State of California
California Environmental Protection Agency
Air Resources Board
Stationary Source Division

PILOT MONITORING STUDY OF CRYSTALLINE SILICA IN AMBIENT AIR IN LOMPOC, CALIFORNIA

Report prepared for the Lompoc Interagency Work Group

April 2003

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Report prepared for the Lompoc Interagency Work Group

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State of California
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A draft of this report was reviewed by members of the Other Environmental Issues Subcommittee of the Lompoc Interagency Work Group. Attempts were made to respond to all comments on the draft report.

Pilot Monitoring Study of Crystalline Silica in Ambient Air in Lompoc, California

SUMMARY

In 1997, the Department of Pesticide Regulation (DPR) formed the Lompoc Interagency Work Group (LIWG) to investigate respiratory illnesses in Lompoc. The primary focus of the investigation has been whether potential exposure to airborne pesticides is associated with the respiratory illnesses. The Other Environmental Issues Subcommittee of the LIWG evaluated other possible environmental causes of the respiratory illnesses. In 1998, the LIWG endorsed recommendations that included having the Air Resources Board (ARB) conduct ambient air monitoring in Lompoc for crystalline silica. The diatomaceous earth mining and processing industry near Lompoc has reported emissions of crystalline silica.

To investigate ambient air concentrations of crystalline silica in Lompoc, a pilot study of ambient monitoring was conducted on selected days from January-March 2001 (see Appendix A). A subset of the LIWG, including a representative of the Celite diatomaceous earth mining and processing industry, approved the study design. Particulate (PM-10) samples were collected at three locations in Lompoc and at a background site in Santa Maria, with subsequent analysis for the cristobalite and quartz forms of crystalline silica.

The analytical report is presented in Appendix B. No significant amounts of cristobalite or quartz were detected in the analysis of the Lompoc air sampling filters. The analytical report notes that because the air concentrations were quite low, it was quite difficult to distinguish between crystalline material such as cristobalite, poorly crystalline material such as opaline silica, and amorphous (noncrystalline) silica. [Note: Concentrations in the analytical report are reported as mass per sample in units of micrograms (μg) per sample. To convert a mass to an air concentration in units of micrograms per cubic meter of air ($\mu g/m^3$), the mass of a sample should be divided by the air sampling volume of 24 cubic meters of air, based on: (air sampling flow rate of 16.7 liters per minute)(60 minutes per hour)(24 hours)(1 cubic meter per 1000 liters).]

All concentrations of cristobalite were below the estimated quantitation limit of 0.57 micrograms per cubic meter ($\mu g/m^3$). For quartz, only three samples were above the estimated quantitation limit of 0.65 $\mu g/m^3$ (all three collected at the background site in Santa Maria), the highest being 2.6 ± 2.4 $\mu g/m^3$. (This concentration reflects the uncertainty of the analytical method, stated in Appendix B as being plus or minus one standard deviation.) This compares with a concentration of 3.45 $\mu g/m^3$ crystalline silica, measured previously in Santa Maria (North Santa Barbara County Crystalline Silica Study, Santa Barbara County Air Pollution Control District, June 1993). This prior study concluded that the measurement of crystalline silica in downtown Santa Maria was probably due to “higher than average ‘re-suspended paved road dust’ impact,” rather than industrial sources.

As stated in the sampling protocol (Appendix A), PVC filters were used for collecting the air samples. The PVC filters, 47 millimeters in diameter, were commercially available in two pore sizes: 0.8 and 5.0 microns. In preparation for this study, attempts were made to use filters with a pore size of 0.8 microns. Unfortunately, particulate matter collected on these filters resulted in a flow restriction and the pumps shut off automatically after less than two hours. Because of this, filters with a 5.0 micron pore size were used for this study. According to a representative of Millipore Corporation, the manufacturer of the filters, during initial stages of air sampling, until a filter is coated with particulate matter, particles much smaller than the pore size (e.g., particles of less than one micron in diameter) may pass through the filter. It is unknown what percent of particles in Lompoc air would have been small enough to pass through the filters during this pilot study.

On the three sampling days targeted for the wind to be from the south (from the direction of the Celite mine towards Lompoc), Celite staff verified that the diatomaceous earth processing plant operated 20-24 hours on those days. Based on the monitoring results, there are no current plans for additional crystalline silica monitoring in the Lompoc area.

Soil from agricultural fields in Lompoc, and soils and materials from the Celite mine near Lompoc were analyzed for the presence of the cristobalite and quartz forms of crystalline silica. The soil sampling protocol is presented in Appendix C. Results of these analyses are presented in the analytical report in Appendix B. One of the Celite products contained as much as 27.5 percent cristobalite, consistent with Celite's own analysis of diatomaceous earth that had been heated and processed. One of the samples of soil from an agricultural field on the west edge of Lompoc contained 15 percent quartz. This finding seems reasonable because typical soil contains 28 percent silicon (Handbook of Chemistry and Physics, 1987), occurring as quartz silica and other silicates.

In addition, the Lompoc water treatment plant uses a Celite product for water filtration. For that reason, a sample was analyzed of white sludge from a drying basin at the water treatment plant. The sample contained no measurable amount of either cristobalite or quartz. No sample was collected of the Celite product used at the water treatment plant.

PM-10 concentrations during the sampling were all below the 24-hour California Ambient Air Quality Standard of 50 micrograms per cubic meter ($\mu g/m^3$). These data are presented in Appendix D, along with the pre- and post-sampling filter weights.

As previously stated, the Other Environmental Issues Subcommittee (OEIS) of the LIWG evaluated other possible environmental causes of respiratory illnesses in Lompoc. One of the local issues evaluated by the OEIS was the potential impacts of emissions from Vandenberg Air Force Base (VAFB). A Minuteman III missile was launched from VAFB during the sampling period of February 6-7, 2001. The launch occurred from a pad on the north portion of the base at about 1:00 a.m. PST on

February 7. Prior to and following the launch, the wind was from the northwest, from the launch site toward Lompoc. No cristobalite or quartz was quantified at any of the three Lompoc sampling sites on this sampling day. The PVC air sampling filters used for collecting the cristobalite and quartz air samples were not appropriate for analysis of possible emissions (e.g., gases or metals) from the missile launch. As shown in Appendix D, the PM-10 air concentrations were slightly higher at all three Lompoc sampling sites during this 24-hour sampling period than any of the other sampling days in Lompoc. Due to the limited number of samples, we cannot speculate as to whether or not this was a coincidence.

As stated in the sampling protocol, air monitoring was conducted based upon forecast wind directions. Three sampling days were targeted for prevailing winds from the west and three sampling days were targeted for winds from the south (from Celite toward Lompoc). Rain fell during one of these southerly wind sampling days (February 17), causing two of the sampling pumps to stop operating. Those two samples were invalidated. The remaining three sampling days had collocated sampling conducted in Lompoc for quality assurance with simultaneous sampling in Santa Maria as a background site. The meteorological data for Lompoc (wind speed and direction, temperature, standard deviation of the wind direction, and rainfall) for the sampling days are presented in Appendix E. Attempts were made to obtain meteorological data for Santa Maria to coincide with the samples collected at the background site in Santa Maria. Unfortunately, only partial days of data could be obtained. These data were not included.

The Lompoc Quality Assurance Team that audited labs associated with pesticide monitoring and analysis for the Lompoc investigation also audited the UC Davis Crocker Nuclear Lab Air Quality Group that analyzed the air samples for crystalline silica. The audit report, presented in Appendix F, concludes that “due to the uncertainty of accurate quantitation and lack of any method to confirm results, the QA team feels any results obtained from this analysis should be considered ‘order of magnitude’ accuracy and used only as an indicator of possible health risks.”

All sampling log sheets and chain of custody forms are presented in Appendix G.

At the request of the LIWG and ARB, the Office of Environmental Health Hazard Assessment (OEHHA) is developing a chronic non-cancer reference exposure level (REL) for crystalline silica. The finalization of this report was delayed with the expectation that the REL could be included in this report. However, as of the date of this report, a REL has not been finalized. As stated in the sampling protocol in Appendix A, this report will be provided to OEHHA for interpretation of the monitoring results.

Appendix A

ARB Sampling Protocol

1/24/01

ARB Sampling Protocol
Pilot Study of Crystalline Silica in Ambient Air in Lompoc, CA
January-February 2001

I. Objective

The objective of this pilot study is to evaluate potential ambient air concentrations of crystalline silica in Lompoc. A limited number of particulate (PM-10) air samples will be collected for subsequent analysis for the quartz and cristobalite forms of crystalline silica. Results may be used to decide if there is a need for more detailed crystalline silica monitoring in the Lompoc area. Other background information, including the analysis method and procedures for data reporting and interpretation, are contained in Attachment 1.

II. Sampling

PM-10 sampling will be conducted by a LIWG contractor at the three sites listed in Attachment 2. These sites are located in the southwest, central, and east portions of Lompoc. Six 24-hour samples will be collected at each of the three sites during January and February 2001. Of these sampling periods, three will be conducted during typical meteorological conditions with prevailing winds from the west and northwest. The remaining three sampling periods will be based on weather forecasts on days when the wind direction is predicted to be from the south prior to the passage of a cold front. A southerly wind would have the greatest potential to bring crystalline silica down into Lompoc from the diatomaceous earth processing plant located in the hills south of Lompoc. The choice of these days will be based on consultation between the contractor collecting the samples and staff of the Air Resources Board (ARB). Meteorological data for this sampling will be obtained from the Santa Barbara County Air Pollution Control District (SBCAPCD) monitoring site in central Lompoc.

Background samples will be collected in Santa Maria, outside of the Lompoc Valley. On three days, samples will be collected at the background site. On these same days, duplicate filters will be collected at the SBCAPCD site in Lompoc using collocated PM-10 samplers for comparison with the background and to assess sampling precision.

PM-10 samplers (BGI model PQ100 samplers, a U.S. EPA reference method for PM-10) will be used for this study. Although the PQ100 samplers are equipped with batteries, the samplers will be connected to AC. Sampling will consist of pulling air at a rate of about 16.7 liters per minute through a PVC filter (47 mm in diameter, 5 µm pore size) over a period of 24 hours. Filters will be pre-weighed and placed in individually numbered petri dish containers. After sample collection, filters will be stored in the same numbered container and placed in a cool, secure location until the completion of sampling, at which time the filters will be transported to ARB's laboratory for gravimetric determination, followed by delivery to UC Davis for crystalline silica analysis. Flows will be verified prior to and following the study with a referenced flow-measuring device. A total of 28 PVC filters (18 primary samples, 3 collocated pairs (6 filters), 3 background samples, and 1 trip blank) will be delivered to the laboratory with a chain of custody form (Attachment 3).

The following steps will be followed in conducting the sampling:

A. perform leak check when assembling sampler (thereafter, check tubing connections)
B. place PVC filter in sampler, glossy side up
C. note filter number on field log sheet (Attachment 4) using waterproof ink
D. note the sample ID as follows: X-Y, where X is the site and Y is the sampling period (e.g., M=Miguelito School, H=H St., HD=H St. site duplicate sampler, MY=Maintenance Yard, SM=Santa Maria)
E. turn on pump (preset to 16.7 liters/minute)
F. set to run for 24 hours (pump will automatically shut off)
G. record starting date, time, and flow on field log sheet
H. under comments on field log sheet, note sample type as background, west wind or south wind sampling event, along with weather conditions
I. upon retrieving filter after 24 hours, turn on pump, record elapsed time, ending flow and time on field log sheet, along with any information that may affect sampling results
J. press reset and turn off pump
K. place filter in original clear plastic container with numbered label affixed to container consistent with sample log number on log sheet

Attachment 1

PILOT STUDY OF CRYSTALLINE SILICA IN AMBIENT AIR IN LOMPOC, CA

Principal Investigator: Britt A. Holmén, University of California, Davis

I. Introduction

In 1997, the Lompoc Interagency Work Group (LIWG) was formed to investigate respiratory illnesses in Lompoc. The primary focus of the LIWG has been to determine whether potential exposure to pesticides is associated with the respiratory illnesses. In 1998, the LIWG endorsed recommendations to conduct ambient air monitoring in Lompoc for pesticides, metals, and crystalline silica.

The Other Environmental Issues Subgroup of the LIWG has been evaluating environmental conditions in Lompoc that may be related to the respiratory illnesses. Of primary interest is crystalline silica that may be emitted by the diatomaceous earth processing industry near Lompoc. To evaluate potential ambient air concentrations of crystalline silica, a limited number of particulate (PM$_{10}$) air samples will be collected for subsequent analysis for the quartz and cristobalite forms of crystalline silica. Results may be used to decide if there is a need for more detailed crystalline silica monitoring in the Lompoc area.

II. Study Design

A. Sampling PM$_{10}$ sampling will be conducted by a LIWG contractor at three sampling sites in Lompoc. These sites are located in the southwest, central, and east portions of town. Six 24-hour samples will be collected at each of the three sites during November-December 2000. Of these sampling periods, three will be conducted during typical meteorological conditions with prevailing winds from the west and northwest. The remaining three sampling periods will be based on weather forecasts on days when the wind direction is predicted to be from the south prior to the passage of a cold front. A southerly wind would have the greatest potential to bring crystalline silica down into Lompoc from the diatomaceous earth processing plant located in the hills south of town. The choice of these days will be based on consultation between the contractor collecting the samples and staff of the Air Resources Board (ARB) and the Santa Barbara County Air Pollution Control District (SBCAPCD). Meteorological data for this sampling will be obtained from the SBCAPCD monitoring site in central Lompoc.

Background samples will be collected in Santa Maria, outside of the Lompoc Valley. On three days, samples will be collected at the background site. On these same days, duplicate filters will be collected at one of the Lompoc sites using collocated PM$_{10}$ samplers for comparison with the background and to assess sampling precision.

PM$_{10}$ samplers (BGI model PQ100 samplers, a U.S. EPA reference method for PM$_{10}$) will be used for this study. Sampling will consist of pulling air at a rate of about 16 liters per minute through a PVC filter (47 mm in diameter, 0.8 or 5.0 µm pore size) over a period of 24 hours. Flows will be verified with a referenced flow-measuring device. Low ash homopolymeric polyvinyl chloride (PVC) membrane filters are recommended by filter manufacturers and laboratories for trapping and subsequent analysis of crystalline silica. A detailed sampling protocol listing sampling procedures will be provided to the sampling technician. The expected sampling duration should allow for collecting ~ 1-2 mg of particulates per filter. Filters will be pre-weighed, numbered and stored in individual petri dish containers prior to sampling. After sample collection, filters will be stored individually in sealed containers in a cool, secure location until the completion of sampling, at which time the filters will be transported to the laboratory for gravimetric and crystalline silica analysis. A total of 28 PVC filters (18 primary samples, 3 collocated pairs (6 filters), 3 background samples, and 1 trip blank) will be delivered to the analysis laboratory with a chain of custody form.

