X.H 7/14/08

SOUTHWEST RESEARCH INSTITUTE
BLANK SUMMARY

Sample ID
PBW - F10E2, F10H1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 27589

Task Order: 050516-5

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminium	<0.0500	0.05
Antimony	<0.0150	0.015
Arsenic	<0.00500	0.005
Barium	<0.00500	0.005
Beryllium	<0.00500	0.005
Bismuth	<0.0100	0.01
Boron	<0.0200	0.02
Cadmium	<0.00500	0.005
Calcium	<0.0500	0.05
Chromium	<0.00500	0.005
Cobalt	<0.00500	0.005
Copper	<0.00500	0.005
Iron	<0.0500	0.05
Lanthanum	<0.00500	0.005
Lead	<0.00500	0.005
Lithium	<0.00500	0.005
Magnesium	<0.0500	0.05
Manganese	<0.00500	0.005
Molybdenum	<0.00500	0.005
Nickel	<0.00500	0.005
Palladium	<0.00500	0.005
Phosphorus	<0.0200	0.02
Potassium	<0.250	0.25
Selenium	<0.00500	0.005
Silicon	<0.0300	0.03
Silver	<0.00500	0.005
Sodium	<0.200	0.2
Strontium	<0.00500	0.005
Sulfur	<0.0200	0.02
Thallium	<0.0100	0.01
Thorium	<0.0250	0.025
Tin	<0.00500	0.005
Titanium	<0.00500	0.005
Tungsten	<0.0100	0.01
Uranium	<0.100	0.1
Vanadium	<0.00500	0.005
Yttrium	<0.00500	0.005
Zinc	<0.00500	0.005
Zirconium	<0.00500	0.005

NA- Not Applicable

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Xihua He 6/30/05

SOUTHWEST RESEARCH INSTITUTE
SAMPLE ANALYSIS DATA SHEET

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Task Order: 050516-5

Client: Division 20

Date Received: 05/16/05

Project No.: 06002.01.222

SRR: 27589

Sample ID	Lab System ID	Iron Result (mg/L)	Silicon Result (mg/L)
PBW - F10E1	----	<0.0500	<0.0300
LCSW - F10E1	----	1.14	3.99
True Value	----	1.00	4.00
Recovery	----	114%	99.8%
60-6	262988	16.0	13.3
60-7	262989	12.5	18.3
60-8	262990	4.86	21.7
90-1	262992	<2.50	6.82
90-2	262993	<2.50	26.5
90-3	262994	<2.50	36.5
90-4	262995	<2.50	42.9
90-5	262996	<2.50	49.9

Reporting Limit: 0.0500 mg/L 0.0300 mg/L

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Xihua He 6/30/05

Preparation of J-13 water

Solution preparation:

Solution A:

1.372 g $CaSO_4 \cdot 2H_2O$ Lot # 4300KBTR
0.951 g $Ca(NO_3)_2 \cdot 4H_2O$ Lot # 027190
0.117 g KCl Lot # 044597
0.573 g $MgCl_2 \cdot 6H_2O$ Lot # 044975
} + D.I water to 1000 mL

Solution B:

6.721 g $NaHCO_3$ Lot # 041522
0.376 g $KF \cdot 2H_2O$ Lot # 09516JC
} + D.I to 1000 mL

Solution C:

25 mL solution A
25 mL solution B
} + D.I to 1000 mL pH = 8.34

+ 7 μL $HClO_4$ adjust pH to 7.16
Lot # 925396

Xi'hua He 6/13/06

Xi'hua He 7/18/05

In-package Chemistry Test

Test ID: J13/A516 60pH

Specimen: A516 carbon steel, Heat # D84944
Specimen Preparation: Specimen machined to small coupons. Coupon surfaces polished to 600 Grit finish using SiC paper. Coupon rinsed in DI water and cleaned in acetone.

