.4	7.1
02	121	129	181	250	218	87	83	91
	7.5	8.0	11.2	19.5	13.5	5.4	5.2	5.6
03	133	150	158	261	219	101	84	95
	8.3	9.3	9.8	16.2	13.6	6.3	5.2	5.9
04	154	144	165	273	205	91	92	102
	9.6	8.9	10.2	16.9	12.7	5.6	5.7	6.3
05	155	172	186	273	194	100	97	81
	9.6	10.7	11.5	16.9	12.0	6.2	6.0	5.0
06	136	149	170	258	201	95	79	101
	8.5	9.3	10.6	16.0	12.5	5.9	4.9	6.3
07	128	128	144	190	192	114	115	87
	8.0	8.0	9.0	11.8	11.9	7.1	7.2	5.4
08	115	79	88	105	146	110	116	129
	7.1	4.9	5.5	6.5	9.1	6.8	7.2	8.0
09	99	36	42	66	108	82	82	129
	6.2	2.2	2.6	4.1	6.7	5.1	5.1	8.0
10	71	21	23	29	67	66	63	113
	4.4	1.3	1.4	1.8	4.2	4.1	3.9	7.0
11	49	17	16	18	63	38	48	107
	3.1	1.1	1.0	1.1	3.9	2.4	3.0	6.7
12	41	10	8	20	36	30	37	91
	2.5	.6	.5	1.2	2.2	1.9	2.3	5.7
13	21	11	7	9	26	25	33	101
	1.3	.7	.4	.6	1.6	1.6	2.0	6.3
14	23	9	12	8	17	17	32	113
	1.4	.6	.7	.5	1.1	1.1	2.0	7.0
15	19	3	11	15	23	17	25	114
	1.2	.2	.7	.9	1.4	1.1	1.6	7.1
16	15	6	8	10	20	27	30	98
	.9	.4	.5	.6	1.2	1.7	1.9	6.1
17	17	11	7	19	19	21	41	98
	1.1	.7	.4	1.2	1.2	1.3	2.5	6.1
18	32	18	19	24	38	32	55	112
	2.0	1.1	1.2	1.5	2.4	2.0	3.4	7.0
19	42	32	34	73	84	55	69	129
	2.6	2.0	2.1	4.5	5.2	3.4	4.3	8.0
20	46	48	59	114	121	81	104	123
	2.9	3.0	3.7	7.1	7.5	5.0	6.5	7.6
21	55	69	82	157	152	88	121	157
	3.4	4.3	5.1	9.7	9.4	5.5	7.5	9.7
22	78	81	122	178	178	94	118	135
	4.8	5.0	7.6	11.0	11.0	5.8	7.3	8.4
23	91	108	127	224	182	87	122	130
	5.6	6.7	7.9	13.9	11.3	5.4	7.6	8.1
	1855	1664	2002	3031	2924	1653	1834	2681
	4.8	4.3	5.2	7.8	7.6	4.3	4.7	6.9

Period: 1969-1973 Meteorology Site: RSR

Source: Whittier Station SCAQMD Average Wind Speed: X

Start Time	S	SSW	SW	WSW	W	WNW	NW	NNW
	123	51	22	43	86	66	43	50
00	2.4	2.8	2.6	2.5	2.3	2.1	2.5	3.2
	115	51	27	38	69	68	40	48
01	2.3	2.6	2.4	2.5	2.2	2.5	3.2	2.8
	115	46	28	32	79	45	45	61
02	2.4	2.5	2.2	2.4	2.1	2.1	3.3	3.0
	96	46	38	29	56	55	33	56
03	2.7	2.4	2.8	2.7	1.8	2.2	3.1	2.4
	92	36	29	25	54	49	31	69
04	2.8	2.3	2.7	2.8	2.1	2.0	2.8	2.4
	86	45	28	19	47	37	40	51
05	2.7	2.7	2.7	2.3	2.1	1.9	2.2	2.2
	109	44	31	25	58	41	47	65
06	2.5	2.5	2.7	1.8	2.3	2.0	2.2	2.4
	145	60	40	34	71	48	37	75
07	2.5	2.6	2.8	2.6	2.3	2.4	2.8	2.5
	182	110	81	52	89	48	57	102
08	2.6	2.6	2.8	2.9	2.3	2.3	3.0	2.7
	257	189	98	101	117	52	65	84
09	2.9	3.3	3.1	3.3	3.0	2.8	3.8	3.3
	283	238	126	142	170	77	48	70
10	3.5	3.7	3.7	4.1	3.5	3.5	4.8	3.9
	275	286	182	168	154	78	53	53
11	4.1	4.5	4.7	4.9	4.7	4.5	5.6	4.8
	280	363	182	173	188	62	41	45
12	5.0	5.5	5.3	6.3	5.8	5.2	5.5	5.9
	244	403	191	230	170	59	40	39
13	5.8	6.0	6.6	6.8	6.6	6.7	6.3	6.5
	274	345	173	252	213	57	35	30
14	6.1	6.7	6.8	7.5	7.3	7.1	7.5	8.0
	257	313	165	285	232	61	49	21
15	6.5	6.7	7.4	7.7	7.5	6.8	8.9	8.2
	257	247	161	255	308	93	55	19
16	5.9	6.4	6.7	7.5	6.9	7.1	8.2	8.3
	235	182	156	244	345	130	67	17
17	5.3	5.6	6.3	6.2	5.8	5.9	7.3	7.7
	215	133	110	202	381	135	68	35
18	4.8	4.9	5.1	5.0	4.6	5.0	5.4	4.3
	186	116	77	138	350	136	59	29
19	4.2	4.5	4.1	4.1	3.7	3.8	4.2	4.0
	188	84	61	92	266	144	43	37
20	3.5	3.9	3.4	3.1	2.9	3.2	3.6	3.4
	157	64	40	84	199	102	55	29
21	3.1	3.3	3.0	2.7	2.5	2.7	3.5	3.3
	155	53	25	62	151	110	30	41
22	3.0	2.9	3.2	2.7	2.0	2.4	2.6	4.1
	127	53	32	53	103	79	44	49
23	2.6	3.2	2.9	2.4	2.1	2.3	2.4	3.8
	4453	3558	2103	2778	3956	1832	1125	1175
	4.1	4.9	5.0	5.4	4.4	3.9	4.5	3.7