B. Analysis The PVC filters will be analyzed for the quartz and cristobalite forms of crystalline silica using X-ray diffraction (XRD). The UC Davis Crocker Nuclear Laboratory Air Quality Group will perform these analyses. OSHA Method ID-142 (Quartz and Cristobalite in Workplace Atmospheres) and NIOSH Method 7500 (Crystalline Silica by XRD) describe the laboratory procedures that will be followed after sample collection. Briefly, the PVC filter will be placed in tetrahydrofuran to dissolve the filter and suspend the particulate matter. Using a filtration apparatus, the particulate matter is deposited onto a silver membrane filter. The silver filter is scanned by X-ray diffraction and the diffraction peaks for quartz and cristobalite are quantified by comparison to reference standards.

III. Results

Results of the two forms of crystalline silica will be reported in units of micrograms per sample (μg/sample) and $\mu g/m^3$. The final report of analytical results will contain: a description of the UCD analytical method, limit of quantitation, results of blanks, replicate analyses of a subset of filters to assess analytical precision, and accuracy of the methods.

In addition, soil/materials samples were collected in September to determine the presence or absence of quartz or cristobalite forms of crystalline silica. Composite soil/materials samples were collected by ARB staff from two fields west of Lompoc and from the following three locations at the Celite mine in the hills south of Lompoc: 1) the overburden pile, 2) mined material prior to processing in the kiln, and 3) of processed material.

UC Davis will report the analytical results for all samples, standards and blanks to the ARB by February 1, 2001.

ARB will provide all data to the Office of Environmental Health Hazard Assessment for interpretation, and to the LIWG. Data will be compared with known human health exposure values and meteorological data.

Attachment 2

Lompoc Crystalline Silica Sampling Sites

1. Miguelito School (southwest corner of Lompoc)
   1600 W. Olive St. at V St.
   Sampler location: roof of restroom building
   Contact: Duane Schuyler or Shirley Edwards (805) 736-2371
   Permission granted by: Earl Wammack (805) 736-2371

2. Santa Barbara County APCD monitoring trailer (downtown Lompoc)
   Between G and H Streets, 1/2 block south of Ocean Ave.
   Sampler location: roof of trailer
   Contact: Joel Cordes (805) 961-8816

3. Santa Barbara County Maintenance Yard (eastern Lompoc)
   Sweeney Rd. at Highway 246
   Sampler location: along fence near office
   Contact: Scott Roberts (805) 737-7773

4. ARB monitoring site (background site)
   906 S. Broadway
   Santa Maria
   Sampler location: roof
   Contact: Curtis Schreiber (626) 575-6856
   Phil Wagner (805) 549-3426

Attachment 3

CHAIN OF CUSTODY FORM
CALIFORNIA AIR RESOURCES BOARD
MONITORING AND LABORATORY DIVISION
P.O. Box 2815, Sacramento CA 95812

CHAIN OF CUSTODY

SAMPLE RECORD

Job #: ________________ Date: ________________
Sample/Run #: __________ Time: ________________
Job Name: ____
Sample Location: ________________________________
Type of Sample: __________________________________
Log #'s: __________ ______________________________

ACTION	DATE	TIME	INITIALS		METHOD OF STORAGE freezer, ice or dry ice
Sample Collected					
			GIVEN BY	TAKEN BY	
Transfer					
Transfer					
Transfer					
Transfer					
Transfer					
Transfer					

LOG #	ID #	

RETURN THIS FORM TO: ________________________________

Attachment 4

Field Log Sheet

Project: Pilot Study of Crystalline Silica in Ambient Air in Lompoc, CA

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial

Appendix B

Lompoc Project Final Report, UC Davis

Lompoc Project Final Report

Pilot Study of Crystalline Silica in Ambient Air in Lompoc, California

Britt A. Holmén and Ryoji Shiraki
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Davis, CA 95616

June 30, 2001

INTRODUCTION

The concentration of crystalline silica (CS; as both the cristobalite and quartz forms) in twenty-seven airborne PM_{10} samples collected by the California Air Resources Board at sites in the city of Lompoc, CA was determined by X-ray diffractometry at the Crocker Nuclear Laboratory, University of California, Davis. The concentration of CS was also determined for 10 grab samples of bulk materials that are considered to be potential sources of airborne dust in the city. This report summarizes the X-ray diffraction sample preparation and analysis methods and sample results. The analytical method is based on NIOSH Method 7500, "Crystalline Silica by XRD" and OSHA Method ID-142, "Quartz and Cristobalite in Workplace Atmospheres".

The samples that were analyzed are listed in Tables 1 and 2.

Table 1. Reference Materials Description

Sample type	UC Davis Lab No.	ARB: Lab ID	ARB: LIMS ID	ARB: Sampling Date	Form
Reference materials					
	LR01	Celite mine, Lompoc	Dark crude	9/27/00	sand
	LR02	Celite mine, Lompoc	Dark crude	9/27/00	block
	LR03	Celite mine, Lompoc	Light crude	9/27/00	block
	LR04	Celite mine, Lompoc	Overburden	9/27/00	soil
	LR05	Celite, Lompoc	Celite 500	9/27/00	product jar
	LR06	Celite, Lompoc	Celite 512	9/27/00	product jar
	LR07	Celite, Lompoc	Hyflo Super - Cel	9/27/00	product jar
	LR08	Olive & V St., Lompoc	Ag. soil	9/27/00	soil
	LR09	Olive & Bodger Rd., Lompoc	Ag. soil	9/27/00	soil
	LR10	Lompoc water treatment plant	From drying basin	2/23/01	white paste

Table 2. Filter Samples Description

Sample type	UC Davis Lab No.	ARB: Lab ID	ARB: LIMS ID	ARB: Sampling Date	ARB: Sample Mass (µg)
Filter samples					
	LF02	PF007602	85217	1/25/01	258
	LF03	PF007603	85218	1/25/01	292
	LF04	PF007604	85219	1/25/01	178
	LF05	PF007605	85220	1/30/01	407
	LF06	PF007606	85221	1/30/01	388
	LF07	PF007607	85222	1/30/01	404
	LF08	PF007608	85223	1/31/01	-3
	LF09	PF007609	85224	2/01/01	322
	LF10	PF007610	85225	2/01/01	478
	LF11	PF007611	85226	2/01/01	423
	LF12	PF007612	85227	2/06/01	522
	LF13	PF007613	85228	2/06/01	570
	LF14	PF007614	85229	2/06/01	504
	LF15	PF007615	85230	2/09/01	332
	LF16	PF007616	85231	2/09/01	227
	LF17	PF007617	85232	2/09/01	356
	LF20	PF007620	85233	2/17/01	360
	LF23	PF007623	85234	3/01/01	39
	LF24	PF007624	85235	3/01/01	559
	LF25	PF007625	85236	3/01/01	618
	LF26	PF007626	85237	3/07/01	388
	LF27	PF007627	85238	3/07/01	420
	LF28	PF007628	85239	3/07/01	658
	LF29	PF007629	85240	3/12/01	523
	LF30	PF007630	85241	3/12/01	539
	LF31	PF007631	85242	3/12/01	810
	LF32	PF007632	85243	3/14/01	-12

ANALYTICAL METHOD

Overview

The California Air Resources Board collected 24-hour PM_{10} samples on PVC filters (47 mm, 5 micron pore size) at a flow rate of 16.7 liters per minute. At UC Davis, the PVC filter containing the PM_{10} sample was placed in tetrahydrofuran (THF) to dissolve the filter and suspend the particulate matter. Using a filtration apparatus, the particulate matter was deposited onto a pre-weighed silver membrane filter. After drying, the silver filter was scanned by X-ray diffraction and the diffraction peaks for quartz and cristobalite were quantified by comparison to calibration standards.

Materials used

- Respirable cristobalite standard (Standard reference material for quantitative XRD prepared by the National Institute of Standards and Technology, 1879a). The range of particle size was between 1 and 10 µm.
- Respirable quartz standard (Standard reference material for quantitative XRD prepared

by the National Institute of Occupational Safety and Health, Q-1). The particle size was smaller than 16 μm (99.1% was < 10 μm).

- 2-propanol (ACS certified grade, Fisher Scientific)
- Tetrahydrofuran (Optima grade, Fisher Scientific)
- Silver (Ag) membrane filter (0.45μm, Osmonics)

Preparation of samples for XRD

A. Calibration standards

The series of quartz and cristobalite standards were prepared from liquid suspensions in 2-propanol. The method proceeded in the following steps:

1. 10 or 50 mg of standard material (NIST cristobalite and NIOSH quartz) was weighed on a microbalance.

2. The standard material was transferred to a 500ml volumetric flask and the volume adjusted to 500 ml with 2-propanol.

3. The suspension was sonicated for 20 minutes.

4. The suspension was stirred magnetically while aliquots of the suspension (0.5 to 20 ml) were removed using a glass volumetric pipet.

5. The aliquots were deposited onto pre-weighed Ag membrane filters mounted in a vacuum filtration apparatus. Different standard masses were prepared by adding different volumes of the suspension to the Ag membrane filter.

6. During the filtration step, about 5 ml of 2-propanol was placed in the filtration apparatus funnel (16 mm I.D., ~ 15 ml in volume) prior to adding the suspension. After the suspension volume was added, the inside of the transfer pipet was washed down two times with 2-propanol.

7. Finally, the suspension was filtered until the Ag filter was visually dry.

8. The Ag membrane filter was air dried overnight in a loosely covered petri dish.

9. The dry Ag membrane filter was re-weighed to determine the mass of standard material.

10. A total of 6 and 8 concentrations were prepared for cristobalite and quartz, respectively and each concentration was prepared and analyzed in triplicate.

11. Three blanks were prepared by filtering ~ 15 ml of 2-propanol through a pre-weighed Ag membrane filter. These blanks were used for both cristobalite and quartz quantification.

B. Filter samples

All PVC filters were dissolved in tetrahydrofuran (THF) using the following procedure:

1. Prior to dissolution, THF was filtered using Ag membrane filters

2. Each filter sample was placed into a clean 250 ml glass beaker containing 20 ml filtered THF and covered with a watch glass.

3. After standing 5 min, the beaker was agitated by hand and then the supernatant was transferred directly into the filtration funnel of the vacuum filtration apparatus described above in Steps A5 andA6.

4. The walls of the 250 ml beaker were rinsed three times each with 10 ml of filtered THF and this solution was added to the filtration funnel.

5. The suspension was filtered until the Ag filter was visually dry.

6. The Ag membrane filter was air dried overnight in a loosely covered petri dish.

7. The dry Ag membrane filter was re-weighed to determine the mass of the sample.

NOTE: Initial experiments examined the dissolution of the PVC filters into tetrahydrofuran (THF) by dissolving four blank PVC filters in untreated THF. The difference in the Ag membrane filter weight before and after dissolution of the four filters was 120 (± 26) μg, suggesting some residue remained on the Ag membrane filters. The source of this residue could be the PVC filters, the THF, or THF oxidation products formed during sonication. Prior to the dissolution of field filter samples, we further investigated the possible sources of the residue by dissolving a series of blank PVC filters treated under a range of conditions. The conditions included filtering different volumes of THF, changing the duration of sonication (0 to 20 min), and using untreated and pre-filtered THF. There was no systematic relationship between experimental conditions and Ag membrane weight gain. The mean weight increase over all "dissolution" blanks was 116 (± 28) μg (n = 13), quite similar to that obtained from the initial four blank PVC filters. Because sonication was not necessary to dissolve these filters and it was considered a potential source of residue formation, the filter sample preparation procedures did not include sonication. Further, all results reported as "Mass used for XRD" (see Table 4) are the measured difference in the weight of the Ag membrane filter before and after the PVC filter dissolution and are not corrected for residue. In other words, the average dissolution blank residue mass was not subtracted from the measured mass difference. The mass fraction values in Table 4 were computed using this laboratory mass value rather than the "Sample Mass" reported by ARB.

C. Reference materials

Two block samples (Celite mine, Lompoc, Dark and light crude, block; UC Davis Lab No. LR02 and LR03) were crushed in their sample bags using a hammer and were then gently crushed using a ceramic pestle in a mortar. Then these samples and five other reference materials (LR01, LR04, LR08 to LR10) were dried at 110°C in an oven over night. Particles smaller than 75 μm were collected by dry sieving these samples. Finally, these powders were ground finely in an agate mortar for about 10 min until a smooth texture was achieved that indicated grain sizes smaller than 10 μm. No treatment was performed for reference materials LR05, LR06, and LR07 prior to filtration onto Ag membrane filters.

Each sample was weighed (~ 500 μg) and transferred to a 50 ml glass beaker to which approximately 10 ml 2-propanol was added. After placing a watch glass on a beaker, the sample – 2-propanol mixture was sonicated for 20 min and filtered onto a pre-weighed Ag membrane filter using the procedures described above for standard and filter samples. The suspension was transferred from the beaker directly into the filtration funnel and the walls of beaker were rinsed twice with 2-propanol.

X-Ray Diffraction

A DIANO-8000 X-ray diffractometer was used for analysis. A graphite monochrometer and Ni filter are attached to this instrument. CuKα radiation generated at 40kV and 20mA was used for all measurements. For quantification, the diffraction intensity of the cristobalite (101) and quartz (101) planes was measured using a 0.01° step scan and a measurement time of 10 sec/step. The 2θ scan range was from 21.3° to 22.8° for cristobalite and 26.0° to 27.5° for quartz. For quartz, the peak intensity was determined as the peak height computed as the average of the 5 data points centered on the peak. Similarly, an average of 5 points centered on the highest point near the cristobalite (101) primary plane ($2\theta = 21.9^{\circ}$) was calculated for cristobalite quantification. All sample and standard quantitation procedures were identical.

In addition to measurements for cristobalite and quartz quantification, some of the reference materials and three filter samples were scanned from 2° to 37° or 15° to 37° to identify coexisting minerals. These measurements were carried out using 0.02° step scans and a measurement time of 1 sec/step.

X-Ray Data Reporting

Cristobalite and quartz masses per sample were quantified using the appropriate standard calibration curve (see below) and are reported in micrograms (Table 4). For this report, the term "cristobalite" is used for all data corresponding to quantification of the XRD peak measured over the 2θ range corresponding to the NIST cristobalite standard despite the fact that some samples may contain poorly crystalline opaline silica or be mixtures of highly crystalline and amorphous silica (see below). One-sigma standard deviations were calculated by propagating errors using the standard errors on the slope and intercept of the calibration curves. The relatively large one-sigma values for quartz are due to the large standard error on the intercept of the quartz calibration curve.

