

Appendix G

SEM/EDS and ESEM/EDS Data for Test #3 Day-30 Gel

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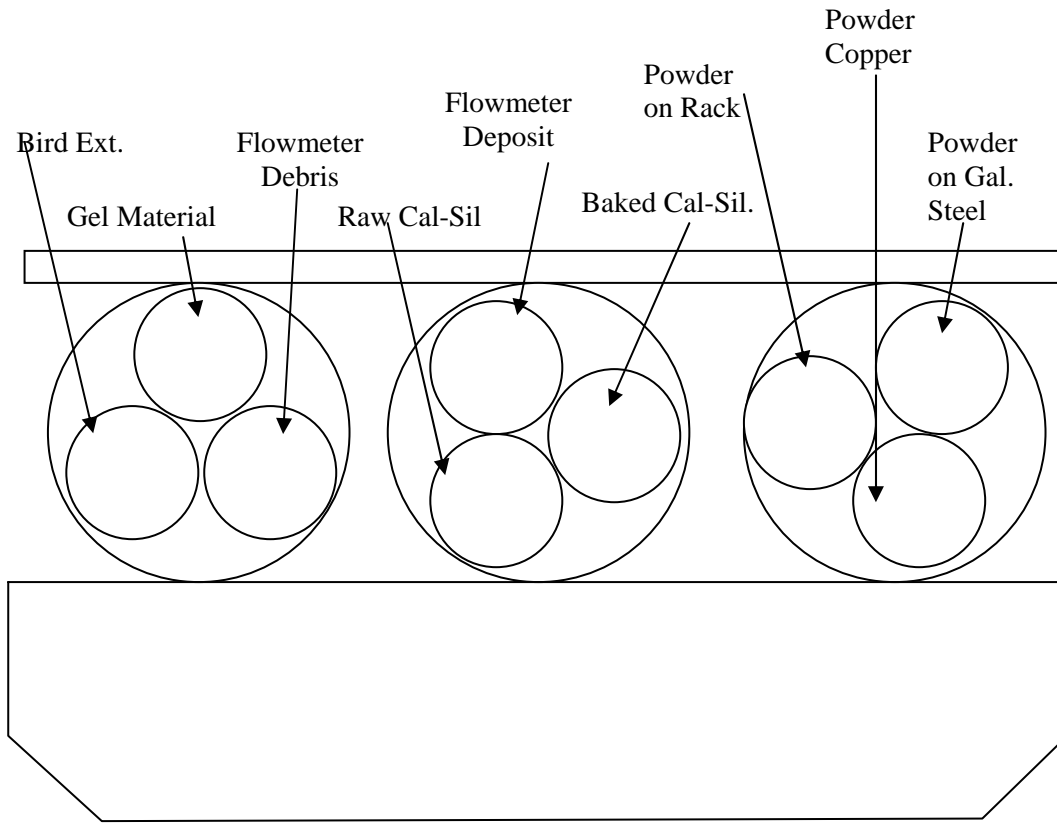
In ICET Test #3, one distinguished phenomenon is the presence of white gel-like precipitates in the testing solution. On the shutting down date of Test #3 deposits of the white gel-like precipitates were observed on the top of the birdcage. These precipitates may increase the containment sump screen head loss during a LOCA, therefore, it is necessary to investigate the morphology and composition of the white gel-like precipitate.

This appendix shows the ESEM/SEM/EDS and XRD/XRF results of the white gel-like precipitates. The precipitates were collected on the date Test #3 was shut down (May 5, 2005). For the SEM examination, the samples were dried in air before being coated with Au/Pd. EDS results provide a semi-quantitative elemental analysis of the sample compositions. Also, XRD results show the crystal structure of the white gel-like precipitates. Based on the XRD results, the composition of the white gel-like precipitates contained crystalline substances of sodium calcium hydrogen carbonate phosphate hydrate ($\text{Ca}_8\text{H}_2(\text{PO}_4)_6 \cdot \text{H}_2\text{O} \cdot \text{NaHCO}_3 \cdot \text{H}_2\text{O}$) and lithium calcium hydrogen carbonate phosphate hydrate ($\text{Ca}_8\text{H}_2(\text{PO}_4)_6 \cdot \text{H}_2\text{O} \cdot \text{Li}_2\text{CO}_3 \cdot \text{H}_2\text{O}$). In addition, XRF results indicate the chemical composition of the precipitates. Available logbook entries for this laboratory session are included in this appendix as transcribed notes.