Number of carbon steel coupons used in the test: one

Initial total weight 2.63727 g
Balance Model: Sartorius Genius **SN:** 12809099

Final total weight 2.59360 g
Cal: 05/11/05 **Due:** 11/11/05

Carbon steel coupon dimensions:
2.62 mm × 11.62 mm × 10.92 mm

Measured with caliper Model: Starrett **SN:** 03031512
Cal: 3/24/05 **Due:** 3/24/06

Calculated carbon steel surface area of all test coupons: 3.7189 cm^2

Solution in Teflon vessel: solution C
Reagents measured with on page 34

Solution volume: 50.9 mL
Model: OHAUS **SN:** 2883
Cal: 1/14/05 **Due:** 7/14/05

Initial pH: 7.16
Final pH: N.A most of the solution evaporated after a few days

Model: Orion EA 920 **SN:** 5001A
Cal: 2/10/05 **Due:** 2/10/06
pH Probe: 13-620296 **SN:** 40791470

Test Temperature: 60°C

Measured with thermocouple meter SN: 41523645
Cal: 6/7/05 **Due:** 6/7/06

Thermocouple SN: ~~335~~ 331
Cal: ~~4/20/04~~ 5/24/05 X.H 9/6/05 Due: ~~7/20/04~~ 11/26/05 X.H 9/6/05 X.H 9/6/05

Specimen examination: specimen is corroded and there are many residuals in solution.

Date and Time	pH	ID for ICP analysis	
7/8/05 10:15 a.m sample in		60-a for original solution	
7/8/05 11:00 a.m	7.26	60-b	
7/8/05 2:40 p.m	8.04	60-c	
solution turns rusty			
7/9/05 4:15 p.m	8.64	60-d	
7/11/05 9:30 a.m	8.37	60-e	
7/12/05 9:30 a.m	8.67	60-f	
7/14/05 10:30 a.m	8.74	60-g	7/28/05 most of the solution evaporated
7/18/05 11:00 a.m	8.79	60-h	7/29/05 @ 2:00 p.m
7/22/05 2:10 p.m	8.82	60-i	pull sample out of test solution

Xi'hua He 7/29/05

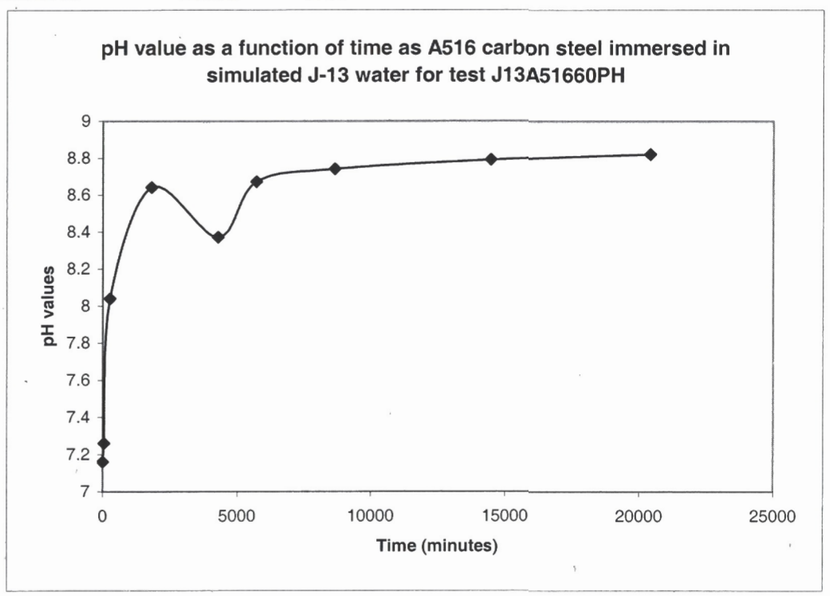
Comments for Test J13A51660PH.

① There are two holes on the Teflon vessel lid which allow pressure balance and allow pH probe to fit into solution. The holes are plugged with plugs while the vessel remained in oven. There was slow solution evaporation which leads to solution loss after a few days.

② ICP analysis results, page 47, show that no detectable Si release into solution. Most dissolved iron form residual which deposits at the bottom of the vessel. Fe content in solution phase is under detection limit. The sulfur content increased with time.