A. "Cristobalite" Identification

It must be recognized that distinguishing the crystalline mineral cristobalite from the poorly crystalline silica phases opal C and opal CT by X-ray diffraction is extremely difficult. This is especially true when concentrations are low, as is the case for the Lompoc filter samples, because often only the primary peak is detectable. All references to "cristobalite" in this report are based on comparison to the NIST α-cristobalite standard; no opal standards were analyzed. The cristobalite standards showed sharp diffraction peaks whereas the majority of the filter and reference material samples had small, broad peaks in the cristobalite peak position. The broadening of the peaks in XRD generally indicates contributions from more amorphous/ poorly crystalline components (i.e., opals in this case). In an effort to distinguish crystalline cristobalite from the poorly crystalline opaline silica polymorphs, four peak types were identified in the Lompoc samples. Each sample's peak type for the cristobalite primary peak scan is indicated in the "C Peak Type" column of Table 4. The peak types are:

Type 1	obvious peak is distinct and location and width were similar to that of the cristobalite standards. The silica polymorph quantified in Type 1 samples is most likely cristobalite. Type 1 samples also include distinct peaks located at slightly lower 2θ position than the NIST standard and with slightly wider peak widths. These are most likely cristobalite of a different crystallinity or particle size than the NIST α-cristobalite standard. The shifted peak assignment is based on the peak positions of the Celite product materials, LR06 and LR07.
Type 2	peak is clearly discernable as a bump above the baseline such that measurement of peak width is possible. Type 2 samples are likely poorly crystalline silica, especially for cases where the peak width was greater than 0.36 degrees, but could represent mixed crystalline/ poorly crystalline silica if the measured peak width was narrow.
Type 3	indistinct broad signal in cristobalite 2θ range that is elevated above the blank (filter B17) signal, but too diffuse to measure a peak width. Type 3 samples with masses above the LOD are likely opaline silica. The diffuse nature of Type 3 peaks suggests a significant amorphous silica component.
Type 4	signal is very close to blank signal. Type 4 samples do not contain measurable cristobalite or opal.

Cristobalite peak widths were measured for each Type 1 and Type 2 sample diffractogram. The values reported in Table 4 are the full width at half the maximum peak height (FWHM) and were measured manually from the average of the two sample orientations. For comparison, all the cristobalite standard peak widths were equal to 0.3 degrees 2θ.

For this report, the term "cristobalite" is used for all data corresponding to quantification of the XRD peak over the range that corresponds to the baseline width of the NIST cristobalite standard (21.7 to 22.4 degrees 2θ). A preliminary estimate of the relative degree of crystallinity of the quantified "cristobalite" (Table 4, column "ID") is based upon the Peak Type and peak width measurements. As a general guideline for interpretation, all Type 1 samples were assigned as crystalline (ID= "C"); Type 2 samples with wider peak widths were assumed to contain more of the poorly crystalline silica and assigned as poorly crystalline (ID= "PC") cristobalite. An arbitrary 20% cutoff peak width relative to the standard value of 0.3 degrees was used to distinguish crystalline (ID= "C") from poorly crystalline (ID= "PC"). In other words, if the measured peak width (FWHM) exceeded 0.36 degrees, the Type 2 sample was assigned a cristobalite ID of "poorly crystalline" in Table 4. Note that small peaks near the baseline have profiles that are very difficult to assign a meaningful peak width. Therefore, when the quantified cristobalite concentrations are near the limit of detection, the ID assignment should be viewed skeptically.

Improved identification of the cristobalite peak mineralogy in the Lompoc samples can be achieved by (a) obtaining additional ancillary data such as sampling location, wind direction (for filter samples) and sample history (i.e., Celite product samples) and (b) conducting more detailed laboratory investigations (i.e., heating tests – Elzea et al., 1994).

RESULTS

Calibration curves

For the cristobalite calibration curve, the intensities of six different standard masses (0.013 to 0.421 mg) and one blank were measured. The lowest standard mass was near the cristobalite quantitation limit. Each standard and the blank were measured in triplicate and each specimen was measured at two different orientations, which were 180 ° opposite each other. Thus, a given standard's XRD intensity was determined as the mean of the six XRD measurements. The cristobalite calibration curve is shown in Fig. 1. The regression of data to a straight line yielded:

$$I_C = 6481\ (\pm 61)\ M_C + 74\ (\pm 25) \qquad (R^2 = 0.9996) \qquad (1)$$

Where Ic and Mc are the intensity of the cristobalite primary peak (in cps) and the total mass of cristobalite (in mg), respectively. The values in parentheses in the regression equation are standard errors.

Quite similarly, the quartz calibration curve was constructed with eight different concentrations (0.013 to 1.908 mg) and one blank. The lowest quartz standard mass was near the quartz quantitation limit. Figure 2 shows the calibration curve obtained from the quartz standards. The regression line is given by:

$$I_Q = 4599\ (\pm 132)\ M_Q + 144\ (\pm 252) \qquad (R^2 = 0.9943) \qquad (2)$$

Where I_Q and M_Q are the intensity of the primary peak of quartz (in cps) and the total mass of quartz (in mg), respectively. Based on these calibration curves, the limit of detection (LOD) and the estimated quantification limit (EQL) are estimated to be 4.1 and 13.6 μg for cristobalite and 4.7 and 15.7 μg for quartz, respectively. Here, LOD and EQL are defined as:

$$LOD \equiv \frac{3\sigma_{blank}}{m_{calCurve}} \qquad \text{and} \qquad EQL \equiv \frac{10\sigma_{blank}}{m_{calCurve}} \qquad (3)$$

Where σ_{blank} is the standard deviation of the blank sample's intensity and $m_{calCurve}$ is the slope of the mineral's calibration curve.

DIANO diffraction peaks

Table 3 summarizes the 2θ values (°) for the primary peaks of minerals identified in the standards and Lompoc samples.

Table 3. DIANO 2θ values (°)

Mineral	Primary Peak
Cristobalite (standard only)	22.07
Quartz	26.73
Albite	28.00
Biotite	8.88
Calcite	29.62
Ag filter (1)	32.36
Ag filter (2)	36.34

Cristobalite and quartz

Analytical results for cristobalite and quartz are shown in Table 4 and the wide scan diffraction patterns of five reference materials (LR01, LR05-07, LR09) and three filter samples (LF05, 23, and 31) are attached to this report in the appendix.

Cristobalite. The cristobalite content of all filter samples was very low. All samples contained less than the EQL (13.6 μg) and the cristobalite mass of four samples (LF08, 16, 24, and 32) was below the LOD (4.1 μg). The highest cristobalite content was measured in two reference materials from the Celite plant, LR06 and LR07. The cristobalite masses in these materials were 78.4 and 150.1 μg, resulting in weight fractions of 19.0 and 27.5%, respectively. Interestingly, the position of the cristobalite peak in these reference materials was shifted to the left and peak widths were slightly higher than the NIST cristobalite standard peaks. This suggests the Celite product cristobalite is different from the NIST standard in terms of degree of crystallinity, grain size, or both. The weight fraction of cristobalite in other reference materials ranged from 2.2 to 4.2 wt%, except for LF10 whose cristobalite content was below the LOD. The relatively broad peaks measured for reference materials LR01, 02, 03 and 04 suggest that the "cristobalite" is actually opaline silica. Surprisingly, Celite 500 product material (LR05) had a Type 3 peak that was indistinct and suggested this material is poorly crystalline.

Based on the Peak Type assignments and peak width interpretations outlined above, only one filter sample, LF23 was positively assigned as containing highly crystalline cristobalite. Some highly crystalline silica was likely present in LF26 and LF31, based on the relatively narrow peak widths (less than 0.3 degrees) of the clearly discernable Type 2 peaks.

Quartz. The quartz content of the air filter samples was also very low. Only three samples (LF23, 28, and 31) had quartz contents higher than the EQL and quartz mass in all other samples was below LOD. The quartz mass fraction of the reference materials ranged from 0.9 to 15.0 %

(but LF06 and LF10 were < LOD). Sample LF08, an agricultural soil, had the highest quartz content (15.0 wt%).

Other Minerals. Wide-range diffraction measurements showed that reference materials from the Celite mine, LR01 to LR05, contained quartz and albite as main constituents (Peaks at $2\theta = \sim 32.2^\circ$ and 36.2° are for the silver membrane substrate). Materials LR06 and LR07 showed distinct cristobalite primary peaks, suggesting those samples contain cristobalite with high crystallinity. The agricultural soil diffraction patterns of LR08 and LR09 showed that the soil contained quartz, albite, and mica (probably biotite). The main constituent of LR10 was calcite.

Other Remarks

The reference samples and filters were analyzed by X-ray diffraction only, as required by the ARB contract. X-ray diffraction is sensitive to the crystallinity and particle size of the sample and is not a reliable quantification technique for amorphous materials. Because the cristobalite standards used for quantitation had highly crystalline material that showed sharp diffraction peaks, but sharp, distinct cristobalite diffraction peaks were relatively rare in the samples, the data reported here should be considered preliminary. The cristobalite Peak Type and FWHM data reported in Table 4 were used to interpret the relative amounts of highly and poorly crystalline silica in the filter and reference material samples. In future studies, quantification of cristobalite in Lompoc air samples could benefit from collecting higher sample masses by employing longer PM_{10} sampling times and possibly by employing a high-temperature (1050 °C) heating test described in the literature (Elzea et al, 1994). These tests were beyond the scope of the present study.

Quartz was detected in three filter samples, but the masses have relatively high uncertainties (1σ in Table 4) due to the large standard error on the quartz calibration curve intercept (Equation 2, Figure 2).

The occurrence of significant albite in the reference agricultural soils, LR08 and LR09, suggested the possibility of interference with the cristobalite primary peak by the albite (20) plane at 22.04 degrees. This was ruled out on the basis of the relative peak ratios of the albite primary peak ($2\theta = 28.00$) to the peak near 22 degrees. The measured ratios were higher than could be explained by albite alone, therefore the peak was quantified as "cristobalite" of uncertain crystallinity in Table 4. Similarly, the peak ratios in the wide scans of the filter samples ruled out significant albite interference.

For these reasons, airborne crystalline silica mass concentrations (e.g., in $\mu g\ m^{-3}$) should be calculated from the data in Table 4 by incorporating the standard deviations reported for each sample using appropriate propagation of error techniques.

References Cited

Elzea, J.M., I.E. Odom, W.J. Miles (1994) Distinguishing well ordered opal-CT and opal-C from high temperature cristobalite by x-ray diffraction. Analytica Chimica Acta, 286 (1) 107-116.

Table 4. X-Ray Diffraction Results for Cristobalite and Quartz in Lompoc Samples

						"Cristobalite"						Quartz			
UC Davis Lab No.	ARB: Lab ID	ARB: LIMS ID	Sampling Date	ARB Sample Mass (µg)	UCD Mass for XRD (µg)	C Mass (µg)	1σ (µg)	C Mass Fraction (%)	C Peak Type (see text)	C Peak FWHM (°)	C Peak ID	Q Mass (µg)	1σ (µg)	Q Mass Fraction (%)	Water Content (%)
Filter samples															
PVC-B17	(Blank of PVC filter dissolution by tetrahydrofuran)				109	< LOD						< LOD			
LF02	PF007602	85217	1/25/01	258	280	4.1	3.9	1.5	3	-	PC	< LOD			
LF03	PF007603	85218	1/25/01	292	305	7.0	3.8	2.3	2	0.44	PC	< LOD			
LF04	PF007604	85219	1/25/01	178	170	4.5	3.8	2.6	3	-	PC	< LOD			
LF05	PF007605	85220	1/30/01	407	422	4.8	3.8	1.1	3	-	PC	< LOD			
LF06	PF007606	85221	1/30/01	388	330	9.0	3.8	2.7	2	0.37	PC	< LOD			
LF07	PF007607	85222	1/30/01	404	264	7.7	3.8	2.9	2	0.51	PC	< LOD			
LF08	PF007608	85223	1/31/01	-3	87	< LOD			4			< LOD			
LF09	PF007609	85224	2/01/01	322	313	4.6	3.8	1.5	3	-	PC	< LOD			
LF10	PF007610	85225	2/01/01	478	373	7.8	3.8	2.1	2	0.47	PC	< LOD			
LF11	PF007611	85226	2/01/01	423	339	6.9	4.3	2.0	2	0.41	PC	< LOD			
LF12	PF007612	85227	2/06/01	522	532	5.9	3.9	1.1	2	0.40	PC	< LOD			
LF13	PF007613	85228	2/06/01	570	590	6.6	3.8	1.1	2	0.40	PC	< LOD			
LF14	PF007614	85229	2/06/01	504	504	7.2	3.8	1.4	2	0.38	PC	< LOD			
LF15	PF007615	85230	2/09/01	332	342	6.1	3.8	1.8	3	-	PC	< LOD			
LF16	PF007616	85231	2/09/01	227	236	< LOD			4			< LOD			
LF17	PF007617	85232	2/09/01	356	291	4.8	3.8	1.6	2	0.40	PC	< LOD			
LF20	PF007620	85233	2/17/01	360	304	8.6	3.9	2.8	2	0.40	PC	< LOD			
LF23	PF007623	85234	3/01/01	39	448	10.2	4.6	2.3	1	0.25	C	24.1	55.2	5.4	
LF24	PF007624	85235	3/01/01	559	440	< LOD			3	-		< LOD			
LF25	PF007625	85236	3/01/01	618	559	6.4	3.8	1.2	3	-	PC	< LOD			
LF26	PF007626	85237	3/07/01	388	319	5.4	3.8	1.7	2	0.28	C?	< LOD			
LF27	PF007627	85238	3/07/01	420	388	4.9	3.8	1.3	3	-	PC	< LOD			
LF28	PF007628	85239	3/07/01	658	609	8.2	3.9	1.3	2	0.43	PC	41.5	54.8	6.8	
LF29	PF007629	85240	3/12/01	523	472	5.6	4.2	1.2	3	-	PC	< LOD			
LF30	PF007630	85241	3/12/01	539	461	5.7	3.8	1.2	3	-	PC	< LOD			
LF31	PF007631	85242	3/12/01	810	686	11.8	3.8	1.7	2	0.22	C?	62.4	56.7	9.1	
LF31	*duplicate analysis*			810	686	*12.5*	*3.8*	*1.8*	*2*	*0.27*	*C?*	*47.0*	*54.9*	*6.9*	
LF32	PF007632	85243	3/14/01	-12	91	< LOD			4			< LOD			
Reference materials															
LR01	Celite mine, Lompoc	Dark crude	9/27/00	sand	457	13.2	3.9	2.9	3	-	PC	15.9	56.4	3.5	27.2
LR02	Celite mine, Lompoc	Dark crude	9/27/00	block	401	13.6	3.9	3.4	2	0.46	PC	19.7	55.3	4.9	47.8
LR03	Celite mine, Lompoc	Light crude	9/27/00	block	477	14.7	3.8	3.1	3	-	PC	7.0	54.9	1.5	29.5
LR04	Celite mine, Lompoc	Overburden	9/27/00		470	11.8	4.1	2.5	2	0.47	PC	45.1	55.1	9.6	34.5
LR05	Celite, Lompoc	Celite 500	9/27/00		554	20.0	3.8	3.6	3	-	PC	26.2	62.6	4.7	
LR06	Celite, Lompoc	Celite 512	9/27/00		412	78.4	9.9	19.0	1	0.37	C	< LOD			
LR07	Celite, Lompoc	Hyflo Super-Cel	9/27/00		546	150.1	4.0	27.5	1	0.49	C	5.1	59.2	0.9	
LR08	Olive & V St., Lompoc	Ag. soil	9/27/00		622	13.9	5.2	2.2	2	0.36	C?	93.1	65.1	15.0	5.8
LR09	Olive & Bodger Rd., Lompoc	Ag. soil	9/27/00		566	13.1	3.8	2.3	2	0.31	C?	45.7	54.8	8.1	6.7
LR10	Lompoc water treatment plant	drying basin	2/23/01		474	< LOD			4			< LOD			53.9

Cristobalite LOD = 4.1 ug; Quartz LOD = 4.7 ug. ARB sample mass = difference (post-pre weights) for field filters; UCD Mass for XRD = difference (post-pre weights) for Ag membrane filters. PC = poorly crystalline; C = highly crystalline; C? = some highly crystalline character.

