

AIHL Lab. Number: 20026

AIHL Analytical Report
Microscopy Unit

Name of Submitter: Robert Lawson Samples Received: 1/15/92
Submitting Agency: Agricultural Health & Safety Center
University of California
Davis, CA 95616-8757 Total Samples Analyzed: 9
Sampling Location: UCD Rice straw
harvest Date Reported 9/23/92

Sample Description: **Ambient Air Filter Samples**

Analysis Requested: **Fibrous Silica (per cc Air)**

Method: **AIHL Provisional TEM Method for Analysis of Fibrous Silica***

Instruments: **Hitachi H-600/H-6010A Scanning Transmission Electron Microscope**
KeveX Delta Class Analyzer
JEOL JSM-35C Scanning Electron Microscope

Notes

* - At this time there is no officially adopted analytical method for determining silica fiber concentrations emitted from the burning of biomass fuels. The AIHL provisional method is based on standard techniques used for other sample types.

Details of the AIHL Provisional TEM Method for Analysis of Fibrous Silica are available upon request.

Signatures of Analysts

Signature of Supervising Analyst

> Donald J. Scales 9-23-92
> John C. Schmidt 9-23-92

> Walter John 9/23/92

AIHL Lab. Number: 20026

Analytical Summary

Field Number	Silica Fibers per cc Air		Al-Silica Fibers per cc Air	
	<5 microns	>=5 microns	<5 microns	>=5 microns
RH1003	2.6	1.7	0.0	0.0
RH1008	Blank			
RH1009	Blank			
RH1010	5.5	2.7	0.20	0.0
RH1011	0.017	0.0	0.017	0.0
RH1012	1.5	0.42	0.053	0.053
RH1013	0.12	0.063	0.0	0.0
RH1014	4.5	2.4	0.58	0.23
RH1015 - 1024, 1026, 1027, 1031 - 1037 are low priority.				
RH1025	1.4 0.95	0.58 0.40	0.0	0.23 0.16
RH1028	1.0 0.71	0.21 0.14	0.32 0.21	0.0
RH1029	Analysis not complete.			
RH1030	Analysis not complete.			
RH1038	Analysis not complete.			
RH1039	Analysis not complete.			
RH1040	Analysis not complete.			

SAX
1/14/93

Formula for calculating the **Minimum Detection Limit (MDL)** in fibers per cc air:

$MDL = 1 \text{ fiber} \times \text{Effective Filter Area} / [1000 \times \text{Grid Area Scanned} \times \text{Sample Volume}]$,

where Sample Volume is given in liters

Formula for calculating **Fiber Concentration (C)** in fibers per cc air:

$$C = (\text{Number of fibers}) \times (MDL)$$

Sample Analysis

AIHL Lab. Number: 20026

Field Number: **RH1003 : FIBER DATA**

Filter Data	Air Pump Data
Type <u>Polycarbonate, 0.4um</u>	Sample Volume <u>36.7 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit <u>0.097 fibers/cc</u>
Grid Openings Scanned	<u>10</u>	Instrument <u>Hitachi H-600/H6010A</u>
		Accelerating Voltage <u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.11</u>	Operator <u>J. Schmidt</u>

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]	Silica Fibers/cc	95% Confidence Range
length number		
<5um 27	2.6	1.62 to 3.60 fibers/cc
>=5um 18	1.7	1.03 to 2.75 fibers/cc

* - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 0	0.0	0.00 to 0.357 fibers/cc
>=5um 0	0.0	0.00 to 0.357 fibers/cc

⁺ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

The following pages of the lab. report are taken directly from the output of a computer program that calculates fiber concentrations from fiber-count data.

For each sample,

Filter Type = Polycarbonate, 0.4 μ m

Filter Diameter = 25 mm

Effective Filter Area = 380 sq. mm

TEM Magnification = 35,000X

Instrument used = Hitachi H-600/H6010A

Accelerating Voltage = 75 kV

Sample Number: RH1003
Sample Volume = 36.7 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.097 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .107 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	27	2.613	1.627	3.598
Silica >=5um	18	1.742	1.033	2.753
=====				
Al-Si <5um	0	0.000	0.000	0.357
Al-Si >=5um	0	0.000	0.000	0.357

Sample Number: RH1010
Sample Volume = 37.6 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.098 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .103 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	56	5.495	4.056	6.934
Silica ≥5um	28	2.747	1.730	3.765
Al-Si <5um	2	0.196	0.024	0.708
Al-Si ≥5um	0	0.000	0.000	0.362

Sample Number: RH1011
Sample Volume = 211 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.017 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .103 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	1	0.017	0.000	0.097
Silica ≥5um	0	0.000	0.000	0.065
=====				
Al-Si <5um	1	0.017	0.000	0.097
Al-Si ≥5um	0	0.000	0.000	0.065

Sample Number: RH1012
Sample Volume = 209 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.018 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .103 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	87	1.536	1.213	1.858
Silica ≥5um	24	0.424	0.254	0.593
Al-Si <5um	3	0.053	0.011	0.155
Al-Si ≥5um	3	0.053	0.011	0.155

Sample Number: RH1013
Sample Volume = 177 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.021 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .103 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	6	0.125	0.046	0.272
Silica ≥5um	3	0.063	0.013	0.183
=====				
Al-Si <5um	0	0.000	0.000	0.077
Al-Si ≥5um	0	0.000	0.000	0.077

Sample Number: RH1014
Sample Volume = 31.8 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.116 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .103 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	39	4.525	3.105	5.945
Silica ≥5um	21	2.436	1.394	3.478
Al-Si <5um	5	0.580	0.188	1.354
Al-Si ≥5um	2	0.232	0.028	0.838

;

Sample Number: RH1025 47.9 ~~107~~ 11/19/93
Sample Volume = ~~32.4~~ liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.118 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.970001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	12	1.412 0.953	0.729 0.493	2.486 1.666
Silica				
>=5um	5	0.588 0.397	0.191 0.129	1.373 0.926
=====				
Al-Si				
<5um	0	0.000	0.000	0.434
Al-Si				
>=5um	2	0.235	0.028	0.849

Sample Number: RH1028 53.4 ~~36.2~~ 1/19/93
Sample Volume = ~~36.2~~ liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.105 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.970001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	10	1.053 0.71	0.505 0.343	1.936 1.313
Silica				
>=5um	2	0.211 0.142	0.025 0.017	0.760 0.514
=====				
Al-Si				
<5um	3	0.316	0.065	0.923
Al-Si				
>=5um	0	0.000	0.000	0.389

Lab. No. 20026Date Received 1-15-92California State Department of Health
Air and Industrial Hygiene Laboratory
2151 Berkeley Way, Berkeley, CA 94704

LABORATORY SERVICE REQUEST

Plant or Place AG Center, UCD No. of Samples 62
Address Rice-Hamilton Bldg Fund Code 255N
Submitting Agency UCD - 004 Phone No. _____
Date Submitted 1-15-92
Send Analytical Report to R. Lawson, AG Center, UCD, Davis CA

Field No.	Date Coll.	Type of Sample (Air, Material)	Volume	Field Information	Analysis Requested
				See attached	Silica-fibers
				Sample Transmittal	Cost 35
				form	

Description of Problem:

20026

SAMPLE LOG: RICE HARVEST & RICE BURN			
R. LAWSON, AG CENTER, UC DAVIS			
Sample #	Elapsed Time	Total Volume	
A59323		0.00	
A59324		0.00	Notes: A#### = Mixed cellulose
A59326	1:47	176.02	RH80### = PVC (not sent)
A59327	1:47	176.02	RH10### = Polycarbonate
A59328	1:47	185.65	0 vol = blank
A59329	2:05	204.38	RH90### = Mixed cellulose water
A59330	2:05	206.88	
A59331	3:03	303.78	
A59332	3:03	288.22	Delete - R. Lawson
A59333	1:11	120.70	
A59334	2:45	279.68	
A59335	1:43	175.10	
A59336	2:32	249.40	
A59337	2:32	244.60	
A59338	2:32	255.40	
A59339	1:26	148.35	
A59340	2:03	211.56	
A59341	0:32	54.40	Delete - R. Lawson
A59342	2:32	250.60	
A59343	2:03	201.11	
A59344	2:14	227.80	
A59345	2:03	209.10	
A59346	2:32	253.00	
A59347	2:32	249.40	
A59348	2:04	207.70	
A59349	2:32	245.20	
A59350	2:32	238.00	
A59356		0.00	
RH1003	0:22	36.74	
RH1008		0.00	
RH1009		0.00	
RH1010	0:22	37.62	
RH1011	2:05	210.63	
RH1012	2:05	208.75	
RH1013	1:44	176.80	
RH1014	0:19	31.83	
RH1015	0:21	36.54	
RH1016	0:19	32.49	
RH1017	0:17	28.48	
RH1018	0:22	37.62	
RH1019	0:22	36.41	
RH1020	0:11	18.65	Delete - R. Lawson
RH1021	0:11	18.10	
RH1022	1:11	120.70	
RH1023	2:45	280.50	

RH1024	1:43	170.47		
RH1025	0:21	32.64		
RH1026	0:22	37.07		
RH1027	0:22	38.50		
RH1028	0:21	36.15		
RH1029	0:15	25.43		
RH1030	0:20	33.90		
RH1031	0:22	36.85		
RH1032	0:22	36.85		
RH1033		0.00		
RH1034	0:32	242.80		
RH1035	1:26	142.76		
RH1036		0.00		
RH1037		0.00		
RH1038	2:03	211.56		
RH1039	2:14	227.80		
RH1040	2:04	207.70		
RH8004		0.00	Not test	
RH8005	4:09	505.47		
RH8006	4:09	428.28		
RH8007	3:03	354.11		
RH8008	3:03	301.04		
RH8009	3:05	372.30		
RH8010	3:05	316.03		
RH8011	2:03	239.24		
RH8012	2:03	202.34		
RH9005	φ	φ		
RH9006	φ	φ		
RH1055	φ	φ		

Data submitted
1/13/92 RLM

AIHL Lab. Number: 20182

AIHL Analytical Report
Microscopy Unit

Name of Submitter: Robert Lawson
Submitting Agency: Agricultural Health & Safety Center
University of California
Davis, CA 95616-8757

Samples Received: 4/22/92

Total Samples Analyzed: 36

Sampling Location: UCD Rice straw
field burn

Date Reported 9/23/92

Sample Description: Ambient Air Filter Samples

Analysis Requested: Fibrous Silica (per cc Air)

Method: AIHL Provisional TEM Method for Analysis of Fibrous Silica^{*}

Instruments: Hitachi H-600/H-6010A Scanning Transmission Electron Microscope
Kevex Delta Class Analyzer
JEOL JSM-35C Scanning Electron Microscope

Notes

* - At this time there is no officially adopted analytical method for determining silica fiber concentrations emitted from the burning of biomass fuels. The AIHL provisional method is based on standard techniques used for other sample types.