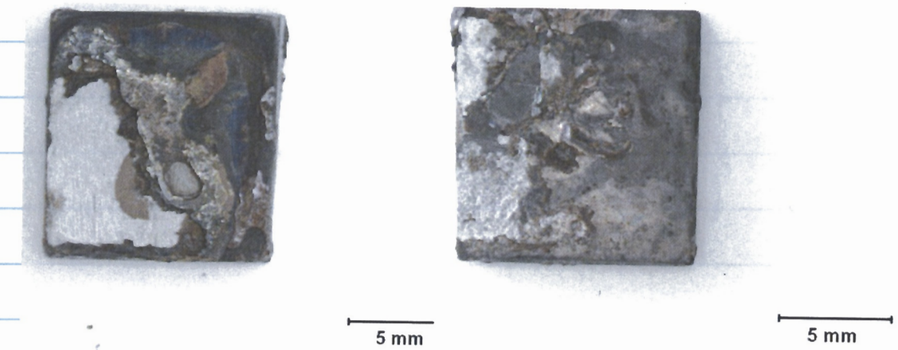
Data summary for Test J13A51660PH

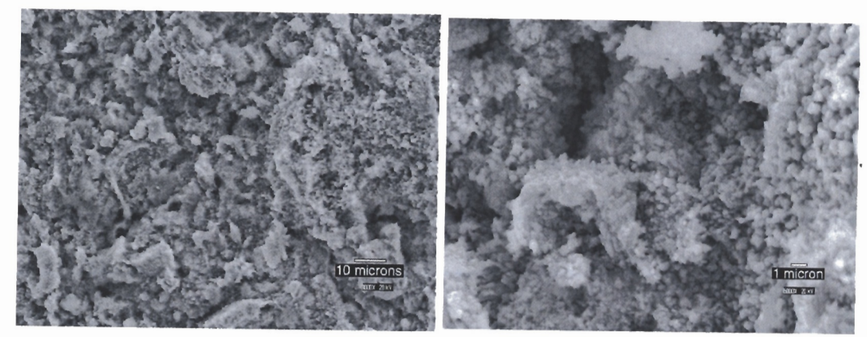
Date	Time (minutes)	pH values
7/8/2005	0	7.16
7/8/2005	45	7.26
7/8/2005	265	8.04
7/9/2005	1800	8.64
7/11/2005	4275	8.37
7/12/2005	5715	8.67
7/14/2005	8655	8.74
7/18/2005	14445	8.79
7/22/2005	20395	8.82

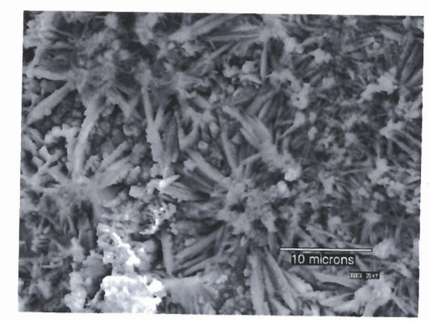


He 8/10/05 * See pg #161 for final weights 8/24/06

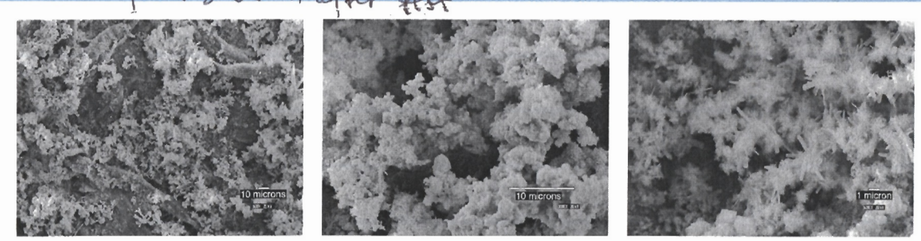
Posttest carbon steel specimen from test J13A51660PH, page 35







Solid material from solution after test Xihua He 9/1/2005



Xihua He 9/2/05

Samples for ICP analysis from pages 8, 9 & 10

Xihua He 7/18/05

SAMPLE LIST/CHAIN OF CUSTODY

Southwest Research Institute
Chemistry and Chemical Engineering Division
6220 Culebra Road
San Antonio, Texas 78238-5166

Shipper Name/Address:

Client: Div 20 CNWRA
Xihua He

Client Purchase Order/Other ID:

Site/Zone ID:

Requested Turnaround:
- ☑ 2 Weeks
- ☐ 3 Weeks
- ☐ Other:

SwRI Contact: Xihua He X 5194

Analyses Requested: See Attached Sheet; ICP Analysis; Fe, Si - Only; QA Nucleus

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	See Attached Sheet	ICP Analysis	Fe, Si - Only									REMARKS
60-9	7/15/05	10:00	L		2												
60-10	↓	↓	↓		↓												
60-11																	
60-12																	
60-13																	
60-14																	
60-15																	

Preservation
- a = HCl to pH <2
- b = HNO_3 to pH <2
- c = H_2SO_4 to pH <2
- d = NaOH to pH >12
- e = Cool (4°C±2°C)
- f = Other (specify)

Matrix Types:
- **A** – Air
- **B** – Biota
- **D** - Dust
- **E** – Emission/Stack
- **L** - Liquid
- **P** – Product
- **Sd** - Solid
- **S** – Soil
- **SED** – Sediment
- **T** - Tissue
- **W** - Water
- **WP** - Wipe

Sample Types:
- **D** - Duplicate
- **ER** – Equipment Rinsate
- **ES** – Environmental Sample
- **FB** – Field Blank
- **FD** – Field Duplicate
- **MS** – Matrix Spike
- **MSD** – Matrix Spike Dup
- **TB** – Trip Blank

Temp: 22°C Therm #: 027

Comments: Rec'd Intact

Relinquished by (Print/Signature)	Date	Time
Brian K. Dealey / [signature] thanks	7/15/05	2:05
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time

SwRI Project#: 20.06002.01.222

Received by SwRI Lab: (Signature) [signature]

Date 7/18/05 Time 1435

Samples Disposed: Date Time

Samples Disposed by:

Div 01 COC Form 01-01-001, Rev 8/02

Page 1 of 1

Samples for ICP analysis from pages 8, 9, and 10.

Xihua He 7/18/05

SAMPLE LIST/CHAIN OF CUSTODY

Southwest Research Institute®
Chemistry and Chemical Engineering Division
6220 Culebra Road
San Antonio, Texas 78238-5166

Shipper Name/Address:

Client: Div 20 CNWRA
Xihua He

Client Purchase Order/Other ID:

Site/Zone ID:

Requested Turnaround:
- ☑ 2 Weeks
- ☐ 3 Weeks
- ☐ Other:

SwRI Contact: Xihua He X 5194.

Analyses Requested: See Attached Sheet; ICP Analysis; Fe, Si - Only

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	See Attached Sheet	ICP Analysis	Fe, Si - Only									REMARKS
90-6	7/17/05	10:00	L		2												
90-7	↓	↓	↓		↓												
90-8																	
90-9																	
90-10																	
9-11																	
9-12																	

Preservation
- a = HCl to pH <2
- b = HNO_3 to pH <2
- c = H_2SO_4 to pH <2
- d = NaOH to pH >12
- e = Cool (4°C±2°C)
- f = Other (specify)

Matrix Types:
- **A** – Air
- **B** – Biota
- **D** - Dust
- **E** – Emission/Stack
- **L** - Liquid
- **P** – Product
- **Sd** - Solid
- **S** – Soil
- **SED** – Sediment
- **T** - Tissue
- **W** - Water
- **WP** - Wipe

Sample Types:
- **D** - Duplicate
- **ER** – Equipment Rinsate
- **ES** – Environmental Sample
- **FB** – Field Blank
- **FD** – Field Duplicate
- **MS** – Matrix Spike
- **MSD** – Matrix Spike Dup
- **TB** – Trip Blank

Temp: 22.0°C Therm #: 027

Comments: Rec'd Intact

Relinquished by (Print/Signature)	Date	Time
Brian K. Dealey / [signature] thanks	7/15/05	2:05
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time

SwRI Project#: 20.06002.01.222

Received by SwRI Lab: (Signature) [signature]

Date 7/18/05 Time 1435

Samples Disposed: Date Time

Samples Disposed by:

Div 01 COC Form 01-01-001, Rev 8/02

Page 1 of 1

Samples for ICP analysis from test J13A5166PH, page 35 & 36

SAMPLE LIST/CHAIN OF CUSTODY
Southwest Research Institute®
Chemistry and Chemical Engineering Division
6220 Culebra Road
San Antonio, Texas 78238-5166

Client Purchase Order/Other ID: Div 20 Cancer
Site/Zone ID
Shipper Name/Address
Client: Xihua He

Requested Turnaround: ☐ 2 Weeks ☐ 3 Weeks ☐ Other:
SwRI Contact: Xihua He x 51941

Analyses Requested: QA Nuclear; ICP Fe, Si, Sodium

REMARKS
Preservation
a = HCl to pH <2
b = HNO_3 to pH <2
c = H_2SO_4 to pH <2
d = NaOH to pH >12
e = Cool (4°C±2°C)
f = Other (specify)

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	See additional sheet for analytical	-			
60A	7/18/05	10:00	L		2	✓	simple ICP			
60B						✓				
60C						✓				
60D						✓				
60E						✓				
60F						✓				
60G						✓				
60H						✓				

Matrix Types: A – Air; B – Biota; D - Dust; E – Emission/Stack; L - Liquid; P – Product; Sd - Solid; S – Soil; SED – Sediment; T - Tissue; W - Water; WP - Wipe

Sample Types: D - Duplicate; ER – Equipment Rinsate; ES – Environmental Sample; FB – Field Blank; FD – Field Duplicate; MS – Matrix Spike; MSD – Matrix Spike Dup; TB – Trip Blank

Temp: 1.10°C Therm #: 027
Comments: Acid Filtered

Relinquished by (Print/Signature): Darin Y Dooley / [signature] Date 7/18/05 Time 2:05
Received by (Print/Signature): Date Time
Relinquished by (Print/Signature): Date Time
Received by (Print/Signature): Date Time
Relinquished by (Print/Signature): Date Time

SwRI Project#: 06002.01.222
Received by SwRI Lab: (Signature) [signature] Date 7/18/05 Time 1435
Samples Disposed: Date Time
Samples Disposed by:

Page 1 of 1

Div 01 COC Form 01-01-001, Rev 8/02

Xihua He 7/18/05

MEMORANDUM

TO: Xihua He
Division 20 Bldg. 189

FROM: Mike Dammann

RE: Project No.: 06002.01.222
Task Order: 050719-3
SRR: 27816
Samples Received: July 18, 2005

Analysis of liquid samples for metals by ICP/ICP-MS.

Raw data and nuclear safety documentation for this project are archived in Division 20 records control and Division 01 QA.

DATE: August 19, 2005

Enclosed, please find the sample results for the analyses referenced above.

The analyses performed comply with the SwRI Program Quality Plan, Document No. PQP-Nuclear Rev. 1, 10CFR 50 Appendix B, 10CFR 21, and 01-QPP-015 Revision 5.

If there are any questions, please feel free to contact me by voice mail at 522-5428 or by fax at 522-3649. I look forward to our continued analytical support of your projects.

010001

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 050719-3
SRR: 27816
SDG: 265146
CASE: CNWRA
VTSR: July 18, 2005
PROJECT#: 06002.01.222

Mike Dammann
[signature] for
Manager, Inorganic Group

for Jo Ann Boyd
[signature]
Manager, Div. 01 Quality Assurance

FINAL REPORT

Xihua He 8/19/05

SOUTHWEST RESEARCH INSTITUTE
SAMPLE ANALYSIS DATA SHEET

Sample ID
60-A

Solutions on page 34

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 265153

Method: 6010B

Client: Division 20

Date Received: 07/18/05

Project No.: 06002.01.222

SRR: 27816

Task Order: 050719-3

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	11.8	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<2.00	2.00
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.125	0.125
Magnesium	1.94	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.125	0.125
Phosphorus	<0.250	0.250
Potassium	4.14	2.50
Selenium	<0.125	0.125
Silicon	<1.00	1.00
Silver	<0.125	0.125
Sodium	28.9	2.50
Strontium	<0.125	0.125
Sulfur	5.99	0.750
Thallium	<0.250	0.250
Thorium	<0.500	0.500
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