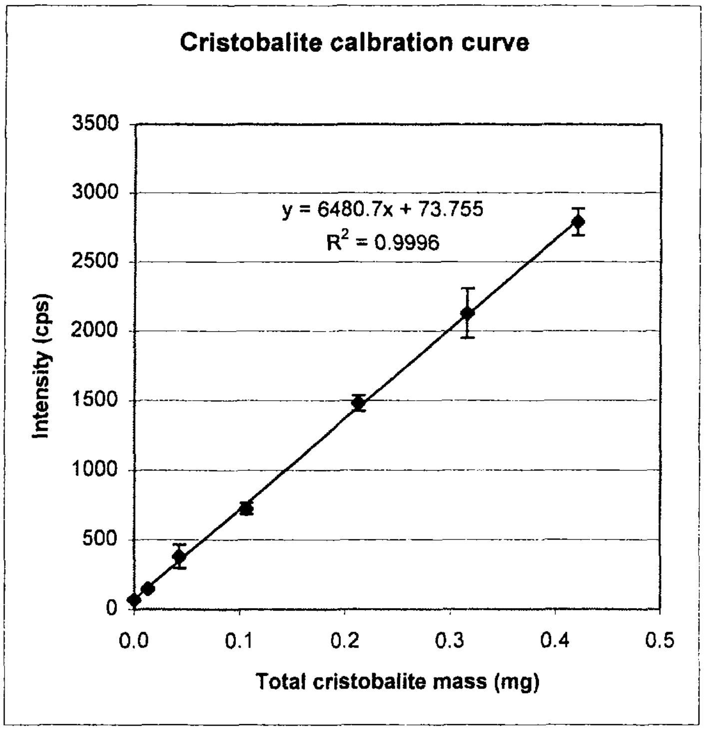


Figure 1. Cristobalite Calibration Curve

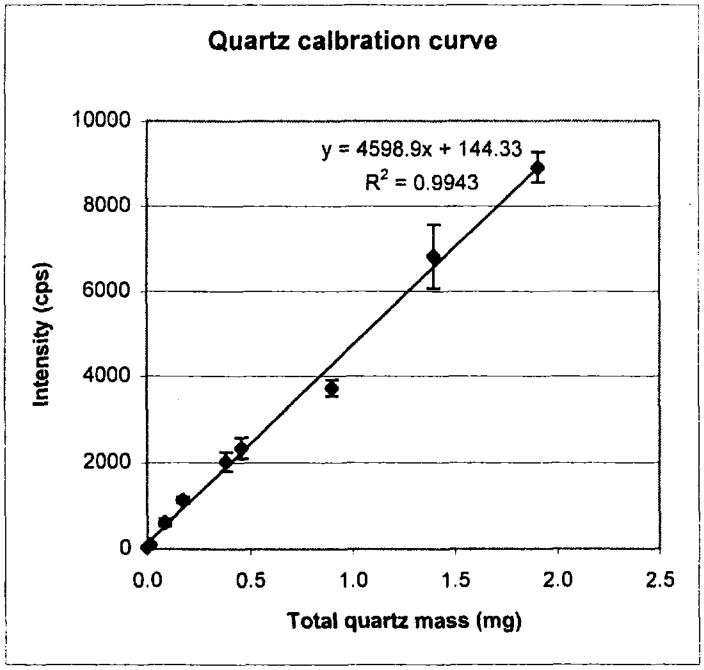
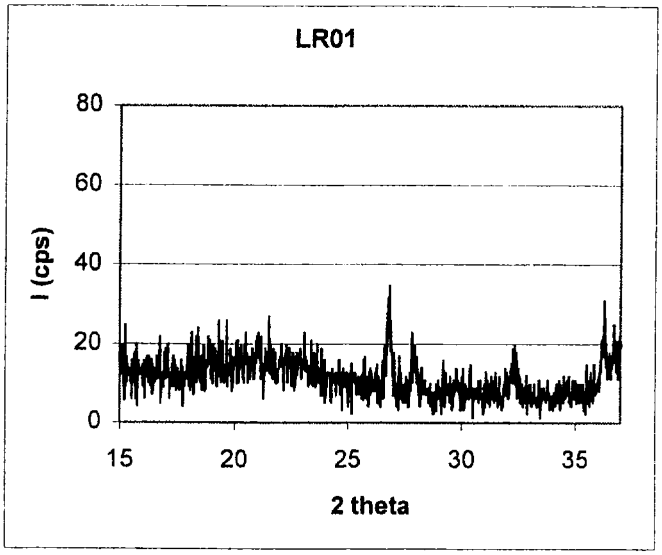


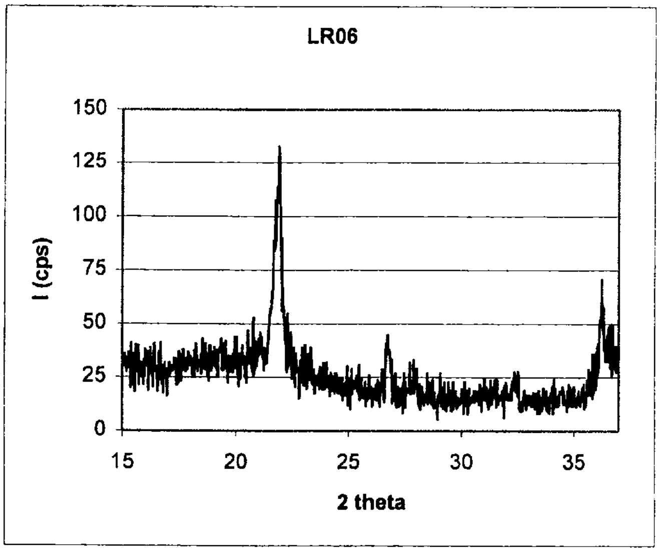
Figure 2. Quartz Calibration Curve

APPENDIX

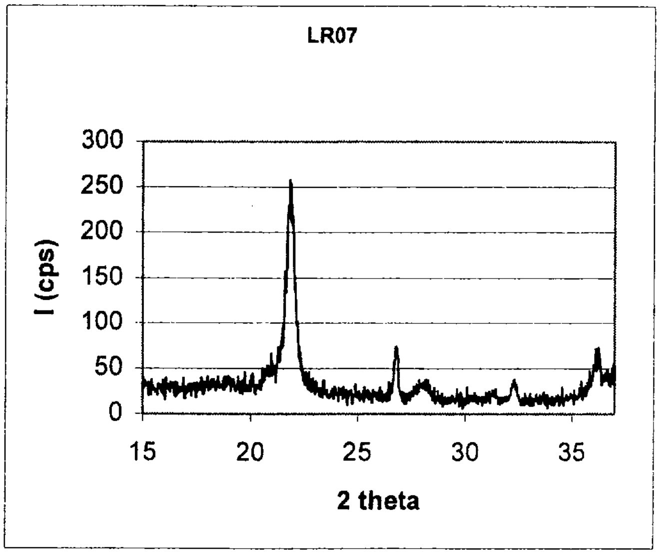
X-ray diffraction patterns (wide scans) of several reference materials and filter samples.



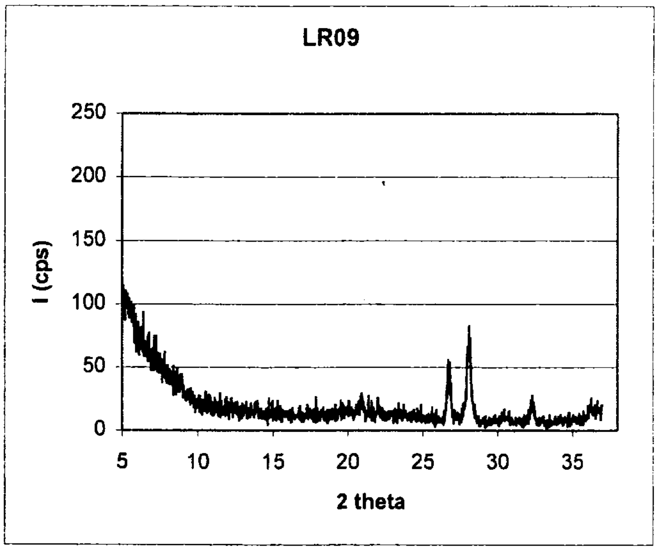
Celite Mine, Lompoc, Dark Crude



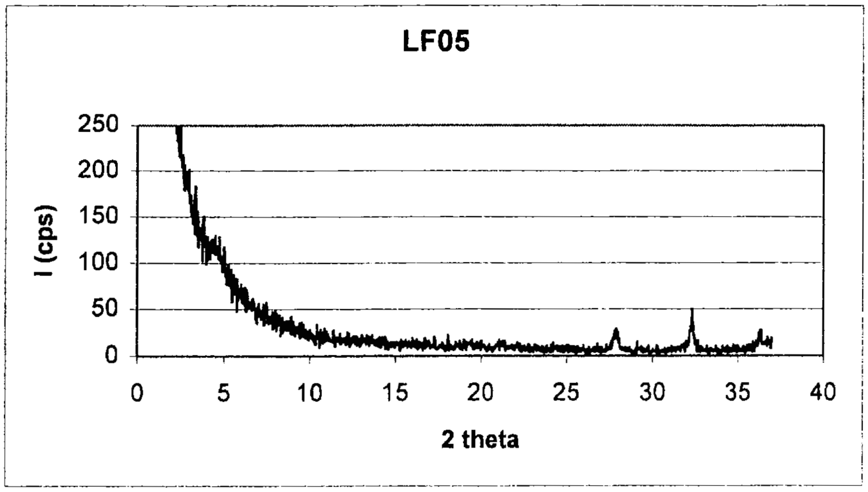
Celite, Lompoc, Celite 512



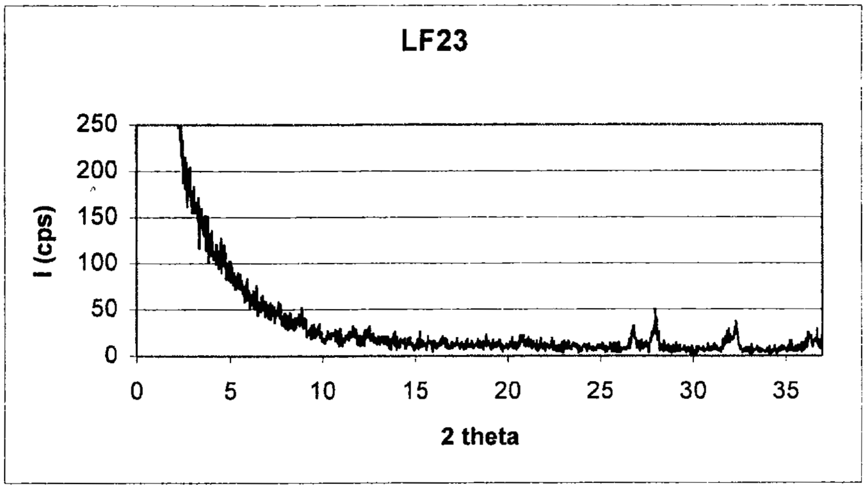
Celite, Lompoc, Hyflo Super – Cel



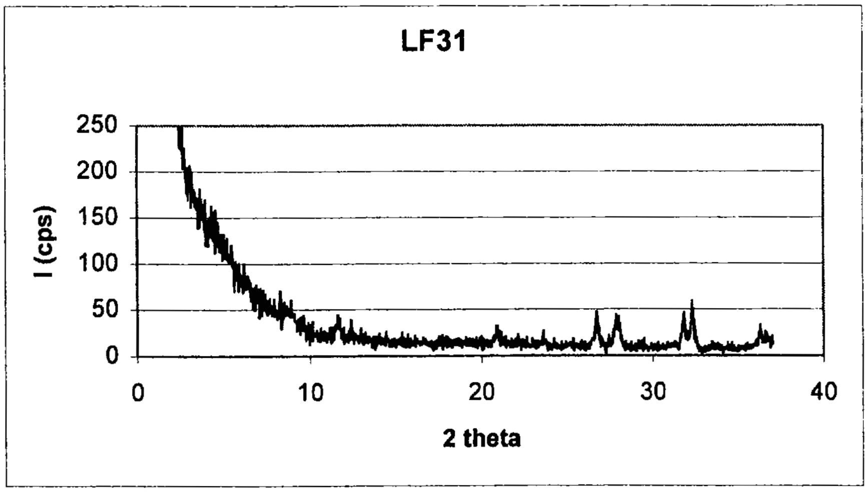
Olive & Bodger Rd., Lompoc, Agricultural Soil



Filter Sample PF007605



Filter Sample PF007623



Filter Sample PF007631

Appendix C

Protocol for Soil/Materials Sampling at Agricultural Fields and Celite Mine in Lompoc – September 2000

9/25/00

PROTOCOL FOR SOIL/MATERIALS SAMPLING AT AGRICULTURAL FIELDS AND CELITE MINE IN LOMPOC - SEPTEMBER 2000

Introduction

In support of the Lompoc Interagency Work Group investigation of respiratory illnesses in Lompoc, the Air Resources Board (ARB) plans to conduct ambient air monitoring for crystalline silica in Lompoc during the fall of 2000. In preparation for this ambient air monitoring, soil/materials samples will be collected at agricultural fields west of Lompoc and at the Celite mine in the hills south of Lompoc. The objective of this soil/materials sampling is to determine the presence or absence of the quartz or cristobalite forms of crystalline silica, which will be analyzed for during the ambient air monitoring. This soil/materials sampling has been coordinated with staff of Celite and the Santa Barbara County Office of the Agricultural Commissioner.

Sampling Procedures

Composite soil samples will be collected by ARB staff from two fields west of Lompoc. Composite soil/materials samples will also be collected from three locations at Celite: 1) from the tailings piles, 2) of mined material prior to processing in the kiln, and 3) of processed material.