Details of the AIHL Provisional TEM Method for Analysis of Fibrous Silica are available upon request.

Signatures of Analysts

> Donald J. Seiler 9-23-92
> John C. Schmidt 9-23-92

Signature of Supervising Analyst

> Walter John 9/23/92

AIHL Lab. Number: 20182

Analytical Summary

Field Number	Silica Fibers per cc Air		Al-Silica Fibers per cc Air	
	<5 microns	>=5 microns	<5 microns	>=5 microns
RB1050T	3.8	2.5	0.0	0.21
RB1052T	1.8	1.9	0.0	0.0
RB1053B	0.023	0.0	0.0	0.0
RB1056T	3.4	4.0	0.0	0.0
RB1057B	0.0	0.0	0.0	0.0
RB1058P	2.1	3.2	0.16	0.0
RB1059B	Filter was overloaded- no analysis attempted			
RB1060T	0.34	1.0	0.17	0.0
RB1061T	0.17	0.85	0.0	0.0
RB1062B	0.03	0.0	0.0	0.0
RB1063T	2.4	4.9	0.0	0.32
RB1064T	0.17	0.17	0.0	0.0
RB1065T	0.17	0.0	0.0	0.0
RB1066T	1.0	1.8	0.0	0.0
RB1067T	Count sheet missing			
RB1068B	0.0	0.0	0.17	0.0
RB1069T	2.9	3.2	0.0	0.0
RB1070P	0.0	0.0	0.035	0.0
RB1071P	1.0	0.13	0.18	0.0
RB1072B	0.0	0.0	0.0	0.0
RB1073B	0.19	0.0	0.0	0.0
RB1074B	0.0	0.0	0.0	0.0
RB1075B	0.0	0.0	0.0	0.0
RB1076B	0.0	0.0	0.0	0.0
RB1077B	0.0	0.0	0.0	0.34
RB1078B	0.36	0.53	0.0	0.36
RB1079B	0.0	0.0	0.0	0.0
RB1080B	0.0	0.18	0.0	0.0
RB1081P	5.4	6.1	0.95	0.68
RB1082B	0.0	0.0	0.0	0.0
RB1083B	0.0	0.024	0.0	0.0
RB1084P	4.2	8.3	0.12	0.0
RB1085B	0.0	0.0	0.0	0.0
RB1086P	7.4	7.2	0.0	0.23
RB1087P	Filter was overloaded- no analysis attempted			
RB1088B	0.0	0.0	0.14	0.0
RB1089P	0.0	0.0	0.0	0.0
RB1091P	Filter was overloaded- no analysis attempted			
RB1100P	Filter was overloaded- no analysis attempted			
RB1104P	Filter was overloaded- no analysis attempted			

Formula for calculating the **Minimum Detection Limit (MDL)** in fibers per cc air:

$MDL = 1 \text{ fiber} \times \text{Effective Filter Area} / [1000 \times \text{Grid Area Scanned} \times \text{Sample Volume}]$.

where Sample Volume is given in liters

Formula for calculating **Fiber Concentration (C)** in fibers per cc air:

$C = (\text{Number of fibers}) \times (MDL)$

Sample Analysis

 AIHL Lab. Number: 20182

 Field Number: **RB1050T: FIBER DATA**

Filter Data	Air Pump Data
Type <u>Polycarbonate. 0.4um</u>	Sample Volume <u>20.4 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit	<u>0.213 fibers/cc</u>
Grid Openings Scanned	<u>10</u>	Instrument	<u>Hitachi H-600/H6010A</u>
		Accelerating Voltage	<u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.09</u>	Operator	<u>D. Scales</u>

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]	Silica Fibers/cc	95% Confidence Range
length number		
<5um 18	3.8	2.27 to 6.05 fibers/cc
>=5um 12	2.6	1.32 to 4.46 fibers/cc

* - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 0	0.0	0.00 to 0.78 fibers/cc
>=5um 1	0.21	0.005 to 1.18 fibers/cc

* - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

The following pages of the lab. report are taken directly from the output of a computer program that calculates fiber concentrations from fiber-count data.

For each sample.

Filter Type = Polycarbonate, 0.4 μ m

Filter Diameter = 25 mm

Effective Filter Area = 380 sq. mm

TEM Magnification = 35,000X

Instrument used = Hitachi H-600/H6010A

Accelerating Voltage = 75 kV

Sample Number: RB1050T
Sample Volume = 20.4 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.213 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	18	3.828	2.269	6.050
Silica				
>=5um	12	2.552	1.318	4.457
=====				
Al-Si				
<5um	0	0.000	0.000	0.785
Al-Si				
>=5um	1	0.213	0.005	1.184

```

*****
Sample Number:  RB1052T
Sample Volume =  27.2  liters
Filter Area =   380  square millimeters
Minimum Detection Limit = 0.159 fibers/cc
Grid Openings Scanned =  10
Grid Area Scanned =  8.759999E-02  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	11	1.754	0.876	3.139
Silica				
>=5um	12	1.914	0.989	3.343
=====				
Al-Si				
<5um	0	0.000	0.000	0.588
Al-Si				
>=5um	0	0.000	0.000	0.588

```

*****

```

Sample Number: RB1053B
Sample Volume = 192 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.023 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	1	0.023	0.001	0.126
Silica				
>=5um	0	0.000	0.000	0.083
=====				
Al-Si				
<5um	0	0.000	0.000	0.083
Al-Si				
>=5um	0	0.000	0.000	0.083

*

Sample Number: RB1056T
Sample Volume = 20.4 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.213 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	16	3.402	1.946	5.524
Silica ≥5um	19	4.040	2.433	6.309
=====				
Al-Si <5um	0	0.000	0.000	0.785
Al-Si ≥5um	0	0.000	0.000	0.785

Sample Number: RB1057B
Sample Volume = 25 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.174 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.640
Silica				
>=5um	0	0.000	0.000	0.640
=====				
Al-Si				
<5um	0	0.000	0.000	0.640
Al-Si				
>=5um	0	0.000	0.000	0.640

Sample Number: RB1058B

Sample Volume = 27.2 liters

Filter Area = 380 square millimeters

Minimum Detection Limit = 0.159 fibers/cc

Grid Openings Scanned = 10

Grid Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	13	2.073	1.104	3.545
Silica				
>=5um	20	3.190	1.949	4.926
=====				
Al-Si				
<5um	1	0.159	0.004	0.888
Al-Si				
>=5um	0	0.000	0.000	0.588

```

*****
Sample Number:  RB1060T
Sample Volume =  25.5  liters
Filter Area =   380  square millimeters
Minimum Detection Limit = 0.170 fibers/cc
Grid Openings Scanned =   10
Grid Area Scanned =  8.759999E-02  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	2	0.340	0.041	1.228
Silica				
>=5um	6	1.021	0.374	2.222
=====				
Al-Si				
<5um	1	0.170	0.004	0.948
Al-Si				
>=5um	0	0.000	0.000	0.628

```

*****

```

Sample Number: RB1061T
Sample Volume = 25.5 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.170 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	1	0.170	0.004	0.948
Silica				
>=5um	5	0.851	0.276	1.985
=====				
Al-Si				
<5um	0	0.000	0.000	0.628
Al-Si				
>=5um	0	0.000	0.000	0.628

Sample Number: RB1062B
Sample Volume = 145 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.030 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	1	0.030	0.001	0.167
Silica				
>=5um	0	0.000	0.000	0.110
=====				
Al-Si				
<5um	0	0.000	0.000	0.110
Al-Si				
>=5um	0	0.000	0.000	0.110

Sample Number: RB1063T
Sample Volume = 27.2 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.159 fibers/cc
Fiber Openings Scanned = 10
Fiber Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica ≤ 5um	15	2.392	1.340	3.946
Silica ≤ 5um	31	4.944	3.204	6.684
Al-Si ≤ 5um	0	0.000	0.000	0.588
Al-Si ≤ 5um	2	0.319	0.039	1.151

```

*****
Sample Number:  RB1064T
Sample Volume =  25.5  liters
Filter Area =   380  square millimeters
Minimum Detection Limit = 0.170 fibers/cc
Grid Openings Scanned =   10
Grid Area Scanned =  8.759999E-02  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	1	0.170	0.004	0.948
Silica				
>=5um	1	0.170	0.004	0.948
=====				
Al-Si				
<5um	0	0.000	0.000	0.628
Al-Si				
>=5um	0	0.000	0.000	0.628

```

*****

```

Sample Number: RB1065T
Sample Volume = 25.5 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.170 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 8.759999E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	1	0.170	0.004	0.948
Silica				
>=5um	0	0.000	0.000	0.628
=====				
Al-Si				
<5um	0	0.000	0.000	0.628
Al-Si				
>=5um	0	0.000	0.000	0.628

Sample Number: RB1066T
Sample Volume = 27.2 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.161 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	6	0.966	0.354	2.102
Silica >=5um	11	1.770	0.884	3.168
=====				
Al-Si <5um	0	0.000	0.000	0.594
Al-Si >=5um	0	0.000	0.000	0.594

Sample Number: RB1068B
Sample Volume = 25.7 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.170 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.629
Silica				
>=5um	0	0.000	0.000	0.629
=====				
Al-Si				
<5um	1	0.170	0.004	0.949
Al-Si				
>=5um	0	0.000	0.000	0.629

Sample Number: RB1069T
Sample Volume = 27.2 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.161 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	18	2.897	1.717	4.579
Silica				
>=5um	20	3.219	1.967	4.972
=====				
Al-Si				
<5um	0	0.000	0.000	0.594
Al-Si				
>=5um	0	0.000	0.000	0.594

Sample Number: RB1070P
Sample Volume = 125 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.035 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.129
Silica				
>=5um	0	0.000	0.000	0.129
=====				
Al-Si				
<5um	1	0.035	0.001	0.195
Al-Si				
>=5um	0	0.000	0.000	0.129

```

*****
Sample Number:  RB1071P
Sample Volume =  99.2  liters
Filter Area =   380   square millimeters
Minimum Detection Limit = 0.044 fibers/cc
Grid Openings Scanned =   10
Grid Area Scanned =  .0868  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	23	1.015	0.600	1.430
Silica				
>=5um	3	0.132	0.027	0.387
=====				
Al-Si				
<5um	4	0.177	0.048	0.452
Al-Si				
>=5um	0	0.000	0.000	0.163

```

*****