Period: 1969-1973 Meteorology Site: RSR

Source: Whittier Station SCAQMD Average Wind Speed: X

Start Time	N	NNE	NE	ENE	E	ESE	SE	SSE
	99	111	162	216	201	105	101	130
00	2.5	2.5	2.6	2.8	2.8	2.9	2.3	2.5
	115	122	170	241	213	90	87	115
01	2.4	2.7	2.5	2.9	2.7	2.8	2.6	2.4
	121	129	181	250	217	87	83	91
02	2.5	2.5	2.7	2.9	2.7	2.7	2.2	2.7
	133	150	158	261	218	101	84	95
03	2.6	2.5	2.7	2.7	2.7	2.8	2.4	2.3
	154	143	165	273	205	91	92	102
04	2.3	2.3	2.9	2.8	2.6	2.7	2.2	2.4
	155	171	186	273	194	100	97	81
05	2.4	2.6	2.8	2.8	2.7	2.7	2.2	2.1
	136	149	170	258	200	95	79	101
06	2.7	2.7	3.0	2.8	2.8	2.9	2.5	2.4
	128	128	144	190	191	114	115	87
07	2.6	2.8	3.3	3.0	3.0	2.9	3.0	2.9
	115	79	88	105	145	110	116	129
08	2.9	2.7	3.4	3.3	3.2	3.1	3.0	2.7
	99	36	42	66	108	82	82	129
09	3.4	3.4	3.8	3.9	3.9	2.9	3.6	3.1
	71	21	23	29	67	66	63	113
10	3.9	3.9	6.0	5.0	4.6	3.4	4.0	3.5
	49	17	16	18	63	38	48	107
11	4.5	4.5	6.4	5.9	5.1	3.8	3.7	3.9
	41	10	8	20	36	30	37	91
12	4.1	4.8	6.8	6.1	6.6	5.6	4.5	4.2
	21	11	7	9	26	25	33	101
13	4.5	5.1	9.0	7.4	7.6	5.8	4.9	5.1
	23	9	12	8	17	17	32	113
14	5.1	6.8	6.8	6.4	8.3	7.1	4.9	5.6
	19	3	11	15	23	17	25	114
15	6.7	7.0	9.0	6.0	7.1	5.9	4.9	5.7
	15	6	8	10	20	27	30	98
16	5.0	3.2	6.6	8.3	6.6	5.2	4.5	5.8
	17	11	7	19	19	21	41	98
17	4.1	3.0	4.4	6.4	4.8	4.1	4.0	4.8
	32	18	19	24	38	32	55	112
18	2.1	2.6	3.5	4.7	3.5	2.6	3.5	4.0
	42	32	34	73	84	55	69	129
19	2.7	2.3	3.3	2.9	2.8	2.8	3.2	3.7
	46	48	59	114	120	81	104	123
20	2.2	2.4	3.0	3.1	2.8	3.0	2.8	3.4
	55	69	82	157	151	88	121	157
21	2.5	2.6	2.9	3.1	3.0	2.7	2.8	3.1
	78	81	122	178	177	94	118	135
22	2.2	2.7	3.0	3.2	2.9	3.0	2.7	2.7
	91	108	127	224	181	87	122	130
23	2.6	2.5	2.9	3.0	2.8	2.9	2.6	2.6
	1855	1662	2001	3031	2914	1653	1834	2681
	2.8	2.7	3.1	3.1	3.1	3.1	3.0	3.5

Period: 1978-1979

Site: Kaiser Steel

Source: SCAQMD*

Meteorology

Direction

Daily Average	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Wind Speed (mph)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Direction (Percent)	10	8	2	2	2	2	2	2	2	8	10	10	10	10	10	10

* Two years data provided: Approximately 16,000 hourly speed and direction averages not computerized therefore results estimated

Period: 1971-1974

Site: Allied,

Source: Lennox Station SCAQMD

Meteorology

Average Wind Speed x

Average Wind Direction

Start Time	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	WNW
	Direction															
00	2.3	2.4	2.2	2.3	2.6	2.7	3.8	2.6	2.1	2.4	2.5	3.2	3.7	3.7	3.3	2.9
01	2.4	2.4	2.1	2.4	2.4	2.6	2.4	2.2	2.1	2.6	2.5	3.4	3.4	3.3	3.0	2.8
02	2.4	2.3	2.1	2.3	2.3	2.6	2.2	2.4	2.4	2.3	2.4	3.4	3.4	3.3	2.8	2.9
03	2.6	2.2	2.1	2.4	2.2	2.6	2.0	1.9	2.4	2.2	2.2	3.2	3.3	3.5	2.8	2.5
04	2.8	2.2	2.0	2.4	2.2	2.3	2.0	2.5	2.2	2.2	2.4	2.8	3.5	3.2	3.1	2.3
05	2.3	2.5	2.1	2.3	2.4	2.4	2.1	2.3	2.2	2.2	2.3	3.0	3.7	3.1	3.1	2.7
06	2.4	2.6	2.5	2.6	2.6	2.7	2.5	2.5	2.4	2.6	2.5	3.3	4.3	3.2	3.7	3.0
07	2.9	3.0	2.6	2.8	2.9	3.0	2.8	2.5	2.8	3.0	3.0	3.3	4.0	3.8	4.0	3.3
08	3.7	3.1	3.0	3.1	3.1	3.1	2.9	3.1	3.0	3.3	3.5	3.9	4.5	3.9	4.6	6.2
09	4.6	3.4	3.0	3.4	3.4	3.6	3.1	3.5	3.5	3.9	4.2	4.6	4.8	4.8	5.3	6.0
10	4.5	3.2	3.4	3.2	3.5	3.6	4.0	3.6	3.7	4.4	5.1	5.6	5.6	5.0	5.9	7.5
11	4.5	3.6	3.7	3.3	3.5	3.9	4.5	4.2	3.7	5.0	5.7	6.4	6.4	5.8	6.1	5.6
12	3.8	2.7	4.5	3.5	3.1	3.8	4.7	4.2	4.0	5.5	6.1	6.9	7.1	6.2	7.0	9.5
13	3.6	3.4	5.2	3.8	3.6	3.6	4.9	4.0	4.9	4.8	6.5	7.1	7.7	6.6	8.6	10.5
14	5.0	2.8	5.2	4.3	5.4	4.8	5.5	4.3	5.1	5.6	5.9	7.2	8.0	6.9	9.2	6.0
15	5.4	ND	6.0	3.6	5.0	5.0	4.8	4.9	3.0	6.0	6.3	7.0	7.8	6.8	8.6	6.0
16	7.0	4.5	4.5	2.7	4.8	5.0	5.3	4.8	3.8	4.7	5.4	6.6	7.3	6.0	8.9	6.0
17	6.5	ND	5.8	1.6	5.0	3.0	3.5	5.1	3.4	4.0	4.7	6.1	6.7	5.2	6.9	4.7
18	8.0	4.3	4.2	3.7	2.2	4.4	3.3	2.9	2.6	3.5	4.3	5.4	6.0	4.8	5.2	6.4
19	5.4	2.8	3.3	3.2	1.9	2.6	3.2	3.6	2.6	3.3	3.7	4.9	5.2	4.8	5.1	3.9
20	3.6	2.1	2.4	2.7	2.2	2.6	2.6	3.4	2.8	2.9	3.3	4.5	4.8	4.0	5.5	4.6
21	4.0	2.5	2.6	2.2	2.3	2.9	2.6	2.8	2.7	2.8	3.0	4.0	4.4	4.0	4.7	4.5
22	3.5	2.2	2.1	2.4	2.2	2.8	2.4	2.5	2.6	2.5	2.7	3.8	4.1	4.3	3.6	3.9
23	3.6	2.5	2.2	2.4	2.2	2.7	2.3	2.8	2.4	2.4	2.7	3.3	4.0	3.9	3.7	2.8
	3.5	2.6	2.5	2.6	2.7	2.9	3.0	3.0	2.8	3.1	4.0	5.7	6.0	4.4	4.3	3.6