Composite samples will consist of four separate 1/4 - 1/2 cup samples from each location. Samples will be collected using disposable plastic cups. A clean cup will be used for each location to avoid cross-contamination between composite samples. Samples will be placed in one-gallon size plastic freezer bags. A sample label will be affixed to each bag. Each sealed bag will be placed inside another clean freezer bag for double containment. All samples will be transported from Lompoc to UC Davis, accompanied by a chain of custody form.

Analysis

A total of five composite soil samples will be analyzed by the UC Davis Crocker Nuclear Laboratory Air Quality Group. Analysis will be conducted for the quartz and cristobalite forms of crystalline silica using X-ray diffraction.

Results

Results will be reported to the ARB by the UC Davis Crocker Nuclear Laboratory along with the results of the ambient air monitoring of crystalline silica.

Appendix D

PM-10 Concentrations on Sampling Days

PM-10 Concentrations on Sampling Days – January – March 2001
($\mu g/m^3$)

	Sampling Sites				
	H Street		Maintenance Yard	Miguelito School	Santa Maria
Sampling Day	Primary	Duplicate			
1/25-26[a]	11		7	12	
1/31-2/1[b]	16		17	17	
2/1-2[b]	20		13	18	
2/6-7[b,d]	24		22	21	
2/9-10[a]	14		13	15	
2/17-18[a]	void		void	15	
3/1-2[c]	23	26			2
3/7-8[c]	16	18			35
3/12-13[c]	22	22			34

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[a] = southerly wind sampling event (wind predicted to be from the south, from the Celite mine and processing plant towards Lompoc)

[b] = westerly wind sampling event (wind predicted to be from the west, the prevailing direction for the Lompoc Valley)

[c] = collocated sampling conducted at H Street site and background sampling conducted at Santa Maria site

[d] = Minuteman III missile launch at Vandenberg AFB during this sampling period

Void samples

Two samples collected on February 17 are noted above as being void. As noted in Appendix G on the log sheets, water from rain got inside the pumps and caused these two pumps to stop operating. These pumps were replaced before additional sampling was conducted in March. In addition, as noted in Appendix G on the log sheets for March 1, two filters are noted as being void. These filters were interchanged before sampling. Since the filters are pre- and post-weighed, to avoid possible error in the final particulate matter weight, these two filters were invalidated and additional filters were used for the March 1 sampling event. No samples were lost on March 1.

Flow checks

Prior to and following sampling in Lompoc, the air sampling flow rates of the BGI PQ100 samplers were checked by ARB's Monitoring and Laboratory Division against a referenced mass flow measuring device. The PQ100 samplers automatically sample at a rate of 16.7 liters per minute. The pre- and post-sampling flow checks indicated that the actual flows were all within 0.1 liters per minute of the flows indicated on the PQ100 digital displays.

Blank filters

Two PVC filters were weighed following the Lompoc sampling as trip blanks. These two filters were weighed along with all of the study filters prior to sampling, accompanied all study filters in storage in Lompoc and were transported back to Sacramento with the study filters. Both blank filters lost mass (3 and12 micrograms, or a loss of 0.01 and 0.05 percent). This is not surprising as PVC filters lose mass due to volatilization of the filter media. This loss does not affect the PM-10 sampling results.

Mass Summary of Lompoc Silica Study

Lab Id	Sampling Date	Pre-Wt Date	Pre-Weight	Post-Wt Date	Post-Weight	Net-Weight	Units
PF007602	01/25/01	12/11/00	23.176	03/19/01	23.434	0.258	milligrams
PF007603	01/25/01	12/11/00	24.275	03/19/01	24.567	0.292	milligrams
PF007604	01/25/01	12/11/00	24.920	03/19/01	25.098	0.178	milligrams
PF007605	01/30/01	12/11/00	27.172	03/19/01	27.579	0.407	milligrams
PF007606	01/30/01	12/11/00	24.942	03/19/01	25.330	0.388	milligrams
PF007607	01/30/01	12/11/00	22.053	03/19/01	22.457	0.404	milligrams
PF007608	01/31/01	12/11/00	28.306	03/19/01	28.303	-0.003	milligrams
PF007609	02/01/01	12/11/00	20.485	03/19/01	20.807	0.322	milligrams
PF007610	02/01/01	12/11/00	22.437	03/19/01	22.915	0.478	milligrams
PF007611	02/01/01	12/11/00	23.079	03/19/01	23.502	0.423	milligrams
PF007612	02/06/01	12/11/00	21.533	03/19/01	22.055	0.522	milligrams
PF007613	02/06/01	12/11/00	22.428	03/19/01	22.998	0.570	milligrams
PF007614	02/06/01	12/11/00	22.682	03/19/01	23.186	0.504	milligrams
PF007615	02/09/01	12/11/00	21.792	03/19/01	22.124	0.332	milligrams
PF007616	02/09/01	12/11/00	22.383	03/19/01	22.610	0.227	milligrams
PF007617	02/09/01	12/11/00	22.356	03/19/01	22.712	0.356	milligrams
PF007620	02/17/01	12/11/00	23.098	03/19/01	23.458	0.360	milligrams
PF007623	03/01/01	12/11/00	22.646	03/19/01	22.685	0.039	milligrams
PF007624	03/01/01	12/11/00	23.956	03/19/01	24.515	0.559	milligrams
PF007625	03/01/01	12/11/00	28.970	03/19/01	29.588	0.618	milligrams
PF007626	03/07/01	12/11/00	32.315	03/19/01	32.703	0.388	milligrams
PF007627	03/07/01	12/11/00	29.677	03/19/01	30.097	0.420	milligrams
PF007628	03/07/01	12/11/00	26.015	03/19/01	26.673	0.658	milligrams
PF007629	03/12/01	12/11/00	26.145	03/19/01	26.668	0.523	milligrams
PF007630	03/12/01	12/11/00	22.842	03/19/01	23.381	0.539	milligrams
PF007631	03/12/01	12/11/00	22.140	03/19/01	22.950	0.810	milligrams
PF007632	03/14/01	12/11/00	22.366	03/19/01	22.354	-0.012	milligrams

Appendix E

Lompoc Meteorological Data for Sampling Days

Lompoc Meteorological Data for Sampling Days

Hourly meteorological data (wind speed and direction, temperature, and standard deviation of the wind direction) for the nine sampling days are presented on the next several pages. The hourly data were provided by the Santa Barbara County Air Pollution Control District from their air monitoring station located between G and H Streets, one half block south of Ocean Avenue in Lompoc. In addition, rainfall data for the sampling days are presented on the next page. The rainfall data were provided by the Lompoc Record from their rain gauge located at the corner of H Street and Ocean Avenue. During the sampling, weather forecasts and real-time meteorological data from the Lompoc Airport were used in making the decision of which days represented desired meteorological conditions for sampling. Following is a summary of the predominant wind directions (the direction the wind was from) from the H Street station for the sampling days:

Sampling Period	Predominant Wind Direction
1	SE, NW
2	W, E
3	W, NE
4	NW
5	SE
6	SE
7	NW, W, NE
8	NW, N
9	NW, S

The attached meteorological data (times are local time, PST) are summarized under the following headings:

WSR = wind speed, resultant, in meters per second
WDR = wind direction, resultant, in degrees
WSA = wind speed, arithmetic average, in meters per second
WDA = wind direction, arithmetic average, in degrees
ATM = ambient temperature (degrees $^{\circ}$C)
SIGT = sigma theta, the standard deviation of the wind direction in degrees

Lompoc Rainfall

Date	Rainfall (inches)
1/25/01	0.00
1/26/01	0.00
1/31/01	0.00
2/1/01	0.00
2/2/01	0.00
2/6/01	0.00
2/7/01	0.00
2/9/01	0.00
2/10/01	0.00
2/17/01	0.30
2/18/01	0.00
3/1/01	0.00
3/2/01	0.00
3/7/01	0.20
3/8/01	0.05
3/12/01	0.00
3/13/01	0.00

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METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:49
For Data From: 25-JAN-2001 00:00

To: 26-JAN-2001 23:00

STATION: LOMPOC-H

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
25-JAN-2001 00:00	0.1	155.	0.6	88.	5.2	102.7	-999.
25-JAN-2001 01:00	0.3	169.	0.7	165.	4.5	85.1	-999.
25-JAN-2001 02:00	0.4	122.	0.7	116.	3.7	92.6	-999.
25-JAN-2001 03:00	0.1	71.	0.6	67.	3.4	101.3	-999.
25-JAN-2001 04:00	0.2	40.	0.4	39.	3.3	75.0	-999.
25-JAN-2001 05:00	0.6	104.	0.7	97.	2.8	31.8	-999.
25-JAN-2001 06:00	0.4	21.	0.8	31.	3.0	61.6	-999.
25-JAN-2001 07:00	0.4	168.	0.8	158.	3.0	71.9	-999.
25-JAN-2001 08:00	0.5	89.	0.6	87.	5.1	40.6	-999.
25-JAN-2001 09:00	0.4	51.	0.7	56.	8.2	64.5	-999.
25-JAN-2001 10:00	1.1	269.	1.2	268.	10.8	33.6	-999.
25-JAN-2001 11:00	2.4	303.	2.6	302.	12.3	25.8	-999.
25-JAN-2001 12:00	3.0	297.	3.3	297.	12.9	25.0	-999.
25-JAN-2001 13:00	2.7	291.	3.0	291.	12.9	27.6	-999.
25-JAN-2001 14:00	3.1	300.	3.4	299.	13.0	23.9	-999.
25-JAN-2001 15:00	2.2	279.	2.5	280.	13.0	27.0	-999.
25-JAN-2001 16:00	1.4	283.	1.6	281.	12.6	31.2	-999.
25-JAN-2001 17:00	1.2	186.	1.3	189.	10.7	27.0	-999.
25-JAN-2001 18:00	0.6	113.	0.9	108.	9.6	89.0	-999.
25-JAN-2001 19:00	1.2	103.	1.4	100.	9.9	43.1	-999.
25-JAN-2001 20:00	1.8	103.	1.9	100.	10.5	25.0	-999.
25-JAN-2001 21:00	1.7	141.	2.0	139.	11.1	44.2	-999.
25-JAN-2001 22:00	2.3	155.	2.6	156.	10.9	29.7	-999.
25-JAN-2001 23:00	1.8	226.	2.8	224.	10.5	50.4	-999.
26-JAN-2001 00:00	0.5	127.	1.5	128.	8.8	92.6	-999.
26-JAN-2001 01:00	2.6	126.	2.7	126.	8.7	16.7	-999.
26-JAN-2001 02:00	2.4	132.	2.7	141.	8.6	38.6	-999.
26-JAN-2001 03:00	1.2	136.	1.6	146.	8.7	49.5	-999.
26-JAN-2001 04:00	1.7	138.	1.8	139.	8.4	18.1	-999.
26-JAN-2001 05:00	1.2	112.	1.5	104.	8.2	49.3	-999.
26-JAN-2001 06:00	0.6	69.	1.2	55.	8.4	67.6	-999.
26-JAN-2001 07:00	0.2	26.	0.9	25.	8.2	93.0	-999.

Sampling Period

1

METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:49
For Data From: 25-JAN-2001 00:00
To: 26-JAN-2001 23:00

STATION: LOMPOC-H

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
26-JAN-2001 08:00	1.0	149.	1.2	156.	8.4	55.9	-999.
26-JAN-2001 09:00	0.9	69.	1.2	70.	9.3	43.4	-999.

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26-JAN-2001 10:00      0.1    294.     0.9    307.    10.3  102.3  -999.

26-JAN-2001 11:00      2.5    275.     2.8    277.    11.7   29.1  -999.
26-JAN-2001 12:00      2.7    288.     3.1    289.    12.0   31.0  -999.
26-JAN-2001 13:00      3.6    279.     3.9    279.    12.2   24.3  -999.
26-JAN-2001 14:00      3.2    278.     3.5    279.    11.1   24.4  -999.

26-JAN-2001 15:00      2.8    303.     3.1    301.    11.3   26.5  -999.
26-JAN-2001 16:00      2.6    314.     2.8    314.    10.9   20.9  -999.
26-JAN-2001 17:00      2.0    304.     2.1    304.    10.0   20.7  -999.
26-JAN-2001 18:00      1.3    264.     1.4    264.     9.0   18.4  -999.

26-JAN-2001 19:00      1.1    267.     1.2    267.     8.3   25.0  -999.
26-JAN-2001 20:00      0.4    249.     0.6    261.     7.3   58.6  -999.
26-JAN-2001 21:00      0.5    222.     0.6    221.     6.8   33.9  -999.
26-JAN-2001 22:00   -999.   -999.      0.6    103.     6.4  -999.  -999.

