

Preface to Appendices

Eight separate appendices were developed to capture more of the images and information obtained for Test #5. Several appendices are further divided into subappendices to better segregate the information according to the time point in the test when the samples were extracted from the test apparatus, the location of the samples in the tank, the type of samples being evaluated, and the type of examinations performed. With the exception of Appendix I, each appendix represents a separate session of laboratory work that can be traced to a batch of samples that were typically processed in chronological order. Appendix I provides the detailed project instructions that were used to initiate Test #5, to conduct routine operations during the test, and to terminate the test with sample recovery and cleaning procedures.

Section 2.4.1.1 of this report reviewed the nomenclature adopted for reporting ICET results. This nomenclature is used in the caption labels for most of the figures presented in the appendices.

As noted in Section 2.4.1.1, the data presented in the appendices are largely qualitative in nature, consisting primarily of SEM and TEM micrographs and EDS spectra. The SEM data are further subdivided into environmental (or low-vacuum) SEM of hydrated samples and microprobe SEM of fully desiccated samples. Microprobe images were generated using secondary electrons, which are sensitive to attenuation, to reveal fine structural details in a sample.

Transcriptions of the laboratory logbooks are provided for each appendix to document better commonalities that existed among the samples at the time of analysis. Logbook information was developed for most, but not all, of the images presented in the appendices. Interpretation and understanding of the images and their accompanying EDS spectra can be improved by referring frequently to the logbook sample descriptions and sequences.

Typically, a relatively large quantity of a test sample was delivered for SEM or TEM analysis, and then several small subsamples of each item were examined. Note that each subsample was assigned a sequential reference number during the laboratory session. These reference numbers have been cited in the figure captions whenever possible to preserve the connection between the micrographs and the notebook descriptions. Electronic filenames have also been stamped on the images to permit retrieval of the original data files, which are archived elsewhere. Individual data sets for a given sample item have been collated into a typical sequence of (1) visual image, (2) EDS spectra, and (3) semiquantitative mass composition.

Semiquantitative mass compositions are also presented for many of the EDS spectra. These results are obtained from a commercial algorithm that decomposes the spectra into the separate contributions of each element. Composition estimates should be interpreted with the caveats stated in Section 2.4.1.1 fully in mind.

Appendix titles are listed below for reference.

Appendix A ESEM/EDS Data for Test #5, Day-4 Fiberglass in Low-Flow Zone

Appendix B ESEM Day-15 Fiberglass

- B1. ESEM/EDS Data for Test #5, Day-15 Fiberglass in Low-Flow Zones
- B2. ESEM Data for Test #5, Day-15 Fiberglass in High-Flow Zones

Appendix C ESEM Day-30 Fiberglass

- C1. ESEM Data for Test #5, Day-30 Fiberglass in Low-Flow Zones
- C2. ESEM/EDS Data for Test #5, Day-30 Fiberglass Samples in a Big Envelope in Low-Flow Zones
- C3. ESEM Data for Test #5, Day-30 Fiberglass in High-Flow Zones
- C4. ESEM Data for Test #5, Day-30 Fiberglass Inserted in Front of Header in High-Flow Zones
- C5. ESEM/EDS Data for Test #5, Day-30 Fiberglass Inserted in Nylon Mesh in High-Flow Zones
- C6. ESEM/EDS and SEM Data for Test #5, Day-30 Drain Collar Fiberglass
- C7. ESEM/EDS Data for Test #5, Day-30 Birdcage Fiberglass

Appendix D SEM/EDS Data for Test #5, Day-30 Deposition Products

Appendix E SEM Day-30 Coupons

- E1. SEM/EDS Data for Test #5, Day-30 Aluminum Coupons
- E2. SEM/EDS Data for Test #5, Day-30 Copper Coupons
- E3. SEM/EDS Data for Test #5, Day-30 Galvanized Steel Coupons
- E4. SEM/EDS Data for Test #5, Day-30 Steel Coupons

Appendix F SEM/EDS Data for Test #5, Day-30 Sediment

Appendix G TEM Data for Test #5 Solution Samples

Appendix H UV Absorbance Spectrum—Day-30 Solution Samples

Appendix I ICET Test #5: Pre-Test, Test, and Post-Test Project Instructions

Appendix A

ESEM/EDS Data for Test #5, Day-4 Fiberglass in Low-Flow Zone

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- Figure A-4. ESEM image magnified 100 times for a Test #5, Day-4 low-flow interior fiberglass sample. (t5d4in04.jpeg)..... A-5
- Figure A-5. ESEM image magnified 500 times for a Test #5, Day-4 low-flow interior fiberglass sample. (t5d4in05.jpeg)..... A-6
- Figure A-6. EDS counting spectrum for the flocculence deposits between fibers shown in Figure A-5. (t5d4in06.jpg)..... A-6
- Figure A-7. ESEM image magnified 500 times for a Test #5, Day-4 low-flow interior fiberglass sample. (t5d4in07.jpeg)..... A-7
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During ICET Test #5, work continued for the purpose of identifying the origin and chemical composition of the products that were formed during the test. One objective of ICET tests is to identify the composition of debris that collects on fiberglass and the particulate substances in the test solution. To address this question partially, low-flow fiberglass samples on Test #5 Day 4 were examined by Environmental SEM (ESEM)/EDS, including both the exterior and the interior location of the fiberglass samples.

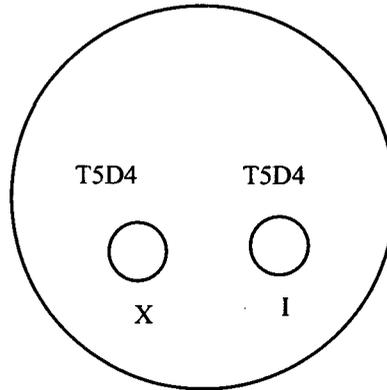
ESEM was employed to analyze the hydrated fiberglass samples. These samples were examined under a low vacuum condition (i.e., 80 Pa) and without any coating, to minimize the modification of the fiberglass samples through drying process. EDS results provide a semi-quantitative elemental analysis of the debris attached on fiberglass.

Test #5 Day-4 low-flow fiberglass samples were obtained on July 30, 2005 (Day 4 for Test #5). SEM/EDS data presented here were obtained on August 3, 2005.

Transcribed Laboratory Log

Laboratory session from August 3, 2005.

ESEM/EDS Test #5 Day-4 fiberglass in low-flow zone



ESEM Exterior Low-Flow Fiberglass Samples

Image: T5D4Ex01	100 ×	ESEM image	Figure A-1
t5d4ex02	100 ×		Figure A-2
t5d4ex03	500 ×	ESEM at higher magnification	Figure A-3

ESEM/EDS Interior Low-Flow Fiberglass Samples

Image: t5d4lfin04	100 ×	ESEM image	Figure A-4
t5d4lfin05	500 ×	ESEM of debris	Figure A-5
EDS: t5d4lfin06		EDS on flocculence deposits t5drlfin05	Figure A-6
Image: t5d4lfin07	500 ×	ESEM image	Figure A-7
EDS: t5d4lfin08		EDS on deposits on t5d4lfin07	Figure A-8



Figure A-1. ESEM image magnified 100 times for a Test #5, Day-4 low-flow exterior fiberglass sample. (T5D4Ex01.jpeg)



Figure A-2. ESEM image magnified 100 times for a Test #5, Day-4 low-flow exterior fiberglass sample. (t5d4ex02.jpeg)

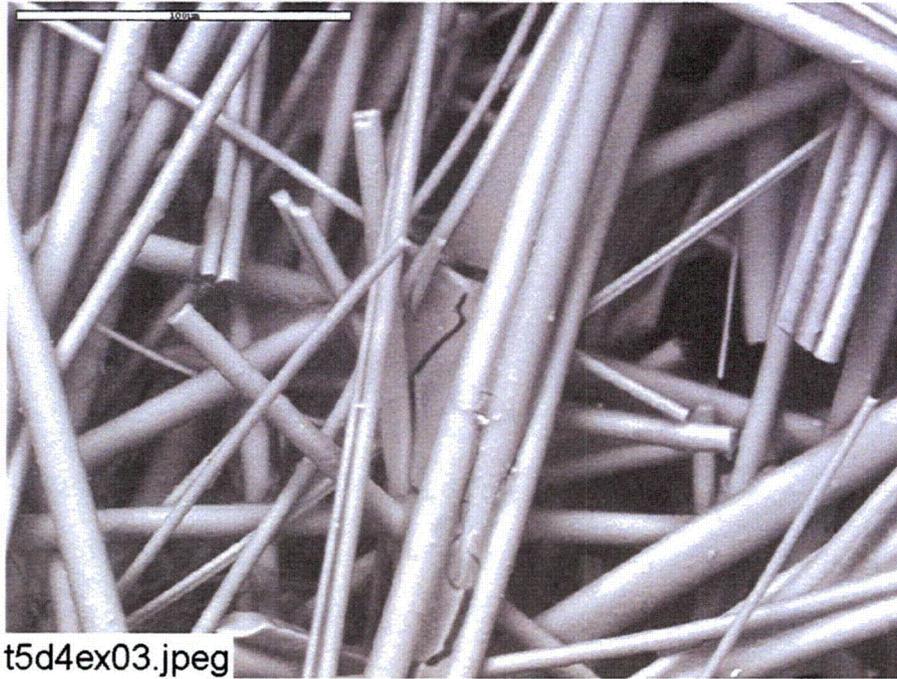


Figure A-3. ESEM image magnified 500 times for a Test #5, Day-4 low-flow exterior fiberglass sample. (t5d4ex03.jpeg)

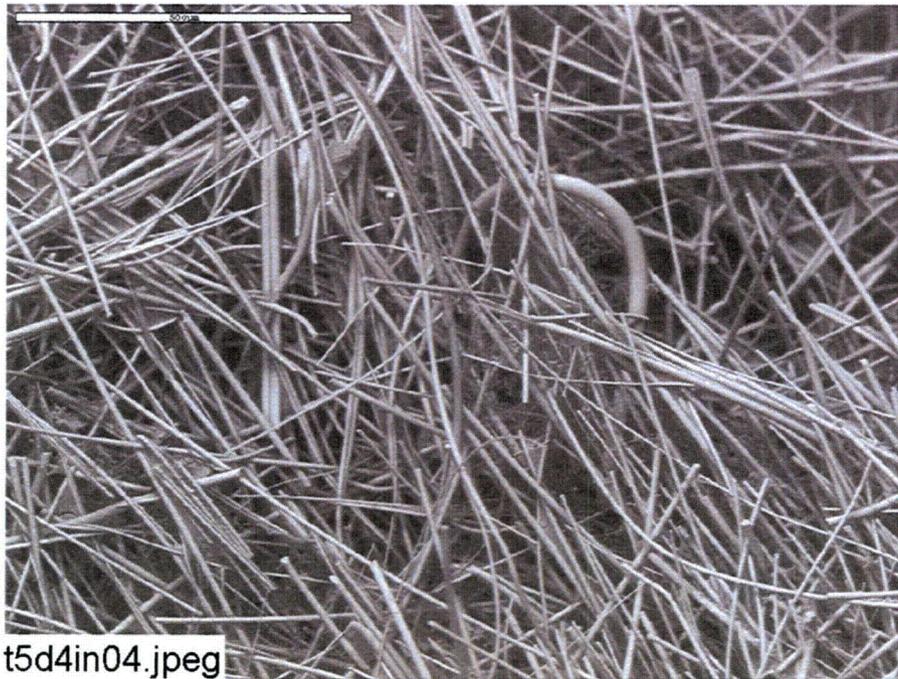


Figure A-4. ESEM image magnified 100 times for a Test #5, Day-4 low-flow interior fiberglass sample. (t5d4in04.jpeg)

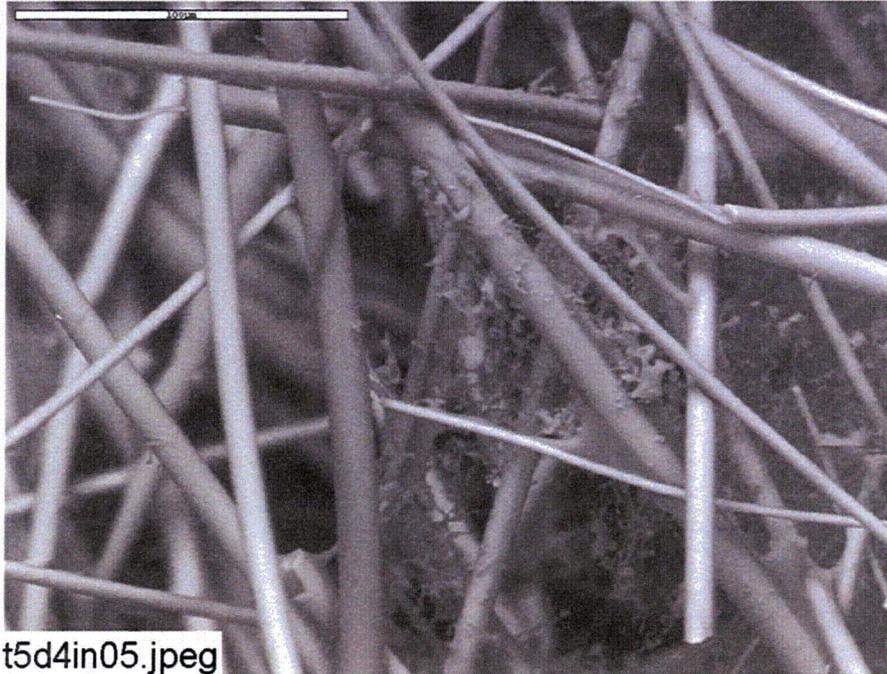


Figure A-5. ESEM image magnified 500 times for a Test #5, Day-4 low-flow interior fiberglass sample. (t5d4in05.jpeg)

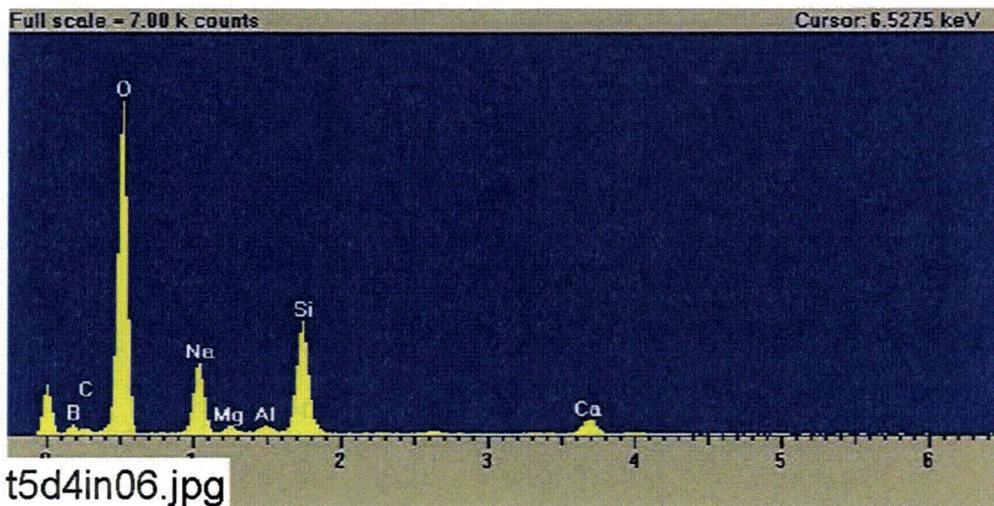
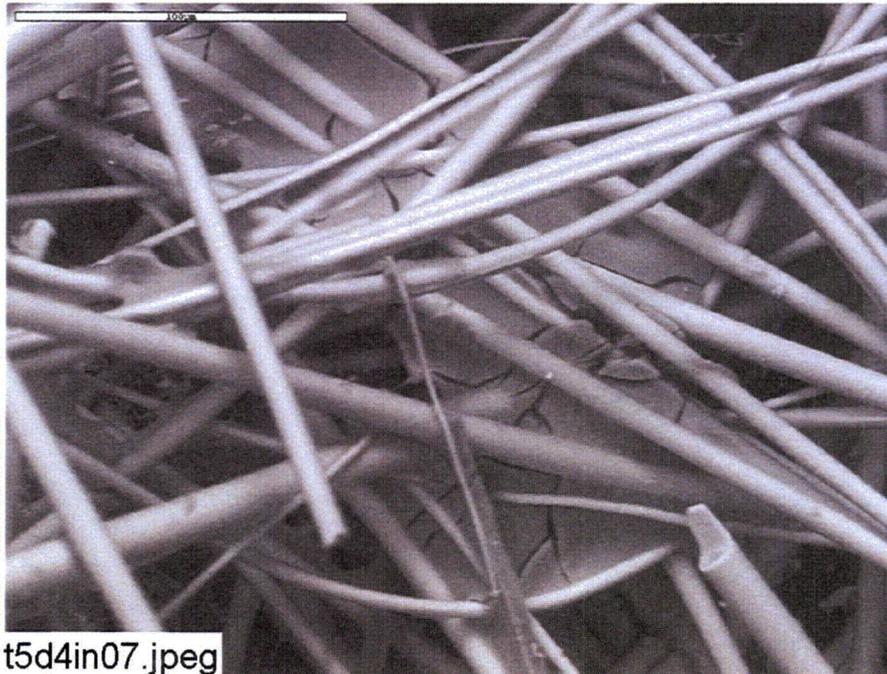


Figure A-6. EDS counting spectrum for the flocculence deposits between fibers shown in Figure A-5. (t5d4in06.jpg)



t5d4in07.jpeg

Figure A-7. ESEM image magnified 500 times for a Test #5, Day-4 low-flow interior fiberglass sample. (t5d4in07.jpeg)

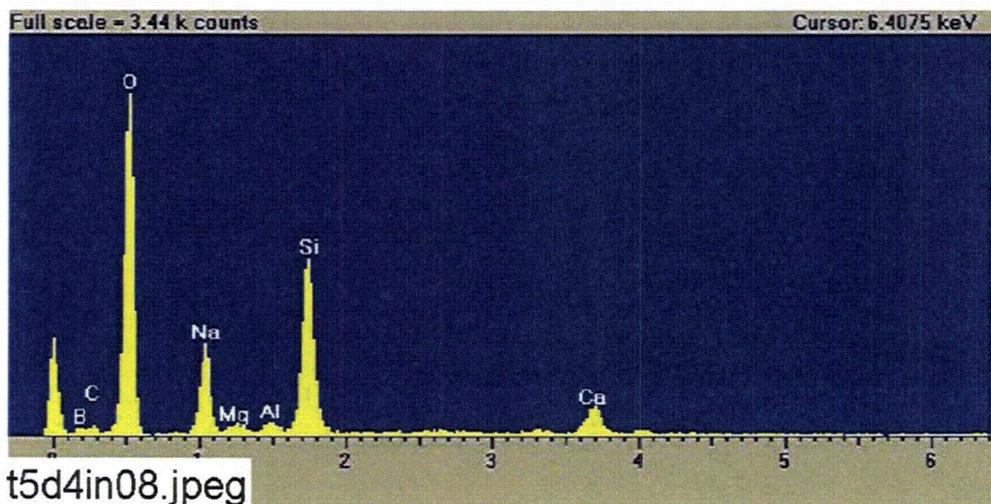


Figure A-8. EDS counting spectrum for the deposits between fibers shown in Figure A-7. (t5d4in08.jpeg)

Appendix B1

ESEM/EDS Data for Test #5, Day-15 Fiberglass in Low-Flow Zones

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Figure B1-5. ESEM image magnified 500 times for a Test #5, Day-15 low-flow interior fiberglass sample. (t5d15li5.jpeg)	B1-7
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Figure B1-7. EDS counting spectrum for the deposits between fibers shown in Figure B1-6. (t5d15li7.jpeg).....	B1-8

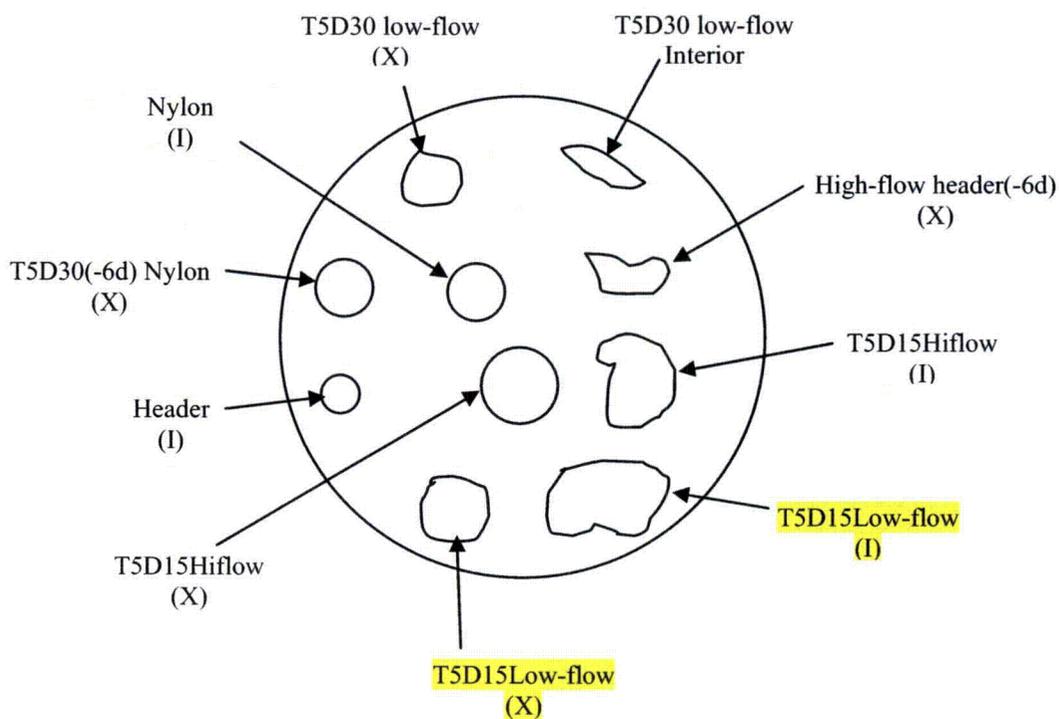
This appendix shows the ESEM/EDS results on ICET Test #5, Day-15 low-flow zone fiberglass samples. The samples were obtained on August 10, 2005 (Day 15 for Test #5). Both exterior and interior locations of the fiberglass samples were examined. ESEM/EDS data presented here were obtained on August 25, 2005. The hydrated fiberglass samples without any coating were examined by ESEM under a low vacuum condition (i.e., 80 Pa). EDS results provide a semi-quantitative elemental analysis of the debris attached on fiberglass.