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Transcribed Laboratory Log

Laboratory session from May 9, 2005.
Test #3 Day-30 Gel Material



Gel Material

Image: T3D30GelMaterial003 100 ×
T3D30GelMaterial004 1000 ×

Figure G-1

Figure G-2

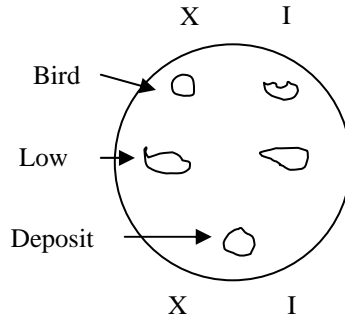
EDS: T3D30Gel02

Whole screen of image 004

Figure G-3

Transcribed Laboratory Log

Laboratory session from May 6, 2005.
Test #3 Day-30 Gel Material



Gel-like Material on Top of Birdcage

Image:	t3Gel08	1000 ×		Figure G-4
EDS:	t3GelED4		White gel has high C and low Si	Figure G-5
	t3geled5		Comparing t3bcexe2 from Appendix C4 & t3GelED4	Figure G-6
	t3geled6		EDS of gel material	Figure G-7
	t3geled7		Comparing t3bcexe2 from Appendix C4 & EDS6	Figure G-8

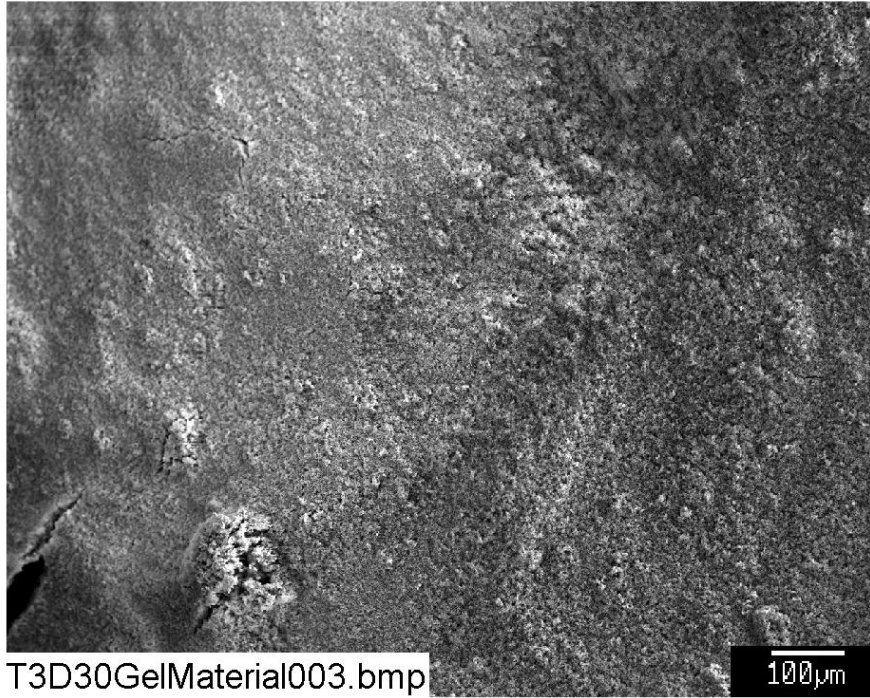


Figure G-1: SEM image magnified 100 times for a Test #3 Day-30 white gel-like material on the top of the birdcage. (T3D30GelMaterial003)