```

Sample Number: RB1072B
Sample Volume = 31.2 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.140 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range
Silica			
5um	0	0.000	0.000 0.518
Silica			
=5um	0	0.000	0.000 0.518
=====			
Al-Si			
5um	0	0.000	0.000 0.518
Al-Si			
=5um	0	0.000	0.000 0.518

```

*****
Sample Number:  RB1073B
Sample Volume =  23  liters
Filter Area =   380  square millimeters
Minimum Detection Limit = 0.190 fibers/cc
Grid Openings Scanned =  10
Grid Area Scanned =  .0868  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	1	0.190	0.005	1.060
Silica				
>=5um	0	0.000	0.000	0.702
=====				
Al-Si				
<5um	0	0.000	0.000	0.702
Al-Si				
>=5um	0	0.000	0.000	0.702

```

*****

```

Sample Number: RB1074B
Sample Volume = 25 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.175 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	0	0.000	0.000	0.646
Silica ≥5um	0	0.000	0.000	0.646
=====				
Al-Si <5um	0	0.000	0.000	0.646
Al-Si ≥5um	0	0.000	0.000	0.646

```

*****
Sample Number:  RB1075B
Sample Volume =  23.4  liters
Filter Area =   380   square millimeters
Minimum Detection Limit = 0.174 fibers/cc
Grid Openings Scanned =  10
Grid Area Scanned =  9.350001E-02  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.641
Silica				
>=5um	0	0.000	0.000	0.641
=====				
Al-Si				
<5um	0	0.000	0.000	0.641
Al-Si				
>=5um	0	0.000	0.000	0.641

```

*****

```

Sample Number: RB1076B
Sample Volume = 31.7 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.138 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.510
Silica				
>=5um	0	0.000	0.000	0.510
=====				
Al-Si				
<5um	0	0.000	0.000	0.510
Al-Si				
>=5um	0	0.000	0.000	0.510

Sample Number: RB1077B
Sample Volume = 25.5 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.172 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	0	0.000	0.000	0.634
Silica ≥5um	0	0.000	0.000	0.634
=====				
Al-Si <5um	0	0.000	0.000	0.634
Al-Si ≥5um	2	0.343	0.042	1.240

Sample Number: RB1078B
Sample Volume = 24.6 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.178 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	2	0.356	0.043	1.285
Silica				
>=5um	3	0.534	0.110	1.561
=====				
Al-Si				
<5um	0	0.000	0.000	0.657
Al-Si				
>=5um	2	0.356	0.043	1.285

Sample Number: RB1079B
Sample Volume = 23.4 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.187 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.690
Silica				
>=5um	0	0.000	0.000	0.690
=====				
Al-Si				
<5um	0	0.000	0.000	0.690
Al-Si				
>=5um	0	0.000	0.000	0.690

Sample Number: RB1080B
Sample Volume = 24.1 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.182 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.670
Silica				
>=5um	1	0.182	0.005	1.012
=====				
Al-Si				
<5um	0	0.000	0.000	0.670
Al-Si				
>=5um	0	0.000	0.000	0.670

```

*****
Sample Number:  RB1081P
Sample Volume =  32.3  liters
Filter Area =   380  square millimeters
Minimum Detection Limit = 0.136 fibers/cc
Grid Openings Scanned =  10
Grid Area Scanned =  .0868  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	40	5.422	3.741	7.102
Silica ≥5um	45	6.099	4.317	7.881
Al-Si <5um	7	0.949	0.381	1.954
Al-Si ≥5um	5	0.678	0.220	1.582

```

*****
:

```



```

*****
Sample Number:  RB1082B
Sample Volume =  25.8  liters
Filter Area =   380  square millimeters
Minimum Detection Limit = 0.189 fibers/cc
Grid Openings Scanned =   9
Grid Area Scanned =   .07812  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica				
5um	0	0.000	0.000	0.696
Silica				
=5um	0	0.000	0.000	0.696
=====				
Al-Si				
5um	0	0.000	0.000	0.696
Al-Si				
=5um	0	0.000	0.000	0.696

Sample Number: RB1083B
Sample Volume = 186 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.024 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	0	0.000	0.000	0.087
Silica >=5um	1	0.024	0.001	0.131
=====				
Al-Si <5um	0	0.000	0.000	0.087
Al-Si >=5um	0	0.000	0.000	0.087

Sample Number: RB1084P
Sample Volume = 35.7 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.123 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = .0868 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	34	4.169	2.768	5.571
Silica ≥5um	68	8.339	6.357	10.321
Al-Si <5um	1	0.123	0.003	0.683
Al-Si ≥5um	0	0.000	0.000	0.453

```

*****
Sample Number:  RB1085B
Sample Volume =  20.4  liters
Filter Area =   380  square millimeters
Minimum Detection Limit = 0.215 fibers/cc
Grid Openings Scanned =   10
Grid Area Scanned =  .0868  square millimeters

```

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.792
Silica				
>=5um	0	0.000	0.000	0.792
=====				
Al-Si				
<5um	0	0.000	0.000	0.792
Al-Si				
>=5um	0	0.000	0.000	0.792

```

*****

```

Sample Number: RB1086P
Sample Volume = 35.7 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.114 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica ≤5um	65	7.400	5.601	9.199
Silica >=5um	63	7.172	5.401	8.943
Al-Si ≤5um	0	0.000	0.000	0.420
Al-Si >=5um	2	0.228	0.028	0.822

Sample Number: RB1088B
Sample Volume = 28.9 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.141 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.519
Silica				
>=5um	0	0.000	0.000	0.519
=====				
Al-Si				
<5um	1	0.141	0.004	0.783
Al-Si				
>=5um	0	0.000	0.000	0.519

Sample Number: RB1089P
Sample Volume = 32.3 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.126 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.464
Silica				
>=5um	0	0.000	0.000	0.464
=====				
Al-Si				
<5um	0	0.000	0.000	0.464
Al-Si				
>=5um	0	0.000	0.000	0.464

Lab. No.

20132

Date Received _____

4-22-92

**California State Department of Health
Air and Industrial Hygiene Laboratory
2151 Berkeley Way, Berkeley, CA 94704**

LABORATORY SERVICE REQUEST

Plant or Place UCD - 005 No. of Samples 54
Address Rice Burn Samples Fund Code 205 N
Submitting Agency UC Davis Phone No. (916) 752-5780
Date Submitted 4-22-92

Send Analytical Report to Aggr. Health & Safety Center, UC Davis, Davis Ca. Attn: Robt. Lawsoi

[illegible]

Description of Problems

SAMPLE TRANSMITTAL TO DON SCALES, AIHL, FROM ROBERT LAWSON, UC DAVIS					
916-752-5180	4/22/92				
All samples are rice burn, or burned field preparation.					
SAMPLE #	SAMPLE TIME	FLOW	VOLUME	FILTER TYPE	
	(HH:MM)	L/MIN	L		
A14513	1:14	1.73	127.65	MCE	
A59354	2:18	1.52	209.76	MCE	
A59358	2:18	1.58	217.35	MCE	
A59359	2:18	1.69	232.53	MCE	
A59360	2:12	1.66	219.12	MCE	
A59361	2:18	1.70	233.91	MCE	
A59362	2:12	1.63	214.50	MCE	
A59363	2:18	1.63	224.25	MCE	
A59365	2:20	1.70	237.30	MCE	
A59366	2:18	1.59	219.42	MCE	
A59367	0:57	1.67	95.19	MCE	
A59368	1:26	1.63	139.75	MCE	
A59369	0:57	1.68	95.48	MCE	
A59370	0:57	1.74	98.90	MCE	
RB1050	0:12	1.70	20.40	POLYCARBONATE	40
RB1052	0:16	1.70	27.20	POLYCARBONATE	
RB1053	1:53	1.70	192.10	POLYCARBONATE	
RB1056	0:12	1.70	20.40	POLYCARBONATE	
RB1057	0:15	1.67	25.05	POLYCARBONATE	
RB1058	0:16	1.70	27.20	POLYCARBONATE	
RB1059	0:15	1.69	25.28	POLYCARBONATE	
RB1060	0:15	1.70	25.50	POLYCARBONATE	
RB1061	0:15	1.70	25.50	POLYCARBONATE	
RB1062	1:26	1.69	144.91	POLYCARBONATE	
RB1063	0:16	1.70	27.20	POLYCARBONATE	
RB1064	0:15	1.70	25.50	POLYCARBONATE	
RB1065	0:15	1.70	25.50	POLYCARBONATE	
RB1066	0:16	1.70	27.20	POLYCARBONATE	
RB1067	0:16	1.70	27.20	POLYCARBONATE	
RB1068	0:15	1.71	25.65	POLYCARBONATE	
RB1069	0:16	1.70	27.20	POLYCARBONATE	
RB1070	1:14	1.70	125.43	POLYCARBONATE	
RB1071	0:57	1.74	99.18	POLYCARBONATE	
RB1072	0:19	1.64	31.16	POLYCARBONATE	
RB1073	0:14	1.64	22.96	POLYCARBONATE	
RB1074	0:15	1.67	25.05	POLYCARBONATE	
RB1075	0:14	1.67	23.38	POLYCARBONATE	
RB1076	0:19	1.67	31.73	POLYCARBONATE	
RB1077	0:15	1.70	25.50	POLYCARBONATE	
RB1078	0:15	1.64	24.60	POLYCARBONATE	

RB1079	0:14	1.67	23.38	POLYCARBONATE
RB1080	0:14	1.72	24.08	POLYCARBONATE
RB1081	0:19	1.70	32.30	POLYCARBONATE
RB1082	0:15	1.72	25.80	POLYCARBONATE
RB1083	1:55	1.62	185.73	POLYCARBONATE
RB1084	0:21	1.70	35.70	POLYCARBONATE
RB1085	0:12	1.70	20.40	POLYCARBONATE
RB1086	0:21	1.70	35.70	POLYCARBONATE
RB1087	0:15	1.70	25.50	POLYCARBONATE
RB1088	0:17	1.70	28.90	POLYCARBONATE
RB1089	0:19	1.70	32.30	POLYCARBONATE
RB1091	0:14	1.70	23.80	POLYCARBONATE
RB1100	0:18	1.65	29.61	POLYCARBONATE
RB1104	0:15	1.70	25.50	POLYCARBONATE

AIHL Lab. Number: 20255

AIHL Analytical Report
Microscopy Unit

Name of Submitter: Robert Lawson
Submitting Agency: Agricultural Health & Safety Center
University of California
Davis, CA 95616-8757
Samples Received: 6/05/92
Total Samples Analyzed: 7
Sampling Location: UCD Rice straw
field burn
Date Reported 9/23/92

Sample Description: **Ambient Air Filter Samples**

Analysis Requested: **Fibrous Silica (per cc Air)**

Method: **AIHL Provisional TEM Method for Analysis of Fibrous Silica***

Instruments: **Hitachi H-600/H-6010A Scanning Transmission Electron Microscope**
KeveX Delta Class Analyzer
JEOL JSM-35C Scanning Electron Microscope

Notes

* - At this time there is no officially adopted analytical method for determining silica fiber concentrations emitted from the burning of biomass fuels. The AIHL provisional method is based on standard techniques used for other sample types.