26-JAN-2001 23:00      0.3    216.     0.6    227.     5.5   84.3  -999.
```

METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:50
For Data From: 31-JAN-2001 00:00
To: 01-FEB-2001 23:00

STATION: LOMPOC-H

Sampling Period 2

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
31-JAN-2001 00:00	0.4	215.	0.9	217.	4.5	79.9	-999.
31-JAN-2001 01:00	0.1	86.	0.7	111.	3.9	102.8	-999.
31-JAN-2001 02:00	0.3	355.	0.4	357.	3.5	46.5	-999.
31-JAN-2001 03:00	0.7	143.	1.0	151.	4.0	75.8	-999.
31-JAN-2001 04:00	0.2	224.	0.9	141.	3.7	103.5	-999.
31-JAN-2001 05:00	1.5	145.	1.7	138.	4.6	37.4	-999.
31-JAN-2001 06:00	0.3	193.	1.1	209.	3.4	96.4	-999.
31-JAN-2001 07:00	0.6	231.	0.8	231.	3.2	61.2	-999.
31-JAN-2001 08:00	1.2	54.	1.4	61.	6.0	38.3	-999.
31-JAN-2001 09:00	1.8	81.	2.0	82.	9.2	28.4	-999.
31-JAN-2001 10:00	1.7	55.	1.9	54.	12.6	27.3	-999.
31-JAN-2001 11:00	0.8	5.	1.9	16.	15.5	64.6	-999.
31-JAN-2001 12:00	2.4	301.	2.7	301.	16.4	26.7	-999.
31-JAN-2001 13:00	3.1	291.	3.4	290.	16.1	25.1	-999.
31-JAN-2001 14:00	3.3	297.	3.6	296.	15.8	22.7	-999.
31-JAN-2001 15:00	3.3	302.	3.5	302.	14.6	20.0	-999.
31-JAN-2001 16:00	3.0	284.	3.3	284.	13.1	25.8	-999.
31-JAN-2001 17:00	2.0	257.	2.1	256.	11.6	20.1	-999.
31-JAN-2001 18:00	1.3	205.	1.4	205.	10.0	23.0	-999.
31-JAN-2001 19:00	0.4	133.	0.8	119.	8.5	66.7	-999.
31-JAN-2001 20:00	0.4	32.	0.5	27.	7.4	26.1	-999.
31-JAN-2001 21:00	0.6	123.	1.0	120.	6.4	68.5	-999.
31-JAN-2001 22:00	0.9	84.	1.1	84.	6.2	47.7	-999.
31-JAN-2001 23:00	1.1	105.	1.4	94.	6.1	43.8	-999.
01-FEB-2001 00:00	1.2	131.	1.7	118.	6.4	79.4	-999.
01-FEB-2001 01:00	1.1	82.	1.3	83.	5.0	38.8	-999.
01-FEB-2001 02:00	0.7	79.	1.1	71.	5.5	60.4	-999.
01-FEB-2001 03:00	0.6	95.	1.5	54.	4.4	79.1	-999.
01-FEB-2001 04:00	1.1	130.	1.5	125.	6.9	69.2	-999.
01-FEB-2001 05:00	0.6	94.	1.7	75.	5.8	86.8	-999.
01-FEB-2001 06:00	1.3	159.	2.2	169.	5.6	57.6	-999.
01-FEB-2001 07:00	0.7	252.	0.9	264.	3.4	51.2	-999.

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METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:50
For Data From: 31-JAN-2001 00:00
To: 01-FEB-2001 23:00

STATION: LOMPOC-H

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
01-FEB-2001 08:00	0.6	276.	0.7	277.	5.7	41.2	-999.
01-FEB-2001 09:00	1.0	260.	1.1	267.	8.2	36.9	-999.

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01-FEB-2001 10:00      1.4    251.     1.5    253.    11.5    24.0   -999.

01-FEB-2001 11:00      1.3    285.     1.6    286.    15.8    37.6   -999.
01-FEB-2001 12:00      2.8    287.     3.0    286.    17.6    24.6   -999.
01-FEB-2001 13:00      3.3    267.     3.6    267.    17.5    21.8   -999.
01-FEB-2001 14:00      2.8    259.     3.0    261.    18.4    22.3   -999.

01-FEB-2001 15:00      2.7    269.     2.9    268.    19.2    22.0   -999.
01-FEB-2001 16:00      3.5    272.     3.7    271.    16.7    21.1   -999.
01-FEB-2001 17:00      2.6    265.     2.8    265.    13.3    19.0   -999.
01-FEB-2001 18:00      2.1    261.     2.2    261.    12.6    17.3   -999.

01-FEB-2001 19:00      1.5    267.     1.6    267.    11.9    18.8   -999.
01-FEB-2001 20:00      0.6     32.     1.0     40.     9.6    56.6   -999.
01-FEB-2001 21:00      0.6     92.     0.8     93.     7.6    55.6   -999.
01-FEB-2001 22:00      0.2    347.     0.6    343.     6.7    73.9   -999.

01-FEB-2001 23:00      0.4    184.     0.7    184.     5.3    62.6   -999.
```

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1
                                          METEOROLOGICAL REPORT

                                          Report Date:    24-OCT-2001 13:50
                                          For Data From:  01-FEB-2001 00:00

                                                     To:  02-FEB-2001 23:00

   STATION: LOMPOC-H

                          WSR    WDR    WSA    WDA    ATM    SIGT   SIGV
   DATE/TIME              M/S    DEG    M/S    DEG    DEG/C  DEG    M/S
   -----------------     ------ ------ ------ ------ ------ ------ ------
   01-FEB-2001 00:00        1.2   131.    1.7   118.    6.4   79.4  -999.
   01-FEB-2001 01:00        1.1    82.    1.3    83.    5.0   38.8  -999.
   01-FEB-2001 02:00        0.7    79.    1.1    71.    5.5   60.4  -999.

   01-FEB-2001 03:00        0.6    95.    1.5    54.    4.4   79.1  -999.
   01-FEB-2001 04:00        1.1   130.    1.5   125.    6.9   69.2  -999.
   01-FEB-2001 05:00        0.6    94.    1.7    75.    5.8   86.8  -999.
   01-FEB-2001 06:00        1.3   159.    2.2   169.    5.6   57.6  -999.

   01-FEB-2001 07:00        0.7   252.    0.9   264.    3.4   51.2  -999.
   01-FEB-2001 08:00        0.6   276.    0.7   277.    5.7   41.2  -999.
   01-FEB-2001 09:00        1.0   260.    1.1   267.    8.2   36.9  -999.
   01-FEB-2001 10:00        1.4   251.    1.5   253.   11.5   24.0  -999.

   01-FEB-2001 11:00        1.3   285.    1.6   286.   15.8   37.6  -999.
   01-FEB-2001 12:00        2.8   287.    3.0   286.   17.6   24.6  -999.
   01-FEB-2001 13:00        3.3   267.    3.6   267.   17.5   21.8  -999.
   01-FEB-2001 14:00        2.8   259.    3.0   261.   18.4   22.3  -999.

   01-FEB-2001 15:00        2.7   269.    2.9   268.   19.2   22.0  -999.
   01-FEB-2001 16:00        3.5   272.    3.7   271.   16.7   21.1  -999.
   01-FEB-2001 17:00        2.6   265.    2.8   265.   13.3   19.0  -999.
   01-FEB-2001 18:00        2.1   261.    2.2   261.   12.6   17.3  -999.

   01-FEB-2001 19:00        1.5   267.    1.6   267.   11.9   18.8  -999.
   01-FEB-2001 20:00        0.6    32.    1.0    40.    9.6   56.6  -999.
   01-FEB-2001 21:00        0.6    92.    0.8    93.    7.6   55.6  -999.
   01-FEB-2001 22:00        0.2   347.    0.6   343.    6.7   73.9  -999.

   01-FEB-2001 23:00        0.4   184.    0.7   184.    5.3   62.6  -999.
   02-FEB-2001 00:00        0.4   242.    0.6   245.    4.9   80.6  -999.
   02-FEB-2001 01:00        0.8   105.    1.0   108.    3.9   38.2  -999.
   02-FEB-2001 02:00        0.3    47.    0.8    39.    4.2   81.4  -999.

   02-FEB-2001 03:00        0.5   274.    0.8   277.    3.9   51.4  -999.
   02-FEB-2001 04:00        0.6   273.    0.8   272.    3.3   49.9  -999.
   02-FEB-2001 05:00        0.8   245.    1.0   251.    2.7   49.1  -999.
   02-FEB-2001 06:00        0.3   199.    0.7   194.    2.4   87.1  -999.

   02-FEB-2001 07:00        0.7   232.    0.8   231.    2.7   30.9  -999.
1
                                          METEOROLOGICAL REPORT

                                          Report Date:    24-OCT-2001 13:50
                                          For Data From:  01-FEB-2001 00:00
                                                     To:  02-FEB-2001 23:00

   STATION: LOMPOC-H

                          WSR    WDR    WSA    WDA    ATM    SIGT   SIGV
   DATE/TIME              M/S    DEG    M/S    DEG    DEG/C  DEG    M/S
   -----------------     ------ ------ ------ ------ ------ ------ ------
   02-FEB-2001 08:00        0.0    81.    0.7    41.    4.5   97.2  -999.
   02-FEB-2001 09:00        0.2    69.    0.7    85.    8.6   96.8  -999.
```

Sampling Period 3

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02-FEB-2001 10:00     0.1    45.    0.7    57.   13.6   95.2  -999.

02-FEB-2001 11:00     1.3   289.    1.6   289.   16.8   43.7  -999.
02-FEB-2001 12:00     3.1   274.    3.3   276.   18.0   24.5  -999.
02-FEB-2001 13:00     4.1   271.    4.4   272.   17.9   21.4  -999.
02-FEB-2001 14:00     4.6   263.    4.9   263.   16.0   18.8  -999.

02-FEB-2001 15:00     4.3   263.    4.5   264.   15.7   20.0  -999.
02-FEB-2001 16:00     4.2   268.    4.4   267.   14.7   20.1  -999.
02-FEB-2001 17:00     3.7   258.    3.9   258.   12.9   17.3  -999.
02-FEB-2001 18:00     1.4   265.    1.8   263.   12.6   57.8  -999.

02-FEB-2001 19:00     0.5   166.    0.7   159.   10.6   85.2  -999.
02-FEB-2001 20:00     0.2    70.    0.6    52.    9.7   92.2  -999.
02-FEB-2001 21:00     0.2   160.    0.5   175.    9.1   89.9  -999.
02-FEB-2001 22:00     0.3    57.    0.5    54.    8.6   49.2  -999.

02-FEB-2001 23:00     0.2   332.    0.8    26.    8.2   86.3  -999.
```

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METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:51
For Data From: 06-FEB-2001 00:00
To: 07-FEB-2001 23:00

STATION: LOMPOC-H

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
06-FEB-2001 00:00	3.1	275.	3.3	276.	12.2	20.8	-999.
06-FEB-2001 01:00	2.4	279.	2.6	280.	11.9	22.8	-999.
06-FEB-2001 02:00	2.1	271.	2.2	272.	12.1	23.4	-999.
06-FEB-2001 03:00	2.1	287.	2.3	289.	11.6	25.3	-999.
06-FEB-2001 04:00	2.7	275.	2.9	276.	11.3	23.8	-999.
06-FEB-2001 05:00	2.5	287.	2.7	287.	11.4	22.7	-999.
06-FEB-2001 06:00	2.3	295.	2.5	294.	11.1	22.9	-999.
06-FEB-2001 07:00	2.3	300.	2.5	299.	11.1	23.0	-999.
06-FEB-2001 08:00	3.3	287.	3.5	287.	11.5	23.6	-999.
06-FEB-2001 09:00	4.2	298.	4.5	297.	12.4	20.9	-999.
06-FEB-2001 10:00	4.5	300.	4.8	299.	12.9	21.5	-999.
06-FEB-2001 11:00	5.7	299.	6.1	298.	13.1	20.6	-999.
06-FEB-2001 12:00	5.3	296.	5.8	295.	13.1	23.6	-999.
06-FEB-2001 13:00	6.0	302.	6.3	301.	12.5	20.9	-999.
06-FEB-2001 14:00	5.9	304.	6.3	304.	12.1	21.0	-999.
06-FEB-2001 15:00	6.2	307.	6.6	307.	11.9	19.2	-999.
06-FEB-2001 16:00	6.4	305.	6.8	304.	11.0	20.4	-999.
06-FEB-2001 17:00	5.4	299.	5.7	299.	10.3	21.5	-999.
06-FEB-2001 18:00	5.5	302.	5.8	301.	9.8	19.8	-999.
06-FEB-2001 19:00	5.6	304.	5.9	304.	9.7	20.2	-999.
06-FEB-2001 20:00	5.3	312.	5.6	311.	9.9	20.0	-999.
06-FEB-2001 21:00	4.7	316.	5.0	315.	9.3	19.3	-999.
06-FEB-2001 22:00	2.9	321.	3.1	323.	8.9	22.4	-999.
06-FEB-2001 23:00	2.1	328.	2.2	328.	8.0	19.6	-999.
07-FEB-2001 00:00	1.9	338.	2.1	337.	7.5	19.2	-999.
07-FEB-2001 01:00	3.2	327.	3.4	326.	8.4	20.9	-999.
07-FEB-2001 02:00	3.8	315.	4.1	314.	8.8	20.5	-999.
07-FEB-2001 03:00	2.9	323.	3.2	326.	8.3	22.9	-999.
07-FEB-2001 04:00	1.7	316.	1.9	313.	6.4	26.3	-999.
07-FEB-2001 05:00	1.2	263.	1.2	262.	5.1	20.9	-999.
07-FEB-2001 06:00	1.0	213.	1.1	213.	3.7	35.0	-999.
07-FEB-2001 07:00	0.7	177.	0.9	167.	4.0	50.0	-999.

Sampling Period 4

METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:51
For Data From: 06-FEB-2001 00:00
To: 07-FEB-2001 23:00

STATION: LOMPOC-H

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
07-FEB-2001 08:00	0.7	189.	0.8	181.	6.2	64.3	-999.
07-FEB-2001 09:00	1.1	345.	1.3	346.	8.2	42.5	-999.

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07-FEB-2001 10:00      3.2    334.      3.5    332.     10.6     26.6   -999.

07-FEB-2001 11:00      3.6    316.      4.1    314.     11.3     29.8   -999.
07-FEB-2001 12:00      4.5    312.      4.8    312.     11.1     23.5   -999.
07-FEB-2001 13:00      4.6    299.      5.0    298.     11.1     22.6   -999.
07-FEB-2001 14:00      4.7    290.      5.1    290.     11.5     23.5   -999.

07-FEB-2001 15:00      4.3    294.      4.7    294.     11.3     23.5   -999.
07-FEB-2001 16:00      4.1    302.      4.4    301.     10.7     21.7   -999.
07-FEB-2001 17:00      3.4    301.      3.6    301.      9.8     19.6   -999.
07-FEB-2001 18:00      1.7    298.      1.9    290.      8.8     33.0   -999.

07-FEB-2001 19:00      1.4    244.      1.5    245.      7.9     18.2   -999.
07-FEB-2001 20:00      0.7    235.      0.9    231.      7.3     55.7   -999.
07-FEB-2001 21:00      1.0    229.      1.1    232.      5.8     31.0   -999.
07-FEB-2001 22:00      0.5    265.      0.9    256.      5.7     64.3   -999.

07-FEB-2001 23:00      0.6    144.      0.9    140.      4.4     76.9   -999.
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METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:51
For Data From: 09-FEB-2001 00:00
To: 10-FEB-2001 23:00

STATION: LOMPOC-H

Sampling Period 5

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
09-FEB-2001 00:00	0.0	304.	1.0	151.	3.5	100.5	-999.
09-FEB-2001 01:00	0.4	201.	1.0	193.	2.5	66.0	-999.
09-FEB-2001 02:00	0.9	76.	1.2	82.	3.3	72.5	-999.
09-FEB-2001 03:00	0.9	273.	1.0	281.	2.6	34.7	-999.
09-FEB-2001 04:00	0.5	109.	0.9	109.	1.8	55.6	-999.
09-FEB-2001 05:00	0.5	90.	0.8	91.	2.4	79.3	-999.
09-FEB-2001 06:00	0.5	38.	0.8	32.	3.5	52.7	-999.
09-FEB-2001 07:00	0.9	284.	1.0	287.	3.8	30.0	-999.
09-FEB-2001 08:00	0.6	102.	1.5	55.	6.3	81.4	-999.
09-FEB-2001 09:00	4.4	145.	4.6	146.	10.5	17.9	-999.
09-FEB-2001 10:00	4.0	140.	4.2	141.	11.4	21.8	-999.
09-FEB-2001 11:00	3.2	135.	3.5	135.	11.0	26.1	-999.
09-FEB-2001 12:00	5.2	139.	5.5	141.	12.4	21.0	-999.
09-FEB-2001 13:00	5.4	142.	5.8	144.	12.7	22.3	-999.
09-FEB-2001 14:00	6.3	138.	6.5	138.	11.3	16.0	-999.
09-FEB-2001 15:00	4.6	140.	4.8	142.	10.3	18.7	-999.
09-FEB-2001 16:00	4.4	144.	4.6	145.	10.2	18.0	-999.
09-FEB-2001 17:00	3.8	136.	3.9	136.	9.6	15.8	-999.
09-FEB-2001 18:00	2.6	145.	2.7	146.	9.8	21.8	-999.
09-FEB-2001 19:00	0.6	114.	1.9	97.	9.7	94.5	-999.
09-FEB-2001 20:00	0.5	105.	1.0	93.	9.6	87.0	-999.
09-FEB-2001 21:00	1.3	163.	1.8	174.	9.8	55.8	-999.
09-FEB-2001 22:00	0.7	132.	1.1	133.	9.7	79.3	-999.
09-FEB-2001 23:00	0.7	142.	0.9	137.	9.3	46.9	-999.
10-FEB-2001 00:00	0.9	161.	1.1	162.	9.1	55.1	-999.
10-FEB-2001 01:00	0.3	115.	0.8	130.	8.9	96.8	-999.
10-FEB-2001 02:00	1.0	157.	1.1	159.	8.0	27.8	-999.
10-FEB-2001 03:00	1.1	121.	1.2	112.	7.3	31.6	-999.
10-FEB-2001 04:00	1.1	92.	1.2	92.	7.1	32.0	-999.
10-FEB-2001 05:00	0.1	211.	1.0	221.	7.1	97.9	-999.
10-FEB-2001 06:00	0.9	115.	1.0	113.	6.9	21.8	-999.
10-FEB-2001 07:00	1.2	139.	1.3	136.	7.4	24.4	-999.