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Xihua He 8/9/05

SOUTHWEST RESEARCH INSTITUTE
DUPLICATE SUMMARY

Sample ID
60-A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 265153

Method: 6010B

Client: Division 20

Date Received: 07/18/05

Project No.: 06002.01.222

SRR: 27816

Task Order: 050719-3

Analysis	Original Sample Result (mg/L)	Duplicate Result (mg/L)	RPD
Aluminum	<1.25	<1.25	0.00%
Antimony	<0.250	<0.250	0.00%
Arsenic	<0.125	<0.125	0.00%
Barium	<0.125	<0.125	0.00%
Beryllium	<0.125	<0.125	0.00%
Bismuth	<0.250	<0.250	0.00%
Boron	<0.500	<0.500	0.00%
Cadmium	<0.125	<0.125	0.00%
✓ Calcium	11.8	11.9	0.84%
Chromium	<0.125	<0.125	0.00%
Cobalt	<0.125	<0.125	0.00%
Copper	<0.125	<0.125	0.00%
Iron	<2.00	<2.00	0.00%
Lanthanum	<0.125	<0.125	0.00%
Lead	<0.125	<0.125	0.00%
Lithium	<0.125	<0.125	0.00%
✓ Magnesium	1.94	1.57	21.1%
Manganese	<0.125	<0.125	0.00%
Molybdenum	<0.125	<0.125	0.00%
Nickel	<0.125	<0.125	0.00%
Palladium	<0.125	<0.125	0.00%
Phosphorus	<0.250	<0.250	0.00%
✓ Potassium	4.14	4.07	1.71%
Selenium	<0.125	<0.125	0.00%
Silicon	<1.00	<1.00	0.00%
Silver	<0.125	<0.125	0.00%
✓ Sodium	28.9	29.6	2.39%
Strontium	<0.125	<0.125	0.00%
✓ Sulfur	5.99	6.09	1.66%
Thallium	<0.250	<0.250	0.00%
Thorium	<0.500	<0.500	0.00%
Tin	<0.125	<0.125	0.00%
Titanium	<0.125	<0.125	0.00%
Tungsten	<0.250	<0.250	0.00%
Uranium	<2.50	<2.50	0.00%
Vanadium	<0.125	<0.125	0.00%
Yttrium	<0.125	<0.125	0.00%
Zinc	<0.125	<0.125	0.00%
Zirconium	<0.125	<0.125	0.00%

NA - Not Applicable

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Xihua He 8/9/05

SOUTHWEST RESEARCH INSTITUTE
MATRIX SPIKE SUMMARY

Sample ID: 60-A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 07/18/05

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 265153

SRR: 27816

Method: 6010B

Task Order: 050719-3

Analysis	Original Sample Result (mg/L)	Spike Result (mg/L)	Spike Added (mg/L)	Recovery
Aluminum	<1.25	47.8	50.0	95.6%
Antimony	<0.250	12.1	12.5	96.8%
Arsenic	<0.125	49.8	50.0	99.6%
Barium	<0.125	48.8	50.0	97.6%
Beryllium	<0.125	1.23	1.25	98.4%
Bismuth	NA	NA	NA	NA
Boron	<0.500	96.7	100	96.7%
Cadmium	<0.125	1.24	1.25	99.2%
Calcium	11.8	508	500	99.2%
Chromium	<0.125	4.86	5.00	97.2%
Cobalt	<0.125	12.1	12.5	96.8%
Copper	<0.125	5.94	6.25	95.0%
Iron	<2.00	27.6	25.0	110.4%
Lanthanum	NA	NA	NA	NA
Lead	<0.125	12.4	12.5	99.2%
Lithium	NA	NA	NA	NA
Magnesium	1.94	494	500	98.4%
Manganese	<0.125	12.2	12.5	97.6%
Molybdenum	NA	NA	NA	NA
Nickel	<0.125	12.1	12.5	96.8%
Palladium	NA	NA	NA	NA
Phosphorus	<0.250	99.5	100	99.5%
Potassium	4.14	431	500	85.4%
Selenium	<0.125	51.2	50.0	102.4%
Silicon	<1.00	96.4	100	96.4%
Silver	<0.125	1.24	1.25	99.2%
Sodium	28.9	472	500	88.6%
Strontium	<0.125	96.7	100	96.7%
Sulfur	5.99	106	100	100.0%
Thallium	<0.250	50.5	50.0	101.0%
Thorium	NA	NA	NA	NA
Tin	NA	NA	NA	NA
Titanium	NA	NA	NA	NA
Tungsten	NA	NA	NA	NA
Uranium	NA	NA	NA	NA
Vanadium	<0.125	12.1	12.5	96.8%
Yttrium	NA	NA	NA	NA
Zinc	<0.125	12.3	12.5	98.4%
Zirconium	NA	NA	NA	NA