Details of the **AIHL Provisional TEM Method for Analysis of Fibrous Silica** are available upon request.

Signatures of Analysts

> Donald J. Scales 9-23-92
> John C. Belmont 9-23-92

Signature of Supervising Analyst

> Matthew John 9/23/92

AIHL Lab. Number: 20255

Analytical Summary

Field Number	Silica Fibers per cc Air		Al-Silica Fibers per cc Air	
	<5 microns	>=5 microns	<5 microns	>=5 microns
RB1090P	2.9	1.9	0.43	0.48
RB1092B	0.0	0.29	0.0	0.0
RB1093P	0.0	0.0	0.08	0.04
RB1094P	0.02	0.0	0.02	0.06
RB1095P	13.0	9.9	1.9	0.89
RB1096B	0.0	0.0	0.0	0.0
RB1097P	0.18	0.0	0.0	0.0
RB1098P	Not analyzed- low priority			
RB1099P	Not analyzed- low priority			
RB1101	Blank			
RB1102P	Not analyzed- low priority			
RB1103	Blank			
RB1105	Blank			
RB1106	Blank			

Formula for calculating the **Minimum Detection Limit (MDL)** in fibers per cc air:

$MDL = 1 \text{ fiber} \times \text{Effective Filter Area} / [1000 \times \text{Grid Area Scanned} \times \text{Sample Volume}]$,

where Sample Volume is given in liters

Formula for calculating **Fiber Concentration (C)** in fibers per cc air:

$$C = (\text{Number of fibers}) \times (MDL)$$

Sample Analysis

 AIHL Lab. Number: 20255

 Field Number: **RB1090P:** **FIBER DATA**

Filter Data	Air Pump Data
Type <u>Polycarbonate. 0.4um</u>	Sample Volume <u>84.7 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit <u>0.048 fibers/cc</u>
Grid Openings Scanned	<u>10</u>	Instrument <u>Hitachi H-600/H6010A</u>
		Accelerating Voltage <u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.09</u>	Operator <u>J. Schmidt</u>

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]	Silica Fibers/cc	95% Confidence Range
length number		
<5um 61	2.9	2.19 to 3.66 fibers/cc
>=5um 40	1.9	1.32 to 2.51 fibers/cc

^{*} - **Silica fibers** are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica [†]	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 9	0.43	0.20 to 0.82 fibers/cc
>=5um 10	0.48	0.23 to 0.88 fibers/cc

[†] - **Al-Silica fibers** are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

The following pages of the lab. report are taken directly from the output of a computer program that calculates fiber concentrations from fiber-count data.

For each sample,

Filter Type = Polycarbonate, 0.4 um

Filter Diameter = 25 mm

Effective Filter Area = 380 sq. mm

TEM Magnification = 35,000X

Instrument used = Hitachi H-600/H6010A

Accelerating Voltage = 75 kV

Sample Number: RB1090P

Sample Volume = 84.7 liters

Filter Area = 380 square millimeters

Minimum Detection Limit = 0.048 fibers/cc

Grid Openings Scanned = 10

Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	61	2.927	2.192	3.662
Silica ≥5um	40	1.919	1.325	2.514
Al-Si <5um	9	0.432	0.198	0.820
Al-Si ≥5um	10	0.480	0.230	0.882

Sample Number: RB1092B
Sample Volume = 28.2 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.144 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.532
Silica				
>=5um	2	0.288	0.035	1.041
=====				
Al-Si				
<5um	0	0.000	0.000	0.532
Al-Si				
>=5um	0	0.000	0.000	0.532

Sample Number: RB1093P
Sample Volume = 101 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.040 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	0	0.000	0.000	0.148
Silica ≥5um	0	0.000	0.000	0.148
=====				
Al-Si <5um	2	0.080	0.010	0.291
Al-Si ≥5um	1	0.040	0.001	0.224

Sample Number: RB1094P
Sample Volume = 203 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.020 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	1	0.020	0.001	0.112
Silica				
>=5um	0	0.000	0.000	0.074
=====				
Al-Si				
<5um	1	0.020	0.001	0.112
Al-Si				
>=5um	3	0.060	0.012	0.176

Sample Number: RB1095P
Sample Volume = 27.4 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.148 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica <5um	88	13.053	10.326	15.780
Silica ≥5um	67	9.938	7.558	12.318
Al-Si <5um	13	1.928	1.026	3.297
Al-Si ≥5um	6	0.890	0.326	1.937

Sample Number: RB1096B
Sample Volume = 29.2 liters
Filter Area = 380 square millimeters
Minimum Detection Limit = 0.139 fibers/cc
Grid Openings Scanned = 10
Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	0	0.000	0.000	0.514
Silica				
>=5um	0	0.000	0.000	0.514
=====				
Al-Si				
<5um	0	0.000	0.000	0.514
Al-Si				
>=5um	0	0.000	0.000	0.514

Sample Number: RB1097B

Sample Volume = 22.7 liters

Filter Area = 380 square millimeters

Minimum Detection Limit = 0.179 fibers/cc

Grid Openings Scanned = 10

Grid Area Scanned = 9.350001E-02 square millimeters

	Number	Fibers per cc	95% Confidence Range	
Silica				
<5um	1	0.179	0.005	0.997
Silica				
>=5um	0	0.000	0.000	0.661
=====				
Al-Si				
<5um	0	0.000	0.000	0.661
Al-Si				
>=5um	0	0.000	0.000	0.661

Date Received 6-2-72

LABORATORY SERVICE REQUEST

000-0000

Plant or Place Rice Harvest + Rice Barn

No. of Samples 21

Address Ag Center UC Davis

Fund Code 205N

Submitting Agency R. Lawson

Phone No. (916) 752 5180

Date Submitted 6-2-92

Send Analytical Report to R. Lawson Ag Center UC Davis

[illegible]

Description of Problem:

note: all samples nice burn on burnt field prep.

SAMPLE LOG: RICE HARVEST & RICE BURN			Notes: carbon = polycarbonate		
R. LAWSON, AG CENTER , UC DAVIS			0 volumes = blanks		
	Sample #	Filter Type	Time 1	Avg Flow 1	Volume
	A14508	mce	1:54	1.66	188.67
	A14509	mce			0.00
	A14510	mce			0.00
	A59357	mce	1:54	1.56	177.84
	A59364	mce	1:54	1.58	179.55
	A59371	mce	2:05	1.65	205.63
	A59372	mce	1:02	1.66	102.92
	RB1090	carbon	0:51	1.66	84.66
	RB1092	carbon	0:17	1.66	28.22
	RB1093	carbon	1:02	1.64	101.37
	RB1094	carbon	2:05	1.63	203.13
	RB1095	carbon	0:17	1.61	27.37
	RB1096	carbon	0:18	1.62	29.16
	RB1097	carbon	0:14	1.62	22.68
	RB1098	carbon	0:15	1.68	25.13
	RB1099	carbon	0:16	1.61	25.76
	RB1101	carbon			0.00
	RB1102	carbon	0:15	1.66	24.83
	RB1103	carbon			0.00
	RB1105	carbon			0.00
	RB1106	carbon			0.00

Note: all samples = rice burn, or burnt field prep.

AIHL Lab. Number: 20330

AIHL Analytical Report
Microscopy Unit

Name of Submitter: Bryan M. Jenkins
Submitting Agency: Agricultural Engineering Dept.
University of California
Davis, CA 95616

Samples Received: 7/16/92

Total Samples Analyzed: 8

Sampling Location: UCD Rice straw
field burn

Date Reported / /

Sample Description: **Ambient Air Filter Samples**

Analysis Requested: **Fibrous Silica (per cc Air)**

Method: AIHL Provisional TEM Method for Analysis of Fibrous Silica*

Instruments: Hitachi H-600/H-6010A Scanning Transmission Electron Microscope
 Kevex Delta Class Analyzer
 JEOL JSM-35C Scanning Electron Microscope

Notes

* - At this time there is no officially adopted analytical method for determining silica fiber concentrations emitted from the burning of biomass fuels. The AIHL provisional method is based on standard techniques used for other sample types.

Details of the AIHL Provisional TEM Method for Analysis of Fibrous Silica are available upon request.

Signatures of Analysts

> Donald J. Scales 9-10-92
> John C. Schmidt 9-10-92

Signature of Supervising Analyst

Valen Jan 9/11/92

AIHL Lab. Number: 20330

Analytical Summary

Field Number	Silica Fibers per cc Air		Al-Silica Fibers per cc Air	
	<5 microns	>=5 microns	<5 microns	>=5 microns
UCRRB131	0.004	0.00	0.022	0.00
UCRRB132	0.009	0.014	0.009	0.005
UCRRB133	0.00	0.00	0.005	0.005
UCRRB134	0.00	0.00	0.00	0.00
UCRRB135	0.004	0.00	0.00	0.00
UCRRB136	0.00	0.00	0.00	0.00
UCRRB137	0.005	0.00	0.00	0.00
UCRRB138	0.00	0.014	0.00	0.00

Formula for calculating the **Minimum Detection Limit (MDL)** in fibers per cc air:

$MDL = 1 \text{ fiber} \times \text{Effective Filter Area} / [1000 \times \text{Grid Area Scanned} \times \text{Sample Volume}]$,

where Sample Volume is given in liters

Formula for calculating **Fiber Concentration (C)** in fibers per cc air:

$$C = (\text{Number of fibers}) \times (MDL)$$

Sample Analysis

AHLL Lab. Number: 20330

Field Number: UCRRB131: **FIBER DATA**

Filter Data	Air Pump Data
Type <u>Polycarbonate, 0.4um</u>	Sample Volume <u>2.130 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35.000X</u>	Minimum Detection Limit <u>0.004</u> fibers/cc
Grid Openings Scanned	<u>4</u>	Instrument <u>Hitachi H-600/H6010A</u>
		Accelerating Voltage <u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.040</u>	Operator <u>J. Schmidt</u>