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METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:51
For Data From: 09-FEB-2001 00:00
To: 10-FEB-2001 23:00

STATION: LOMPOC-H

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
10-FEB-2001 08:00	0.4	225.	1.0	243.	8.2	78.9	-999.
10-FEB-2001 09:00	0.4	20.	0.7	15.	10.0	67.7	-999.

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METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:51
For Data From: 17-FEB-2001 00:00
To: 18-FEB-2001 23:00

STATION: LOMPOC-H

Sampling Period 6

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
17-FEB-2001 00:00	1.2	173.	1.3	174.	7.8	26.7	-999.
17-FEB-2001 01:00	0.1	100.	0.7	41.	7.3	96.7	-999.
17-FEB-2001 02:00	1.9	117.	2.0	115.	9.0	16.1	-999.
17-FEB-2001 03:00	1.4	127.	2.1	141.	9.3	73.4	-999.
17-FEB-2001 04:00	0.8	229.	1.0	230.	8.3	60.9	-999.
17-FEB-2001 05:00	0.6	57.	0.9	59.	7.9	70.5	-999.
17-FEB-2001 06:00	1.6	110.	1.7	110.	9.3	12.5	-999.
17-FEB-2001 07:00	1.3	102.	1.7	108.	9.8	59.5	-999.
17-FEB-2001 08:00	1.7	102.	2.0	98.	11.4	38.3	-999.
17-FEB-2001 09:00	3.5	124.	3.6	124.	13.1	16.7	-999.
17-FEB-2001 10:00	4.3	123.	4.6	121.	15.4	29.9	-999.
17-FEB-2001 11:00	5.2	134.	5.5	136.	16.4	20.5	-999.
17-FEB-2001 12:00	4.3	145.	4.7	148.	15.9	25.2	-999.
17-FEB-2001 13:00	3.9	157.	4.3	157.	15.4	24.4	-999.
17-FEB-2001 14:00	4.7	143.	5.1	144.	15.7	22.2	-999.
17-FEB-2001 15:00	4.4	154.	4.7	154.	14.5	22.2	-999.
17-FEB-2001 16:00	3.8	145.	4.0	147.	13.3	19.3	-999.
17-FEB-2001 17:00	3.3	143.	3.5	144.	12.9	19.0	-999.
17-FEB-2001 18:00	4.1	137.	4.2	138.	13.0	15.6	-999.
17-FEB-2001 19:00	4.3	130.	4.5	131.	12.8	19.1	-999.
17-FEB-2001 20:00	3.2	141.	3.4	142.	12.7	19.5	-999.
17-FEB-2001 21:00	5.6	133.	5.8	133.	12.8	14.2	-999.
17-FEB-2001 22:00	5.9	138.	6.1	139.	12.7	15.8	-999.
17-FEB-2001 23:00	5.9	138.	6.1	138.	10.8	15.4	-999.
18-FEB-2001 00:00	4.7	144.	4.9	145.	10.2	17.7	-999.
18-FEB-2001 01:00	4.6	137.	4.8	137.	10.4	15.5	-999.
18-FEB-2001 02:00	3.9	143.	4.1	145.	10.9	18.9	-999.
18-FEB-2001 03:00	3.1	126.	3.2	126.	11.0	15.6	-999.
18-FEB-2001 04:00	3.3	126.	3.5	128.	10.4	20.6	-999.
18-FEB-2001 05:00	1.1	146.	1.5	154.	10.4	78.2	-999.
18-FEB-2001 06:00	1.2	127.	1.4	122.	10.5	51.1	-999.
18-FEB-2001 07:00	0.5	115.	1.0	110.	10.7	99.7	-999.

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METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:51
For Data From: 17-FEB-2001 00:00
To: 18-FEB-2001 23:00

STATION: LOMPOC-H

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
18-FEB-2001 08:00	3.0	125.	3.2	127.	11.4	45.4	-999.
18-FEB-2001 09:00	2.7	138.	2.9	140.	12.3	20.5	-999.

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                                              METEOROLOGICAL REPORT

                                              Report Date:   24-OCT-2001 13:52
                                              For Data From: 01-MAR-2001 00:00

                                                       To:   02-MAR-2001 23:00


 STATION: LOMPOC-H

                        WSR    WDR    WSA    WDA    ATM    SIGT   SIGV
 DATE/TIME              M/S    DEG    M/S    DEG    DEG/C  DEG    M/S
 -----------------     ------ ------ ------ ------ ------ ------ ------
 01-MAR-2001 00:00        0.4    57.    1.0    83.    8.5   84.8  -999.
 01-MAR-2001 01:00        0.5   164.    0.8   162.    7.5   75.7  -999.
 01-MAR-2001 02:00        0.2   143.    0.8   165.    7.1  100.9  -999.

 01-MAR-2001 03:00        0.3   175.    0.7   186.    6.3   69.5  -999.
 01-MAR-2001 04:00        0.3   359.    0.6    13.    5.8   75.5  -999.
 01-MAR-2001 05:00        0.5   223.    0.8   224.    5.3   76.0  -999.
 01-MAR-2001 06:00        0.6    91.    0.9    94.    5.1   79.4  -999.

 01-MAR-2001 07:00        0.6    87.    0.8    84.    6.8   62.4  -999.
 01-MAR-2001 08:00        0.6    25.    1.0    29.    8.9   64.4  -999.
 01-MAR-2001 09:00        0.4   287.    1.0   299.   11.0   83.4  -999.
 01-MAR-2001 10:00        0.4   318.    1.3   308.   13.2   79.5  -999.

 01-MAR-2001 11:00        1.7   305.    2.1   304.   15.2   45.8  -999.
 01-MAR-2001 12:00        3.4   294.    3.7   293.   15.5   25.6  -999.
 01-MAR-2001 13:00        3.4   286.    3.7   285.   15.2   25.7  -999.
 01-MAR-2001 14:00        3.6   271.    3.9   271.   15.0   22.4  -999.

 01-MAR-2001 15:00        3.6   274.    3.8   274.   15.0   23.0  -999.
 01-MAR-2001 16:00        3.4   265.    3.6   266.   14.7   21.0  -999.
 01-MAR-2001 17:00        2.6   281.    2.8   282.   13.4   24.0  -999.
 01-MAR-2001 18:00        2.2   264.    2.3   264.   11.8   17.5  -999.

 01-MAR-2001 19:00        2.0   258.    2.1   258.   11.4   16.3  -999.
 01-MAR-2001 20:00        2.0   265.    2.1   265.   11.4   18.1  -999.
 01-MAR-2001 21:00        1.4   279.    1.5   284.   11.1   29.7  -999.
 01-MAR-2001 22:00        0.2    25.    0.6    50.    9.5   72.6  -999.

 01-MAR-2001 23:00        0.4    52.    0.7    64.    8.6   92.8  -999.
 02-MAR-2001 00:00        0.1    67.    0.5    18.    8.4   92.9  -999.
 02-MAR-2001 01:00        0.6    54.    0.7    43.    8.2   42.8  -999.
 02-MAR-2001 02:00        0.3    65.    0.5    37.    8.3   87.1  -999.

 02-MAR-2001 03:00        0.6    65.    0.7    69.    8.3   31.0  -999.
 02-MAR-2001 04:00        0.3   310.    0.5   312.    8.7   48.4  -999.
 02-MAR-2001 05:00        0.4    43.    0.7    42.    8.7   63.8  -999.
 02-MAR-2001 06:00        0.1   141.    0.5    96.    8.9  100.6  -999.

 02-MAR-2001 07:00        0.3    47.    0.4    32.    9.4   47.6  -999.
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                                              METEOROLOGICAL REPORT

                                              Report Date:   24-OCT-2001 13:52
                                              For Data From: 01-MAR-2001 00:00
                                                       To:   02-MAR-2001 23:00


 STATION: LOMPOC-H

                        WSR    WDR    WSA    WDA    ATM    SIGT   SIGV
 DATE/TIME              M/S    DEG    M/S    DEG    DEG/C  DEG    M/S
 -----------------     ------ ------ ------ ------ ------ ------ ------
 02-MAR-2001 08:00        1.3   288.    1.5   287.   11.3   38.0  -999.
 02-MAR-2001 09:00        1.6   282.    1.8   283.   12.5   30.5  -999.
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Sampling Period 7

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02-MAR-2001 10:00      3.1   281.    3.4   281.   13.7   26.6  -999.

02-MAR-2001 11:00      3.5   278.    3.8   278.   13.6   25.5  -999.
02-MAR-2001 12:00      3.2   272.    3.5   272.   13.7   25.0  -999.
02-MAR-2001 13:00      3.3   266.    3.6   265.   12.9   23.9  -999.
02-MAR-2001 14:00      2.7   265.    2.9   267.   12.6   24.8  -999.

02-MAR-2001 15:00      2.9   268.    3.1   268.   12.4   22.9  -999.
02-MAR-2001 16:00      2.5   270.    2.7   271.   12.2   24.5  -999.
02-MAR-2001 17:00      2.7   283.    2.9   282.   11.7   24.2  -999.
02-MAR-2001 18:00      2.6   299.    2.8   298.   11.3   22.1  -999.

02-MAR-2001 19:00      2.5   298.    2.7   297.   11.6   23.0  -999.
02-MAR-2001 20:00      2.0   302.    2.1   301.   11.5   21.1  -999.
02-MAR-2001 21:00      1.7   299.    1.8   297.   11.3   23.0  -999.
02-MAR-2001 22:00      2.0   294.    2.2   294.   11.2   22.2  -999.

02-MAR-2001 23:00      2.1   284.    2.3   284.   11.2   23.5  -999.
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                                               METEOROLOGICAL REPORT

                                               Report Date:    24-OCT-2001 13:52
                                               For Data From:  07-MAR-2001 00:00

                                                        To:    08-MAR-2001 23:00


 STATION: LOMPOC-H

                         WSR    WDR    WSA    WDA    ATM    SIGT   SIGV
 DATE/TIME               M/S    DEG    M/S    DEG    DEG/C  DEG    M/S
 -----------------       ------ ------ ------ ------ ------ ------ ------
 07-MAR-2001 00:00          0.2   162.    0.8   171.   10.4   99.3  -999.
 07-MAR-2001 01:00          0.5   247.    0.7   248.   10.7   54.1  -999.
 07-MAR-2001 02:00          0.5    93.    0.7    97.   10.7   54.5  -999.

 07-MAR-2001 03:00          0.2   113.    0.6    71.   10.8   96.5  -999.
 07-MAR-2001 04:00          0.5    80.    0.7    71.   11.0   47.5  -999.
 07-MAR-2001 05:00          0.3   184.    0.6   201.   10.9   85.2  -999.
 07-MAR-2001 06:00          0.2   181.    0.5   178.   10.1   79.0  -999.

 07-MAR-2001 07:00          0.5    34.    0.6    43.   10.8   48.2  -999.
 07-MAR-2001 08:00          2.2   270.    2.4   272.   13.6   24.6  -999.
 07-MAR-2001 09:00          2.9   267.    3.1   268.   14.2   22.4  -999.
 07-MAR-2001 10:00          3.4   259.    3.6   259.   15.0   19.5  -999.

 07-MAR-2001 11:00          3.4   273.    3.6   274.   16.1   23.6  -999.
 07-MAR-2001 12:00          4.3   277.    4.7   277.   15.9   23.8  -999.
 07-MAR-2001 13:00          4.7   275.    5.0   275.   15.5   22.1  -999.
 07-MAR-2001 14:00          4.0   271.    4.3   271.   15.7   23.0  -999.

 07-MAR-2001 15:00          4.2   265.    4.5   265.   15.0   20.6  -999.
 07-MAR-2001 16:00          3.9   268.    4.1   268.   14.0   21.9  -999.
 07-MAR-2001 17:00          2.9   282.    3.1   283.   13.3   25.4  -999.
 07-MAR-2001 18:00          2.3   291.    2.4   289.   12.9   23.8  -999.

 07-MAR-2001 19:00          2.1   290.    2.2   290.   12.8   23.6  -999.
 07-MAR-2001 20:00          1.9   284.    2.1   284.   12.8   24.2  -999.
 07-MAR-2001 21:00          1.8   281.    2.0   281.   12.9   22.4  -999.
 07-MAR-2001 22:00          1.6   276.    1.7   277.   12.9   27.2  -999.

 07-MAR-2001 23:00          1.5   277.    1.6   278.   12.8   25.8  -999.
 08-MAR-2001 00:00          1.0   304.    1.4   306.   12.6   46.0  -999.
 08-MAR-2001 01:00          1.0    17.    1.2    16.   12.3   29.3  -999.
 08-MAR-2001 02:00          1.1   343.    1.2   341.   12.1   25.7  -999.

 08-MAR-2001 03:00          1.1     3.    1.2     3.   11.9   21.0  -999.
 08-MAR-2001 04:00          1.0    43.    1.1    43.   11.8   23.6  -999.
 08-MAR-2001 05:00          0.9     8.    1.0     9.   11.6   23.9  -999.
 08-MAR-2001 06:00          1.3   324.    1.4   322.   11.6   23.4  -999.