Period: 1971-1974

Source: Lennox Station

Meteorology

Site: Allied

Average Wind Speed _____
Average Wind Direction x

Direction

Start Time	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	WNW
00	2.7	7.1	8.5	8.0	9.2	5.1	3.2	2.9	4.4	7.6	6.8	8.0	11.9	6.0	5.8	2.8
01	2.2	7.1	9.5	9.2	10.8	6.0	2.1	3.7	4.4	6.7	6.3	6.2	9.6	6.1	6.6	3.3
02	2.1	8.4	9.5	9.3	12.5	6.2	3.4	4.7	4.2	5.3	5.6	5.2	8.4	5.7	6.6	2.9
03	2.5	6.6	10.8	9.7	12.9	7.3	4.7	4.1	4.9	4.4	4.8	4.1	8.4	6.7	5.5	2.5
04	2.4	6.4	10.8	10.9	14.3	7.6	5.5	3.7	4.6	4.4	4.3	4.8	6.1	5.9	5.9	2.4
05	2.2	6.2	9.7	11.5	16.4	7.3	5.5	4.5	4.1	3.8	4.7	3.9	6.0	5.7	5.7	2.7
06	1.8	7.6	7.9	12.6	18.1	7.9	4.6	3.8	4.4	4.3	4.3	3.7	5.8	4.4	6.2	2.8
07	1.8	6.5	9.1	12.9	15.9	8.8	5.0	4.4	5.0	4.3	4.2	5.1	7.0	3.0	4.9	2.1
08	1.5	6.1	9.4	11.6	14.4	8.0	6.5	5.5	5.9	3.4	4.8	7.2	9.4	2.3	2.6	1.3
09	1.4	4.0	6.9	7.4	10.8	6.3	5.5	6.2	7.1	4.4	6.7	11.9	14.7	3.3	2.4	1.1
10	1.6	2.6	4.6	4.4	6.6	5.6	5.0	5.7	5.0	3.3	8.0	21.7	19.7	3.0	2.3	.9
11	.9	1.4	3.2	2.5	3.7	2.7	3.8	4.1	4.1	2.3	8.8	31.3	25.1	3.3	2.2	.6
12	1.3	.7	1.9	1.4	2.0	1.7	2.7	2.5	2.3	2.1	10.5	34.6	30.7	3.4	2.0	.2
13	.6	.5	1.2	.8	1.1	.9	1.5	1.2	1.3	2.6	9.3	39.2	34.8	3.4	1.5	.2
14	.3	.4	.9	.5	.7	.7	1.1	.9	1.0	2.2	6.1	41.2	39.2	3.4	1.4	.1
15	.4	ND	.2	.5	.9	.5	1.2	.9	.3	2.0	5.7	41.0	41.6	3.4	1.3	.1
16	.5	.2	.2	.5	.7	.3	1.2	.8	.5	2.3	4.4	39.0	43.8	4.4	1.1	.2
17	.6	ND	.4	.4	.5	.5	.9	.7	1.1	1.9	5.5	37.2	43.5	5.0	1.5	.3
18	.9	.2	.4	.2	1.0	.5	1.2	.9	1.0	2.8	6.0	34.6	42.0	4.9	2.9	.6
19	1.1	.3	.9	.9	.6	1.4	1.1	1.4	3.1	6.0	7.3	28.2	36.8	5.0	4.2	1.6
20	2.0	1.7	1.5	1.2	2.3	1.6	1.3	1.9	5.1	7.6	7.4	23.9	30.5	6.0	3.6	2.2
21	2.0	2.2	2.6	2.9	5.0	2.8	2.6	2.2	6.9	8.7	9.9	16.9	23.4	5.4	4.2	2.3
22	2.4	4.2	5.3	4.0	5.9	4.0	3.4	3.4	6.2	9.8	7.9	14.4	17.5	4.5	4.7	2.7
23	2.3	5.9	8.6	5.9	8.4	4.0	3.7	3.0	6.5	8.0	6.8	9.8	14.9	4.8	5.2	2.2
	1.6	3.6	5.2	5.4	7.3	4.1	3.2	3.0	3.9	4.6	6.5	19.7	22.1	4.5	3.8	1.6

Period: 1962-1974

Site: Stauffer

Source: Long Beach SCAQMD

Meteorology

Average Wind Speed

Average Wind Direction X

Start Time	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	WNW
								Direction								
00	7.8	7.7	8.9	11.5	11.2	4.6	3.5	5.2	3.8	1.5	1.3	2.1	5.9	12.9	7.3	4.8
01	7.1	8.6	9.6	12.8	12.2	4.5	4.5	4.3	3.8	1.7	1.3	1.9	4.9	11.5	6.0	5.3
02	8.2	8.6	10.9	13.2	11.6	5.8	4.1	3.8	3.1	2.0	1.3	1.5	5.1	10.7	5.0	5.1
03	8.0	10.1	11.4	13.5	12.2	5.9	3.8	3.8	3.4	1.5	1.1	2.0	4.4	9.2	5.0	4.6
04	8.5	10.3	11.9	12.9	12.2	6.4	4.3	3.5	3.1	1.4	1.3	2.0	4.2	8.6	4.4	4.9
05	9.5	10.2	11.1	13.4	13.2	5.9	4.2	3.5	3.2	1.3	1.3	1.7	3.8	8.9	4.5	4.4
06	9.1	10.5	11.2	13.2	13.1	5.9	4.1	3.7	2.7	1.4	1.3	1.4	3.8	8.7	5.5	4.2
07	7.7	9.6	10.4	12.3	13.7	7.0	4.8	4.4	4.0	1.7	1.6	1.8	4.3	7.7	4.9	4.2
08	6.0	7.6	8.3	10.3	13.1	6.3	6.0	6.1	6.8	3.3	2.0	2.4	5.3	8.6	4.2	3.7
09	4.4	5.0	5.7	7.3	11.3	6.5	5.4	7.5	11.3	5.9	3.9	3.6	7.4	8.0	3.8	3.1
1[illegible]	3.8	2.8	3.3	4.6	8.4	5.4	4.8	7.7	16.5	10.6	4.8	4.1	8.0	8.3	4.0	2.9
11	2.3	1.5	1.7	3.0	5.1	3.7	4.2	7.1	21.2	14.4	6.8	5.5	9.5	8.6	3.8	1.7
12	1.5	.8	1.1	1.7	3.1	2.8	3.1	5.7	23.5	16.6	7.4	6.3	11.4	10.7	3.2	1.2
13	1.0	.4	.8	1.1	1.8	1.7	2.3	4.3	23.7	16.8	7.3	5.6	14.2	14.7	3.4	.8
14	.7	.6	.6	1.0	1.8	1.3	1.4	3.4	20.3	14.2	5.6	5.1	17.9	21.1	4.1	.9
15	.5	.3	.3	.9	1.4	1.0	1.2	3.3	15.0	10.3	4.8	4.7	22.3	27.4	5.8	.7
16	.6	.2	.4	.7	1.5	.9	1.2	3.0	10.8	7.5	3.0	4.6	24.3	33.8	7.0	.7
17	.6	.3	.6	1.0	1.4	1.0	1.0	2.6	7.7	4.9	2.3	3.9	24.7	37.8	9.2	1.0
18	1.2	.6	.8	1.3	1.6	1.1	1.5	2.6	5.7	3.3	1.7	3.2	23.0	39.6	10.7	2.1
19	2.1	1.6	1.8	2.2	2.8	1.5	1.6	3.1	4.7	2.4	1.4	3.0	18.2	36.8	12.8	3.9
20	3.3	3.2	3.5	4.4	3.7	1.9	2.1	3.7	3.8	2.1	1.4	3.0	13.8	32.0	12.8	5.2
21	5.0	3.9	5.3	6.8	6.6	2.8	2.9	4.0	3.5	1.6	1.5	2.5	10.9	24.6	11.5	6.5
22	6.4	5.2	6.6	9.0	8.6	3.5	3.4	4.6	3.6	1.7	1.5	2.6	8.6	18.1	9.9	6.7
2[illegible]	7.0	6.7	8.1	10.4	10.1	4.0	3.9	4.5	4.1	1.3	1.1	2.7	7.0	14.4	8.2	6.5
	4.7	4.8	5.6	7.0	7.6	3.8	3.3	4.4	8.7	5.4	2.8	3.2	11.0	17.6	6.6	3.5