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]	Silica Fibers/cc	95% Confidence Range
length number		
<5um 1	0.004	0.000 to 0.025 fibers/cc
>=5um 0	0.000	0.000 to 0.017 fibers/cc

^{*} - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 5	0.022	0.007 to 0.052 fibers/cc
>=5um 0	0.000	0.000 to 0.017 fibers/cc

⁺ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIRL Lab. Number: 20330

Field Number: **UCRRB132:** **FIBER DATA**

Filter Data	Air Pump Data
Type <u>Polycarbonate, 0.4um</u>	Sample Volume <u>1,340 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit <u>0.005 fibers/cc</u>
Grid Openings Scanned	<u>6</u>	Instrument <u>Hitachi H-600/H6010A</u>
		Accelerating Voltage <u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.060</u>	Operator <u>J. Schmidt/D. Scales</u>

IDENTIFIED FIBERS	CALCULATED FIBER CONCENTRATION (PER CC AIR)	
Silica ⁺	Silica Fibers/cc	95% Confidence Range
length number		
<5um 2	0.009	0.001 to 0.034 fibers/cc
>=5um 3	0.014	0.003 to 0.042 fibers/cc

⁺ - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS	CALCULATED FIBER CONCENTRATION (PER CC AIR)	
Al-Silica ⁺	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 2	0.009	0.001 to 0.034 fibers/cc
>=5um 1	0.005	0.000 to 0.026 fibers/cc

⁺ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIHL Lab. Number: 20330

Field Number: UCRRB133: FIBER DATA

Filter Data	Air Pump Data
Type <u>Polycarbonate, 0.4um</u>	Sample Volume <u>2.110 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit	<u>0.005 fibers/cc</u>
Grid Openings Scanned	<u>4</u>	Instrument	<u>Hitachi H-600/H6010A</u>
		Accelerating Voltage	<u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.040</u>	Operator	<u>D. Scales</u>

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica ⁺	Silica Fibers/cc	95% Confidence Range
length number		
<5um 0	0.000	0.000 to 0.017 fibers/cc
>=5um 0	0.000	0.000 to 0.017 fibers/cc

⁺ - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 1	0.005	0.000 to 0.025 fibers/cc
>=5um 1	0.005	0.000 to 0.025 fibers/cc

⁺ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIHL Lab. Number: 20330

Field Number: UCRRB134: FIBER DATA

Filter Data		Air Pump Data	
Type	<u>Polycarbonate, 0.4um</u>	Sample Volume	<u>2,200 liters</u>
Diameter (mm)	<u>25</u>		
Effective Area (mm ²)	<u>380</u>		

TEM Analytical Parameters			
Magnification	<u>35,000X</u>	Minimum Detection Limit	<u>0.004 fibers/cc</u>
Grid Openings Scanned	<u>4</u>	Instrument	<u>Hitachi H-600/H6010A</u>
		Accelerating Voltage	<u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.040</u>	Operator	<u>D. Scales</u>

IDENTIFIED FIBERS		CALCULATED FIBER CONCENTRATION (PER CC AIR)	
Silica [*]		Silica Fibers/cc	95% Confidence Range
length number			
<5um	0	0.00	0.000 to 0.016 fibers/cc
>=5um	0	0.00	0.000 to 0.016 fibers/cc

* - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS		CALCULATED FIBER CONCENTRATION (PER CC AIR)	
Al-Silica ⁺		Al-Silica Fibers/cc	95% Confidence Range
length number			
<5um	0	0.00	0.000 to 0.016 fibers/cc
>=5um	0	0.00	0.000 to 0.016 fibers/cc

⁺ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIHL Lab. Number: 20330

Field Number: UCRRB135: FIBER DATA

Filter Data	Air Pump Data
Type <u>Polycarbonate, 0.4um</u>	Sample Volume <u>1260 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit	<u>0.004 fibers/cc</u>
Grid Openings Scanned	<u>7</u>	Instrument	<u>Hitachi H-600/H6010A</u>
		Accelerating Voltage	<u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.070</u>	Operator	<u>D. Scales</u>

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica ⁺	Silica Fibers/cc	95% Confidence Range
length number		
<5um 1	0.004	0.000 to 0.024 fibers/cc
>=5um 0	0.000	0.000 to 0.016 fibers/cc

⁺ - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 0	0.000	0.000 to 0.016 fibers/cc
>=5um 0	0.000	0.000 to 0.016 fibers/cc

⁺ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIHL Lab. Number: 20330

Field Number: **UCRRB136:** **FIBER DATA**

Filter Data	Air Pump Data
Type <u>Polycarbonate, 0.4um</u>	Sample Volume <u>659 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit	<u>0.006 fibers/cc</u>
Grid Openings Scanned	<u>10</u>	Instrument	<u>Hitachi H-600/H6010A</u>
		Accelerating Voltage	<u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.10</u>	Operator	<u>D. Scales</u>

IDENTIFIED FIBERS	CALCULATED FIBER CONCENTRATION (PER CC AIR)	
Silica [*]	Silica Fibers/cc	95% Confidence Range
length number		
<5um 0	0.000	0.000 to 0.021 fibers/cc
>=5um 0	0.000	0.000 to 0.021 fibers/cc

* - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS	CALCULATED FIBER CONCENTRATION (PER CC AIR)	
Al-Silica [†]	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 0	0.000	0.000 to 0.021 fibers/cc
>=5um 0	0.000	0.000 to 0.021 fibers/cc

† - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIHL Lab. Number: 20330

Field Number: UCRRB137: **FIBER DATA**

Filter Data	Air Pump Data
Type <u>Polycarbonate, 0.4um</u>	Sample Volume <u>1340 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit <u>0.005 fibers/cc</u>
Grid Openings Scanned	<u>6</u>	Instrument <u>Hitachi H-600/H6010A</u>
		Accelerating Voltage <u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.06</u>	Operator <u>D. Scales</u>

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]	Silica Fibers/cc	95% Confidence Range
length number		
<5um 1	0.005	0.000 to 0.026 fibers/cc
>=5um 0	0.000	0.000 to 0.017 fibers/cc

* - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺	Al-Silica Fibers/cc	95% Confidence Range
length number		
<5um 0	0.000	0.000 to 0.017 fibers/cc
>=5um 0	0.000	0.000 to 0.017 fibers/cc

* - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

 AIHL Lab. Number: 20330

 Field Number: **UCRRB138:** **FIBER DATA**

<u>Filter Data</u>	<u>Air Pump Data</u>
Type <u>Polycarbonate, 0.4um</u>	Sample Volume <u>1130 liters</u>
Diameter (mm) <u>25</u>	
Effective Area (mm ²) <u>380</u>	

TEM Analytical Parameters

Magnification	<u>35,000X</u>	Minimum Detection Limit	<u>0.005 fibers/cc</u>
Grid Openings Scanned	<u>7</u>	Instrument	<u>Hitachi H-600/H6010A</u>
		Accelerating Voltage	<u>75 kV</u>
Grid Area Scanned (mm ²)	<u>0.07</u>	Operator	<u>D. Scales</u>

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]	length	number	Silica Fibers/cc	95% Confidence Range
<5um		0	0.000	0.000 to 0.018 fibers/cc
>=5um		3	0.014	0.003 to 0.042 fibers/cc

^{*} - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺	length	number	Al-Silica Fibers/cc	95% Confidence Range
<5um		0	0.000	0.000 to 0.018 fibers/cc
>=5um		0	0.000	0.000 to 0.018 fibers/cc

⁺ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

20330

Lab. No.

Date Received

California State Department of Health
Air and Industrial Hygiene Laboratory
2151 Berkeley Way, Berkeley, CA 94704

LABORATORY SERVICE REQUEST

Plant or Place UCD-007, UCRRB

No. of Samples

8

Address Greer, Rominger, CA.

Fund Code

205 N

Submitting Agency UCD

Phone No.

(16) 752-1422

Date Submitted

5/5/92

Send Analytical Report to

B. Jenkins / B. Lawson

CAT 35 DS

Field No.	Date Coll.	Type of Sample (Air, Material)	Volume	Field Information	Analysis Requested
131	4/12	Air		See Attached data sheet	Silica TEM
132					
133					
134					
135					
136					
137					
138					

Description of Problem:

Sample Submittal/Chain of Custody Form:										
UC Davis/Rice Research Board/Air Resources Board										
Sampling Program for Biogenic Silica Fiber Emission										
Originating Form from UC Davis (Prof. B. Jenkins, 916-752-1422)										
	Date			Flow	Elapsed	Total		Collected	Transferred	Date
Sample ID	Sampled	Filter #	Cyclone	(LPM)	Hours	Flow (L)	Location	By	To	Transferred
UCRRB131	4/8/92	-	no	9.3	3.82	2,132	Upwind/Greer	SQT/RBW	J. Schmidt	5/5/92
UCRRB132	4/8/92	-	no	5.9	3.78	1,338	Downwind	SQT/RBW	}	}
UCRRB133	4/8/92	-	no	10.1	3.48	2,109	Downwind	SQT/RBW		
UCRRB134	4/8/92	-	no	10.1	3.63	2,200	0.6 mi Downwind	SQT/RBW		
UCRRB135	4/9/92	-	no	9.5	2.22	1,265	Upwind/Rominger	BMJ/SQT		
UCRRB136	4/9/92	-	no	4.9	2.24	659	Downwind	BMJ/SQT	}	}
UCRRB137	4/9/92	-	no	10.1	2.21	1,339	Downwind	BMJ/SQT		
UCRRB138	4/9/92	-	no	9.4	2.01	1,134	0.5 mi Downwind	BMJ/SQT		

6 October 1992

Robert Lawson
Agricultural Health & Safety Center
University of California
Davis, California 95616-8757

Dear Bob,

Here are the lab. results from one blank that was submitted under Project UCD-004
and three blanks from Project UCD-006.

As you see, no fibers (or particles) were found on any of these samples.

Yours truly,

A handwritten signature in cursive script, appearing to read "Don".