Transcribed Laboratory Log

Laboratory session from August 25, 2005.

Test #5, Day-15 fiberglass in low-flow zones

ESEM



ESEM Fiberglass Low-Flow Exterior

Image: T5D15lx1 100 × ESEM image of fiberglass
t5d15lx2 500 × ESEM image of fiberglass

Figure B1-1

Figure B1-2

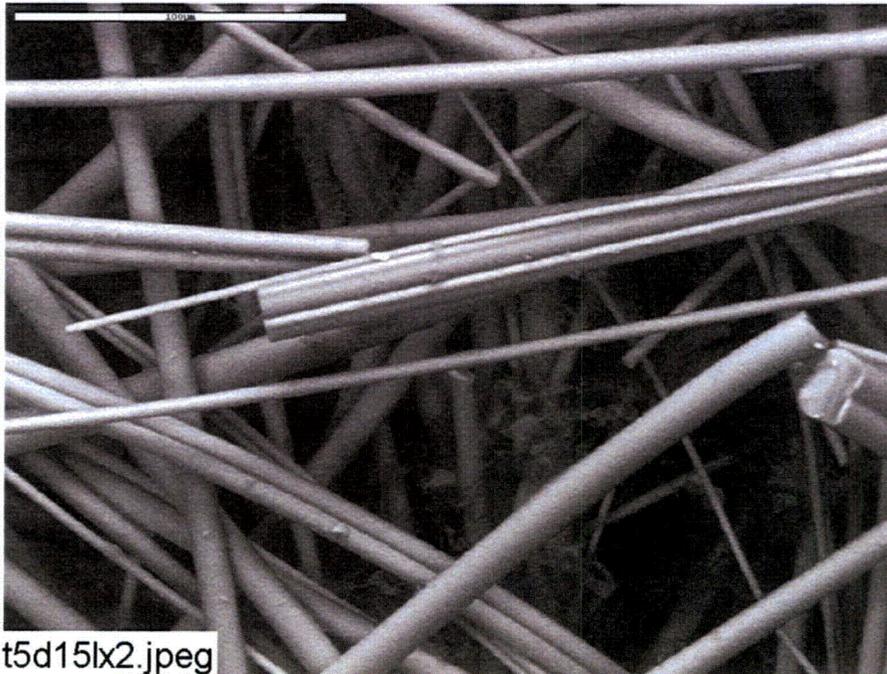
ESEM Fiberglass Low-Flow Interior

Image:	T5d15li3	100 ×	ESEM image of fiberglass	Figure B1-3
	t5d15li4	500 ×	ESEM image at higher magnification	Figure B1-4
	t5d15li5	500 ×	ESEM image	Figure B1-5
	t5d15li6	500 ×	Annotated ESEM image	Figure B1-6
EDS:	t5d15li7		EDS on deposits between fibers for t5d15li6	Figure B1-7



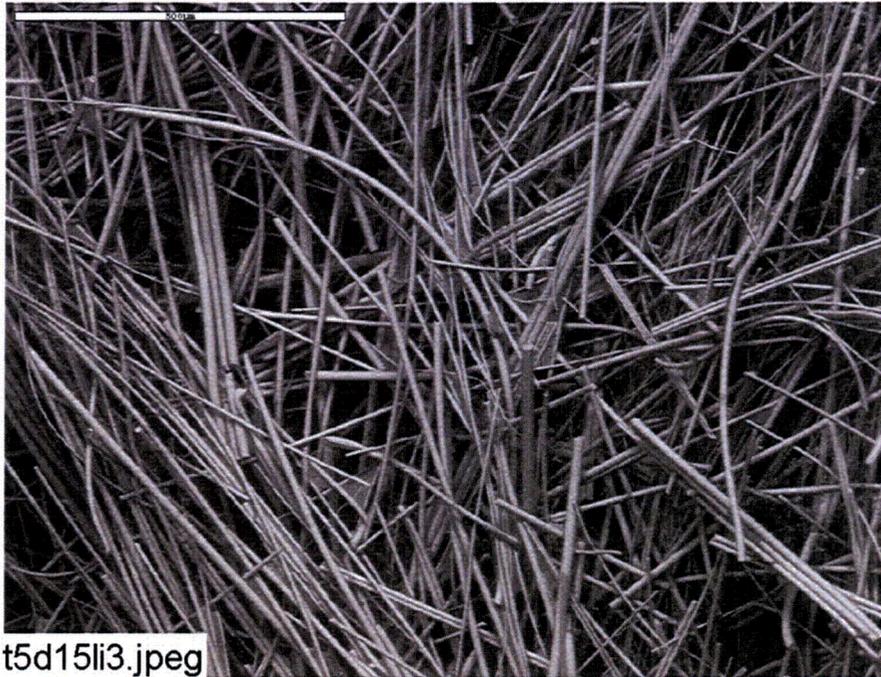
t5d15lx1.jpeg

Figure B1-1. ESEM image magnified 100 times for a Test #5, Day-15 low-flow exterior fiberglass sample. (T5D15lx1.jpeg)



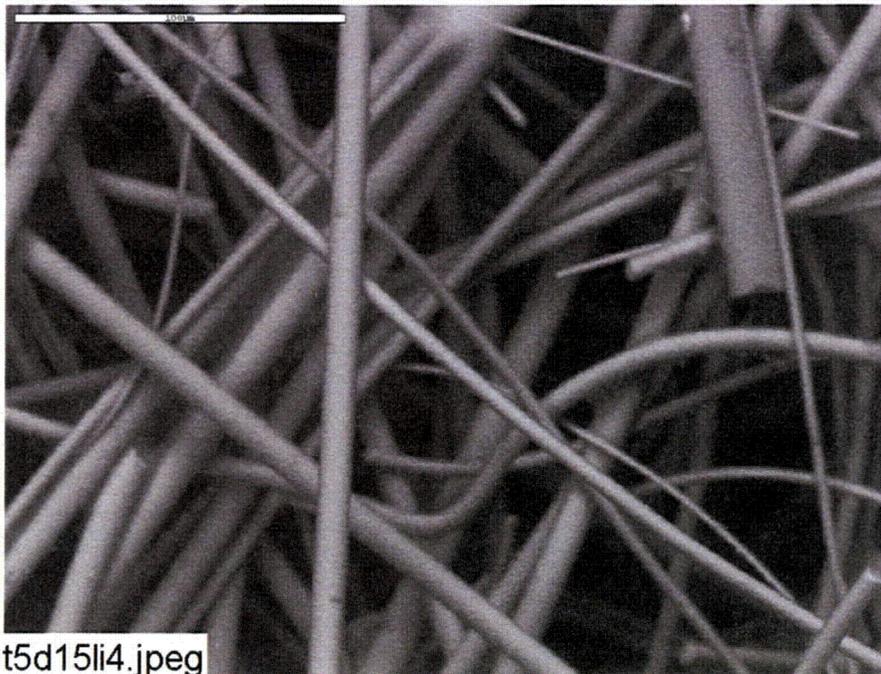
t5d15lx2.jpeg

Figure B1-2. ESEM image magnified 500 times for a Test #5, Day-15 low-flow exterior fiberglass sample. (t5d15lx2.jpeg)



t5d15li3.jpeg

Figure B1-3. ESEM image magnified 100 times for a Test #5, Day-15 low-flow interior fiberglass sample. (t5d15li3.jpeg)



t5d15li4.jpeg

Figure B1-4. ESEM image magnified 500 times for a Test #5, Day-15 low-flow interior fiberglass sample. (t5d15li4.jpeg)

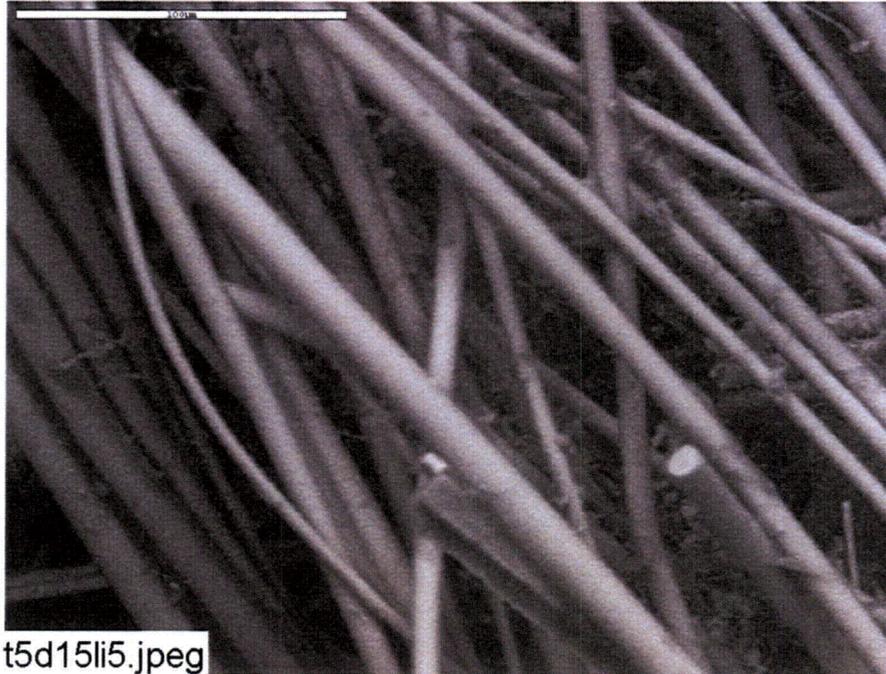


Figure B1-5. ESEM image magnified 500 times for a Test #5, Day-15 low-flow interior fiberglass sample. (t5d15li5.jpeg)

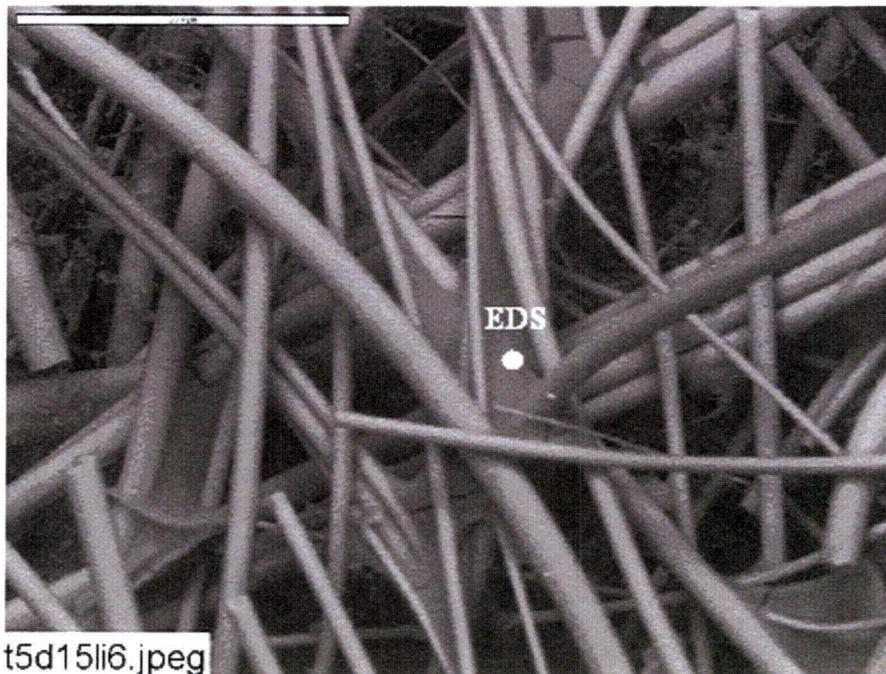


Figure B1-6. Annotated ESEM image magnified 500 times for a Test #5, Day-15 low-flow interior fiberglass sample. (t5d15li6.jpeg)

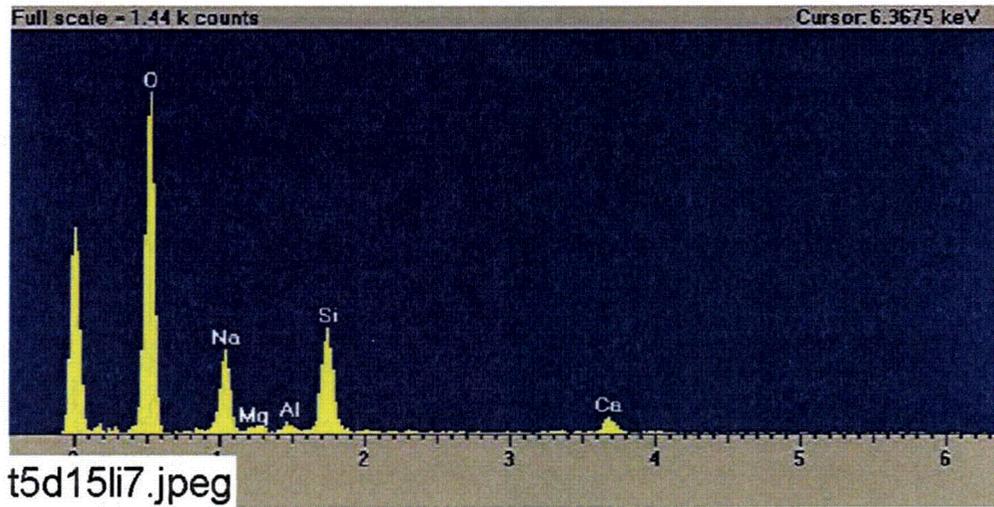


Figure B1-7. EDS counting spectrum for the deposits between fibers shown in Figure B1-6. (t5d15li7.jpeg)

Appendix B2

ESEM Data for Test #5, Day-15 Fiberglass in High-Flow Zones

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- Figure B2-3. ESEM image magnified 100 times for a Test #5, Day-15 high-flow interior fiberglass sample. (T5D15HI3.jpeg)..... B2-6
- Figure B2-4. ESEM image magnified 500 times for a Test #5, Day-15 high-flow interior fiberglass sample. (t5d15hi4.jpeg)..... B2-6

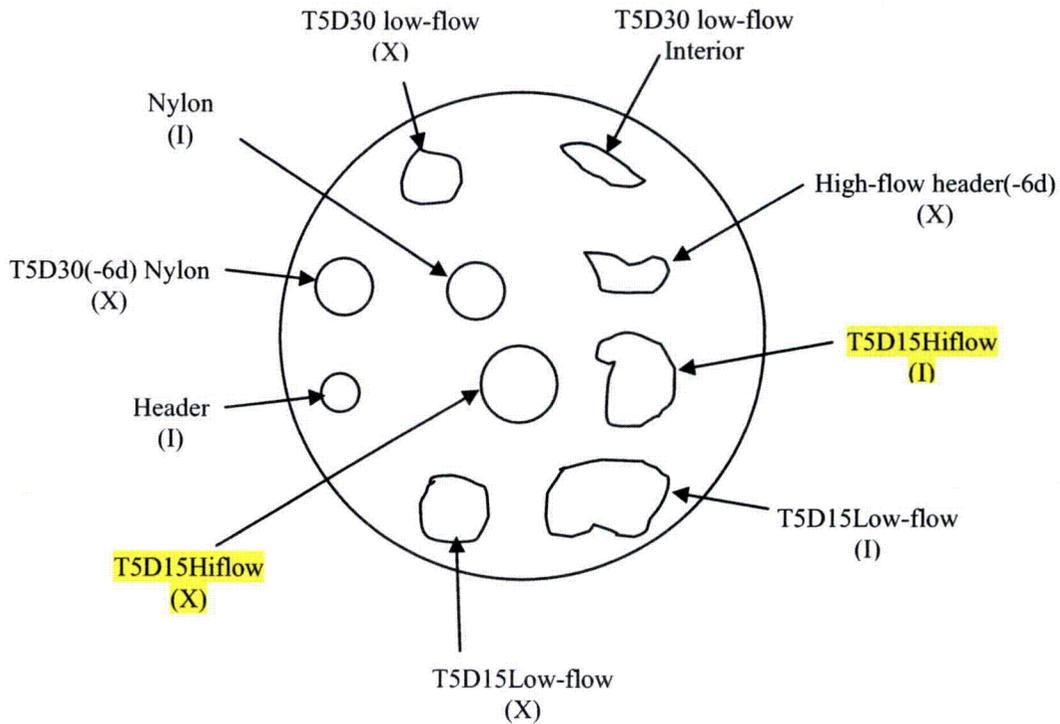
This appendix lists the ESEM/EDS results on ICET Test #5, Day-15 high-flow zone fiberglass samples. The samples were obtained on August 10, 2005 (Day 15 for Test #5). Both exterior and interior locations of the fiberglass samples were examined. ESEM/EDS data presented here were obtained on August 25, 2005. The hydrated fiberglass samples without any coating were examined by ESEM under a low-vacuum condition (i.e., 80 Pa).

Transcribed Laboratory Log

Laboratory session from August 25, 2005.