Period: 1962-1974

Site: Stauffer

Source: Long Beach

Meteorology

Average Wind Speed ✕

Average Wind Direction

Direction

Start Time	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	WNW
00	2.6	2.5	2.3	2.4	2.6	3.0	4.3	3.8	3.5	3.2	3.8	2.9	3.7	3.0	2.5	2.7
01	2.8	2.4	2.3	2.3	2.4	3.1	3.9	3.8	3.8	2.9	2.9	3.1	3.7	2.9	2.5	2.5
02	2.8	2.6	2.4	2.4	2.5	3.1	3.8	3.5	3.5	3.3	3.1	2.7	3.5	2.9	2.5	2.5
03	2.8	2.7	2.3	2.3	2.5	3.2	3.5	3.7	3.3	3.5	2.8	2.8	3.4	2.9	2.5	2.7
04	2.9	2.7	2.3	2.3	2.6	3.0	3.5	3.7	3.2	3.5	2.2	2.7	3.3	2.8	2.9	2.8
05	2.9	2.6	2.4	2.3	2.7	3.0	3.6	3.4	3.3	3.5	2.6	2.7	3.2	3.0	2.8	2.5
06	3.0	2.6	2.5	2.4	2.7	3.2	3.5	3.5	3.7	3.2	3.3	2.6	3.0	3.2	2.6	2.7
07	2.9	2.8	2.7	2.7	2.8	3.3	4.0	3.8	3.3	3.5	4.1	3.3	3.5	3.3	2.9	2.7
08	3.2	3.0	2.8	3.0	3.1	3.4	3.9	3.8	3.7	3.7	3.5	3.0	3.4	3.7	3.5	2.9
09	3.0	3.2	2.8	3.2	3.3	3.6	3.8	4.3	4.3	4.3	3.8	3.2	3.9	4.1	3.9	2.9
10	3.0	3.2	3.3	3.7	3.6	3.9	4.3	4.6	4.8	4.8	4.2	4.4	4.5	4.6	4.0	3.4
11	3.3	3.3	3.4	4.0	4.2	4.3	5.0	4.9	5.2	5.3	5.3	4.6	5.4	5.2	4.9	3.2
12	3.6	3.5	4.3	5.4	5.3	5.5	5.8	5.2	5.7	5.8	5.7	5.6	6.3	6.3	5.8	4.2
13	4.0	4.3	4.5	5.8	6.3	6.9	6.1	5.6	5.8	6.0	6.1	6.5	7.5	7.5	7.2	4.0
14	4.2	3.9	4.4	6.2	6.7	7.5	6.1	5.9	6.0	5.9	6.3	6.8	8.8	8.1	8.4	5.5
15	5.0	5.2	5.5	7.0	6.7	8.1	6.4	6.1	5.8	5.7	5.8	7.3	8.9	8.5	9.1	5.6
16	4.9	4.4	5.4	7.1	6.6	7.3	6.6	5.8	5.6	5.4	5.7	6.9	8.7	8.1	8.4	6.6
17	4.5	5.8	3.7	6.0	6.0	6.0	5.8	5.2	5.4	4.9	4.7	6.3	8.0	7.3	7.1	5.0
18	3.0	2.8	3.7	4.0	4.8	5.3	4.9	5.1	4.9	4.5	3.9	4.7	6.9	6.2	5.5	4.3
19	2.4	2.4	2.8	3.4	3.3	4.8	4.5	4.4	4.4	3.9	3.6	4.0	5.9	5.2	4.5	3.4
20	2.0	2.0	2.1	2.6	2.9	4.3	3.6	4.1	4.3	3.7	3.1	3.7	5.1	4.3	3.9	2.9
21	2.4	2.1	2.1	2.4	2.7	3.5	4.1	4.2	4.1	3.8	2.8	3.5	4.4	3.7	3.1	2.7
22	2.2	2.2	2.2	2.3	2.7	3.4	3.9	4.2	4.1	3.3	3.0	3.4	4.1	3.3	2.9	2.5
23	2.4	2.2	2.3	2.2	2.6	3.2	4.0	3.9	3.7	3.6	2.8	3.4	3.9	3.1	2.6	2.7
	2.8	2.7	2.5	2.7	3.0	3.7	4.2	4.4	5.0	5.1	4.7	4.7	6.3	5.4	4.4	2.9

Period 1956-1974

Source: DOW

Site: DOW and DuPONT

Meteorology

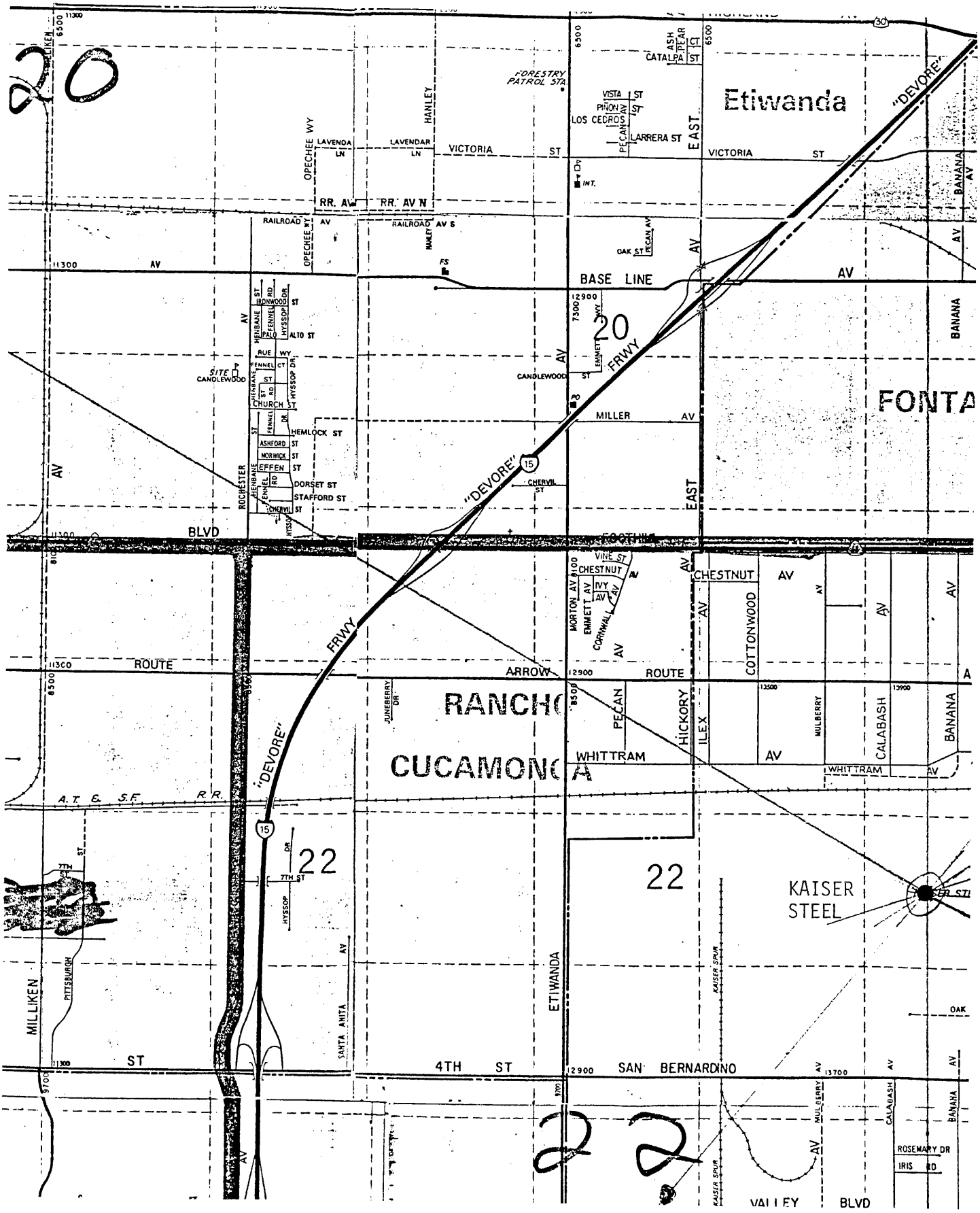
Direction

Daily Average	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Wind Speed (mph)	6.8	5.2	3.8	4.7	2.5	2.5	3.5	3.7	3.7	4.7	5.0	7.5	9	10	7.7	7.7
Direction (Percent)	3.8	2.5	1.3	1.5	2.5	2.6	7.6	3.6	2.0	2.5	6	10	16	18.8	12.8	6.5