Don Scales

Sample Analysis

AIHL Lab. Number: 20026

Field Number: RH1009: BLANK

Filter Data		Air Pump Data	
Type	Polycarbonate, 0.4um	Sample Volume	0 liters
Diameter (mm)	25		
Effective Area (mm ²)	380		

TEM Analytical Parameters

Magnification	35.000X	Minimum Detection Limit	***** fibers/cc
Grid Openings Scanned	10	Instrument	Hitachi H-600/H6010A
		Accelerating Voltage	75 kV
Grid Area Scanned (mm ²)	0.10	Operator	D. Scales

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]		Silica Fibers/cc	95% Confidence Range
length	number		
<5um	0	0.0	
>=5um	0	0.0	

* - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺		Al-Silica Fibers/cc	95% Confidence Range
length	number		
<5um	0	0.0	
>=5um	0	0.0	

+ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIHL Lab. Number: 20255

Field Number: RB1101: BLANK

Filter Data		Air Pump Data	
Type	Polycarbonate, 0.4um	Sample Volume	0 liters
Diameter (mm)	25		
Effective Area (mm ²)	30		

TEM Analytical Parameters

Magnification	25,000X	Minimum Detection Limit	***** fibers/cc
Grid Openings Scanned	10	Instrument	Hitachi H-600/H6010A
		Accelerating Voltage	75 kV
Grid Area Scanned (mm ²)	0.09	Operator	D. Scales

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]		Silica Fibers/cc	95% Confidence Range
length	number		
<5um	0	0.0	
>=5um	0	0.0	

* - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺		Al-Silica Fibers/cc	95% Confidence Range
length	number		
<5um	0	0.0	
>=5um	0	0.0	

+ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIHL Lab. Number: 20255

Field Number: RB1103: BLANK

Filter Data		Air Pump Data
Type	Polycarbonate 1.4um	Sample Volume 0 liters
Diameter (mm)	25	
Effective Area (mm ²)	380	

TEM Analytical Parameters

Magnification	35,000X	Minimum Detection Limit	***** fibers/cc
Grid Openings Scanned	10	Instrument	Hitachi H-600/H6010A
		Accelerating Voltage	75 kV
Grid Area Scanned (mm ²)	09	Operator	D. Scales

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]		Silica Fibers/cc	95% Confidence Range
length	number		
<5um	0	0.0	
>=5um	0	0.0	

* - **Silica fibers** are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺		Al-Silica Fibers/cc	95% Confidence Range
length	number		
<5um	0	0.0	
>=5um	0	0.0	

+ - **Al-Silica fibers** are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

Sample Analysis

AIHL Lab. Number: 20255

Field Number: RB1105: BLANK

Filter Data		Air Pump Data
Type	Polycarbonate, 0.4um	Sample Volume 0 liters
Diameter (mm)	25	
Effective Area (mm ²)	380	

TEM Analytical Parameters

Magnification	35,000X	Minimum Detection Limit	***** fibers/cc
Grid Openings Scanned	10	Instrument	Hitachi H-600/H6010A
		Accelerating Voltage	75 kV
Grid Area Scanned (mm ²)	0.10	Operator	D. Scales

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Silica [*]		Silica Fibers/cc	95% Confidence Range
Length	Number		
<5um	0	0.0	
>=5um	0	0.0	

* - Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate a dominant silicon X-ray fluorescence peak with no aluminum peak.

IDENTIFIED FIBERS

CALCULATED FIBER CONCENTRATION (PER CC AIR)

Al-Silica ⁺		Al-Silica Fibers/cc	95% Confidence Range
Length	Number		
<5um	0	0.0	
>=5um	0	0.0	

+ - Al-Silica fibers are structures that have an aspect ratio of 3:1 or greater and demonstrate both an aluminum and silicon X-ray fluorescence peak.

**APPENDIX C: DUPLICATE, REPLICATE, AND RECOUNT RESULTS
 AND STATISTICAL ANALYSES**

Table of Duplicates

Field Number	Silica Fibers per cc Air		Al-Silica Fibers per cc Air		Operator
	<5 microns	>=5 microns	<5 microns	>=5 microns	
RB1084P	4.2	8.3	0.12	0.00	JCS
RB1086P	7.4	7.2	0.00	0.23	JCS
RB1087P	Overloaded	-----	-----	-----	
RB1104	Overloaded	-----	-----	-----	
RH1001	7.5	1.6	0.75	0.00	JCS
RH1002	5.9	1.7	0.12	0.00	JCS
RB1050T	3.8	2.5	0.00	0.21	DJS, JCS
RB1056T	3.4	4.0	0.00	0.00	JCS
RB1060T	0.34	1.0	0.17	0.00	JCS
RB1061T	0.17	0.85	0.00	0.00	JCS
RB1064T	0.17	0.17	0.00	0.00	JCS
RB1065T	0.17	0.00	0.00	0.00	JCS
RH1003	2.6	1.7	0.00	0.00	JCS
RH1010	5.5	2.7	0.20	0.00	JCS

Table of Replicates

Field Number	Silica Fibers per cc Air		Al-Silica Fibers per cc Air		Operator
	<5 microns	>=5 microns	<5 microns	>=5 microns	
RB1052T	1.8	1.9	0.0	0.0	DJS, JCS
RB1058P	2.1	3.2	0.16	0.0	JCS
RB1063T	2.4	4.9	0.0	0.32	JCS
RB1066T	1.0	1.8	0.0	0.0	DJS
RB1067T	Count sheet missing				
RB1069T	2.9	3.2	0.0	0.0	JCS

Provisional
Transmission Electron Microscopy
Method for the Analysis of
Fibrous Plant Silica

Sample Recounts

The numbers in the following tables refer to fiber counts made by two operators. Don Scales (DJS) and John Schmidt (JCS). Each operator counted each sample at least two times: DJS-1, DJS-2, etc.

D.J. Scales
J.C. Schmidt

September 1992

Sample **RH-2**: Rice Harvest/LN 10528/UCD-001

Sample Volume: 48.1 liters

Minimum Detection Limit = 0.09 fibers/cc

	<u>DJS-1</u> 10/9/91	<u>DJS-2</u> 1/24/92	<u>JCS-1</u> 10/25/91	<u>JCS-2</u> 1/31/92
<u>Si</u>				
< 5 um	2	10	12	5
>=5 um	1	2	3	5
 <u>Al-Si</u>				
< 5 um	1	0	1	0
>= 5 um	1	0	1	0

Sample RH-7: Rice Harvest/LN 10528/UCD-001

Sample Volume: 204 liters

Minimum Detection Limit = 0.02 fibers/cc

	<u>DJS-1</u> 1/21/92	<u>DJS-2</u> 5/28/92	<u>JCS-1</u> 11/05/91	<u>JCS-2</u> 1/14/92
<u>Si</u>				
< 5 um	15	17	60	33
>=5 um	5	8	6	7

<u>Al-Si</u>				
< 5 um	3	2	7	3
>= 5 um	2	3	4	2

Sample **RH-1004**: Rice Harvest/LN 10529/UCD-002

Sample Volume: 291 liters

Minimum Detection Limit = 0.015 fibers/cc

	<u>DJS-1</u> 6/01/92	<u>DJS-2</u> 6/11/92	<u>JCS-1</u> 12/06/91	<u>JCS-2</u> 2/03/92
<u>Si</u>				
< 5 um	--	--	89	90
>=5 um	6	8	16	13
 <u>Al-Si</u>				
< 5 um	--	--	4	2
>= 5 um	1	2	0	0

Sample **RB-1045**: Rice Burn/LN 10530/UCD-003 [Sample taken after field burn on bulldozer]

Sample Volume: 22.1 liters

Minimum Detection Limit = 0.16 fibers/cc

	<u>DJS-1</u> 1/09/92	<u>DJS-2</u> 3/19/92	<u>JCS-1</u> 3/23/92	<u>JCS-2</u> 3/25/92
<u>Si</u>				
< 5 um	16 [5A,11C]	18 [9A,9C]	28 [9A,19C]	21 [17A,4C]
>=5 um	8 [4A,4C]	14 [4A,10C]	15 [3A,11C]	17 [6A,11C]

<u>Al-Si</u>				
< 5 um	0	0	2 [2C]	2 [2C]
>= 5 um	0	0	0	0

Sample **RB-1051**: Rice Burn/LN 10530/UCD-003 [Sample taken after field burn on
bulldozer]

Sample Volume: 22.1 liters
Minimum Detection Limit = 0.19 fibers/cc

	<u>DJS-1</u> 11/27/91	<u>DJS-2</u> 3/18/92	<u>JCS-1</u> 5/27/92	<u>JCS-2</u> 5/29/92
<u>Si</u>				
< 5 um	5 [5A]	6 [3A,3C]	8 [7A,1C]	4 [4A]
>=5 um	5 [4A,1C]	4 [1A, 3C]	5 [4A,1C]	1 [1C]

<u>Al-Si</u>				
< 5 um	0	0	2 [1A,1C]	0
>= 5 um	0	0	1 [1C]	0

Sample **RB1063T**: LN20182/UCD-005

Sample Volume: 27.2 liters

Minimum Detection Limit = 0.16 fibers/cc

	<u>DJS-1</u>	<u>DJS-2</u>	<u>JCS-1</u>	<u>JCS-2</u>	<u>JCS-3</u>
<u>Si</u>					
< 5 um	13	7	15	18	31
>=5 um	7	9	31	16	20
<u>Al-Si</u>					
< 5 um	0	1	0	0	1
>=5 um	0	1	2	0	1

Sample **RB1066T**: LN20182/UCD-005

Sample Volume: 22.1 liters

Minimum Detection Limit = 0.19 fibers/cc

	<u>DJS-1</u>	<u>DJS-2</u>	<u>JCS-1</u>	<u>JCS-2</u>
<u>Si</u>				
< 5 um	6	10	12	16
>=5 um	11	7	20	20
<u>Al-Si</u>				
< 5 um	0	0	0	2
>=5 um	0	0	0	0

LeeAnne Lischak
Jan 15, 1993

RICE SAMPLE DUPLICATES (Side-by-side sampling, submitted blind for analysis)

Analyst - John Schmidt

Sample Number	f/cc total	Average	StdDev	σ/Av , %
RB 1084P	12.5	13.55	1.48	11.0
RB 1086P	14.6			
RH 1001	9.1	8.35	1.06	12.7
RH 1002	7.6			
RB 1050T	6.3	6.85	0.78	11.4
RB 1056T	7.4			
RB 1060T	1.34	1.18	0.23	19.2
RB 1061T	1.02			
RB 1064T	0.34	0.26	0.12	47.1
RB 1065T	0.17			
1087P	Overloaded	(Overloaded)		
1104	Overloaded			
RH 1003	4.3	6.25	2.76	44.1
RH 1010	8.2			

Average Coefficient of Variation = 24%

Lee Anne Lischak
Jan. 15, 1993

RICE SAMPLE RECOUNTS (Same sample counted twice by each analyst)

Key: D_i - Don Scales, Count i; J_i - John Schmidt, Count i
D_{J_{av}} - Average of D_{av} and J_{av}