Test #5, Day-15 fiberglass in high-flow zones

ESEM



ESEM Fiberglass High-Flow Exterior

Image:	T5D15HX1	100 ×	ESEM image	Figure B2-1
	t5d15hx2	500 ×	ESEM image at higher magnification	Figure B2-2

ESEM Fiberglass High-Flow Interior

Image:	T5D15HI3	100 ×	ESEM image	Figure B2-3
	t5d15hi4	500 ×	ESEM image at higher magnification	Figure B2-4



Figure B2-1. ESEM image magnified 100 times for a Test #5, Day-15 high-flow exterior fiberglass sample. (T5D15HX1.jpeg)

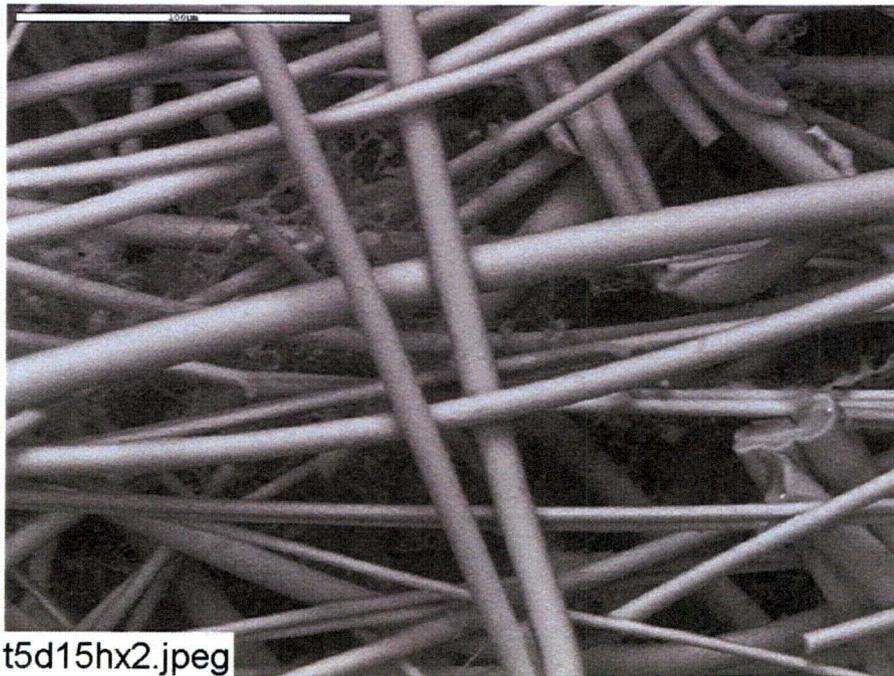


Figure B2-2. ESEM image magnified 500 times for a Test #5, Day-15 high-flow exterior fiberglass sample. (t5d15hx2.jpeg)

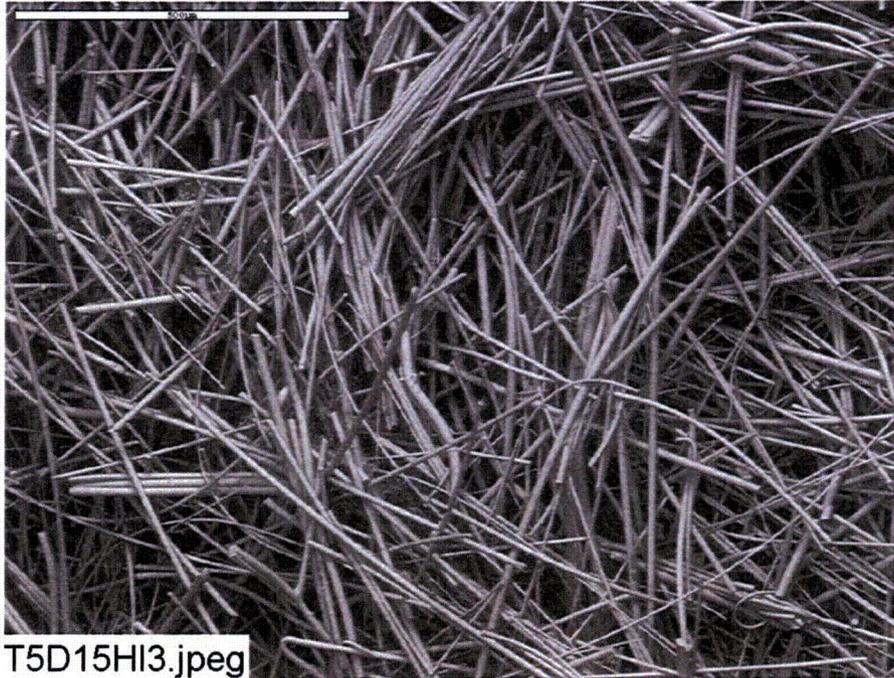


Figure B2-3. ESEM image magnified 100 times for a Test #5, Day-15 high-flow interior fiberglass sample. (T5D15HI3.jpeg)

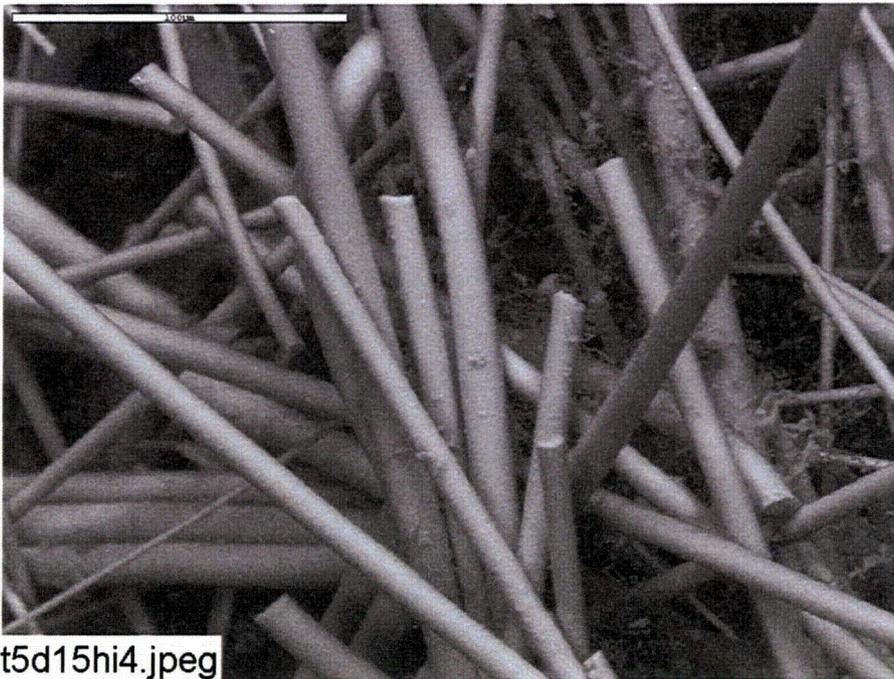


Figure B2-4. ESEM image magnified 500 times for a Test #5, Day-15 high-flow interior fiberglass sample. (t5d15hi4.jpeg)

Appendix C1

ESEM Data for Test #5, Day-30 Fiberglass in Low-Flow Zones

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Figure C1-5. ESEM image magnified 500 times for a Test #5, Day-30 low-flow interior fiberglass sample. (t5d30li7.jpeg)	C1-7

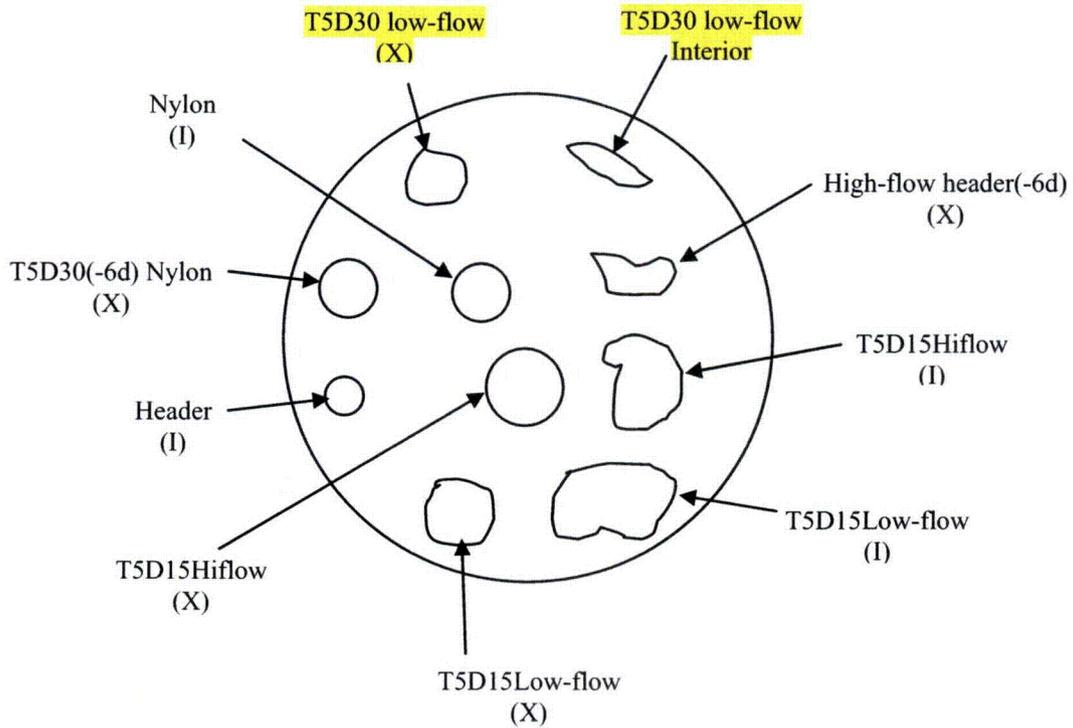
In this appendix, the fiberglass samples were extracted from the test tank on August 25, 2005, the date Test #5 was shut down. Both exterior and interior locations of the fiberglass samples were examined. SEM was used to analyze the hydrated fiberglass samples under a low-vacuum condition (i.e., 80 Pa), and without any coating. This examination approach minimizes the modification of the fiberglass samples that can occur if samples are dried. The results of Test #5, Day-30 low-flow fiberglass samples were obtained on August 25, 2005. EDS results provide a semi-quantitative elemental analysis of the debris attached on fiberglass.

Transcribed Laboratory Log

Laboratory session from August 25, 2005.

Test #5, Day-30 Low-Flow Fiberglass

ESEM



ESEM Low-Flow Exterior

Image: t5d30lx3	100 ×	ESEM image	Figure C1-1
t5d30lx4	500 ×	ESEM image higher magnification	Figure C1-2
t5d30lx5	500 ×	ESEM image	Figure C1-3

ESEM Low-Flow Interior

Image: t5d30li6	100 ×	ESEM image of fiberglass	Figure C1-4
t5d30li7	500 ×	ESEM image higher magnification	Figure C1-5

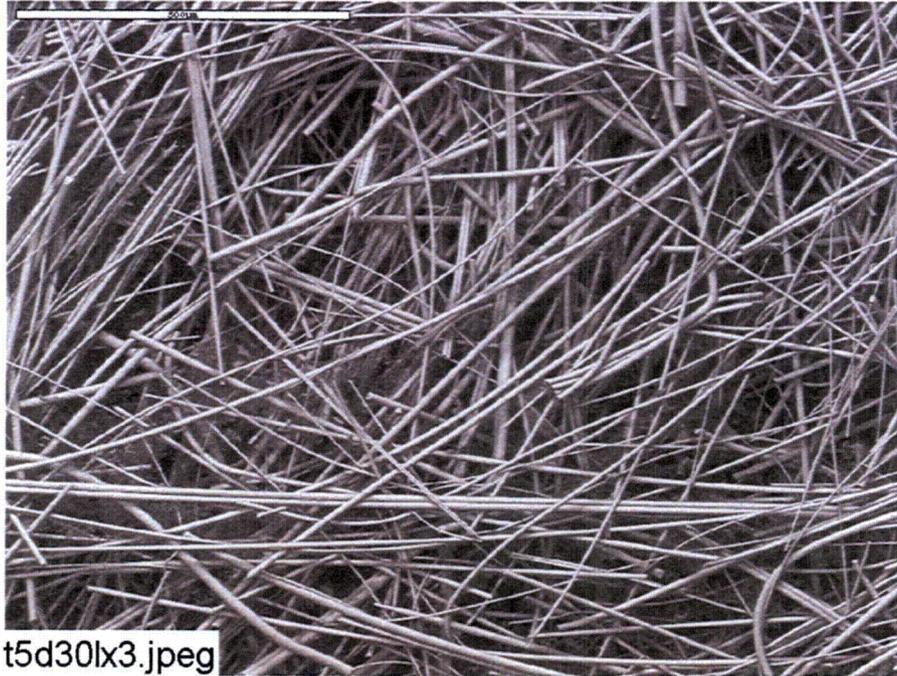


Figure C1-1. ESEM image magnified 100 times for a Test #5, Day-30 low-flow exterior fiberglass sample. (t5d30lx3.jpeg)

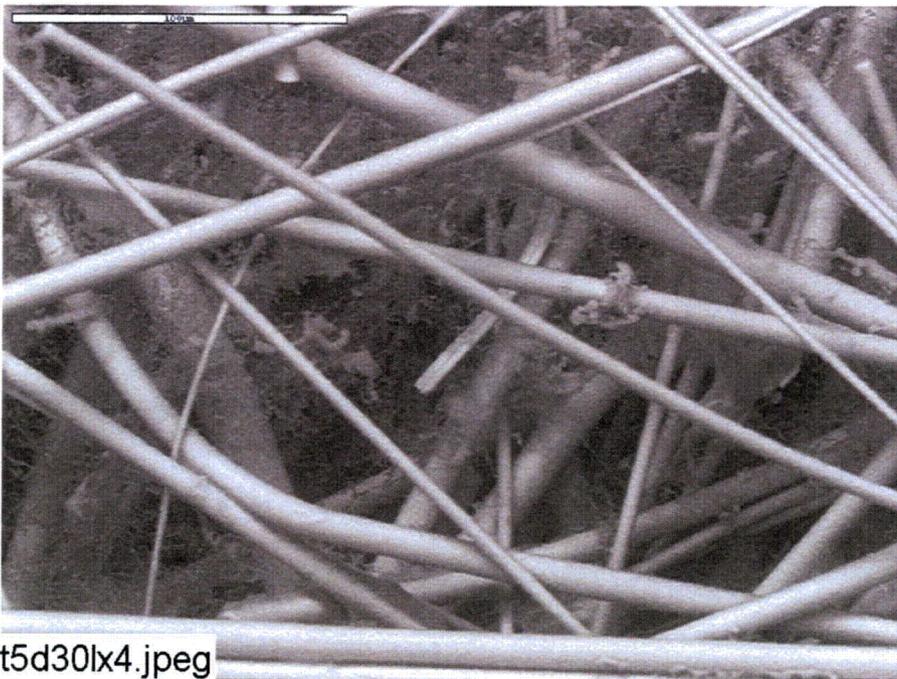


Figure C1-2. ESEM image magnified 500 times for a Test #5, Day-30 low-flow exterior fiberglass sample. (t5d30lx4.jpeg)

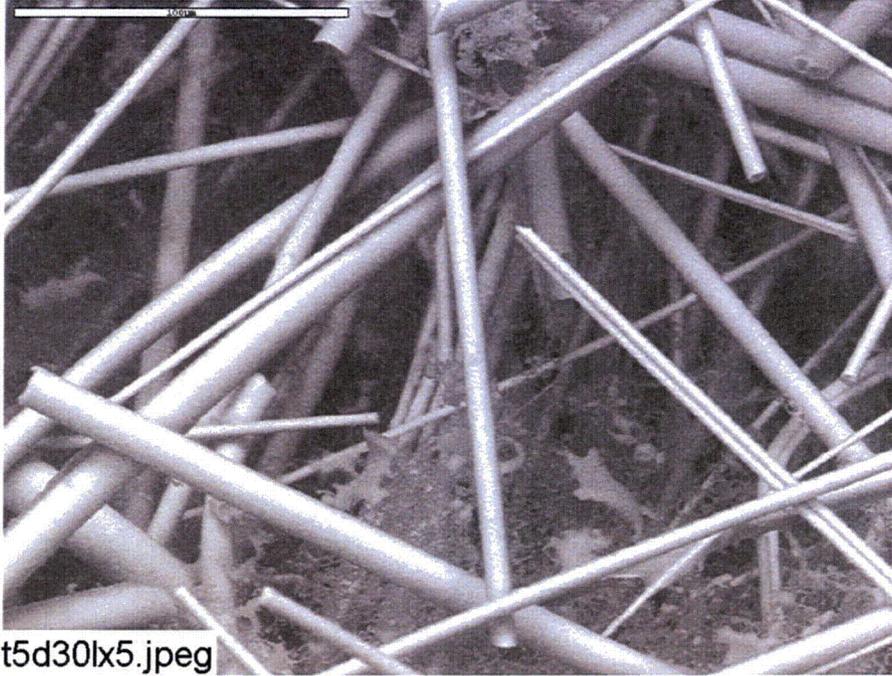


Figure C1-3. ESEM image magnified 500 times for a Test #5, Day-30 low-flow exterior fiberglass sample. (t5d30lx5.jpeg)



Figure C1-4. ESEM image magnified 100 times for a Test #5, Day-30 low-flow interior fiberglass sample. (t5d30ll6.jpeg)

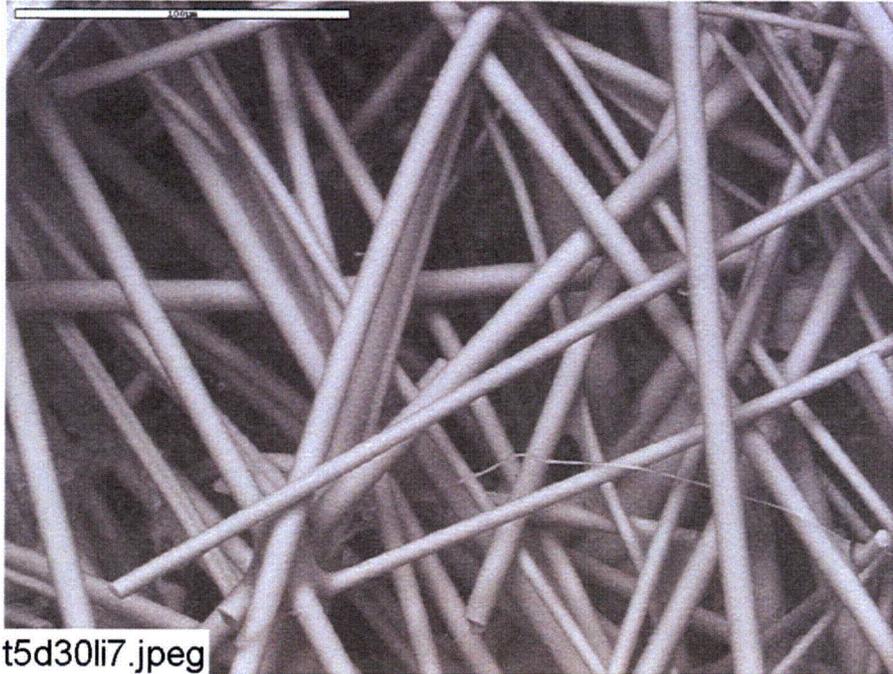
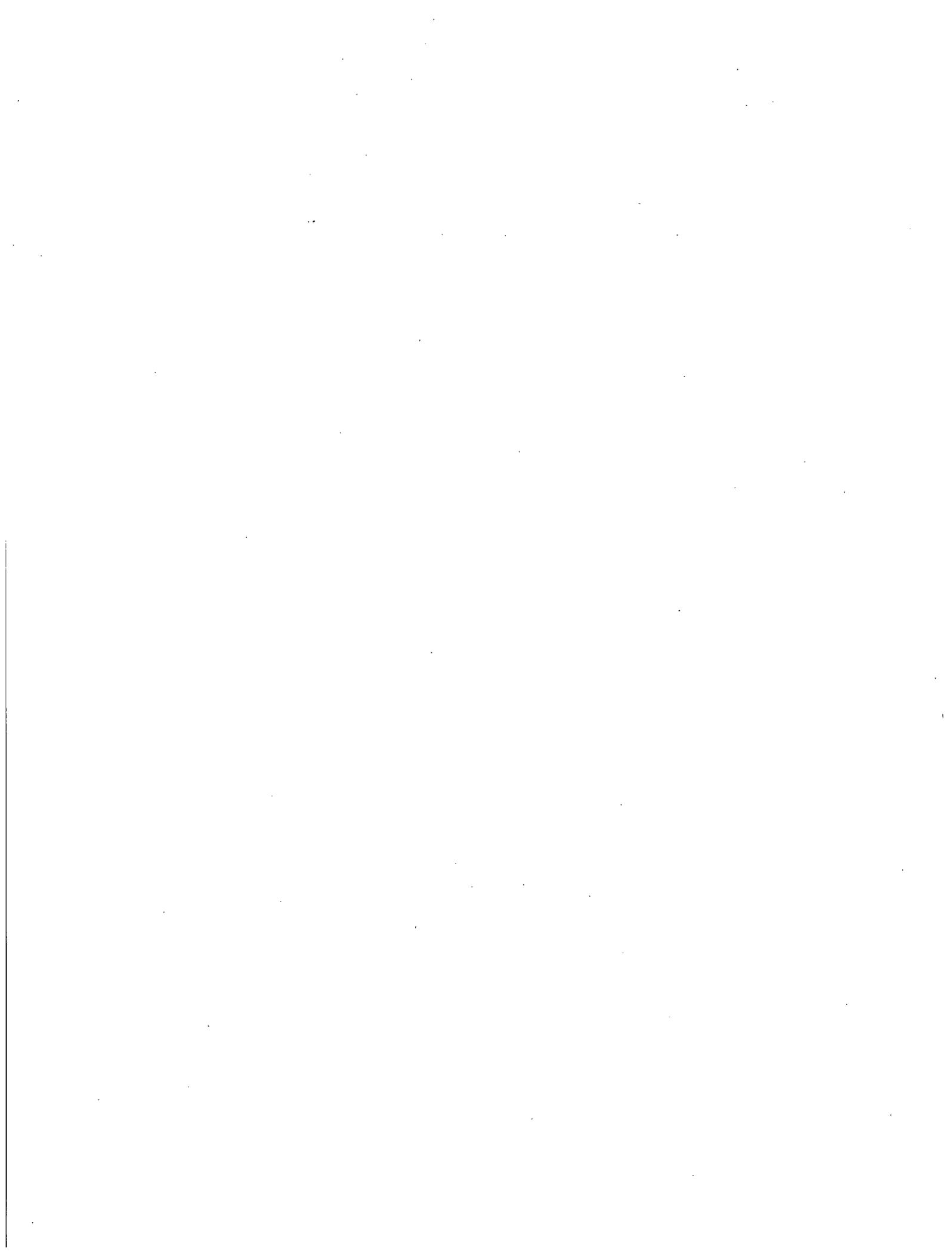


Figure C1-5. ESEM image magnified 500 times for a Test #5, Day-30 low-flow interior fiberglass sample. (t5d30li7.jpeg)



Appendix C2

ESEM/EDS Data for Test #5, Day-30 Fiberglass Samples in a Big Envelope in Low-Flow Zones

List of Figures

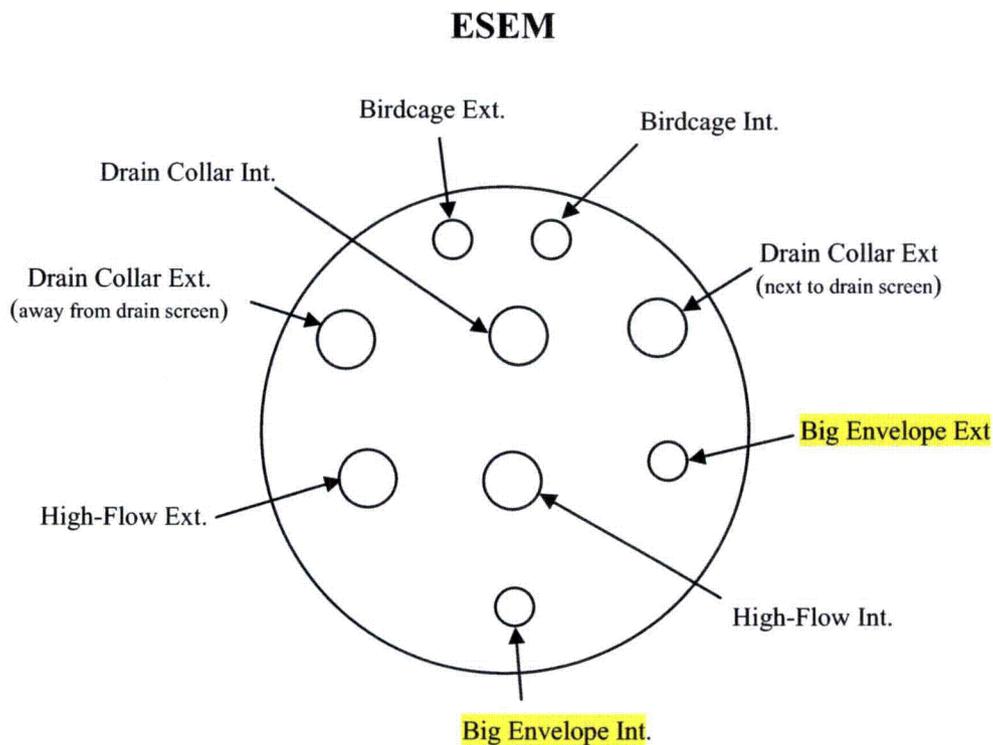
- Figure C2-1. ESEM image magnified 100 times for a Test #5, Day-30 low-flow exterior fiberglass sample in a big envelope. (T5enpx01.jpeg) C2-5
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- Figure C2-5. ESEM image magnified 500 times for a Test #5, Day-30 low-flow interior fiberglass sample in a big envelope. (T5enpi05.jpeg)..... C2-7

In this appendix, the fiberglass samples submerged in a big envelope in a low-flow zone of the test tank were extracted on the date Test #5 was shut down (August 25, 2005). Both exterior and interior locations of the fiberglass samples were examined. ESEM was used to analyze the hydrated fiberglass samples under a low-vacuum condition (i.e., 80 Pa) and without any coating. This examination approach minimizes the modification of the fiberglass samples that can occur if samples are dried. The results of Test #5, Day-30 low-flow fiberglass samples in a big envelope were obtained on August 26, 2005. EDS results provide a semi-quantitative elemental analysis of the debris attached on fiberglass.