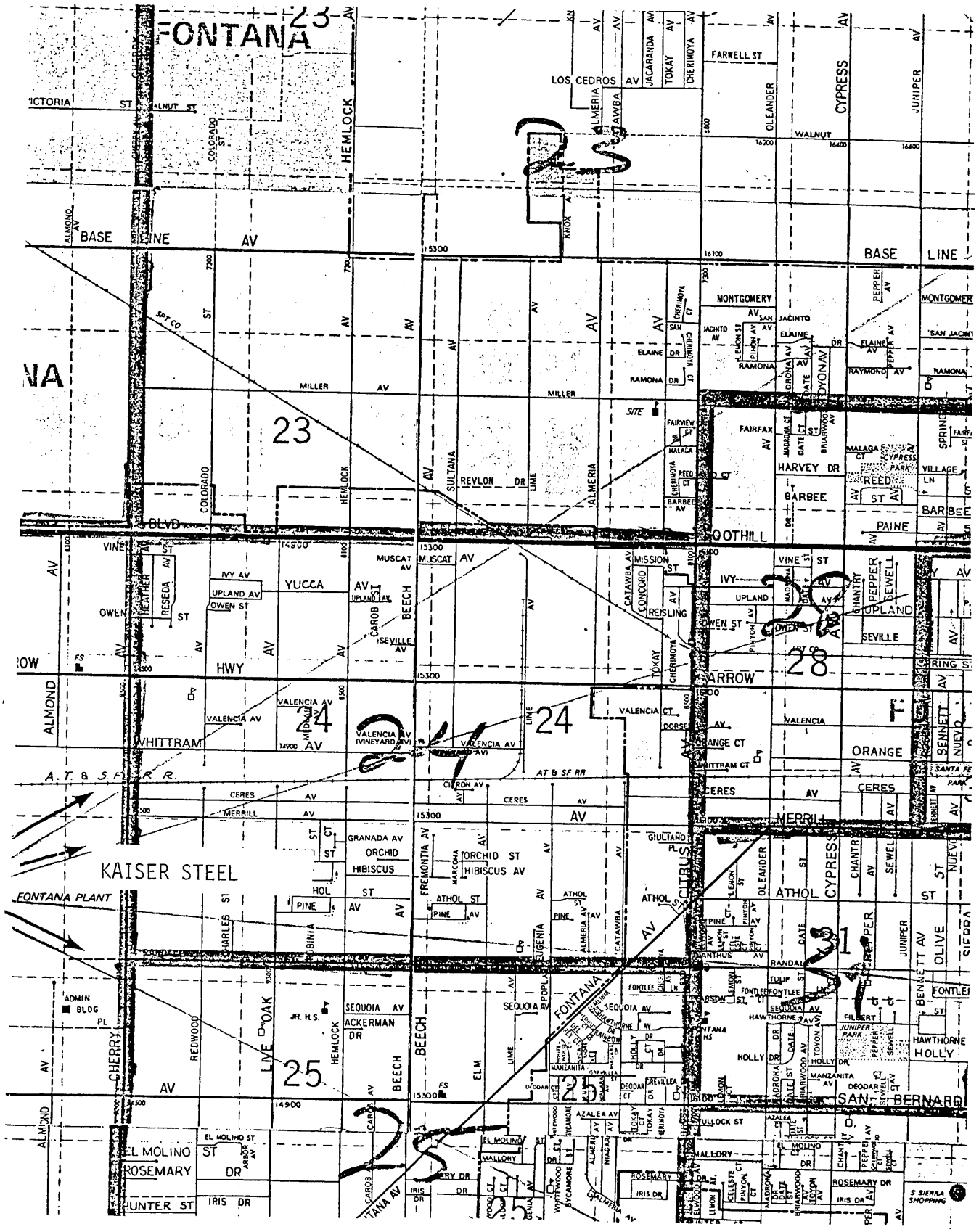
APPENDIX H

Census Tract Maps for Exposure Calculations

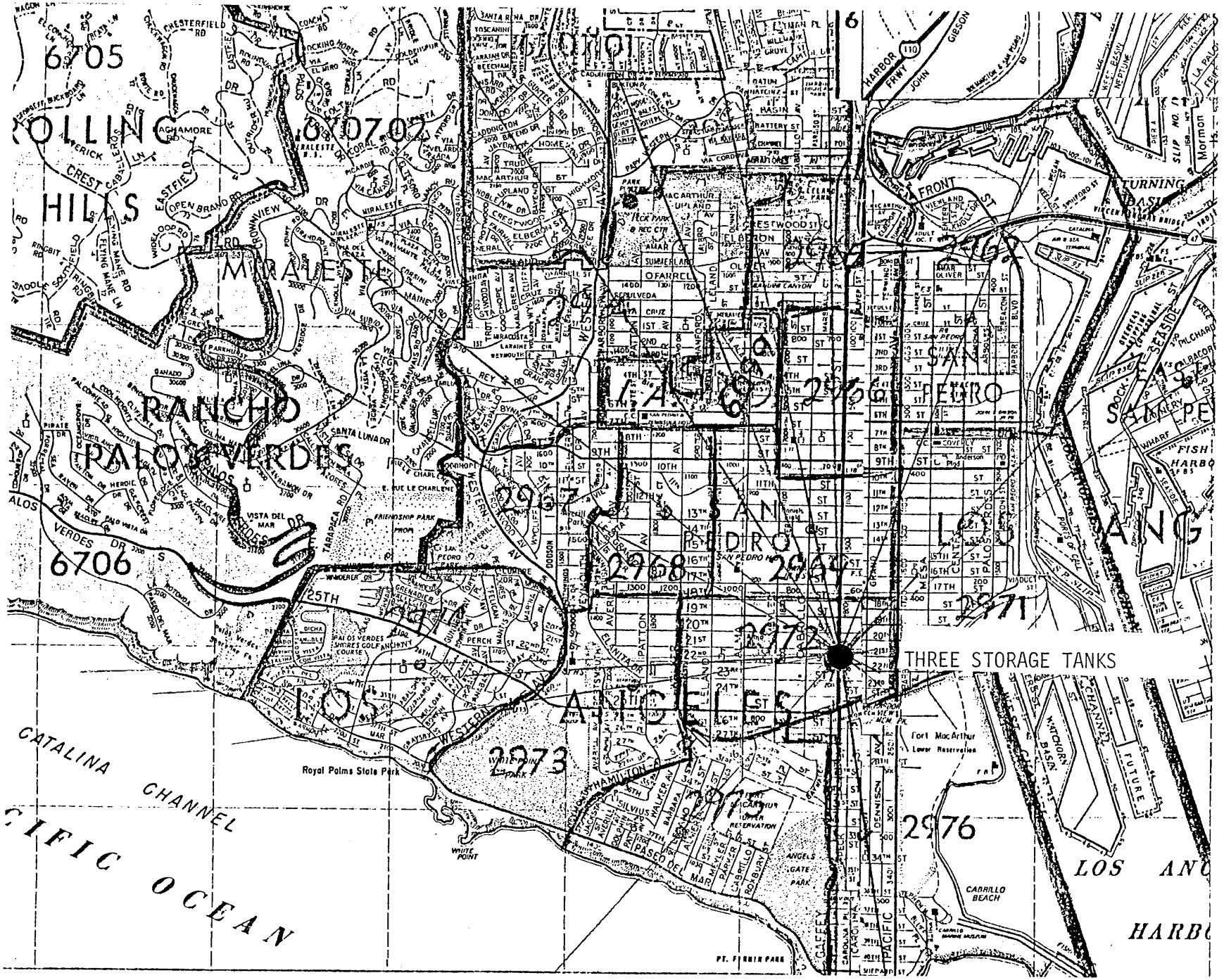
Western Plant Area - Kaiser Steel, Fontana