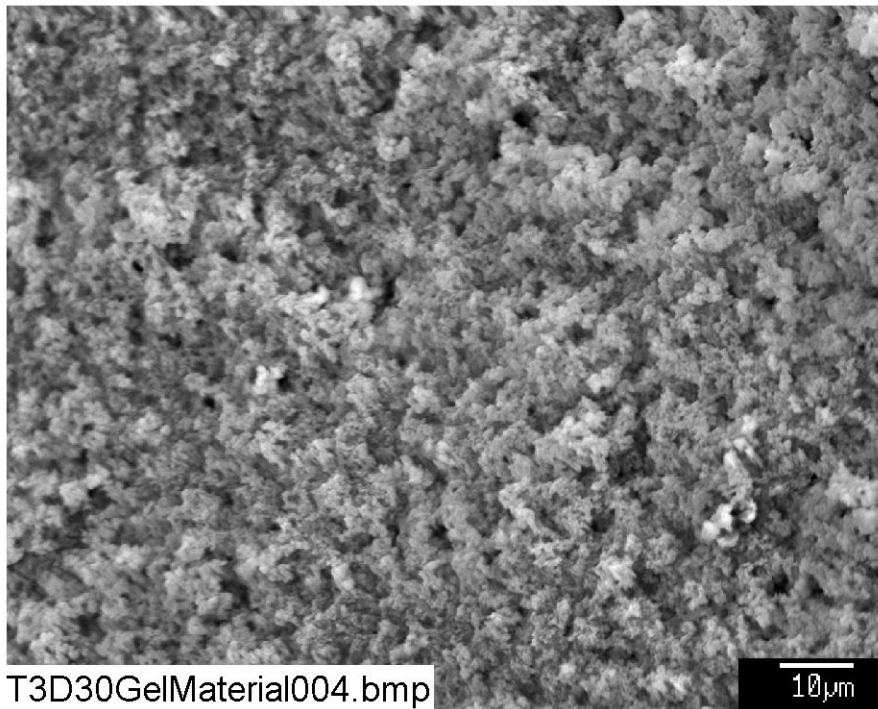


Figure G-2: SEM image magnified 1000 times for a Test #3 Day-30 white gel-like material on the top of the birdcage. (T3D30GelMaterial004)

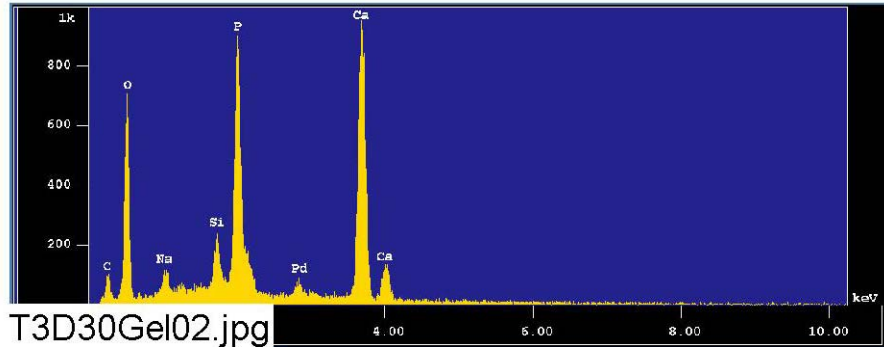


Figure G-3: EDS counting spectrum for the white gel-like material (whole image) shown in Figure G-2. (T3D30Gel02)

The results from the chemical composition analysis for T3D30Gel02 are given in Table G-1.

Table G-1. Chemical Compositions for T3D30Gel02, Figure G-3.

May 9 2005

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Group      : NRC
Sample     : T3D30 ID# : 2
Comment    : GelMaterial
Condition  : Full Scale : 20KeV(10eV/ch,2Kch)
             Live Time  : 60.000 sec   Aperture #   : 1
             Acc. Volt   : 15.0 KV     Probe Current : 1.606E-09 A
             Stage Point : X=79.625 Y=59.260 Z=11.424
             Acq. Date   : Mon May 9 11:42:11 2005
    