Transcribed Laboratory Log

Laboratory session from August 26, 2005.

Test #5, Day-30 Low-Flow Fiberglass Samples in a Big Envelope



Big Envelope Exterior, Low Flow

Image: T5enpx01	100 ×	ESEM image	Figure C2-1
t5enpx02	500 ×	ESEM image higher magnification	Figure C2-2
EDS: t5enpx03		EDS on particle in image t5enpx02	Figure C2-3

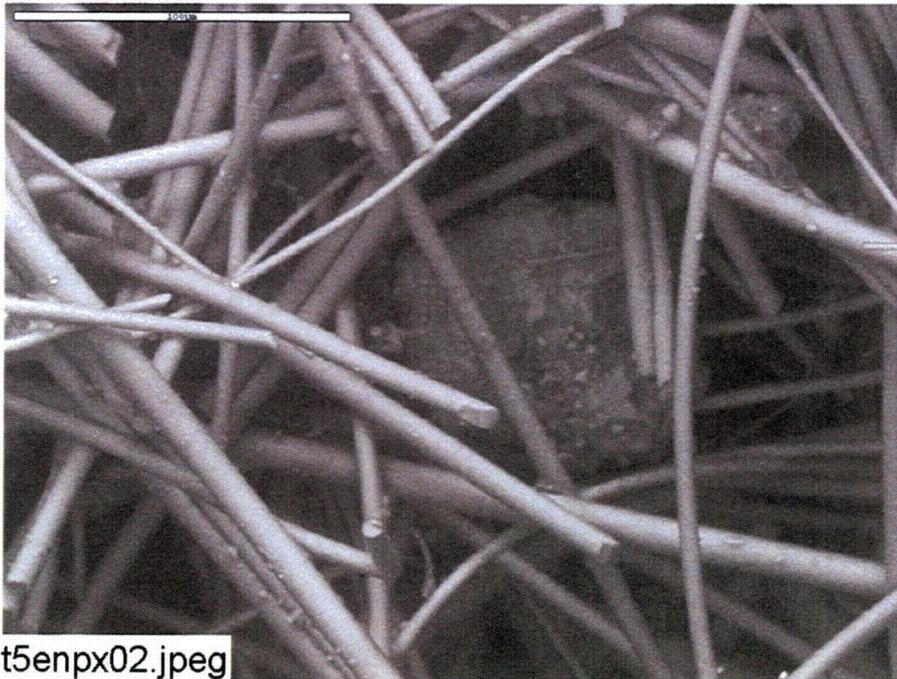
Big Envelope Interior, Low Flow

Image: T5empi04	100 ×	ESEM image	Figure C2-4
T5enpi05	500 ×	ESEM image higher magnification	Figure C2-5



T5enpx01.jpeg

Figure C2-1. ESEM image magnified 100 times for a Test #5, Day-30 low-flow exterior fiberglass sample in a big envelope. (T5enpx01.jpeg)



t5enpx02.jpeg

Figure C2-2. ESEM image magnified 500 times for a Test #5, Day-30 low-flow exterior fiberglass sample in a big envelope. (t5enpx02.jpeg)

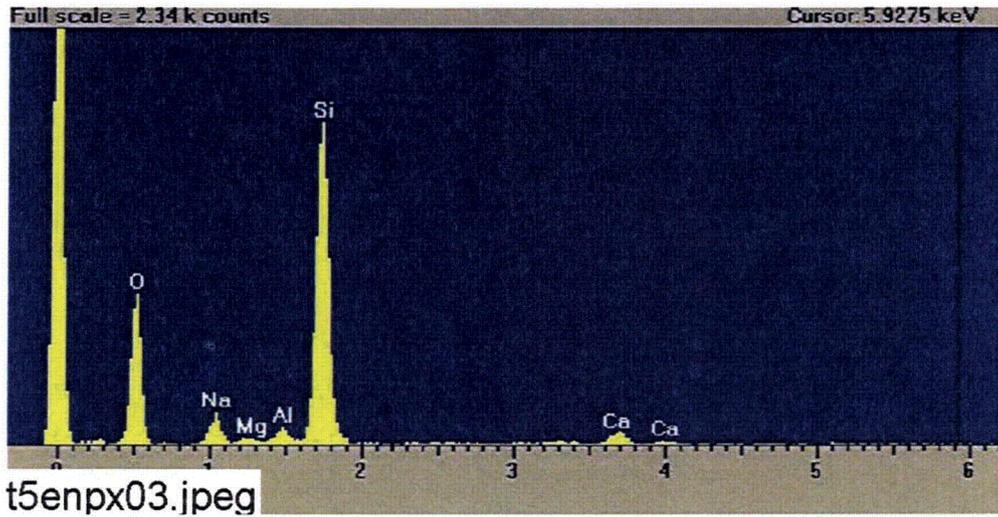


Figure C2-3. EDS counting spectrum for the particulate deposits between the fibers shown in Figure C2-2. (t5enpx03.jpeg)



Figure C2-4. ESEM image magnified 100 times for a Test #5, Day-30 low-flow interior fiberglass sample in a big envelope. (T5enpi04.jpeg)

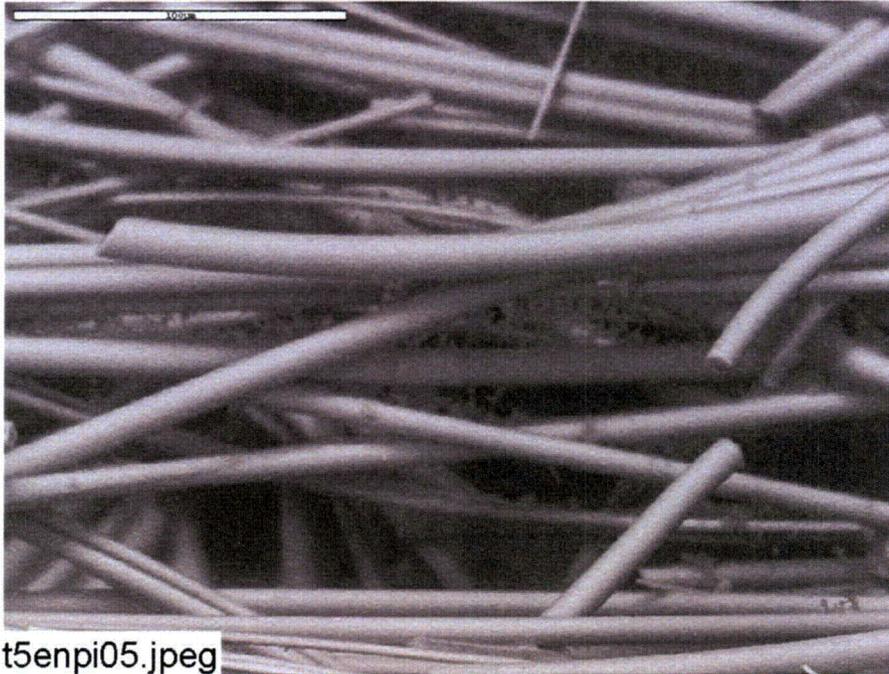


Figure C2-5. ESEM image magnified 500 times for a Test #5, Day-30 low-flow interior fiberglass sample in a big envelope. (T5enpi05.jpeg)

Appendix C3

ESEM Data for Test #5, Day-30 Fiberglass in High-Flow Zones

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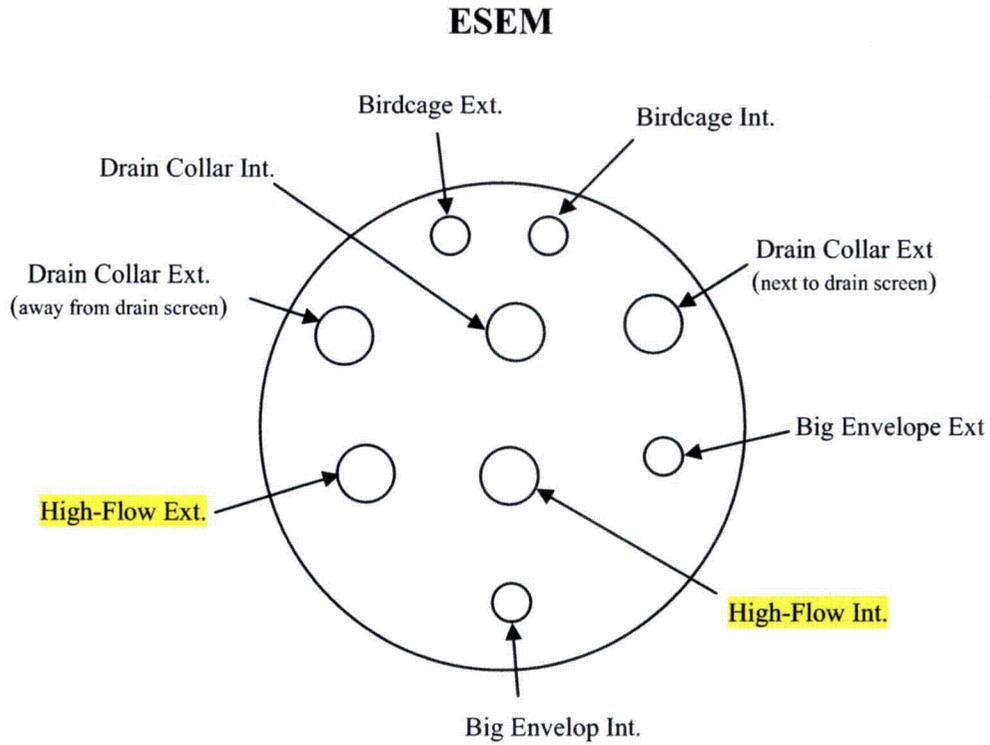
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- Figure C3-2. ESEM image magnified 100 times for a Test #5, Day-30 high-flow exterior fiberglass sample. (t5d30hx2.jpeg)..... C3-5
- Figure C3-3. ESEM image magnified 500 times for a Test #5, Day-30 high-flow exterior fiberglass sample. (t5d30hx3.jpeg)..... C3-6
- Figure C3-4. ESEM image magnified 100 times for a Test #5, Day-30 high-flow interior fiberglass sample. (T5D30HI4.jpeg) C3-6
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This appendix presents the fiberglass samples submerged in a high-flow zone, which were extracted on the date Test #5 was shut down (August 25, 2005). Both exterior and interior locations of the fiberglass samples were examined. ESEM was used to analyze the hydrated fiberglass samples under a low-vacuum condition (i.e., 80 Pa) and without any coating. This examination approach minimizes the modification of the fiberglass samples that can occur if samples are dried. The results of Test #5, Day-30 high-flow fiberglass samples were obtained on August 26, 2005.

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Test #5, Day-30 High-Flow Fiberglass



Exterior High-Flow Fiberglass

Image: T5D30HX1	100 ×	ESEM image	Figure C3-1
t5d30hx2	100 ×	ESEM image	Figure C3-2
t5d30hx3	500 ×	ESEM image higher magnification	Figure C3-3

Interior High-Flow Fiberglass

Image: T5D30HI4	100 ×	ESEM image	Figure C3-4
t5d30hi5	100 ×	ESEM image	Figure C3-5
t5d30hi6	500 ×	ESEM image higher magnification	Figure C3-6



Figure C3-1. ESEM image magnified 100 times for a Test #5, Day-30 high-flow exterior fiberglass sample. (T5D30HX1.jpeg)



Figure C3-2. ESEM image magnified 100 times for a Test #5, Day-30 high-flow exterior fiberglass sample. (t5d30hx2.jpeg)

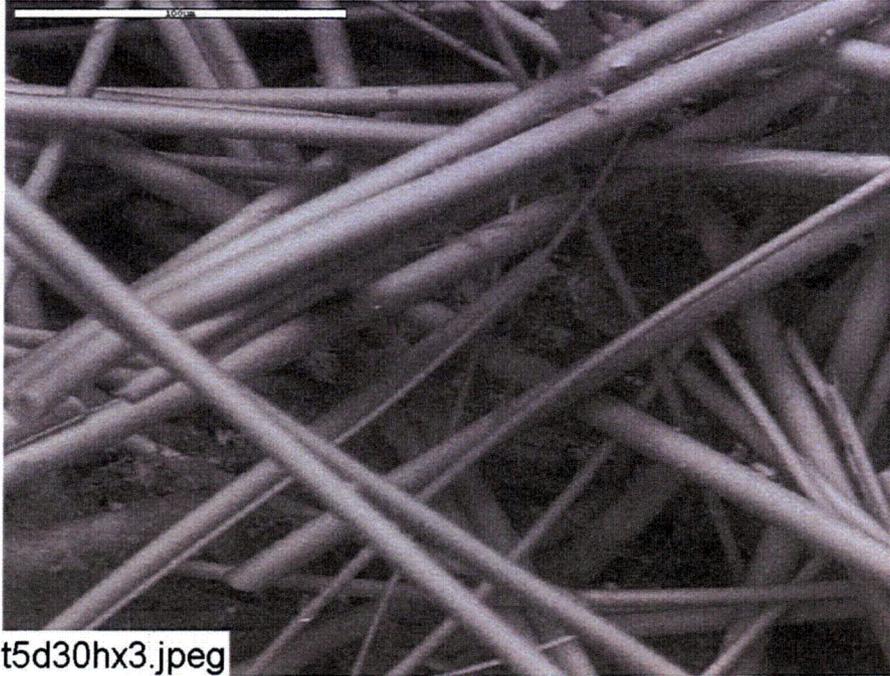


Figure C3-3. ESEM image magnified 500 times for a Test #5, Day-30 high-flow exterior fiberglass sample. (t5d30hx3.jpeg)



Figure C3-4. ESEM image magnified 100 times for a Test #5, Day-30 high-flow interior fiberglass sample. (T5D30HI4.jpeg)

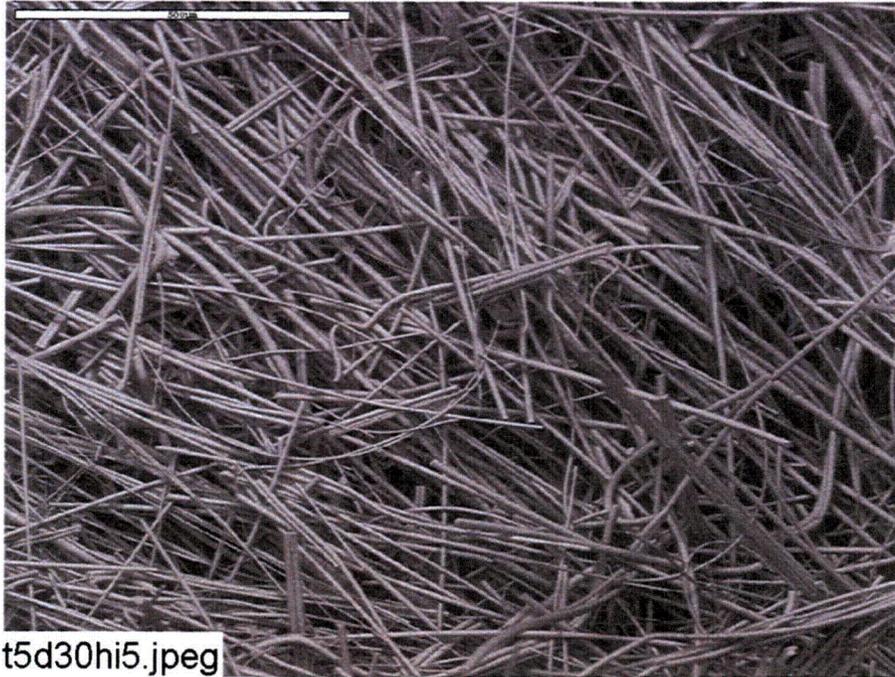


Figure C3-5. ESEM image magnified 100 times for a Test #5, Day-30 high-flow interior fiberglass sample. (t5d30hi5.jpeg)

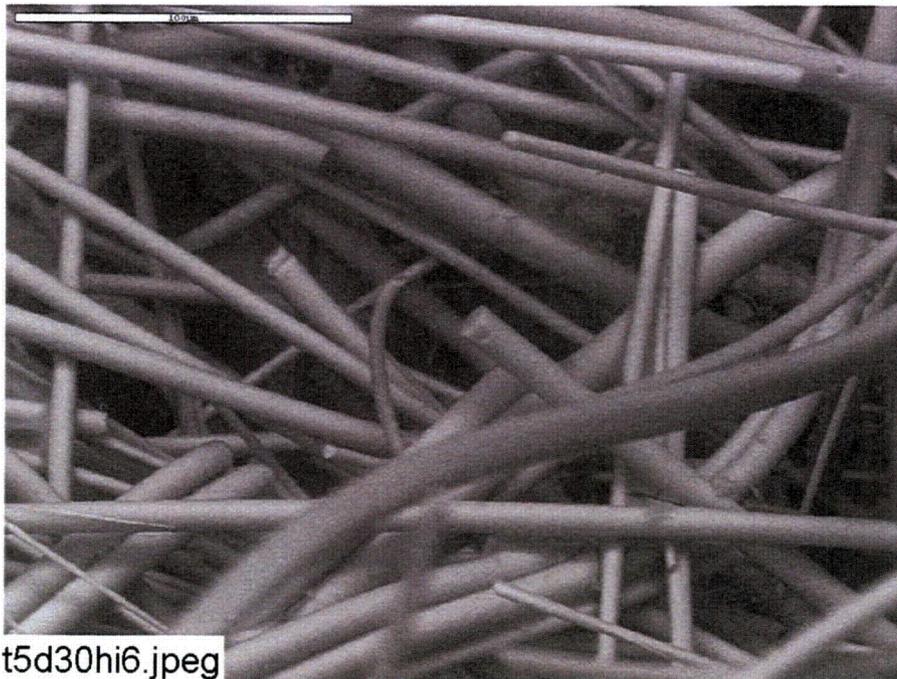


Figure C3-6. ESEM image magnified 500 times for a Test #5, Day-30 high-flow interior fiberglass sample. (t5d30hi6.jpeg)

Appendix C4

ESEM Data for Test #5, Day-30 Fiberglass Inserted in Front of a Header in a High-Flow Zone

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- Figure C4-2. ESEM image magnified 100 times for a Test #5, Day-30 high-flow exterior fiberglass sample in front of the header. The sample was put in the tank on Day 6. (t5hdex 02.jpeg)..... C4-5
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- Figure C4-4. ESEM image magnified 100 times for a Test #5, Day-30 high-flow interior fiberglass sample in front of the header. The sample was put in the tank on Day 6. (t5hdin 04.jpeg)..... C4-6
- Figure C4-5. ESEM image magnified 500 times for a Test #5, Day-30 high-flow interior fiberglass sample in front of the header. The sample was put in the tank on Day 6. (t5hdin 05.jpeg)..... C4-7