Counts are total number of fibers detected

Sample	D1	D2	D _{av}	σ_D/D_{av}	J1	J2	J _{av}	σ_J/J_{av}	$\sigma_{DJ}/D_{J_{av}}$	J _{av} /D _{av}
RH2	3	12	7.5	0.85	15	10	12.5	0.28	0.51	1.67
RH7	20	25	22.5	0.16	66	40	53.0	0.35	0.55	2.36
RH1004	6	8	7	0.20	105	103	104.0	0.01	1.01	14.86
RB1045	24	32	28	0.20	43	38	40.5	0.09	0.24	1.45
RB1051	10	10	10	0.00	13	5	9.0	0.63	0.35	0.90
RB1063T	20	16	18	0.16	34	51	42.5	0.28	0.52	2.36
RB1066T	17	17	17	0.00	32	36	34.0	0.08	0.39	2.00
Averages				0.22				0.25	0.51	3.66 ±4.97

Walter John
9/23/92

Rice Sample Duplicates (Side-by-side sampling, submitted blind for analysis)

Analyst - John Schmidt

Sample Number	f/cc, $>5\mu\text{m}$	Average	StdDev	σ/Av , %
RB 1084P	8.3	7.75	0.78	10.0
RB 1086P	7.2			
RH 1001	1.6	1.65	0.07	4.3
RH 1002	1.7			
RB 1050T	2.5	3.25	1.06	32.6
RB 1056T	4.0			
RB 1060T	1.0	0.93	0.11	11.4
RB 1061T	0.85			
RB 1064T	0.17	(At limit of detection)		
RB 1065T	0.00			
1087P	Overloaded	(Overloaded)		
1104	Overloaded			
RH 1003	1.7	2.20	0.71	32.1
RH 1010	2.7			

Average Coefficient of Variation 18%

Walter John
9/23/92

Rice Sample Recounts (Same sample counted twice by each analyst)

Key: Di - Don Scales, Count i; Ji - John Schmidt, Count i
DJ_{av} - Average of D_{av} and J_{av}

Counts are number of fibers >5μm in length

Sample	D1	D2	D _{av}	σ_D/D_{av}	J1	J2	J _{av}	σ_J/J_{av}	σ_{DJ}/DJ_{av}	J _{av} /D _{av}
RH2	1	2	1.5	0.47	3	5	4.0	0.35	0.64	2.67
RH7	5	8	6.5	0.32	6	7	6.5	0.11	0.0	1.0
RH1004	6	8	7.0	0.20	16	13	14.5	0.15	2.0	2.07
RB1045	8	14	11.0	0.38	15	17	16.0	0.09	0.26	1.45
RB1051	5	4	4.5	0.16	5	1	3.0	0.94	0.28	0.67
RB1063T	7	9	8.0	0.18	31	16	23.5	0.45	0.70	2.94
RB1066T	11	7	9.0	0.31	20	20	20.0	0.0	0.54	2.22
Averages				0.29				0.30	0.63	1.86 ±0.85

Walter John
9/24/92

Rice Sample Replicates (Six samplers side-by-side, submitted blind)

Silica Fibers $>5\mu\text{m}$

Sample Number	fibers/cc	Analyst
RB 1052T	1.9	D,J
RB 1058P	3.2	J
RB 1063T	4.9	J
RB 1066T	1.8	D
RB 1067T	(data missing)	-
RB 1069T	3.2	J
Average	3.0 ± 1.3	