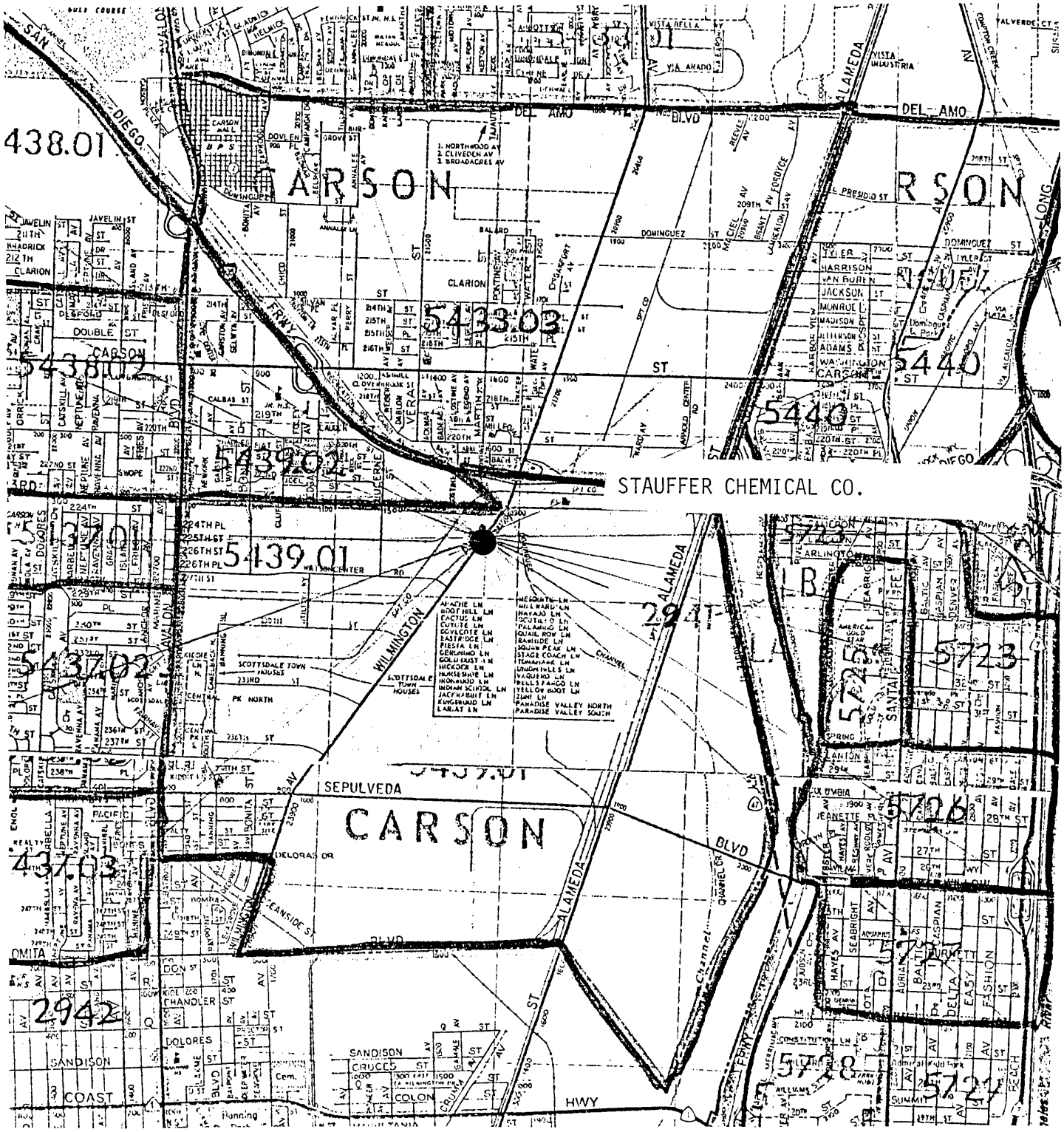
Eastern Plant Area - Kaiser Steel, Fontana



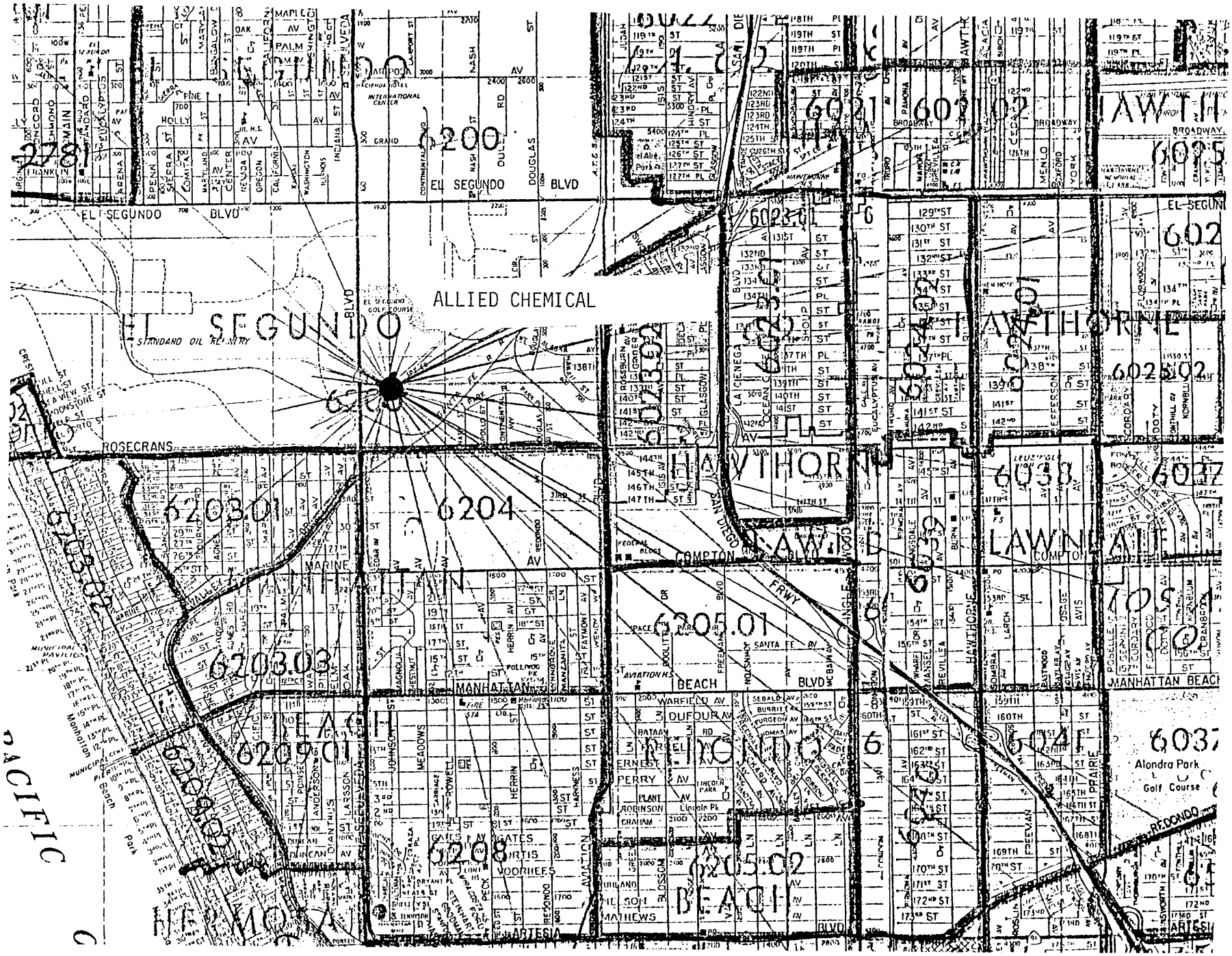
Offsite Storage Tanks - Stauffer Chemical Co., San Pedro