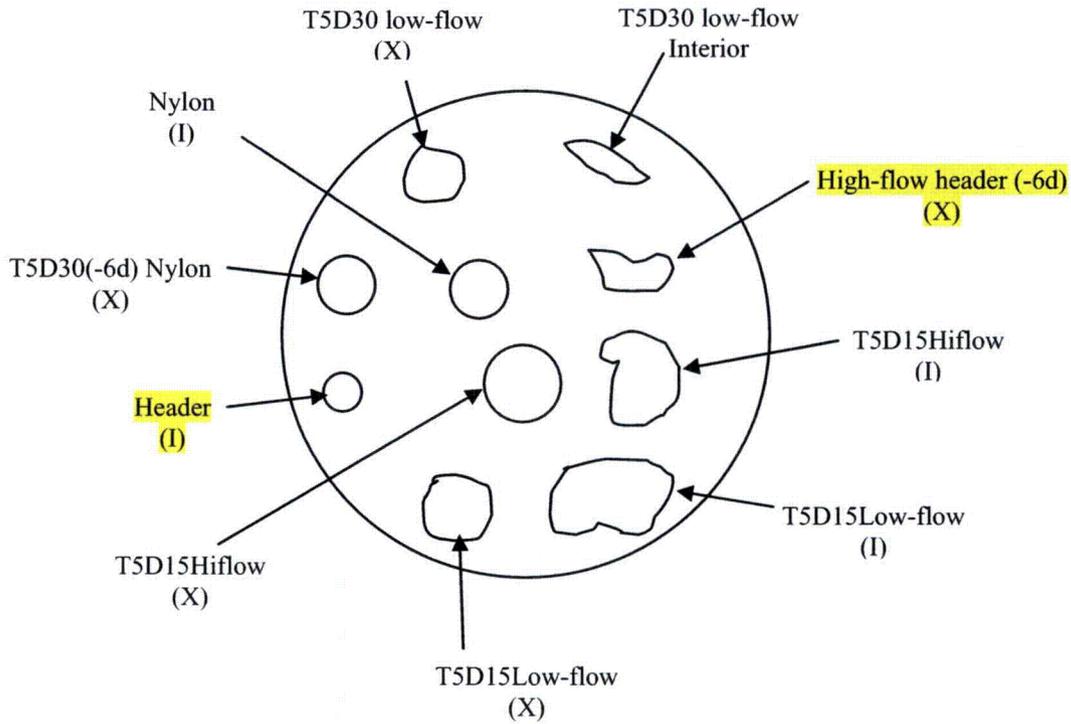
This appendix presents the results of the examinations performed on the high-flow fiberglass samples located in front of a test tank flow header. These samples were extracted on the date Test #5 was shut down (August 25, 2005). The samples were put in the tank on Day 6 of Test #5 (August 1, 2005). Both exterior and interior locations of the fiberglass samples were examined. ESEM was used to analyze the hydrated fiberglass samples under a low-vacuum condition (i.e., 80 Pa) and without any coating. This examination approach minimizes the modification of the fiberglass samples that can occur if samples are dried. The results of Test #5, Day-30 high-flow fiberglass samples were obtained on August 25, 2005.

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Test #5, Day-30 Fiberglass in Front of Header in High Flow

ESEM



High-Flow Header (-6-Day) Exterior

Image: T5HDEX01	100 ×	ESEM image	Figure C4-1
t5hdex02	100 ×	ESEM image	Figure C4-2
t5hdex03	500 ×	ESEM image higher magnification	Figure C4-3

High-Flow Header (-6-Day) Interior

Image: t5hdin04	100 ×	ESEM image of fiberglass	Figure C4-4
t5hdin05	500 ×	ESEM image higher magnification	Figure C4-5

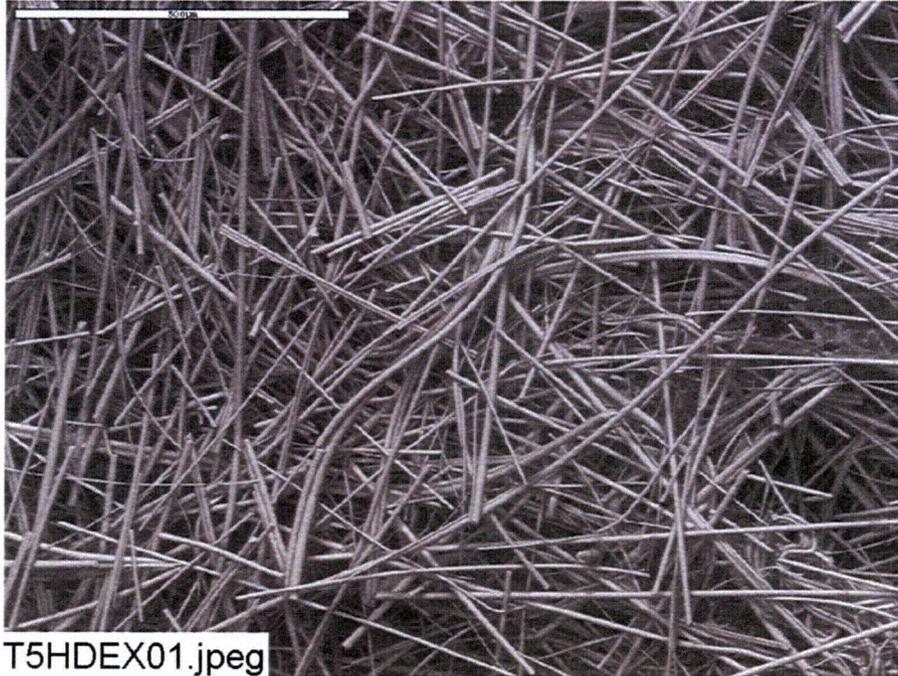


Figure C4-1. ESEM image magnified 100 times for a Test #5, Day-30 high-flow exterior fiberglass sample in front of the header. The sample was put in the tank on Day 6. (T5HDEX01.jpeg)

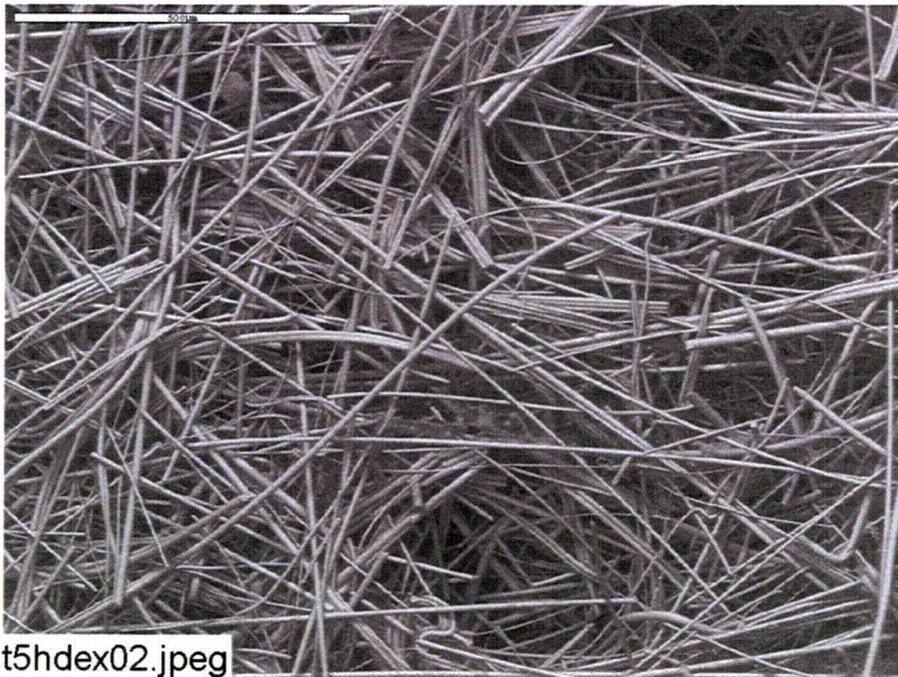
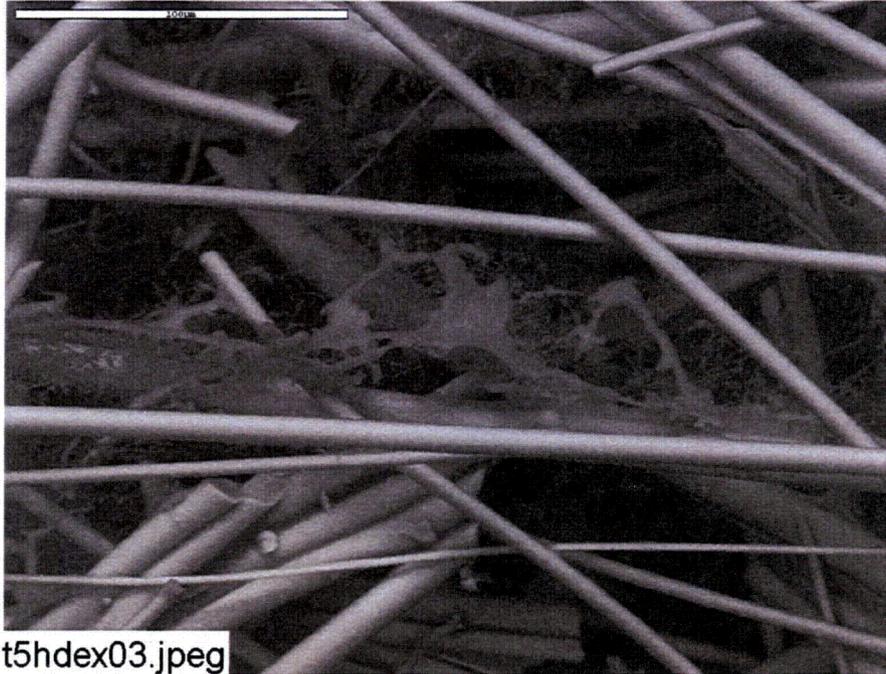
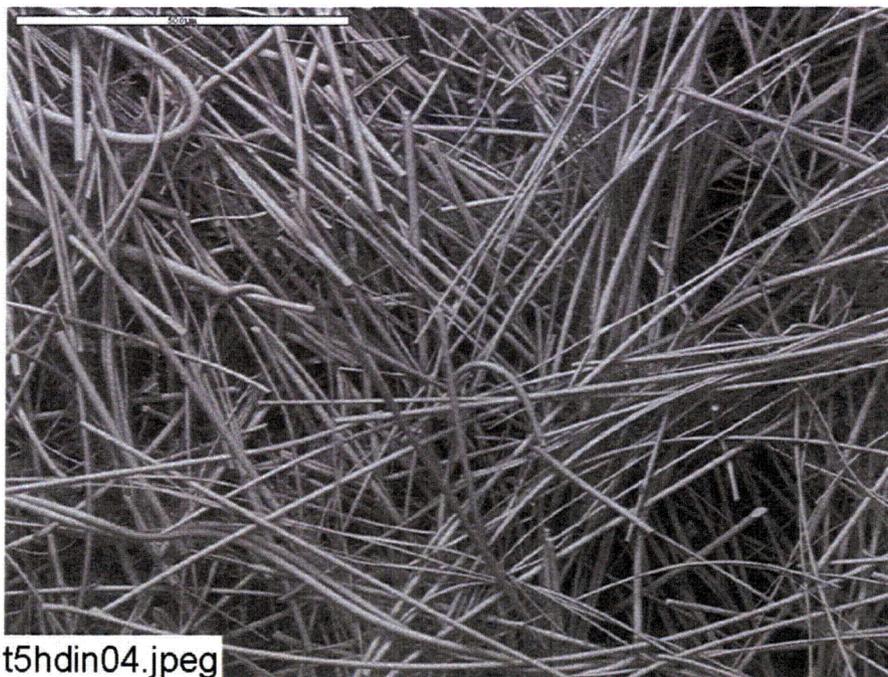


Figure C4-2. ESEM image magnified 100 times for a Test #5, Day-30 high-flow exterior fiberglass sample in front of the header. The sample was put in the tank on Day 6. (t5hdex02.jpeg)



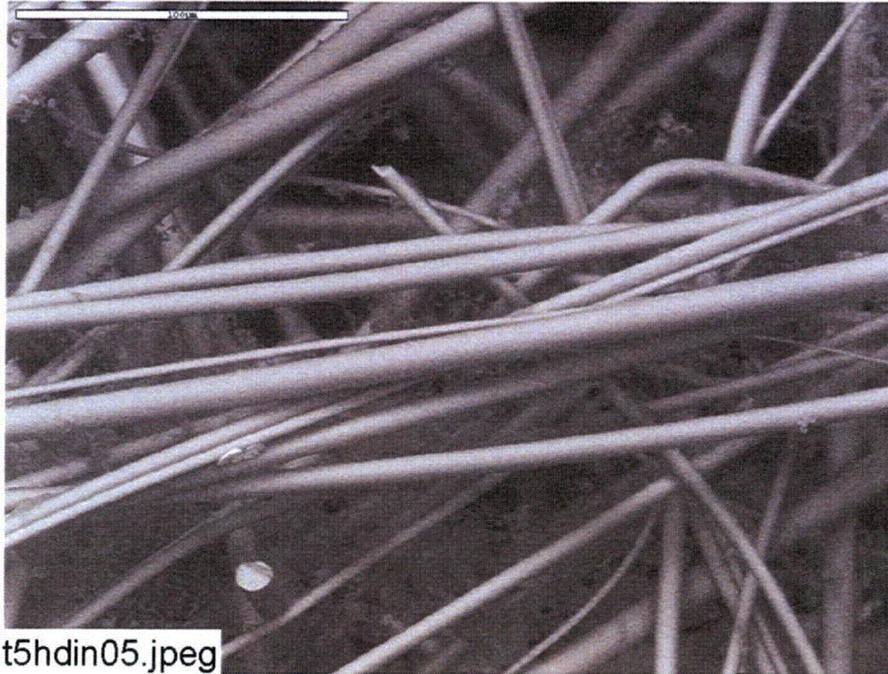
t5hdex03.jpeg

Figure C4-3. ESEM image magnified 500 times for a Test #5, Day-30 high-flow exterior fiberglass sample in front of the header. The sample was put in the tank on Day 6. (t5hdex03.jpeg)



t5hdin04.jpeg

Figure C4-4. ESEM image magnified 100 times for a Test #5, Day-30 high-flow interior fiberglass sample in front of the header. The sample was put in the tank on Day 6. (t5hdin04.jpeg)



t5hdin05.jpeg

Figure C4-5. ESEM image magnified 500 times for a Test #5, Day-30 high-flow interior fiberglass sample in front of the header. The sample was put in the tank on Day 6. (t5hdin05.jpeg)

Appendix C5

ESEM/EDS Data for Test #5, Day-30 Fiberglass Inserted in Nylon Mesh in Low-Flow Zones

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- Figure C5-5. EDS counting spectrum for the deposits between the fibers shown in Figure C5-4. (t5nlhfi5.jpeg) C5-7

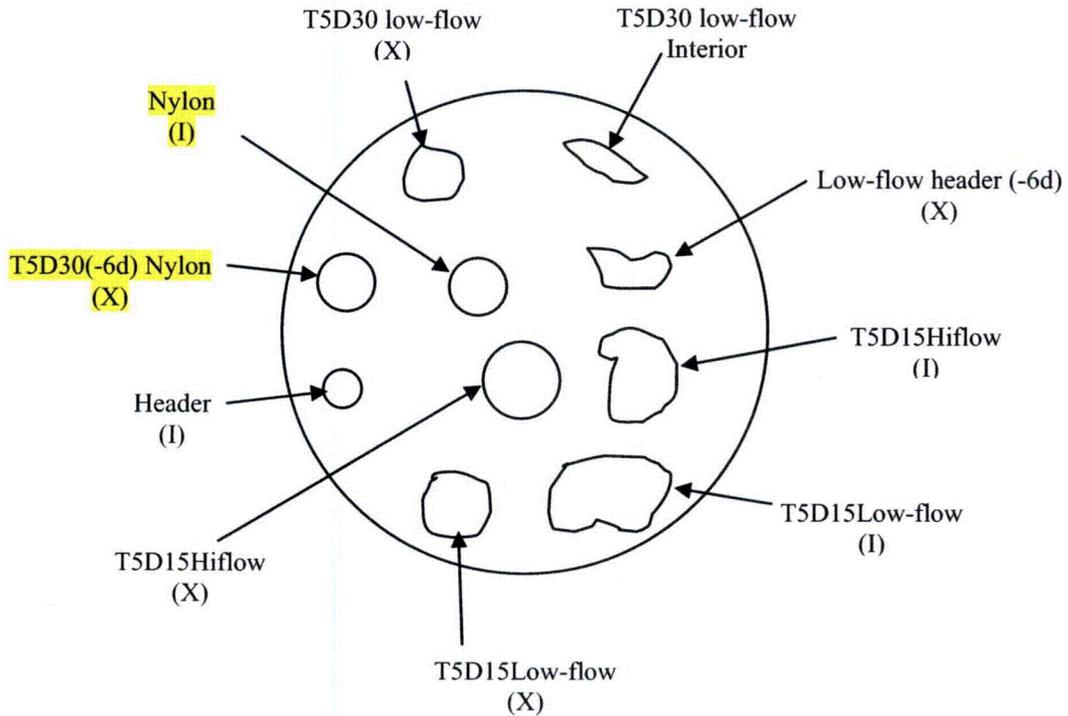
This appendix presents the ESEM results on fiberglass samples inserted in a nylon mesh submerged in a low-flow zone in the test tank. The purpose of using a nylon mesh is to see if the mesh material (i.e., stainless steel or nylon) affects the deposits on fiberglass samples. The samples were put in the tank on Day 6 (August 1, 2005). The fiberglass samples were extracted on August 25, 2005, the date Test #5 was shut down. Both exterior and interior locations of the fiberglass samples were examined. ESEM was used to analyze the wet fiberglass samples without any coating and under a low-vacuum condition (i.e., 80 Pa). This examination approach minimizes the modification of the fiberglass samples that can occur if samples are dried. The results of Test #5, Day-30 low-flow fiberglass samples in a nylon mesh were obtained on August 25, 2005.