```

Element	Mode	ROI (KeV)	K-ratio(%)	+/-	Net/Background
C K	Normal	0.09- 0.46	0.6057	0.0005	338 / 119
O K	Normal	0.25- 0.77	12.2043	0.0032	4587 / 68
Na K	Normal	0.81- 1.27	0.5675	0.0010	613 / 50
Si K	Normal	1.50- 2.05	0.9391	0.0005	1366 / 271
P K	Normal	1.75- 2.38	8.4975	0.0055	7628 / 107
Ca K	Normal	3.39- 4.30	17.1295	0.0038	12109 / 26

 Chi_square = 42.7915

Element	Mass%	Atomic%	ZAF	Z	A	F
C	4.355	7.8616	3.7318	1.0194	3.6611	0.9999
O	45.521	61.6928	1.9361	0.9721	1.9917	1.0000
Na	1.639	1.5456	1.4989	1.0256	1.4614	1.0000
Si	2.072	1.5994	1.1451	0.9756	1.1812	0.9937
P	13.776	9.6435	0.8415	1.1708	0.7203	0.9978
Ca	32.638	17.6571	0.9890	0.9947	0.9943	1.0000

 Total 100.000 100.0000
 Normalization factor = 1.9265
 Total 100.000 100.0000
 Normalization factor = 2.1120

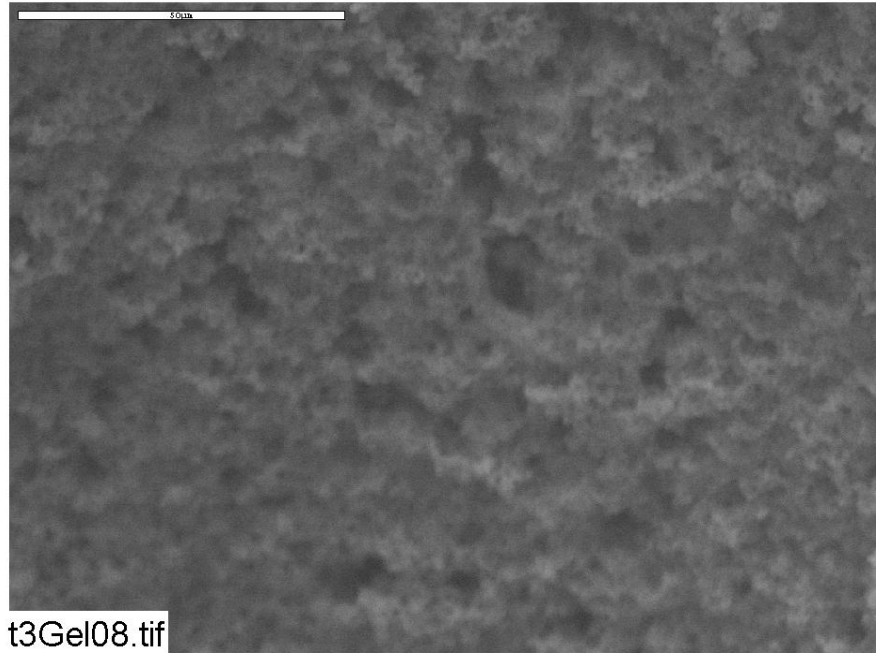


Figure G-4: ESEM image magnified 1000 times for a Test #3 Day-30 white gel-like material on the top of the birdcage. (t3Gel08)

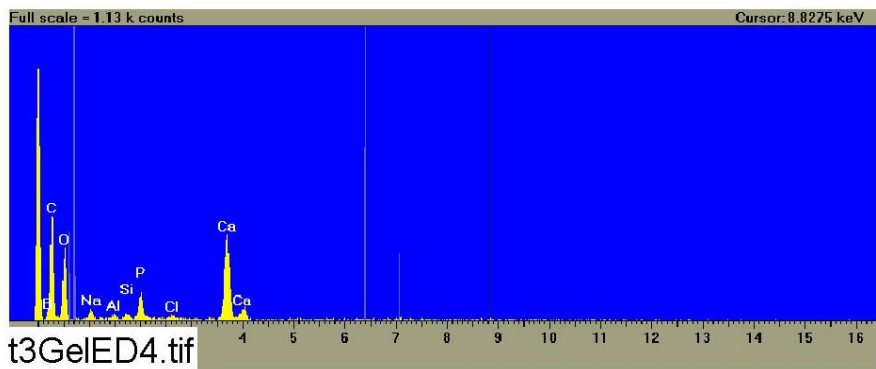


Figure G-5: EDS counting spectrum for the white gel-like material shown in Figure G-4. (t3GelED4)

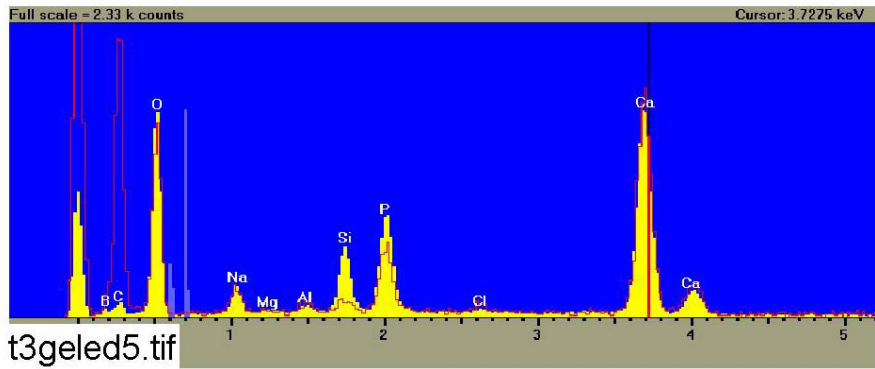


Figure G-6: Comparison of EDS counting spectra for Figure G-5 (red, the gel-like materials shown in Figure G-4) and Figure C4-5 (yellow, the large deposits taken from the birdcage exterior shown in Figure C4-4). . (t3geled5)

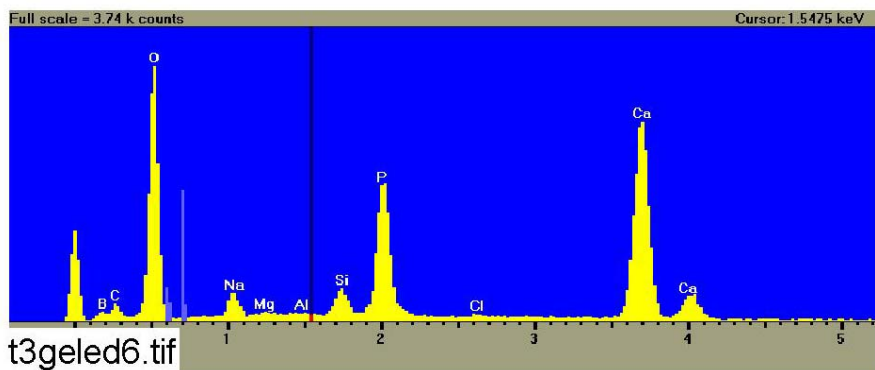


Figure G-7: Another EDS counting spectrum for the white gel-like material shown in Figure G-4. (t3geled6)