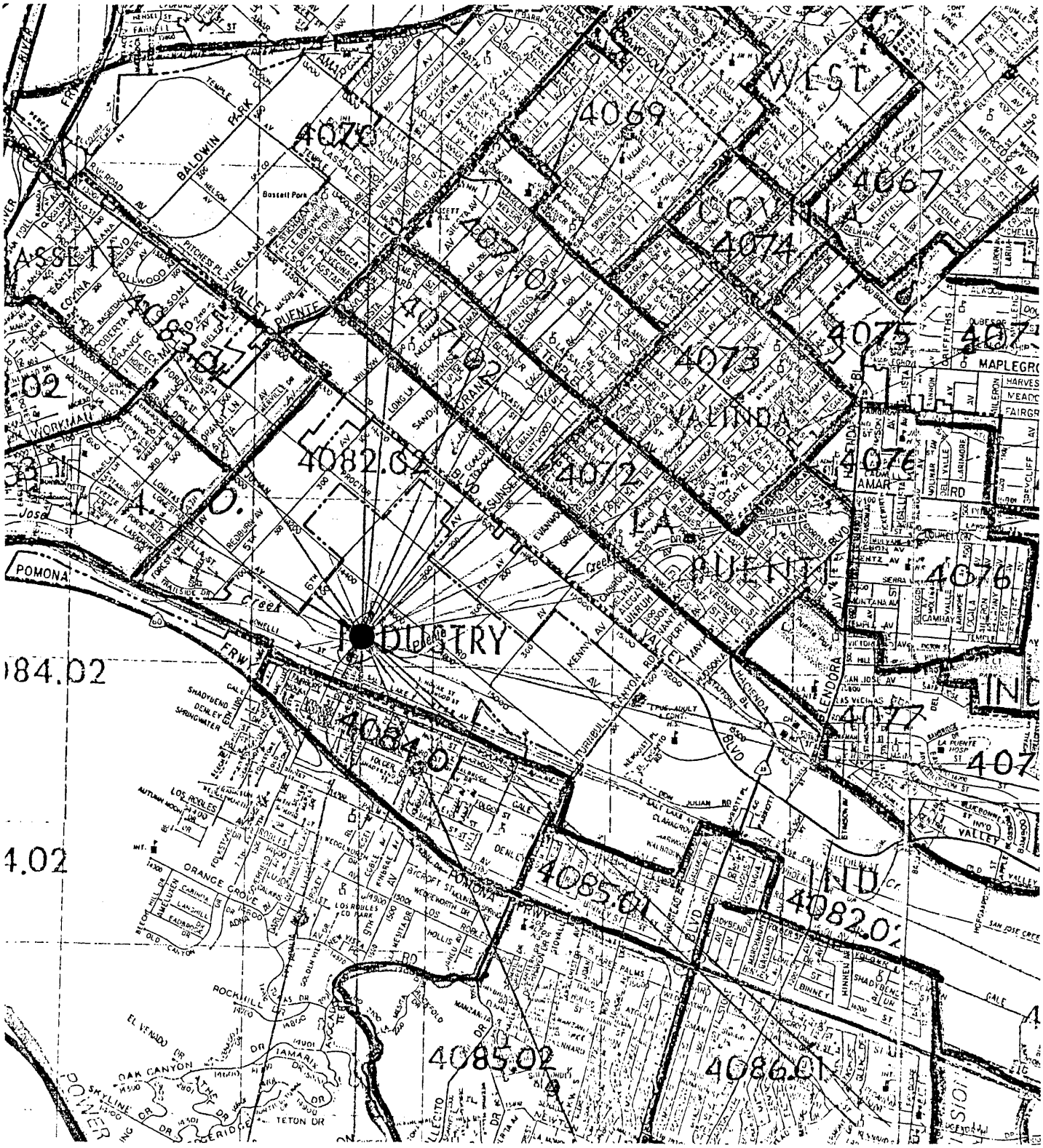
Main Plant Site - Stauffer Chemical Co., Carson



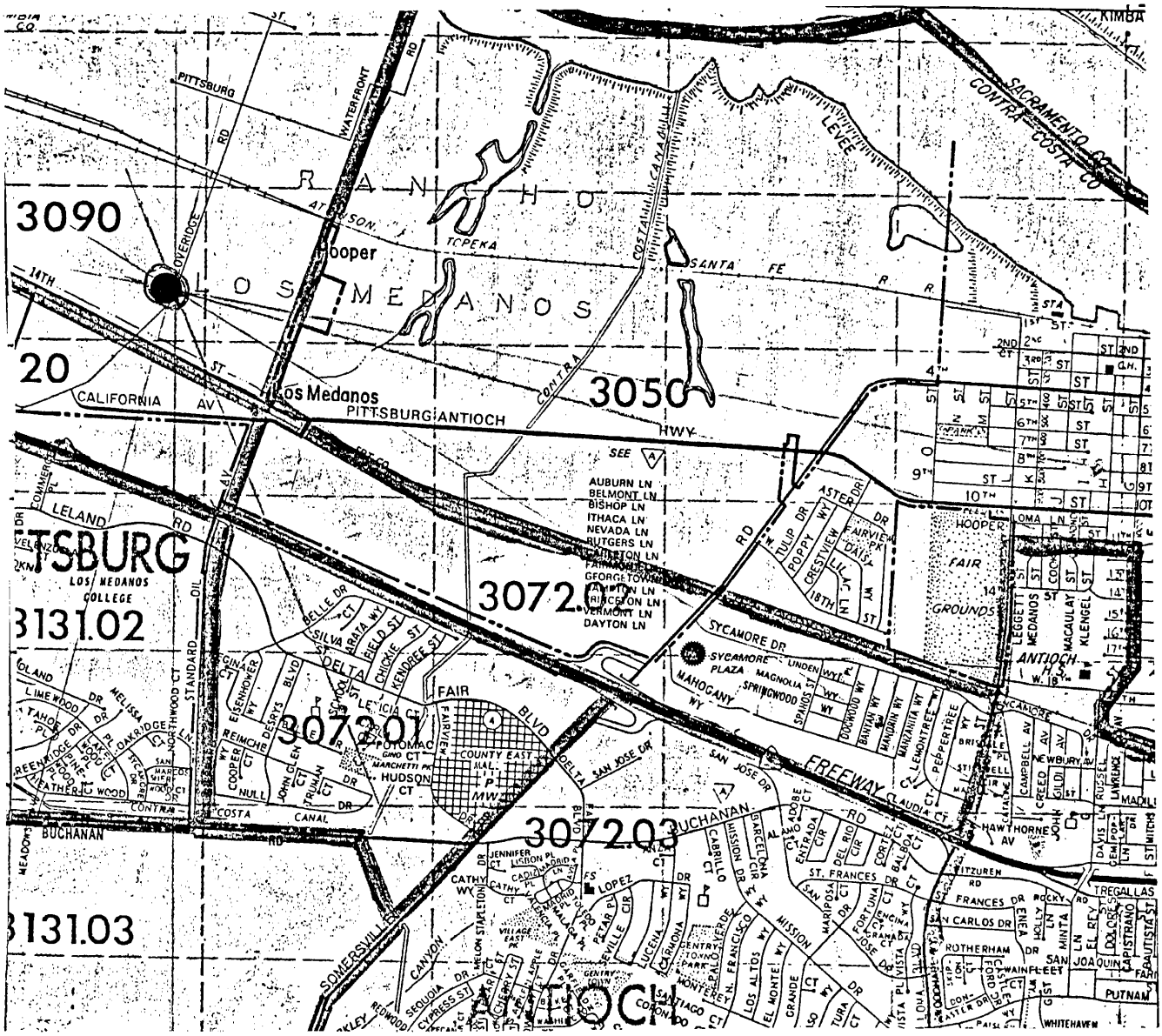
Plant Site - Allied Chemical, El Segundo