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Test #5, Day-30 Nylon Mesh in Low-Flow Zones

ESEM



Nylon Low-Flow Exterior (-6 days)

Image: T5NLHFX1 100 × ESEM image

Figure C5-1

t5nlhfx1 500 × ESEM image

Figure C5-2

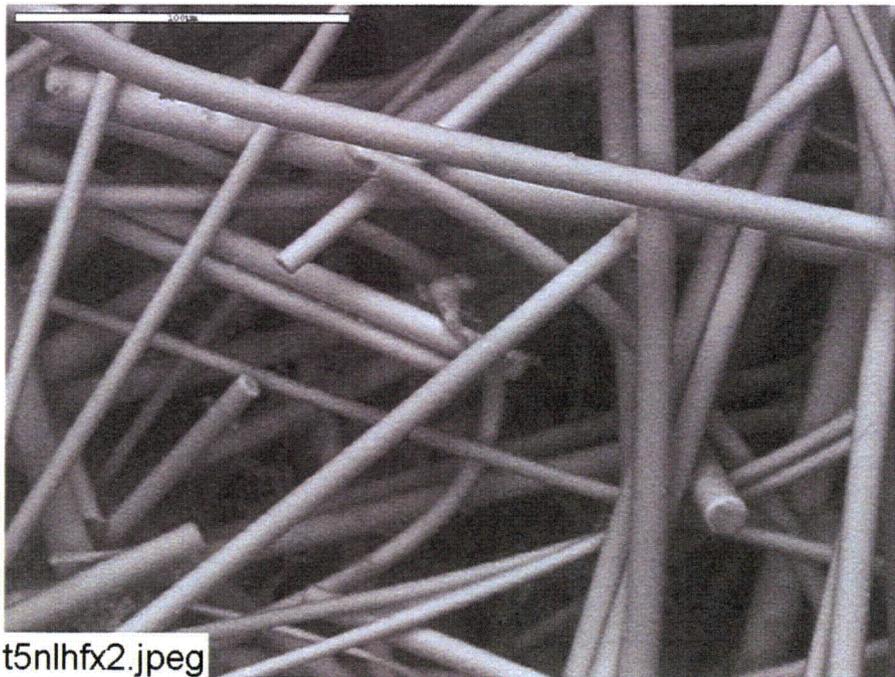
Nylon Low-Flow Interior (-6 days)

Image:	t5nlhfi3	100 ×	ESEM image of fiberglass	Figure C5-3
	t5nlhfi4	500 ×	ESEM image higher magnification	Figure C5-4
EDS	t5nlhfi5		EDS on floc in image t5nlhfi4	Figure C5-5



T5NLHFX1.jpeg

Figure C5-1. ESEM image magnified 100 times for a Test #5, Day-30 low-flow exterior fiberglass sample in a nylon mesh. The sample was put in the tank on Day 6. (T5NLHFX1.jpeg)



t5nlhfx2.jpeg

Figure C5-2. ESEM image magnified 500 times for a Test #5, Day-30 low-flow exterior fiberglass sample in a nylon mesh. The sample was put in the tank on Day 6. (t5nlhfx2.jpeg)



Figure C5-3. ESEM image magnified 100 times for a Test #5, Day-30 low-flow interior fiberglass sample in a nylon mesh. The sample was put in the tank on Day 6. (t5nlhfi3.jpeg)

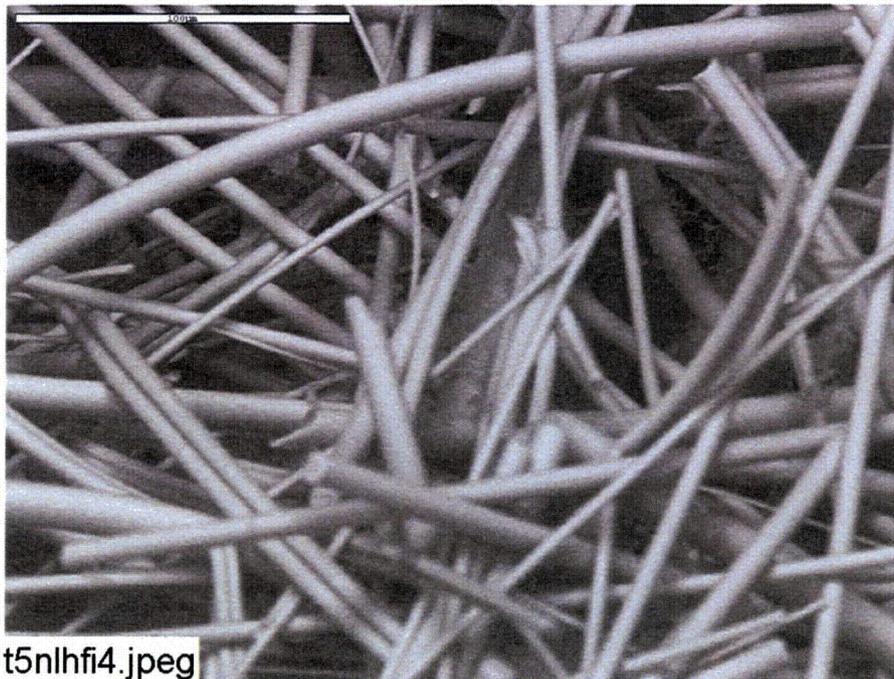


Figure C5-4. ESEM image magnified 500 times for a Test #5, Day-30 low-flow interior fiberglass sample in a nylon mesh. The sample was put in the tank on Day 6. (t5nlhfi4.jpeg)

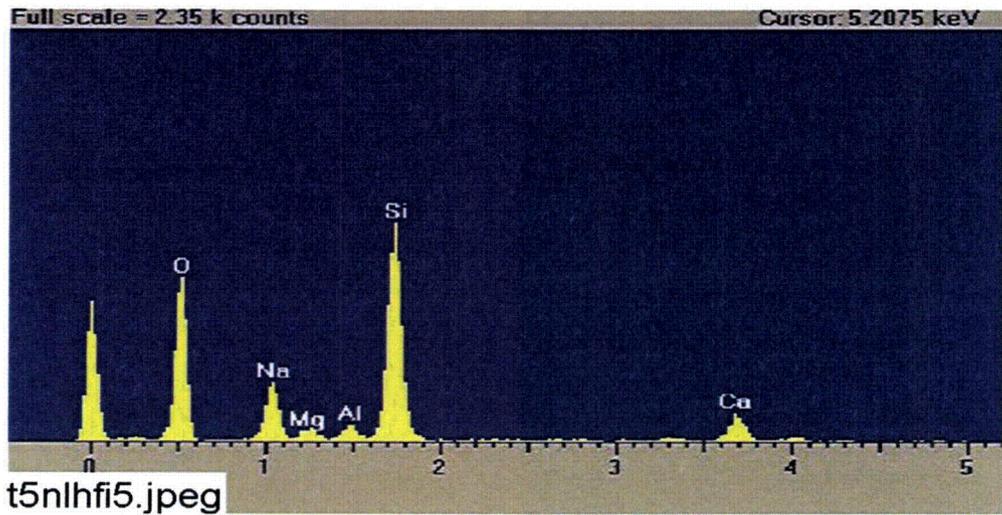


Figure C5-5. EDS counting spectrum for the deposits between the fibers shown in Figure C5-4. (t5nlhfi5.jpeg)

Appendix C6

ESEM/EDS and SEM Data for Test #5, Day-30 Drain Collar Fiberglass

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- Figure C6-3. Annotated ESEM image magnified 500 times for a Test #5, Day-30 exterior drain collar fiberglass sample farthest from the drain screen. (t5dcxx03.jpeg) C6-6
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- Figure C6-7. ESEM image magnified 100 times for a Test #5, Day-30 exterior drain collar fiberglass sample next to the drain screen. (t5dcix01.jpeg) C6-9
- Figure C6-8. ESEM image magnified 100 times for a Test #5, Day-30 exterior drain collar fiberglass sample next to the drain screen. (t5dcix05.jpeg) C6-9
- Figure C6-9. ESEM image magnified 100 times for a Test #5, Day-30 exterior drain collar fiberglass sample next to the drain screen. (t5dcix02.jpeg) C6-10

Figure C6-10. ESEM image magnified 500 times for a Test #5, Day-30 exterior drain collar fiberglass sample next to the drain screen. (t5dcix03.jpeg)	C6-10
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Figure C6-12. ESEM image magnified 100 times for a Test #5, Day-30 interior drain collar fiberglass sample. (t5dcii01.jpeg)	C6-11
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Figure C6-16. EDS counting spectrum by probe SEM for the flocculence deposits between fibers shown in Figure C6-15. (T5D30fiber flocc17.jpg)	C6-13

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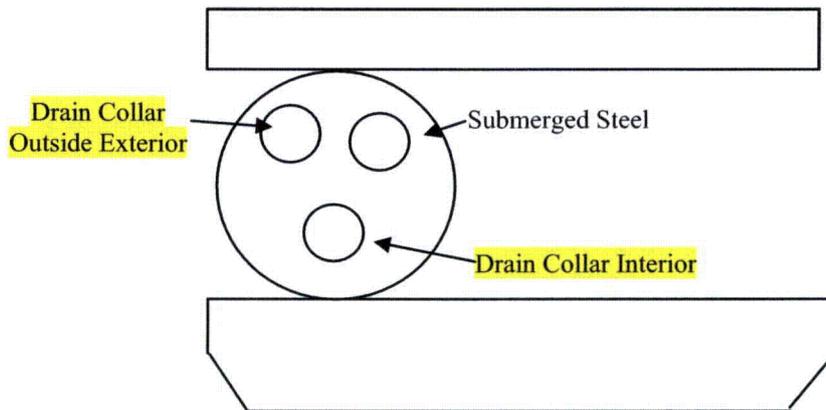
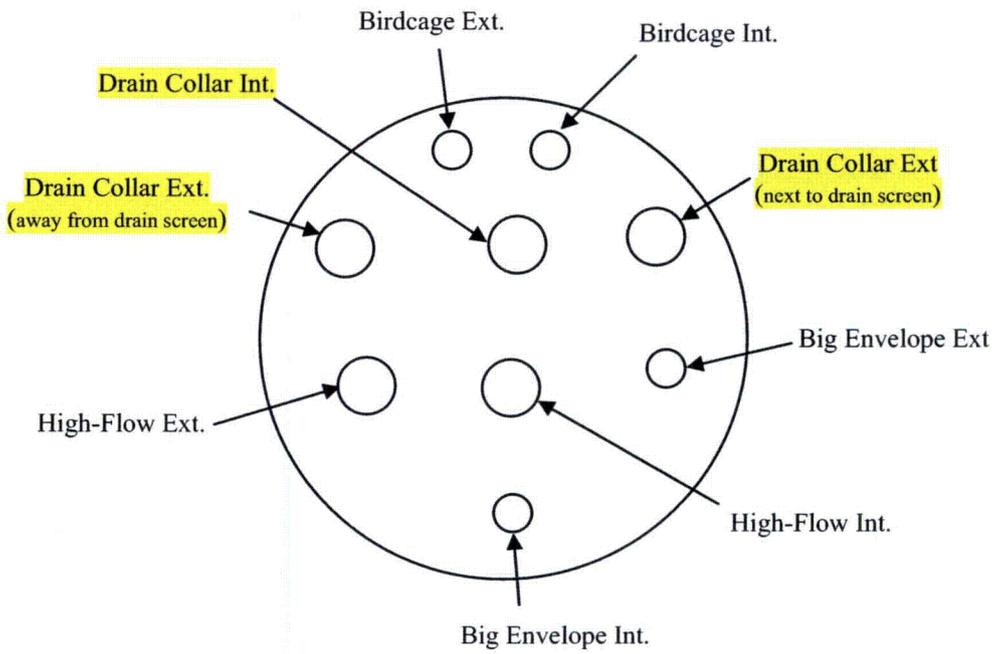
In this appendix, the fiberglass samples within the drain collar were extracted on the date Test #5 was shut down (August 25, 2005). The fiberglass samples located at the exterior farthest from the drain screen, the exterior next to the drain screen, and the interior were examined. ESEM was used to analyze the wet fiberglass samples under a low-vacuum condition (i.e., 80 Pa) and without any coating. In addition to ESEM analysis, the samples were totally dried and coated with Au/Pd for probe SEM examination. ESEM/EDS results of the Test #5, Day-30 drain collar fiberglass samples were obtained on August 26, 2005, and probe SEM/EDS results were obtained on August 30, 2005, and September 6, 2005. EDS results provide a semi-quantitative elemental composition analysis of the debris attached on fiberglass.

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Test #5, Day-30 Drain Collar Fiberglass

ESEM



Drain Collar Exterior (away from the drain screen)

Image:	T5DCXX01	100 ×	ESEM image	Figure C6-1
	t5dcxx02	100 ×	ESEM image	Figure C6-2
	t5dcxx03	500 ×	Annotated ESEM image	Figure C6-3
EDS:	t5dcxx04		EDS on particles in t5dcxx03	Figure C6-4
	t5dcxx05		EDS on particles in t5dcxx03	Figure C6-5
	T5D30Draincollar Particle16		EDS on particles on exterior of drain collar	Figure C6-6

Drain Collar Exterior (next to the drain screen)

Image:	t5dcix01	100 ×	ESEM image	Figure C6-7
	t5dcix05	100 ×	ESEM image	Figure C6-8
	t5dcix02	100 ×	ESEM image higher magnification	Figure C6-9
	t5dcix03	500 ×	ESEM image high magnification	Figure C6-10
EDS:	t5dcix04		EDS on particles image t5dcix03	Figure C6-11

Drain Collar Interior

Image:	t5dcii01	100 ×	ESEM image	Figure C6-12
	T5D30DraincollarInt027	200 ×	Probe SEM image	Figure C6-13
	t5dcii02	500 ×	ESEM image	Figure C6-14
	T5D30DraincollarInt026	1000 ×	Probe SEM image higher	Figure C6-15
EDS:	T5D30fiber flocc17		EDS on particles in t4dcix08	Figure C6-16



Figure C6-1. ESEM image magnified 100 times for a Test #5, Day-30 exterior drain collar fiberglass sample farthest from the drain screen. (T5DCXX01.jpeg)



Figure C6-2. ESEM image magnified 100 times for a Test #5, Day-30 exterior drain collar fiberglass sample farthest from the drain screen. (t5dcxx02.gif)

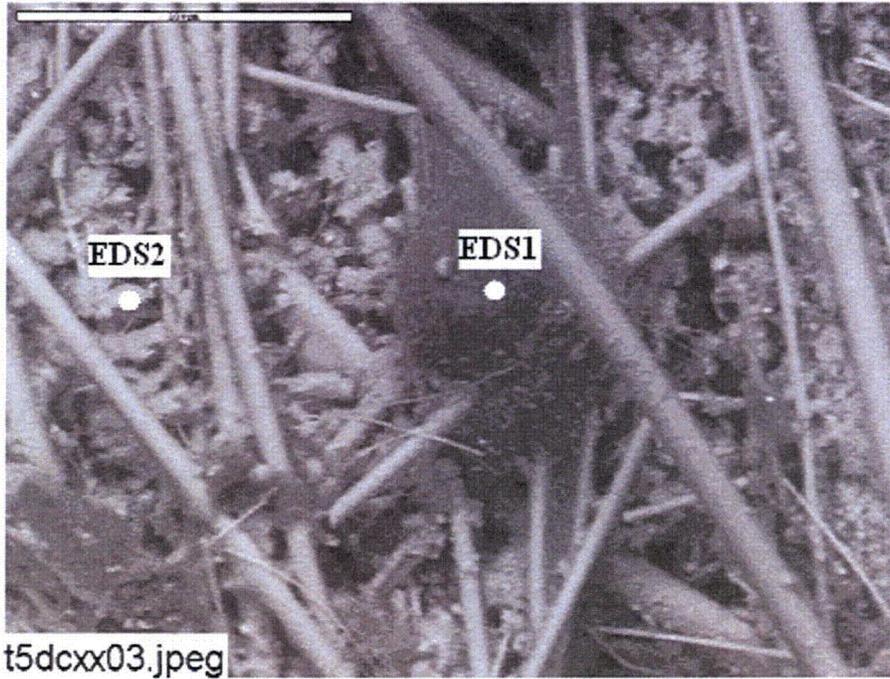


Figure C6-3. Annotated ESEM image magnified 500 times for a Test #5, Day-30 exterior drain collar fiberglass sample farthest from the drain screen. (t5dcxx03.jpeg)

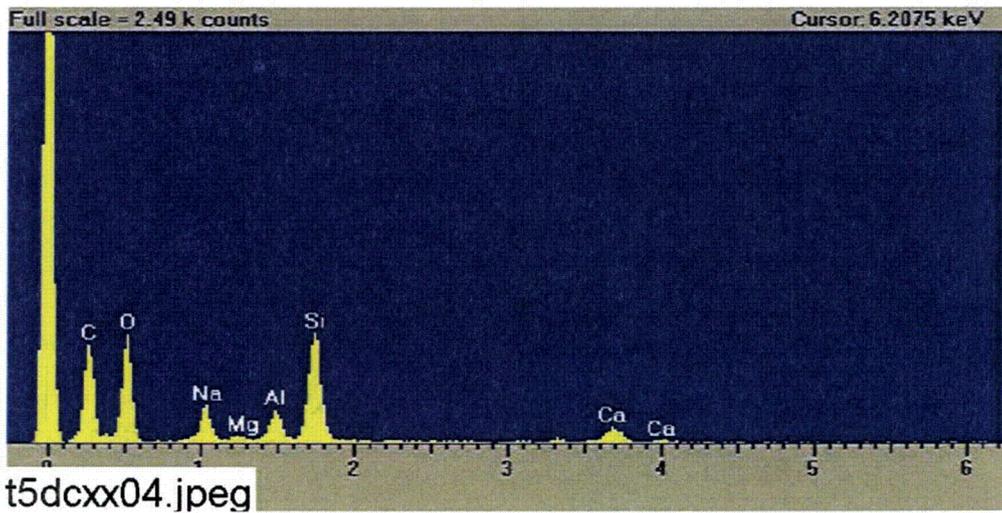


Figure C6-4. EDS counting spectrum for the dark deposits (EDS1) between fibers shown in Figure C6-3. (t5dcxx04.jpeg)

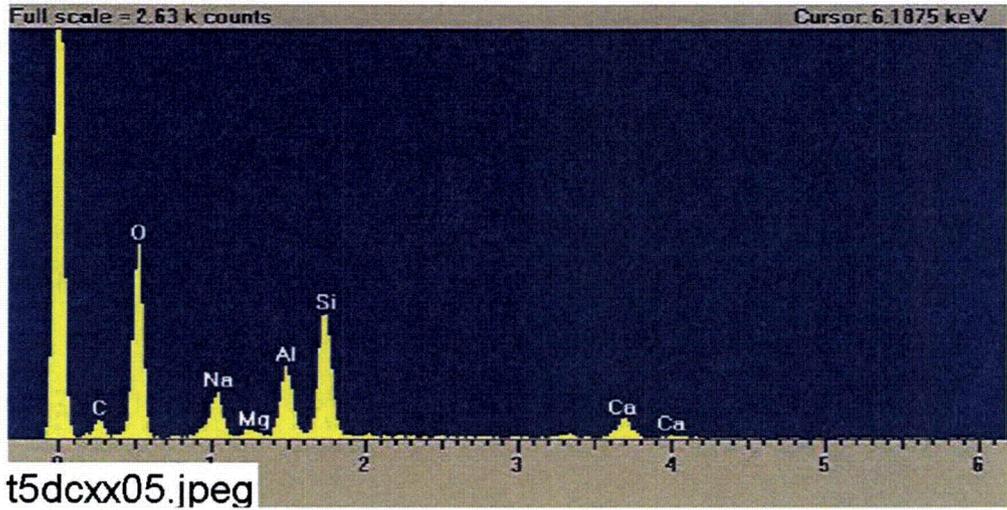


Figure C6-5. EDS counting spectrum for the small particulate deposits (EDS2) between fibers shown in Figure C6-3. (t5dcxx05.jpeg)

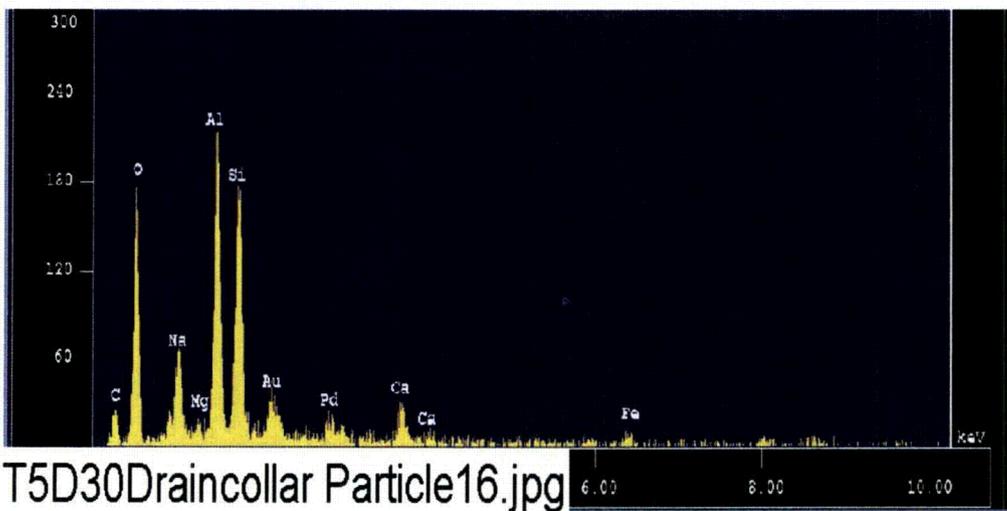


Figure C6-6. EDS counting spectrum by probe SEM for the small particulate deposits (EDS2) between fibers shown in Figure C6-3. (T5D30Draincollar Particle16.jpg)

The results from the chemical composition analysis for T5D30Draincollar Particle16.jpg are given in Table C6-1.