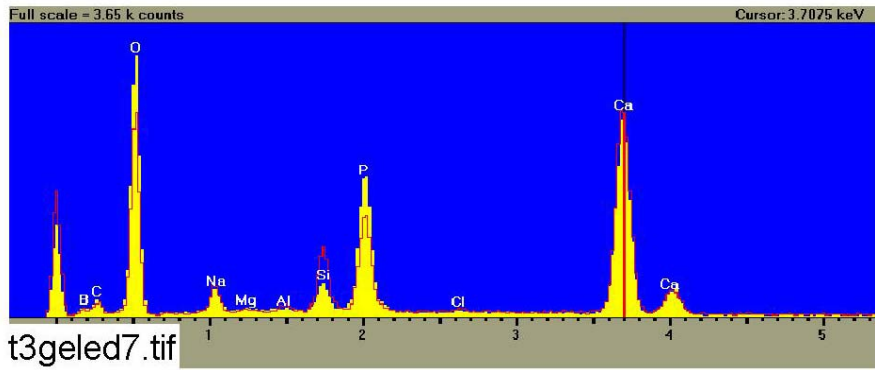


Figure G-8: Comparison of EDS counting spectra for Figure G-7 (yellow, the gel-like materials shown in Figure G-4) and Figure C4-5 (red, the large deposits taken from the birdcage exterior shown in Figure C4-4). (t3geled7)

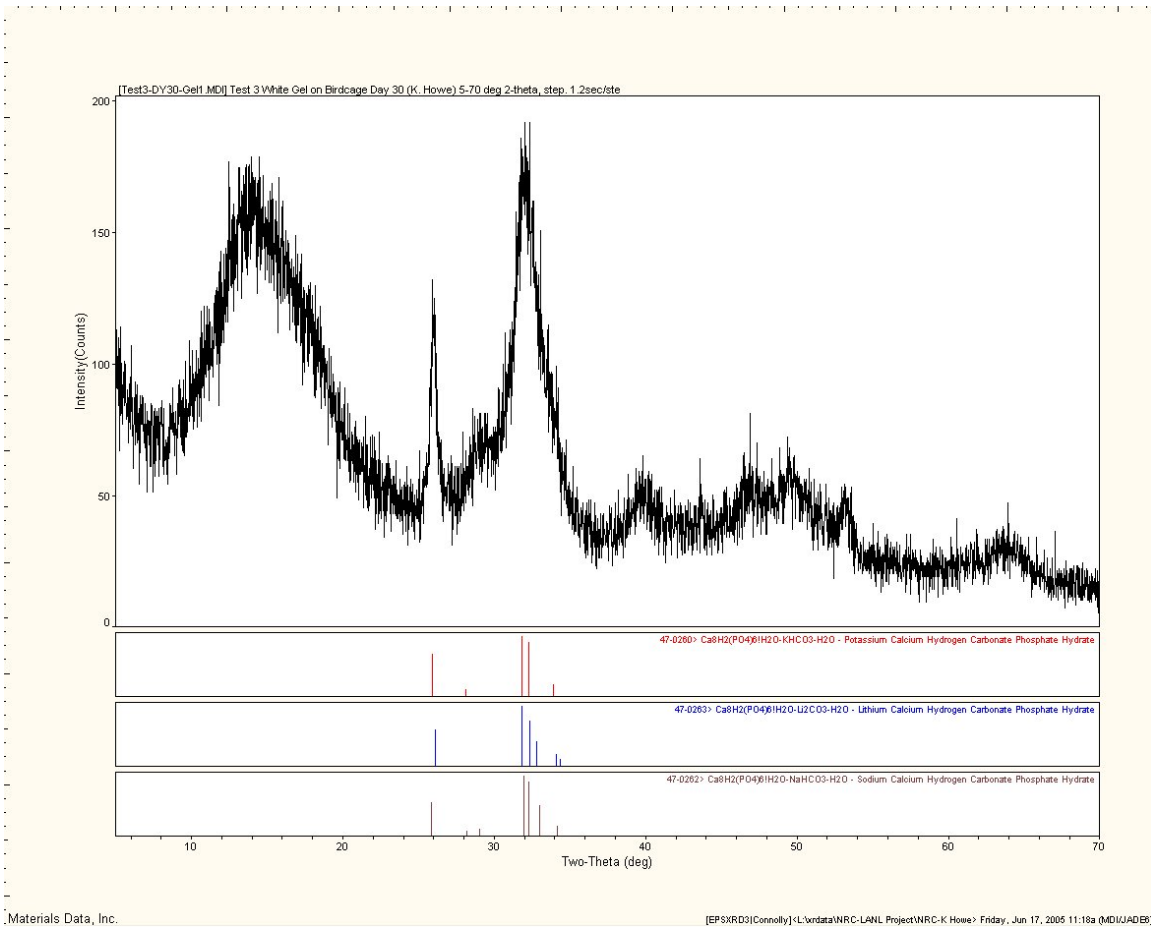


Figure G-9: XRD Results for Test #3 Day-30 White Gel-like Material.

Table G-2. Dry Mass Composition of a Test #3 Day 30 White Gel-like Sample by XRF Analysis

Sample ID	SiO₂	TiO₂	Al₂O₃	Fe₂O₃	FeO	MnO	MgO	CaO	Na₂O	K₂O	H₂O(-)	H₂O(+) CO₂	P₂O₅	Total	H₂O(+) CO₂ /DF (10) & Cover. To %
Test #3 Day 30 White Gel	5.26	0.02	0.63	0.07	0.00	0.00	0.25	35.01	2.39	0.06	4.75	19.24	27.09	94.77	1.0196