Coefficient of variation 43%

APPENDIX D: PHOTOGRAPHS OF AMORPHOUS SILICA FIBERS FROM RICE FARMING



Photo # 1



Photo # 2



Photo # 3

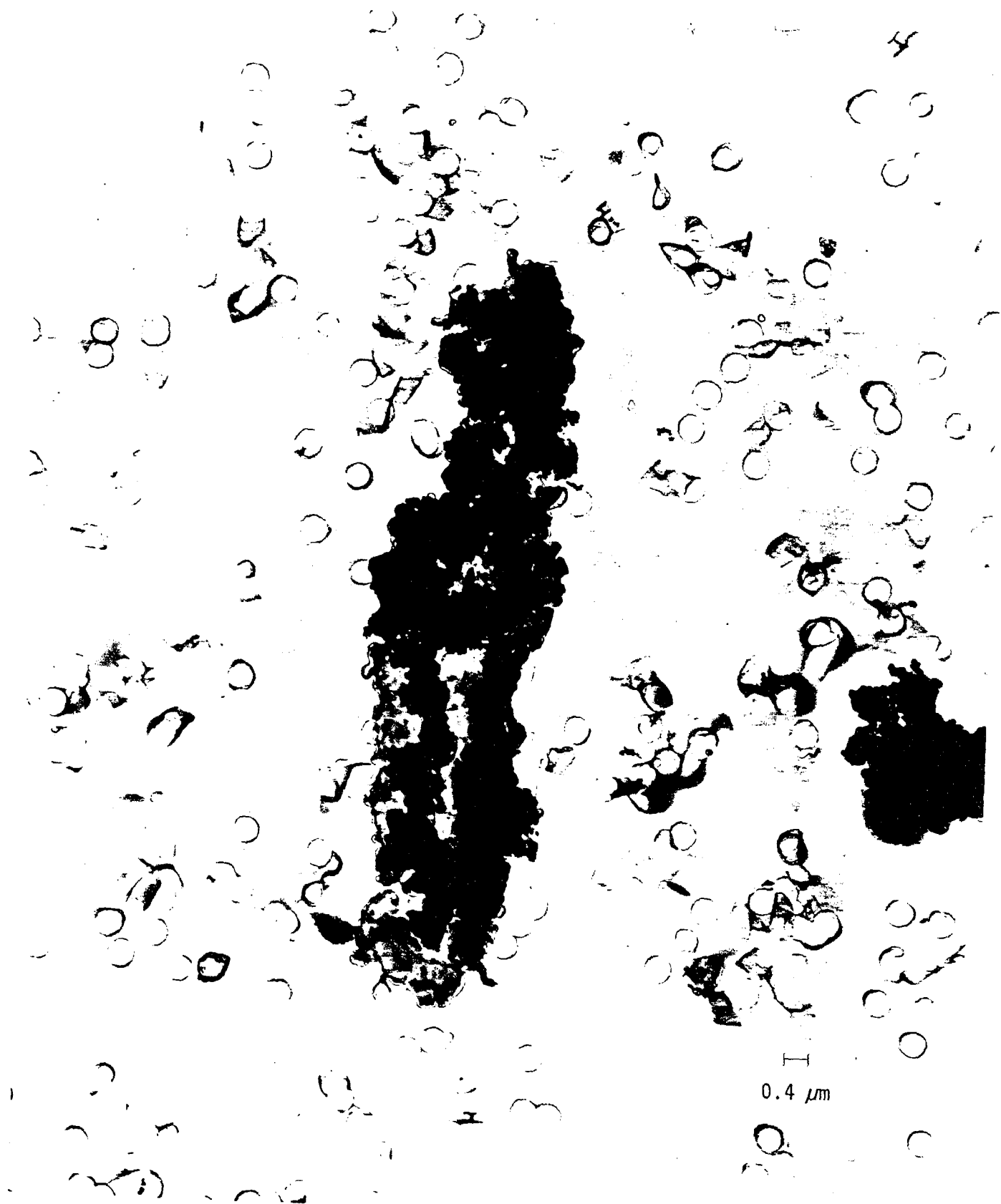


Photo # 4



Photo # 5

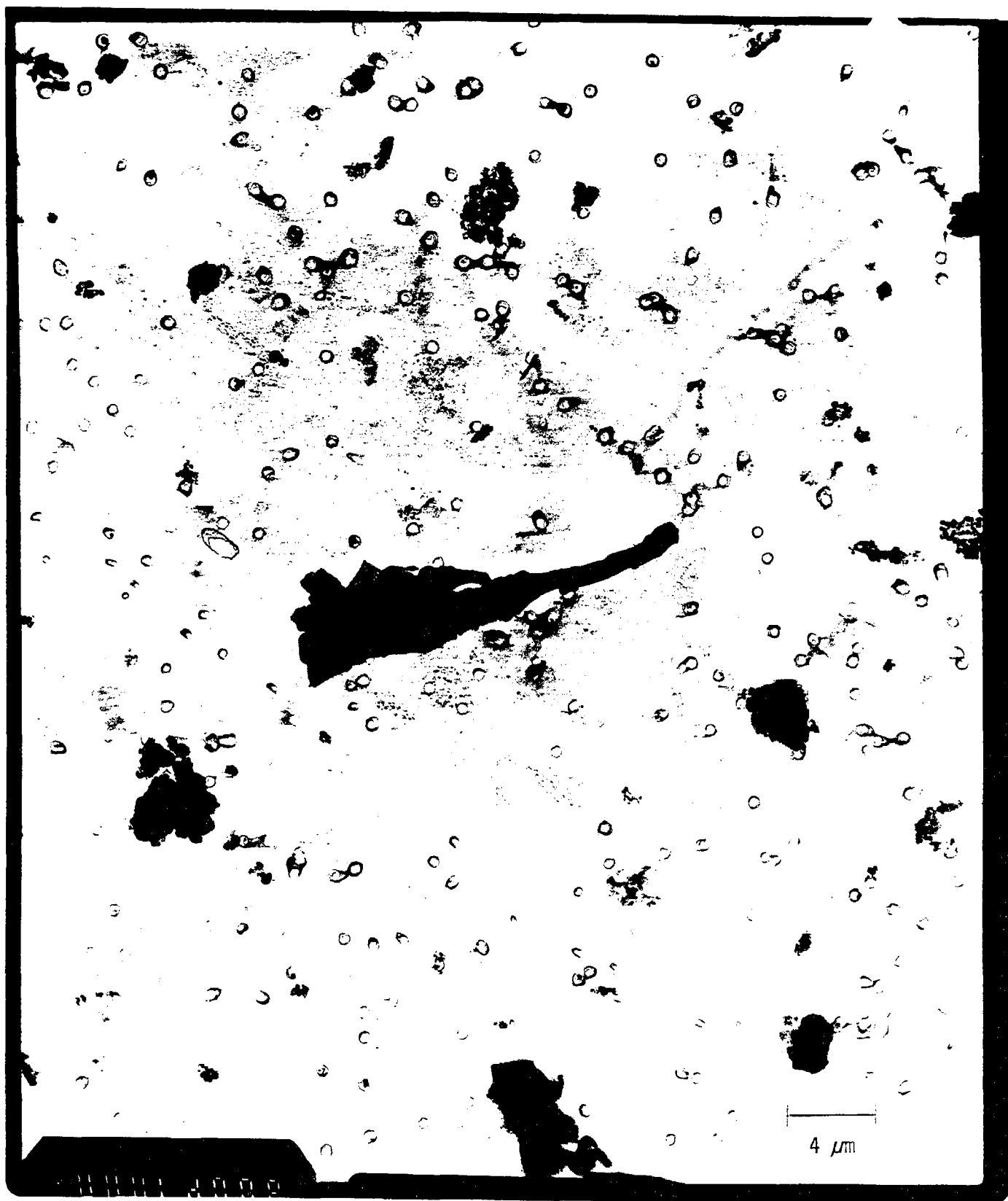


Photo # 6

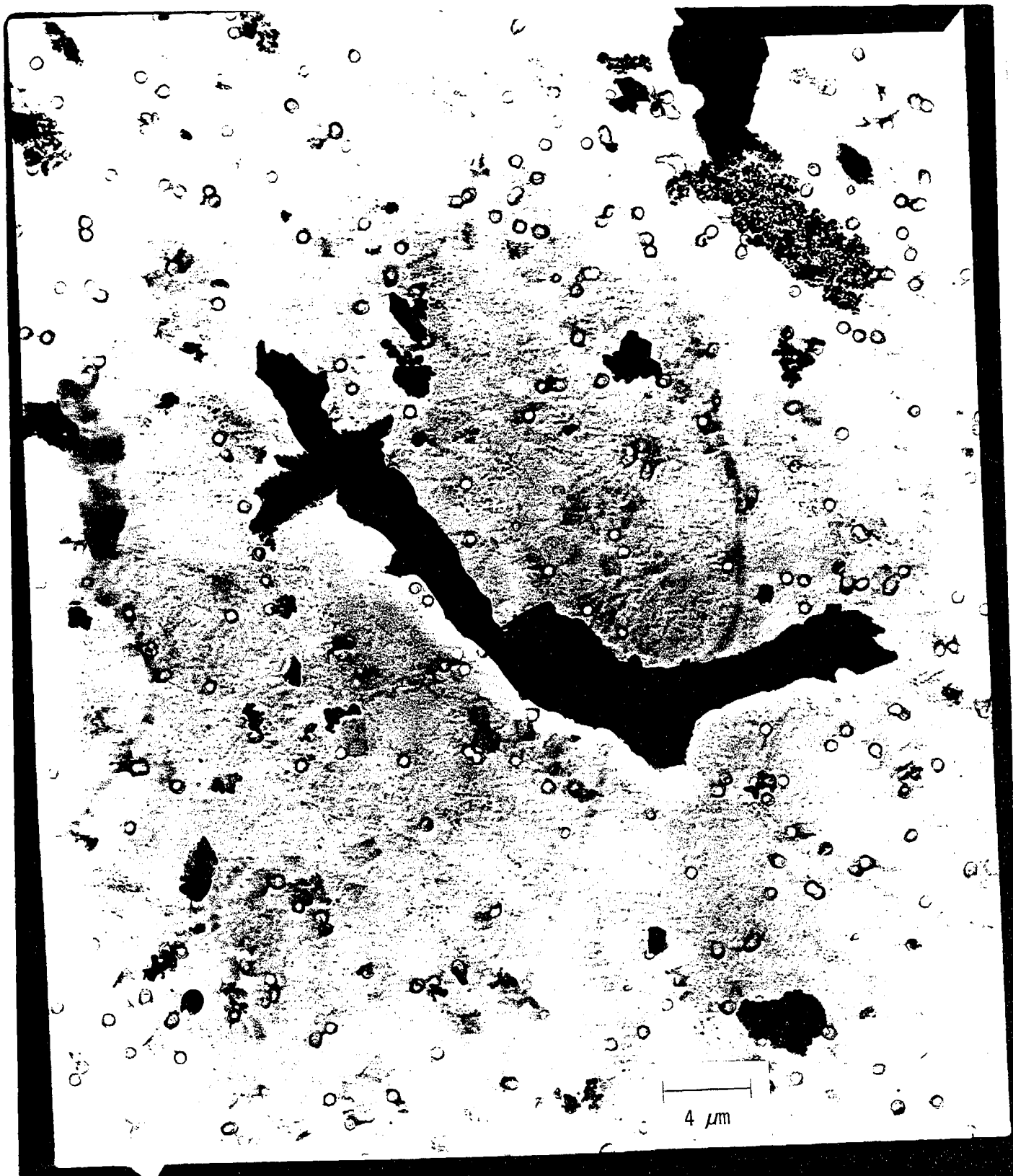
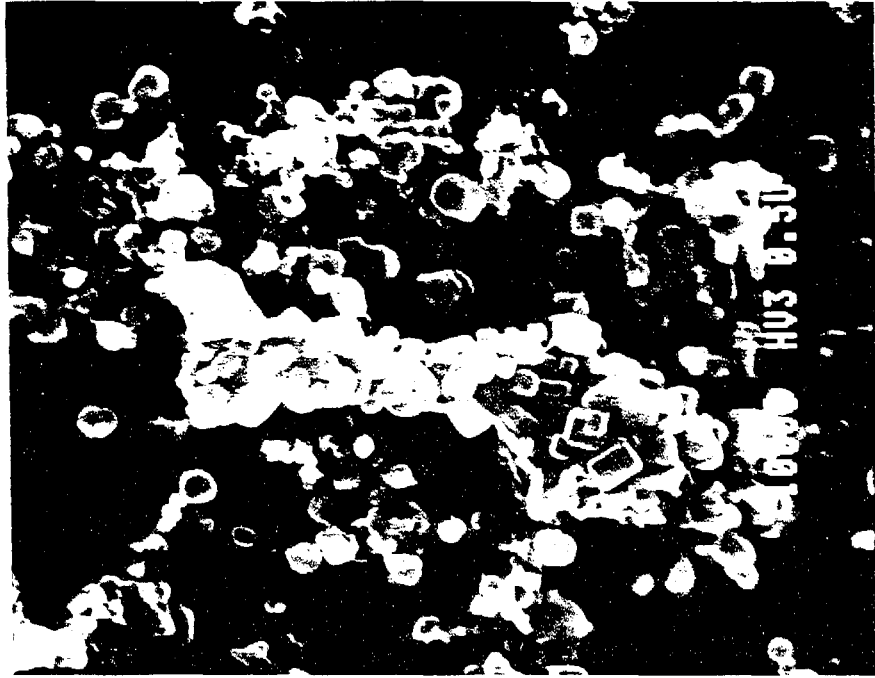


Photo # 7



5H5

Photo # 9

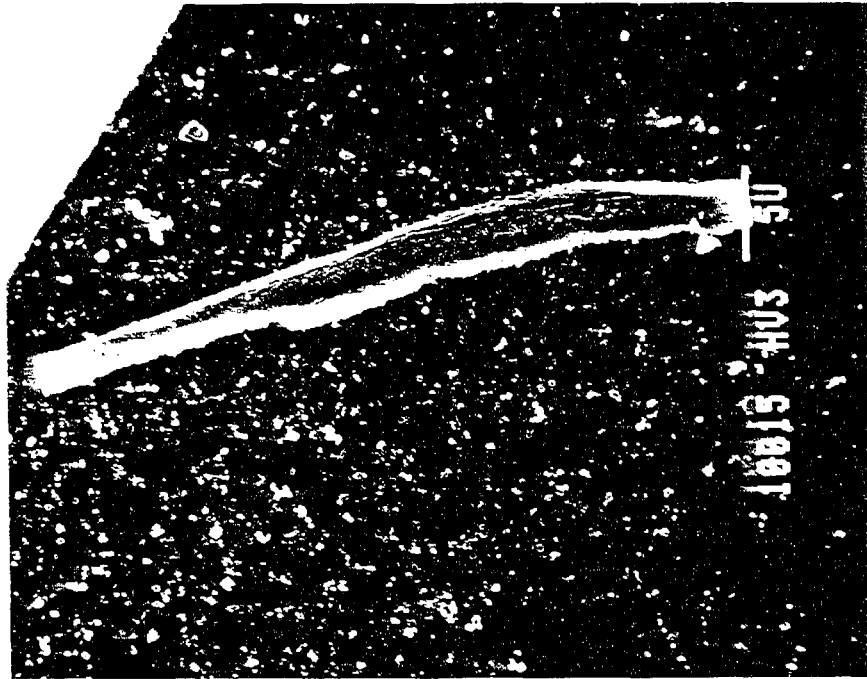
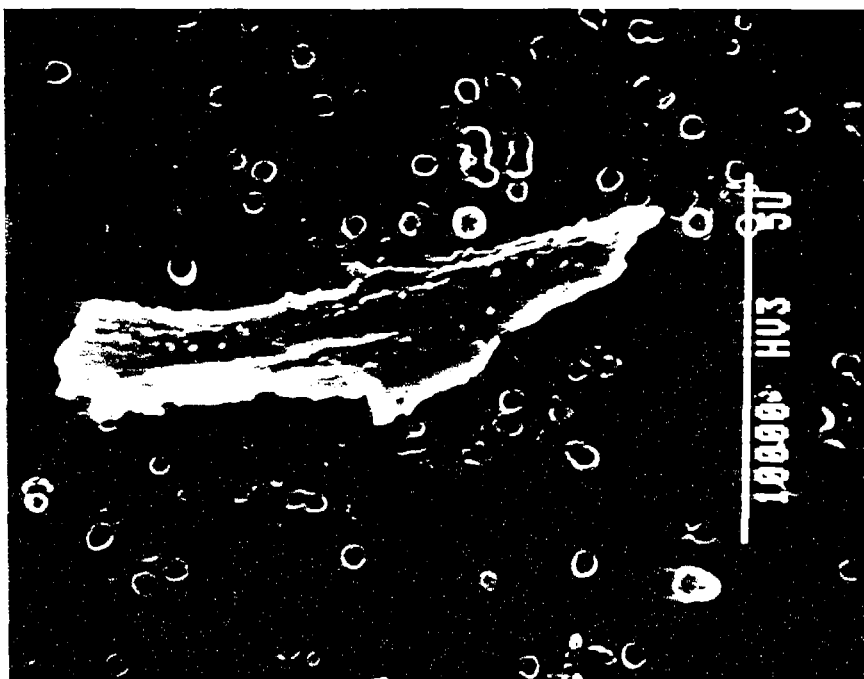


Photo # 8

200000x



T581 140000x

Photo # 10

00004280



ASSET