Table C6-1. Chemical Compositions for T5D30Draincollar Particle16.jpg, Figure C6-6

```

Group      : NRC
Sample     : T5D30 ID# : 22
Comment    : Particles on Drain collar out exterior
Condition  : Full Scale : 20KeV(10eV/ch,2Kch)
             Live Time  : 72.190 sec      Aperture #   : 1
             Acc. Volt  : 15.0 KV         Probe Current : 1.003E-09 A
             Stage Point : X=76.455 Y=54.980 Z=11.000
             Acq. Date  : Tue Aug 30 18:08:20 2005
    
```

Element	Mode	ROI (KeV)	K-ratio(%)	+/-	Net/Background	
Na K	Normal	0.83- 1.28	0.3947	0.0041	351 /	16
Al K	Normal	1.26- 1.78	1.2712	0.0008	1702 /	55
Si K	Normal	1.50- 2.07	1.0873	0.0004	1598 /	110
Ca K	Normal	3.40- 4.30	0.4688	0.0034	332 /	4
Hg K	Normal	1.00- 1.53	0.1133	0.0002	85 /	66
O K	Normal	0.31- 0.74	4.4301	0.0055	5013 /	7
C K	Normal	0.11- 0.47	14.5489	0.0068	176 /	25
Fe K	Normal	6.04- 7.40	0.4946	0.0012	158 /	2

Chi_square = 2.8684

Element	Mass%	Atomic%	ZAF	Z	A	F
Na	2.761	1.9859	1.0916	0.9815	1.1113	1.0007
Al	8.876	5.4401	1.0897	0.9899	1.1034	0.9977
Si	8.579	5.0513	1.2314	0.9822	1.2538	0.9999
Ca	2.914	1.2022	0.9700	0.9929	0.9778	0.9991
Hg	1.039	0.7068	1.4318	0.9712	1.4778	0.9976
O	42.666	44.1002	1.5030	0.9888	1.5200	1.0000
C	29.326	40.3765	0.3146	0.9920	0.3171	1.0000
Fe	3.840	1.1369	1.2115	1.2176	0.9950	1.0000

Total 100.000 100.0000
 Normalization factor = 6.4077

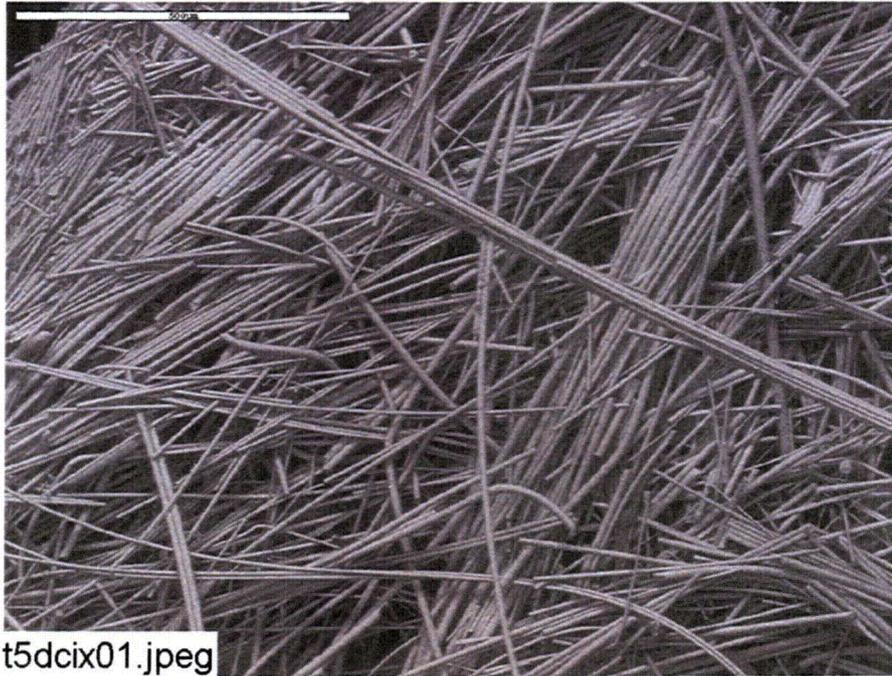


Figure C6-7. ESEM image magnified 100 times for a Test #5, Day-30 exterior drain collar fiberglass sample next to the drain screen. (t5dcix01.jpeg)

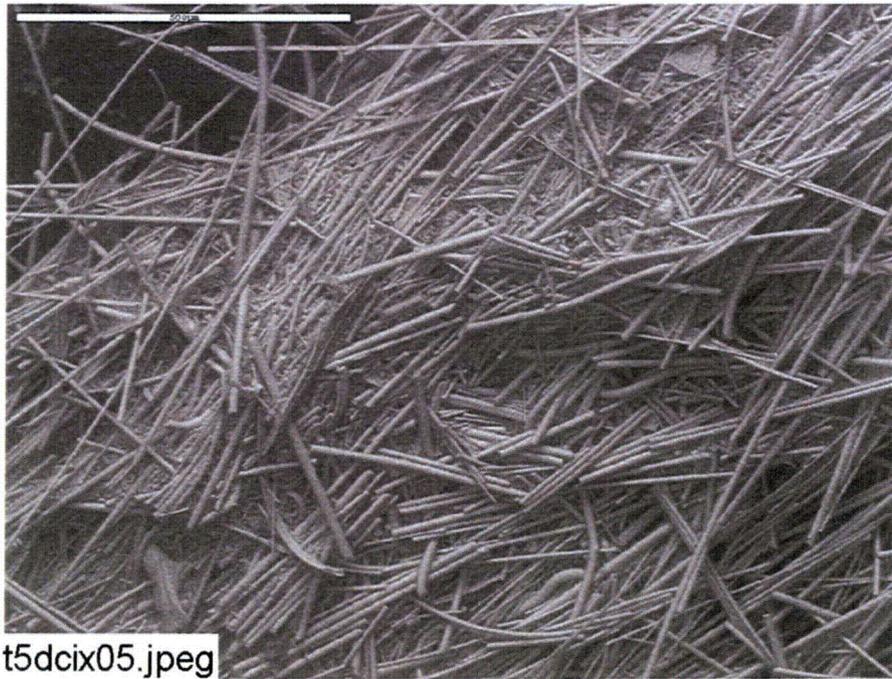


Figure C6-8. ESEM image magnified 100 times for a Test #5, Day-30 exterior drain collar fiberglass sample next to the drain screen. (t5dcix05.jpeg)



t5dcix02.jpeg

Figure C6-9. ESEM image magnified 100 times for a Test #5, Day-30 exterior drain collar fiberglass sample next to the drain screen. (t5dcix02.jpeg)



t5dcix03.jpeg

Figure C6-10. ESEM image magnified 500 times for a Test #5, Day-30 exterior drain collar fiberglass sample next to the drain screen. (t5dcix03.jpeg)

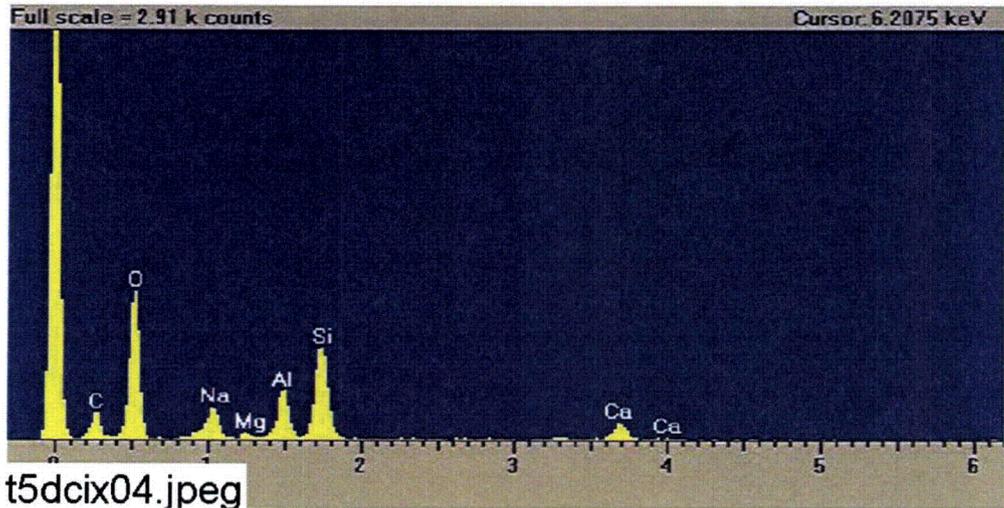


Figure C6-11. EDS counting spectrum for the particulate deposits between fibers shown in Figure C6-10. (t5dcix04.jpeg)

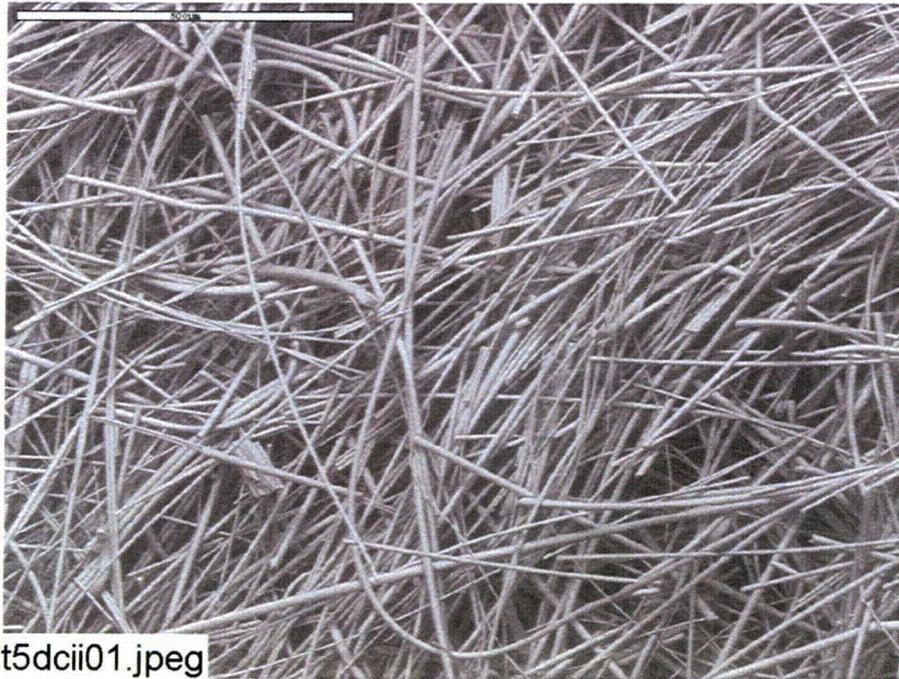


Figure C6-12. ESEM image magnified 100 times for a Test #5, Day-30 interior drain collar fiberglass sample. (t5dcii01.jpeg)



Figure C6-13. Probe SEM image magnified 200 times for a Test #5, Day-30 interior drain collar fiberglass sample. (T5D30DraincollarInt027.bmp)

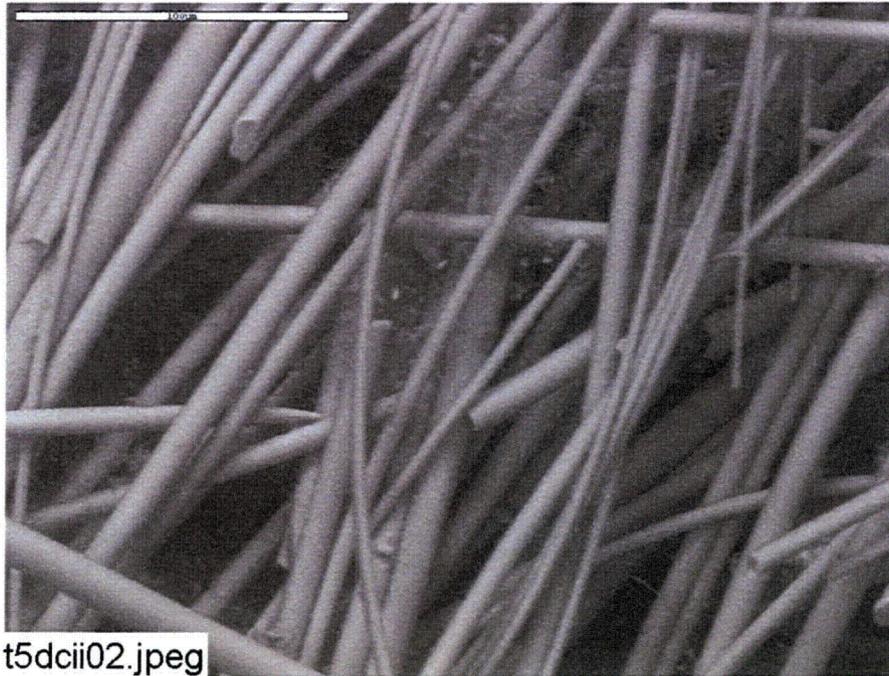


Figure C6-14. ESEM image magnified 500 times for a Test #5, Day-30 interior drain collar fiberglass sample. (t5dcii02.jpeg)

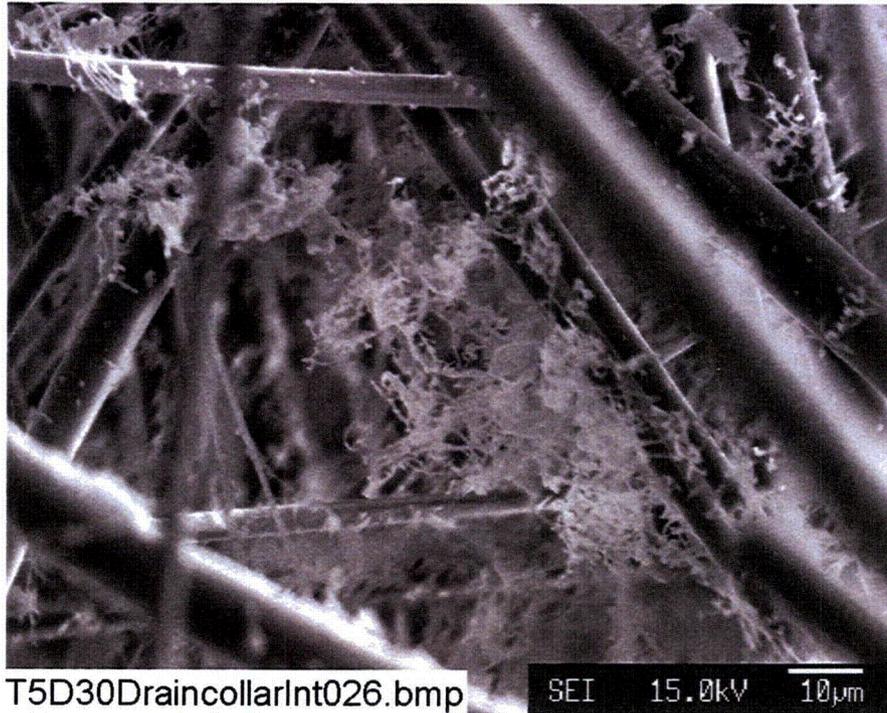


Figure C6-15. Probe SEM image magnified 1000 times for a Test #5, Day-30 interior drain collar fiberglass sample. (T5D30DraincollarInt026.bmp)

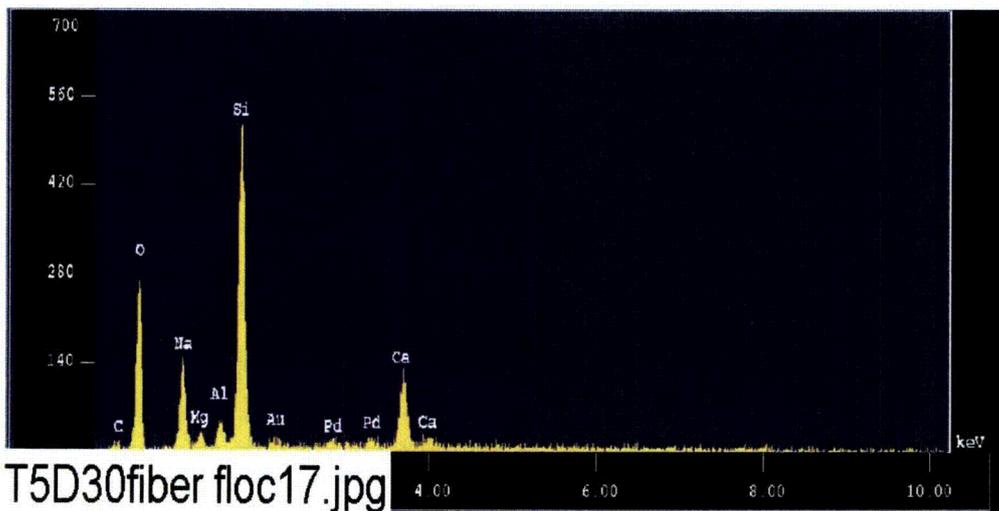


Figure C6-16. EDS counting spectrum by probe SEM for the flocculence deposits between fibers shown in Figure C6-15. (T5D30fiber flocc17.jpg)

The results from the chemical composition analysis for T5D30fiber flocc17.jpg are given in Table C6-2.

Table C6-2. Chemical Compositions for T5D30fiber flocc17.jpg, Figure C6-16

```

Group      : NRC
Sample     : T5D30 ID# : 23
Comment    : Flocculence on draincollar interior
Condition  : Full Scale : 20KeV(10ev/ch,2Kch)
             Live Time  : 96.780 sec      Aperture #   : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.003E-09 A
             Stage Point : X=76.455 Y=54.980 Z=11.000
             Acq. Date   : Tue Aug 30 18:19:56 2005
    
```

Element	Mode	ROI (KeV)	K-ratio (%)	+/-	Net/Background
Na K	Normal	0.83- 1.28	0.9051	0.0053	1078 / 18
Mg K	Normal	1.00- 1.53	0.1687	0.0003	171 / 53
Al K	Normal	1.26- 1.78	0.1798	0.0004	323 / 152
Si K	Normal	1.50- 2.07	2.4443	0.0007	4815 / 36
Ca K	Normal	3.40- 4.30	1.4547	0.0064	1380 / 14
O K	Normal	0.31- 0.74	5.4142	0.0068	8214 / 4
C K	Normal	0.11- 0.47	3.3646	0.0061	55 / 46

Chi_square = 3.5353

Element	Mass%	Atomic%	ZAF	Z	A	F
Na	6.733	5.4856	1.0942	0.9931	1.1011	1.0007
Mg	1.737	1.3379	1.5143	0.9825	1.5445	0.9979
Al	1.396	0.9688	1.1419	1.0012	1.1470	0.9944
Si	19.786	13.1947	1.1906	0.9932	1.1990	0.9998
Ca	9.803	4.5812	0.9912	1.0027	0.9884	1.0001
O	51.409	60.1836	1.3966	1.0008	1.3954	1.0000
C	9.137	14.2483	0.3994	1.0042	0.3978	0.9999

Total 100.000 100.0000
 Normalization factor = 6.7987

Appendix C7

ESEM/EDS Data for Test #5, Day-30 Birdcage Fiberglass

List of Figures

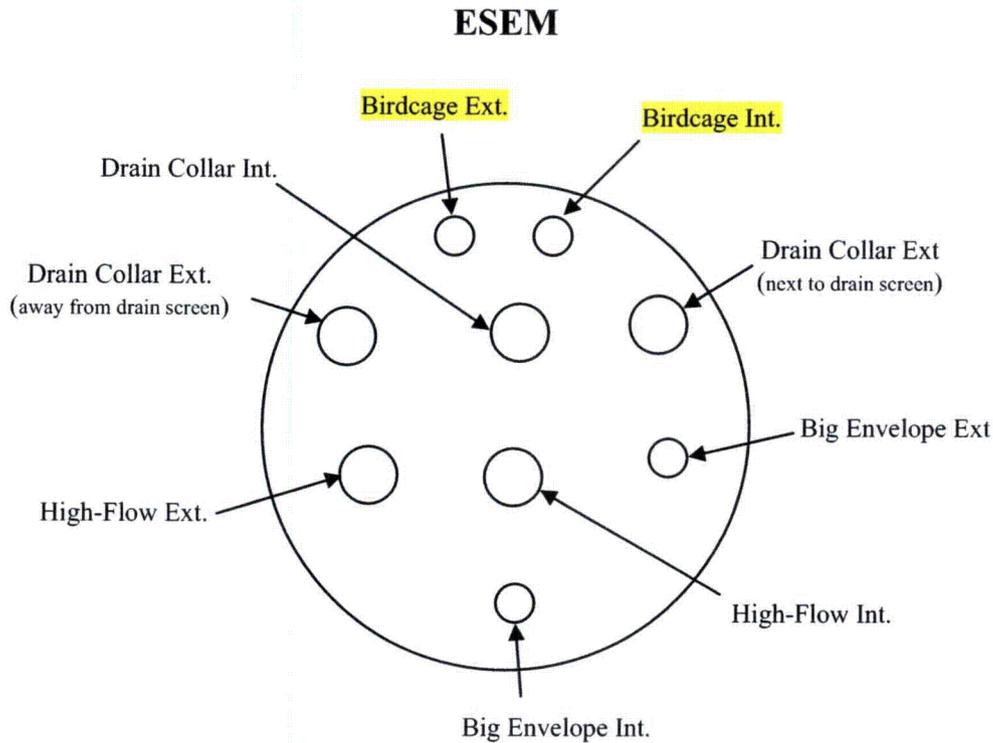
Figure C7-1. ESEM image magnified 100 times for a Test #5, Day-30 exterior fiberglass sample within the birdcage. (T5BCX01.jpeg).....	C7-5
Figure C7-2. ESEM image magnified 100 times for a Test #5, Day-30 exterior fiberglass sample within the birdcage. (t5bcx02.jpeg).....	C7-5
Figure C7-3. ESEM image magnified 500 times for a Test #5, Day-30 exterior fiberglass sample within the birdcage. (t5bcx03.jpeg).....	C7-6
Figure C7-4. EDS counting spectrum for the deposits between fibers shown in Figure C7-3. (t5bcx04.jpeg).....	C7-6
Figure C7-5. ESEM image magnified 500 times for a Test #5, Day-30 exterior fiberglass sample within the birdcage. (t5bcx05.jpeg).....	C7-7
Figure C7-6. ESEM image magnified 100 times for a Test #5, Day-30 interior fiberglass sample within the birdcage. (t5bcI01.jpeg)	C7-7
Figure C7-7. ESEM image magnified 100 times for a Test #5, Day-30 interior fiberglass sample within the birdcage. (t5bci03.jpeg).....	C7-8
Figure C7-8. ESEM image magnified 500 times for a Test #5, Day-30 interior fiberglass sample within the birdcage. (t5bci02.jpeg).....	C7-8

This appendix lists the ESEM/EDS results for the fiberglass samples within the birdcage submerged in the testing solution. The purpose of this analysis was to determine the degree and the extent to which particulate debris migrates and attaches to fiberglass. In this appendix, the fiberglass samples within the birdcage were extracted on the date Test #5 was shut down (August 25, 2005). Both exterior and interior fiberglass samples were examined. ESEM was used to analyze the hydrated fiberglass samples without any coating under a low-vacuum condition (i.e., 80 Pa). ESEM/EDS results of the Test #5, Day-30 birdcage fiberglass samples were obtained on August 26, 2005.