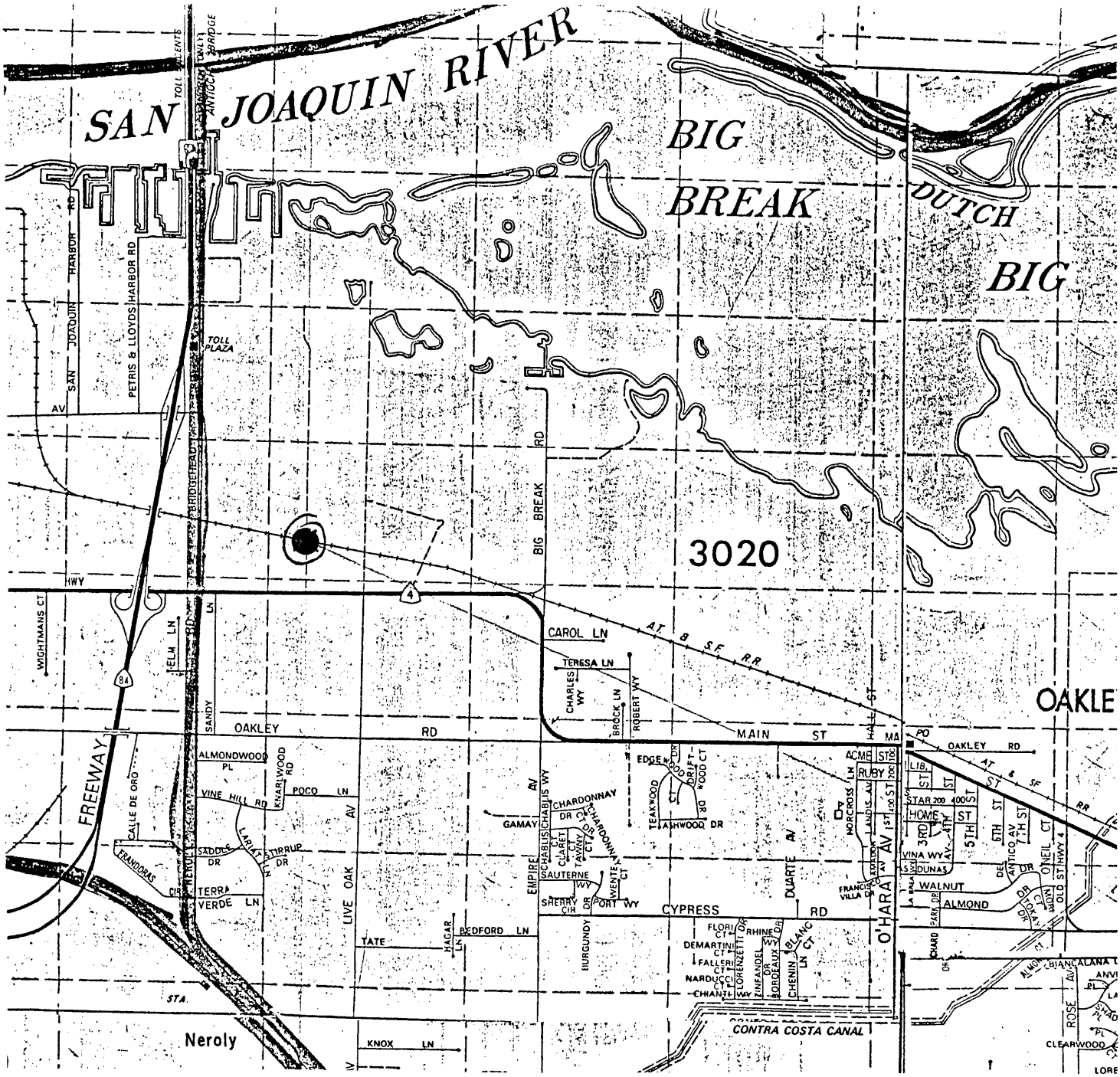
Plant Site RSR Corp., City of Industry



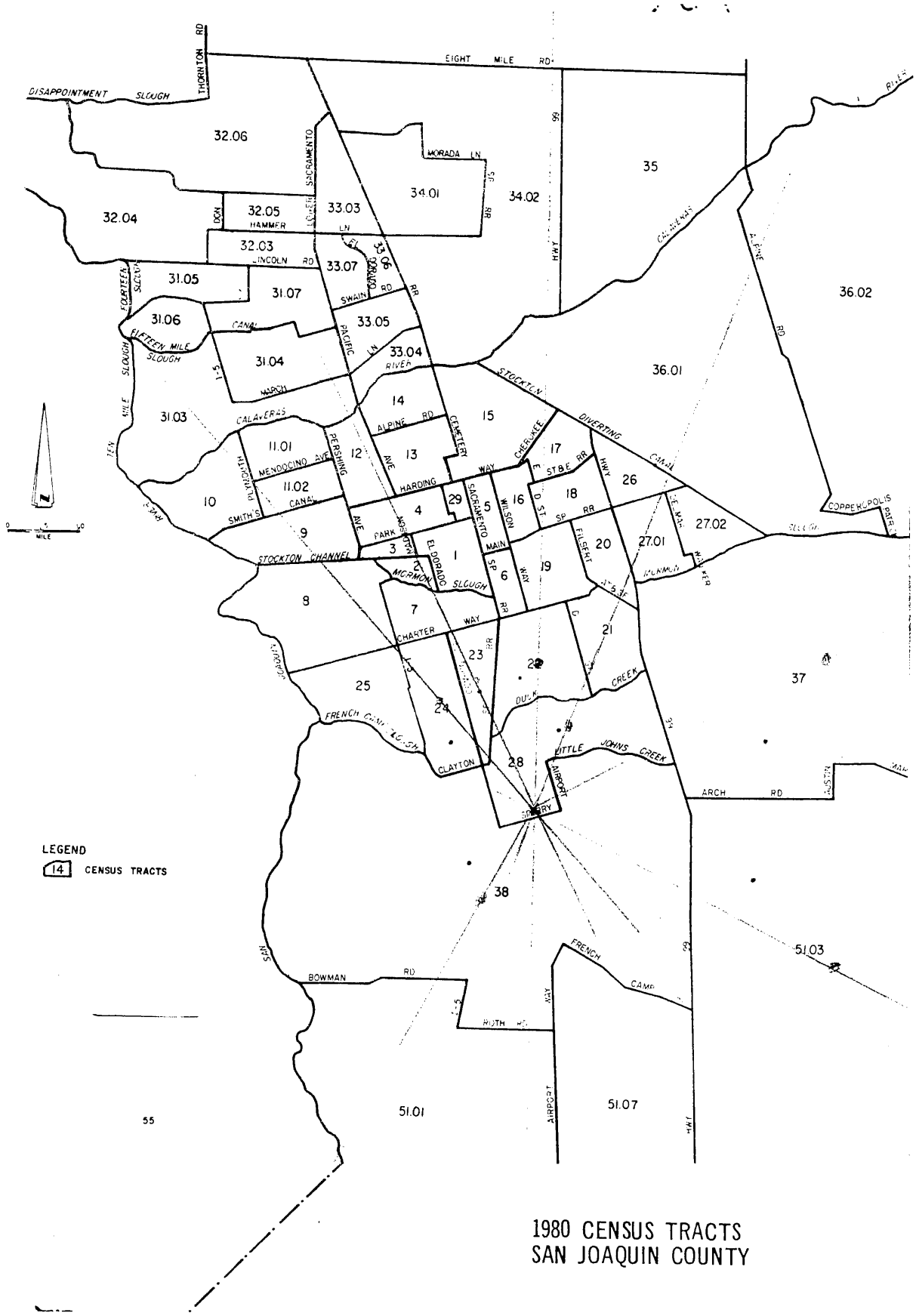
Plant Site - Dow Chemical U.S.A., Pittsburg



Plant Site - Du Pont, Antioch



Plant Site - Johns Manville, Stockton



1980 CENSUS TRACTS
SAN JOAQUIN COUNTY