 08-MAR-2001 07:00          0.6   356.    1.1    13.   11.6   64.7  -999.
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                                               METEOROLOGICAL REPORT

                                               Report Date:    24-OCT-2001 13:52
                                               For Data From:  07-MAR-2001 00:00
                                                        To:    08-MAR-2001 23:00


 STATION: LOMPOC-H

                         WSR    WDR    WSA    WDA    ATM    SIGT   SIGV
 DATE/TIME               M/S    DEG    M/S    DEG    DEG/C  DEG    M/S
 -----------------       ------ ------ ------ ------ ------ ------ ------
 08-MAR-2001 08:00          0.4   212.    0.7   208.   12.0   61.0  -999.
 08-MAR-2001 09:00          1.1   287.    1.3   286.   12.3   27.8  -999.
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Sampling Period 8

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08-MAR-2001 10:00      2.0   275.     2.2   275.    12.8    24.0   -999.

08-MAR-2001 11:00      1.8   278.     2.0   279.    13.1    26.1   -999.
08-MAR-2001 12:00      2.2   271.     2.4   271.    13.5    24.3   -999.
08-MAR-2001 13:00      3.2   275.     3.4   276.    13.4    23.3   -999.
08-MAR-2001 14:00      3.0   278.     3.2   279.    13.0    22.9   -999.

08-MAR-2001 15:00      2.9   279.     3.1   279.    12.8    23.3   -999.
08-MAR-2001 16:00      2.8   288.     3.0   288.    12.5    25.3   -999.
08-MAR-2001 17:00      2.7   299.     2.8   299.    12.2    20.8   -999.
08-MAR-2001 18:00      2.3   295.     2.4   294.    11.9    22.7   -999.

08-MAR-2001 19:00      2.4   302.     2.6   301.    11.8    20.6   -999.
08-MAR-2001 20:00      2.2   299.     2.4   299.    11.7    21.1   -999.
08-MAR-2001 21:00      2.4   299.     2.6   298.    11.5    21.8   -999.
08-MAR-2001 22:00      2.4   307.     2.6   307.    11.4    21.1   -999.

08-MAR-2001 23:00      2.2   300.     2.4   300.    11.1    21.7   -999.
```

1

METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:52
For Data From: 12-MAR-2001 00:00
To: 13-MAR-2001 23:00

STATION: LOMPOC-H

Sampling Period 9

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
12-MAR-2001 00:00	0.7	185.	0.7	180.	9.8	31.8	-999.
12-MAR-2001 01:00	0.3	116.	0.6	116.	9.2	69.6	-999.
12-MAR-2001 02:00	0.4	169.	0.8	163.	8.6	74.7	-999.
12-MAR-2001 03:00	0.8	161.	1.1	159.	8.2	65.6	-999.
12-MAR-2001 04:00	0.4	197.	1.2	181.	8.5	81.0	-999.
12-MAR-2001 05:00	0.4	94.	1.1	100.	8.2	103.7	-999.
12-MAR-2001 06:00	0.5	94.	0.8	99.	7.8	77.6	-999.
12-MAR-2001 07:00	0.3	264.	0.8	293.	8.7	75.7	-999.
12-MAR-2001 08:00	1.1	69.	1.3	66.	10.8	37.9	-999.
12-MAR-2001 09:00	0.9	42.	1.2	36.	13.1	56.4	-999.
12-MAR-2001 10:00	0.3	339.	1.2	360.	15.4	87.8	-999.
12-MAR-2001 11:00	0.9	244.	1.7	226.	17.6	69.0	-999.
12-MAR-2001 12:00	3.7	295.	4.0	294.	17.0	23.9	-999.
12-MAR-2001 13:00	3.8	301.	4.1	300.	17.1	23.3	-999.
12-MAR-2001 14:00	4.0	298.	4.3	297.	16.6	24.0	-999.
12-MAR-2001 15:00	3.2	294.	3.5	293.	16.4	24.7	-999.
12-MAR-2001 16:00	2.8	291.	3.1	291.	14.9	24.8	-999.
12-MAR-2001 17:00	2.3	277.	2.6	276.	13.6	25.3	-999.
12-MAR-2001 18:00	1.4	263.	1.5	263.	12.8	19.6	-999.
12-MAR-2001 19:00	1.2	197.	1.3	197.	11.3	20.0	-999.
12-MAR-2001 20:00	0.6	154.	0.7	153.	10.6	47.4	-999.
12-MAR-2001 21:00	0.7	210.	0.8	218.	9.4	36.0	-999.
12-MAR-2001 22:00	0.4	84.	1.1	86.	9.2	100.2	-999.
12-MAR-2001 23:00	0.5	223.	1.1	212.	8.4	82.0	-999.
13-MAR-2001 00:00	0.4	151.	0.9	147.	7.8	82.9	-999.
13-MAR-2001 01:00	0.3	43.	0.8	57.	7.8	96.0	-999.
13-MAR-2001 02:00	0.4	212.	0.9	210.	6.7	69.6	-999.
13-MAR-2001 03:00	0.2	126.	0.6	120.	6.5	93.3	-999.
13-MAR-2001 04:00	0.0	279.	0.6	279.	6.3	87.5	-999.
13-MAR-2001 05:00	0.1	180.	0.5	211.	5.9	96.0	-999.
13-MAR-2001 06:00	0.2	96.	0.4	99.	5.7	67.8	-999.
13-MAR-2001 07:00	0.1	222.	0.8	90.	7.4	97.3	-999.

1

METEOROLOGICAL REPORT

Report Date: 24-OCT-2001 13:52
For Data From: 12-MAR-2001 00:00
To: 13-MAR-2001 23:00

STATION: LOMPOC-H

DATE/TIME	WSR M/S	WDR DEG	WSA M/S	WDA DEG	ATM DEG/C	SIGT DEG	SIGV M/S
13-MAR-2001 08:00	0.5	353.	0.8	358.	10.4	53.7	-999.
13-MAR-2001 09:00	1.5	276.	1.8	279.	14.7	45.5	-999.

Appendix F

Quality Assurance Audit Report

Air Resources Board

Alan C. Lloyd, Ph.D.
Chairman
1001 I Street • P.O. Box 2815 • Sacramento, California 95812 • www.arb.ca.gov

Winston H. Hickox
Agency Secretary

Gray Davis
Governor

MEMORANDUM

TO: Lynn Baker, Staff Air Pollution Specialist
Stationary Source Division

FROM: Michael Miguel, Manager
Quality Assurance Section

DATE: June 19, 2001

SUBJECT: AUDIT REPORT OF CROCKER LABORATORY FOR SILICA

On May 24, 2001, the Quality Assurance (QA) team evaluated the Crocker Nuclear Laboratory at UC Davis that is analyzing samples for crystalline silica (quartz and cristobalite). Overall, the laboratory has acceptable quality assurance/quality control (QA/QC) procedures; however, it was found to be primarily a research facility and therefore does not have in place the QA/QC procedures expected of a laboratory routinely conducting such analyses. Below are the findings and comments of the QA team.

1. The standards of crystalline silica (obtained from the apparent source) analyzed by the laboratory to date, indicate a mixture of particle sizes. Particles of different sizes have different responses to X-ray diffraction. This makes quantitation of ambient samples extremely difficult. The laboratory is minimizing this difficulty by: 1) using peak height rather than peak area for quantitation, 2) all samples are going to be analyzed using two angles of orientation instead of one, and 3) selected samples will be fully scanned to determine possible interferences.

2. The laboratory has adopted the NIOSH Method 7500 for analysis; however, no standard operating procedure (SOP) specific to this laboratory is being followed. The U.S. EPA recommends a laboratory-specific SOP be used for analyses.

3. Prior to analysis, only high levels of standards have been used for calibration curves. It is recommended that standards at or near the detection limit and limit of quantitation (LOQ) also be used. The laboratory indicated that any samples above the LOQ will be bracketed by standards.

4. Although it is preferred that a second method of analysis be used to confirm analytical results, the laboratory indicated no alternate method of analysis is available.

Due to the uncertainty of accurate quantitation and lack of any method to confirm results, the QA team feels any results obtained from this analysis should be considered "order of magnitude" accuracy and used only as an indicator of possible health risks.

If you have any questions regarding the laboratory audit results, please contact Don Fitzell of my staff at (916) 322-3892 or e-mail at dfitzell@arb.ca.gov.

cc: Britt Holmen, Ph.D., UC Davis
Mathew Plate, U.S. EPA Region IX
Randy Segawa, DPR
Kathy Orr, DPR
Don Fitzell

Appendix G

Log Sheets and Chain of Custody Forms

Field Log Sheet

Project: Pilot Study of Crystalline Silica in Ambient Air in Lompoc, CA

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
1	H1	1-25-01 VOID FILTER LOST while INSTALLING								DBU
2	H1	1-25-01 1-26-01	1300 1300	16.7	16.7	✓	–	SOUTH 1440 MIN	K PC	DBU
3	M1	1-25-01 1-26-01	1300 1300	16.7	16.7	✓	–	SOUTH 1440 MIN	K PC	DBU
4	MY1	1-25-01 1-26-01	1300 1300	16.7	16.7	✓	–	SOUTH 1440 MIN	K PC	DBU
5	MY2	1-31-01 2-1-01	1100 1100	16.7	16.7	–	–	W/E 1440 MIN	K K	DBU
6	H2	1-31-01 2-1-01	1100 1100	16.7	16.7	–	–	W/E 1440 MIN	K K	DBU
7	M2	1-31-01 2-1-01	1100 1100	16.7	16.7	–	–	W/EAST 1440 MIN	K K	DBU
8	B1	1-25-01	1300					BLANK		DBU
9	MY3	2-1-01 2-2-01	1700 1700	16.7	16.7	–	–	WEST 1440 MIN	K K	DBU
10	H3	2-1-01 2-2-01	1700 1700	16.7	16.7	–	–	WEST 1440 MIN	K K	DBU
11	M3	2-1-01 2-2-01	1700 1700	16.7	16.7	–	–	WEST 1440 MIN	K K	DBU
12	MY4	2-6-01 2-7-01	1600 1600	16.7	16.7	–	–	WEST 1440 MIN	PC K	DBU
13	H4	2-6-01 2-7-01	1600 1600	16.7	16.7	–	–	WEST 1440 MIN	PC K	DBU
14	M4	2-6-01 2-7-01	1600 1600	16.7	16.7	–	–	WEST 1440 MIN	PC K	DBU
15	H5	2-9-01 2-10-01	0400 0400	16.7	16.7	–	–	SOUTH 1440 ~~1037~~ MIN	K O	DBU
** 16	MY5	2-9-01 2-10-01	0400	16.7	16.7	–	–	SOUTH 1037 MIN	K O	DBU
17	M5	2-9-01 2-10-01	0400 0400	16.7	16.7	–	–	SOUTH 1440 MIN	K O	DBU
18	MY	2-17-01	0000	VOID		LOST COVER + SAMPLER FRAYED				
DID NOT RUN WATER IN DISPLAY → 19	H6	2-17-01	0000	16.7		–		FLOW RESTRAIN 0.0 MIN	K	DBU
20	M6	2-17-01 2-18-01	0000 0001	16.7	16.7	–		1440 MIN SOUTH	K	DBU

#4 FILTER TORE WHEN REMOVING IT FROM CASSETTE ON 1-30-01

*5 " " " " IT " " ON 2-1-01

** 16 BREAKER ~~[illegible]~~ OFF. LOW BAT SHUT DOWN

Field Log Sheet

Project: Pilot Study of Crystalline Silica in Ambient Air in Lompoc, CA

	Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
VOID	21	H8W	3-1-01	1400	16.8		-		VOID	K	DBU
VOID	22	H7E	3-1-01	1400	16.7		-		NOT SURE which is which	K	DAU
	23	SM1	3-1-01 3-2-01	1400 1400	16.7	16.7	-	-	1440 MIN BACKGROUND	K C	DAU
	24	H7W	3-1-01 3-2-01	1400 1400	16.7	16.7	-	-	B.G 1440 MIN	K C	DAV
	25	H7E	3-1-01 3-2-01	1400 1400	16.7	16.7	-	-	B.G 1440 MIN	K C	DAU
	26	H8W	3-7-01 3-8-01	1000 1000	16.7	16.7			1440 MIN B.G	PC	DBU
	27	H8E	3-7-01 3-8-01	1000 1000	16.7	16.7			B.G 1440 MIN	PC	DAU
MAX LOAD EXCEEDED	28	SM2	3-7-01 3-8-01	1000 0430	16.7	16.7			1111 MIN 18.5 HRS B.G		DBU
	29	H9W	3-12-01 3-13-01	0000 0000	16.7	16.7			1440 MIN B.G		DAU
	30	H9E	3-12-01 3-13-01	0000 0000	16.7	16.7			1440 MIN B.G		DAU
	31	SM3	3-12-01 3-13-01	0000 0600	16.7	16.7			1440 MIN B.G		DBU
	32	B2	3-14-01						Blank		LB

EAST 245
WEST 41

CHAIN OF CUSTODY FORM
CALIFORNIA AIR RESOURCES BOARD
MONITORING AND LABORATORY DIVISION
P.O. Box 2815, Sacramento CA 95812

CHAIN OF CUSTODY

SAMPLE RECORD

Job #: ____________ Date: ____________
Sample/Run #: ____________ Time: ____________
Job Name: ____________
Sample Location: Lompoc
Type of Sample: PVC filters
Log #'s: ____________

ACTION	DATE	TIME	INITIALS		METHOD OF STORAGE freezer, ice or dry ice
Sample Collected					
			GIVEN BY	TAKEN BY	
Transfer	3-14-01	1000	DB Vener	L Baker	
Transfer	3/15/01	0900	L. Baker	M. Poore M	
Transfer	3/15/01	1230		P. Sam	
Transfer	3/22/01	8:45	P. Sam	L. Baker	
Transfer	3/30/01	12:24	L. Baker	B. H	
Transfer					

LOG #	ID #	
1-32		PVC FILTERS FROM LOMPOC & S.M STUDY
		- filters stored in cool garage until
		3-14 when transported to Sacramento
		(total of 27 filters)
		- filters weighed between 3/15 & 3/21

RETURN THIS FORM TO: ____________

CHAIN OF CUSTODY FORM
CALIFORNIA AIR RESOURCES BOARD
MONITORING AND LABORATORY DIVISION

P.O. Box 2815, Sacramento CA 95812

~~PESTICIDE~~

CHAIN OF CUSTODY

SAMPLE RECORD

Job #: ______________ Date: ______________

Sample/Run #: ______________ Time: ______________

Job Name: ______________

Sample Location: Lompoc

Type of Sample: Soil / mine material

Log #'s: ______________

ACTION	DATE	TIME	INITIALS		METHOD OF STORAGE freezer, ice or dry ice
Sample Collected	9-27-00		LB		
			GIVEN BY	TAKEN BY	
Transfer					
Transfer					
Transfer					
Transfer					
Transfer					
Transfer					

LOG #	ID #	
1		Celite mine - dark crude
2		" "
3		" - light crude
4		" - overburden
5		" - Celite 500 product (filter aid)
6		" - Celite 512 " "
7		" - Hyflo Super-Cel product "
8		Ag. soil from Olive & V St., Lompoc
9		Ag. soil from Olive & Bodger Rd., Lompoc

RETURN THIS FORM TO: ______________