Transcribed Laboratory Log

Laboratory session from August 26, 2005.

Test #5, Day-30 Birdcage Fiberglass

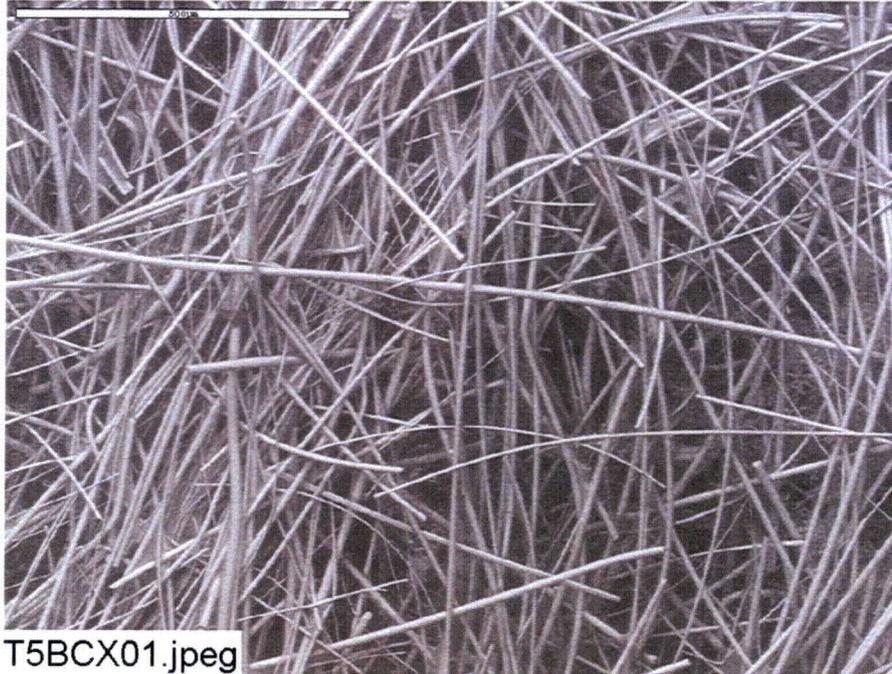


Birdcage Exterior

Image: T5BCX01	100 ×	ESEM image	Figure C7-1
t5bcx02	100 ×	ESEM image	Figure C7-2
t5bcx03	500 ×	ESEM image higher magnification	Figure C7-3
EDS: t5bcx04		EDS on particles on t5bcx03	Figure C7-4
Image: t5bcx05	500 ×	ESEM image	Figure C7-5

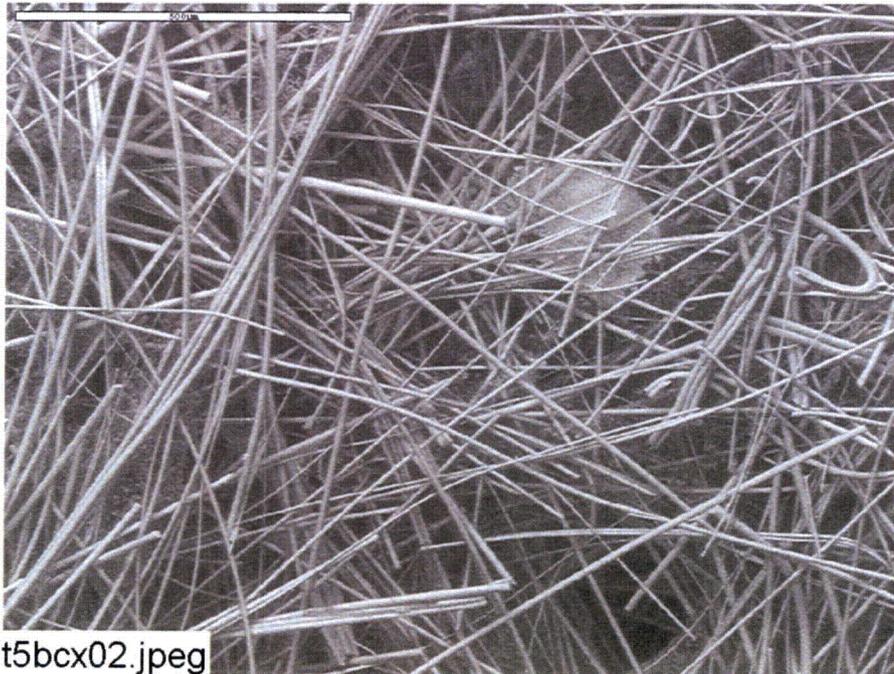
Birdcage Interior

Image: t5bcI01	100 ×	ESEM image of fiberglass	Figure C7-6
t5bci03	100 ×	ESEM image	Figure C7-7
t5bci02	500 ×	ESEM image higher magnification	Figure C7-8



T5BCX01.jpeg

Figure C7-1. ESEM image magnified 100 times for a Test #5, Day-30 exterior fiberglass sample within the birdcage. (T5BCX01.jpeg)



t5bcx02.jpeg

Figure C7-2. ESEM image magnified 100 times for a Test #5, Day-30 exterior fiberglass sample within the birdcage. (t5bcx02.jpeg)

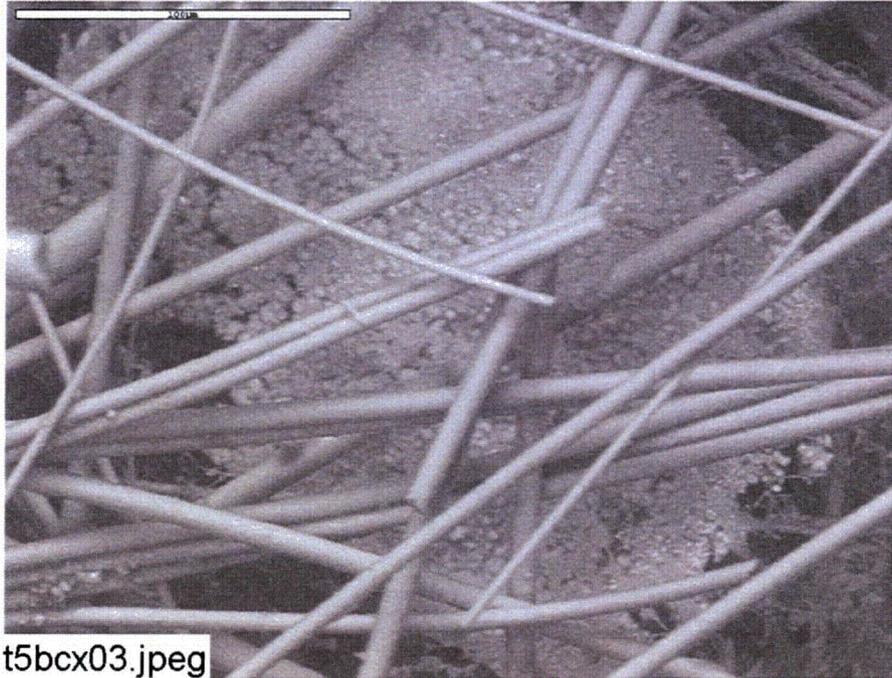


Figure C7-3. ESEM image magnified 500 times for a Test #5, Day-30 exterior fiberglass sample within the birdcage. (t5bcx03.jpeg)

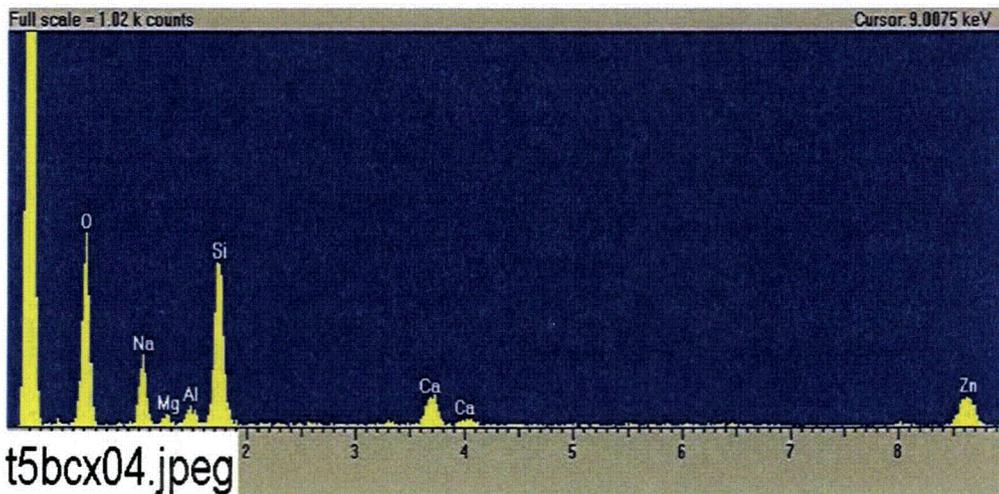
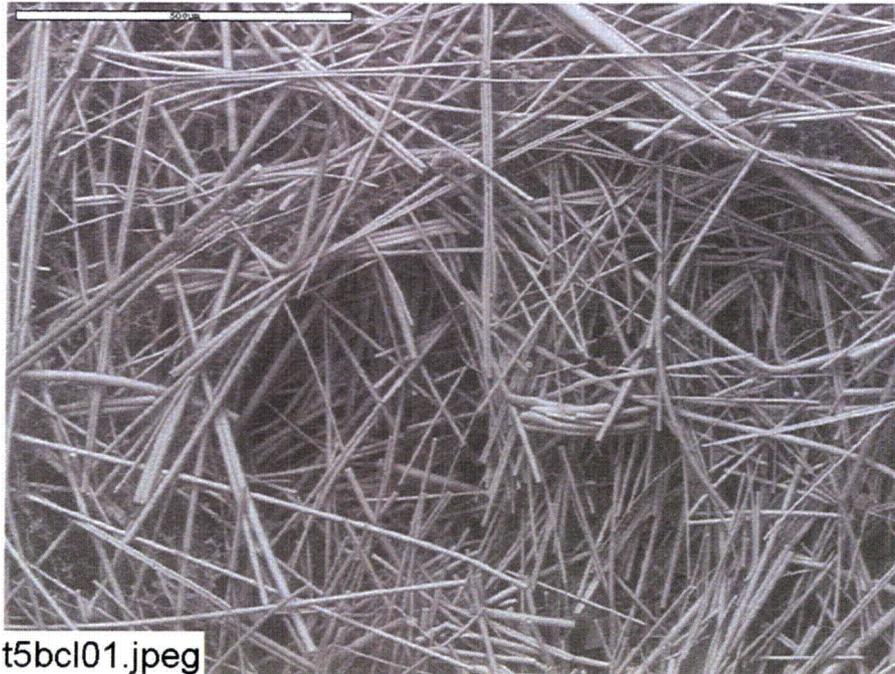


Figure C7-4. EDS counting spectrum for the deposits between fibers shown in Figure C7-3. (t5bcx04.jpeg)



t5bcx05.jpeg

Figure C7-5. ESEM image magnified 500 times for a Test #5, Day-30 exterior fiberglass sample within the birdcage. (t5bcx05.jpeg)



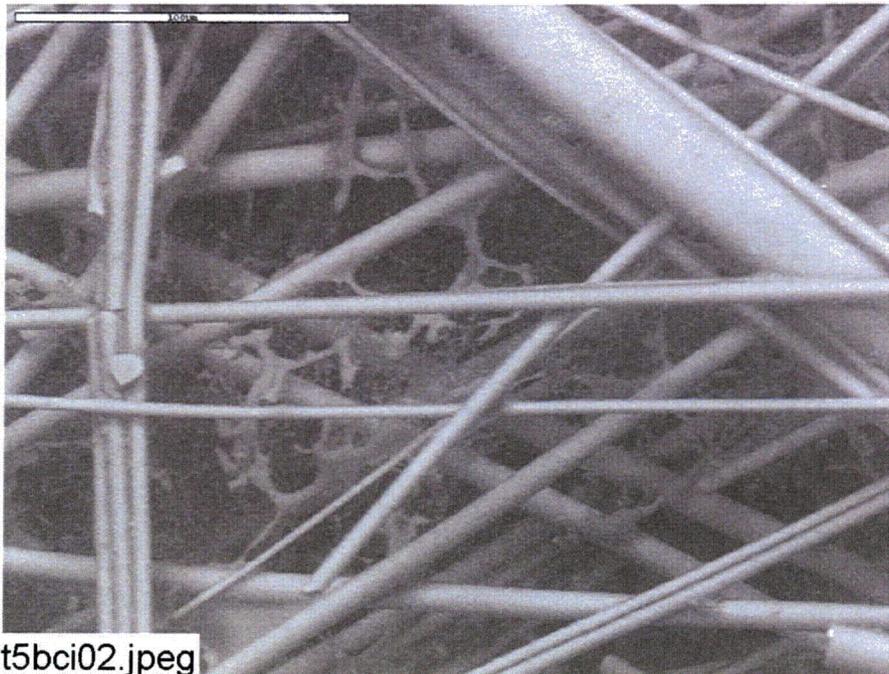
t5bcl01.jpeg

Figure C7-6. ESEM image magnified 100 times for a Test #5, Day-30 interior fiberglass sample within the birdcage. (t5bcl01.jpeg)



t5bci03.jpeg

Figure C7-7. ESEM image magnified 100 times for a Test #5, Day-30 interior fiberglass sample within the birdcage. (t5bci03.jpeg)



t5bci02.jpeg

Figure C7-8. ESEM image magnified 500 times for a Test #5, Day-30 interior fiberglass sample within the birdcage. (t5bci02.jpeg)

Appendix D

SEM/EDS Data for Test #5 Day-30 Deposition Products

List of Figures

- Figure D-1. SEM image magnified 100 times for the Test #5, Day-30 fine yellow powder on the submerged rack. (T5D30YellowDeposits001.bmp)..... D-4
- Figure D-2. SEM image magnified 200 times for the Test #5, Day-30 fine yellow powder on the submerged rack. (T5D30YellowDeposits002.bmp)..... D-4
- Figure D-3. Annotated SEM image magnified 1000 times for the Test #5, Day-30 fine yellow powder on the submerged rack. (T5D30YellowDeposits003.bmp)..... D-5
- Figure D-4. EDS counting spectrum for the particulate deposit shown in Figure D-3. (T5D30yllw~partcl02.jpg) D-5

List of Tables

- Table D-1. Chemical Compositions for T5D30yllw~partcl02.jpg, Figure D-4 D-6

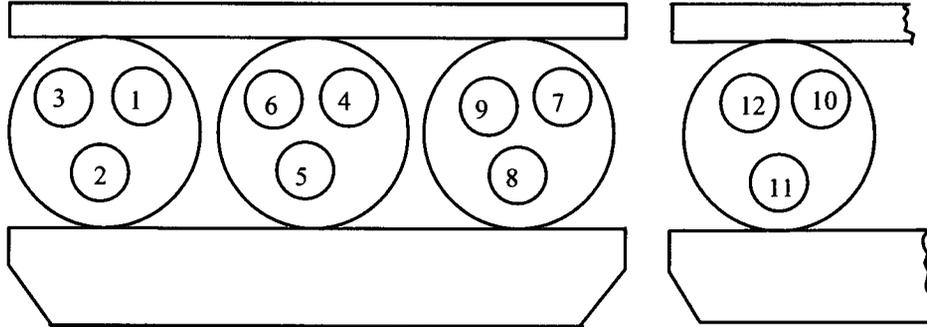
Deposition products were collected on the date Test #5 was shut down (August 25, 2005). The products examined were fine yellow powders that had deposited on a horizontal piece of the submerged CPVC rack.

These products were collected by directly adhering onto a double-sided carbon tape for probe SEM/EDS examination. After the samples were dried in air, an Au/Pd coating was applied to enhance the surface conductivity of the samples and to prevent possible charging problems during SEM examination. Based on EDS results, a semi-quantitative elemental analysis was performed after calibration. This appendix presents the SEM/EDS data that were obtained on September 6, 2005.

Transcribed Laboratory Log

Laboratory session from September 6, 2005.

Test #5, Day-30 Deposition Products



Conditions: e=15.0kV, WD=11mm

1--Yellow Deposits on Submerged Rack	2--Sediment (T5D30)	3--Al-Suspended
4--Al-Submerged	5--Gal-Steel Suspended	6--Gal-Steel Submerged
7--Cu Suspended	8--Cu-Submerged	9--Steel-Suspended
10--Steel-Submerged	11--Drain Collar Interior	12--Drain Collar Outside Ext.

Yellow Deposits on Submerged Rack

Image:	T5D30YellowDeposits001	100 ×	SEM image	Figure D-1
	T5D30YellowDeposits002	500 ×	SEM image	Figure D-2
	T5D30YellowDeposits003	1000 ×	Annotated SEM image	Figure D-3
EDS:	T5D30yllw~partcl02		EDS on particulate deposits	Figure D-4



Figure D-1. SEM image magnified 100 times for the Test #5, Day-30 fine yellow powder on the submerged rack. (T5D30YellowDeposits001.bmp)



Figure D-2. SEM image magnified 200 times for the Test #5, Day-30 fine yellow powder on the submerged rack. (T5D30YellowDeposits002.bmp)



Figure D-3. Annotated SEM image magnified 1000 times for the Test #5, Day-30 fine yellow powder on the submerged rack. (T5D30YellowDeposits003.bmp)

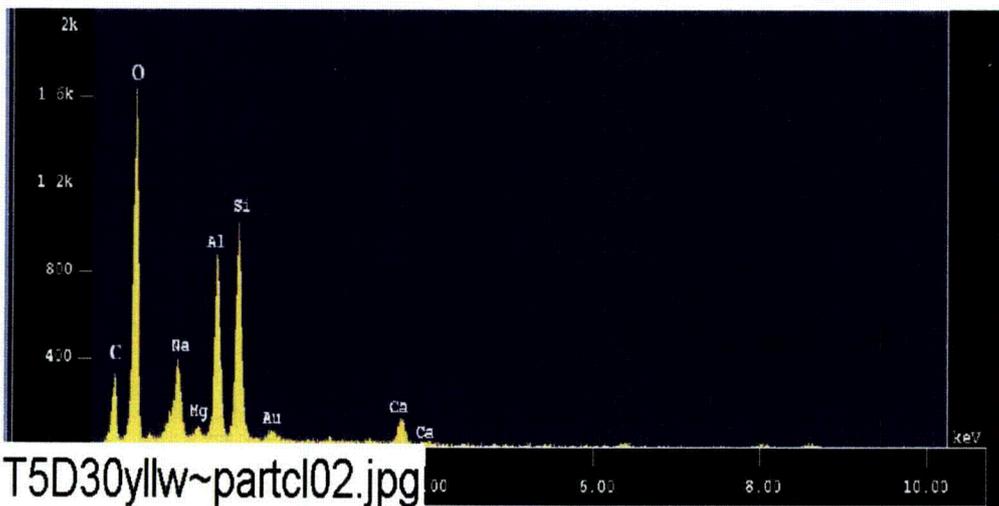


Figure D-4. EDS counting spectrum for the particulate deposit shown in Figure D-3. (T5D30yllw~partcl02.jpg)

The results from the chemical composition analysis for T5D30yllw~partcl02.jpg are given in Table D-1.

Table D-1. Chemical Compositions for T5D30yllw~partcl02.jpg, Figure D-4

```

Group      : NRC
Sample     : T5D30 ID# : 30
Comment    : Yellow deposits on submerged rack
Condition  : Full Scale : 20KeV(10eV/ch,2Kch)
            Live Time  : 76.130 sec Aperture # : 5
            Acc. Volt  : 15.0 KV Probe Current : 1.996E-08 A
            Stage Point: X=45.414 Y=58.152 Z=11.027
            Acq. Date  : Tue Sep 6 10:38:29 2005
    
```

Element	Mode	ROI (KeV)	K-ratio (%)	+/-	Net/Background
Na K	Normal	0.83- 1.28	133.9949	0.0097	1973 / 65
Mg K	Normal	1.00- 1.53	28.4267	0.0005	356 / 338
Si K	Normal	1.50- 2.07	366.8570	0.0009	8937 / 400
Ca K	Normal	3.40- 4.30	130.0604	0.0070	1526 / 18
Al K	Normal	1.26- 1.78	325.7976	0.0016	7232 / 315
O K	Normal	0.31- 0.74	2565.1008	0.0170	48124 / 66
C K	Normal	0.11- 0.47	11427.6719	0.0238	2293 / 258

Chi_square = 18.5321

Element	Mass%	Atomic%	ZAF	Z	A	F
Na	1.894	1.2481	1.0715	0.9872	1.0843	1.0010
Mg	0.525	0.3269	1.3990	0.9770	1.4341	0.9985
Si	5.653	3.0482	1.1678	0.9883	1.1817	0.9999
Ca	1.657	0.6263	0.9658	1.0002	0.9655	1.0001
Al	4.586	2.5745	1.0669	0.9959	1.0732	0.9982
O	50.493	47.7996	1.4919	0.9942	1.5005	1.0000
C	35.192	44.3764	0.2334	0.9972	0.2341	1.0000

Total 100.000 100.0000
 Normalization factor = 0.0132