NA - Not Applicable

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Xihua He 8/9/05

SOUTHWEST RESEARCH INSTITUTE
LABORATORY CONTROL SAMPLE

Sample ID: LCSW - G22H3

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: NA

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: NA

SRR: 27816

Method: 6010B

Task Order: 050719-3

Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Aluminum	48.1	50.0	96.2%
Antimony	12.2	12.5	97.6%
Arsenic	50.0	50.0	100.0%
Barium	49.1	50.0	98.2%
Beryllium	1.24	1.25	99.2%
Bismuth	NA	NA	NA
Boron	97.7	100	97.7%
Cadmium	1.25	1.25	100.0%
Calcium	501	500	100.2%
Chromium	4.88	5.00	97.6%
Cobalt	12.2	12.5	97.6%
Copper	5.95	6.25	95.2%
Iron	28.6	25.0	114.4%
Lanthanum	NA	NA	NA
Lead	12.4	12.5	99.2%
Lithium	NA	NA	NA
Magnesium	496	500	99.2%
Manganese	12.3	12.5	98.4%
Molybdenum	NA	NA	NA
Nickel	12.1	12.5	96.8%
Palladium	NA	NA	NA
Phosphorus	99.7	100	99.7%
Potassium	429	500	85.8%
Selenium	51.2	50.0	102.4%
Silicon	98.3	100	98.3%
Silver	1.30	1.25	104.0%
Sodium	456	500	91.2%
Strontium	99.4	100	99.4%
Sulfur	101	100	101.0%
Thallium	50.7	50.0	101.4%
Thorium	NA	NA	NA
Tin	NA	NA	NA
Titanium	NA	NA	NA
Tungsten	NA	NA	NA
Uranium	NA	NA	NA
Vanadium	12.1	12.5	96.8%
Yttrium	NA	NA	NA
Zinc	12.3	12.5	98.4%
Zirconium	NA	NA	NA

NA- Not Applicable

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Xihua He 8/9/05

SOUTHWEST RESEARCH INSTITUTE
BLANK SUMMARY

Sample ID
PBW - G22H3

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Method: 6010B

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 27816

Task Order: 050719-3

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	<1.25	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<2.00	2.00
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.125	0.125
Magnesium	<1.25	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.125	0.125
Phosphorus	<0.250	0.250
Potassium	<2.50	2.50
Selenium	<0.125	0.125
Silicon	<1.00	1.00
Silver	<0.125	0.125
Sodium	<2.50	2.50
Strontium	<0.125	0.125
Sulfur	<0.750	0.750
Thallium	<0.250	0.250
Thorium	<0.500	0.500
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

NA- Not Applicable

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Xilma Ha 8/9/05

SOUTHWEST RESEARCH INSTITUTE
SAMPLE ANALYSIS DATA SHEET

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Task Order: 050719-3

Method: 6010B

Client: Division 20

Date Received: 07/18/05

Project No.: 06002.01.222

SRR: 27816

Sample ID	Lab System ID	Iron Result (mg/L)	Silicon Result (mg/L)	Sulfur Result (mg/L)
PBW - G22H4	----	<2.00	<1.00	<0.750
LCSW - G22H4	----	24.4	96.2	95.3
True Value	----	25.0	100	100
Recovery	----	97.6%	96.2%	95.3%
60-10	265146	<2.00	24.8	3.29
Duplicate result	265146	<2.00	24.2	3.37
RPD	265146	0.00%	2.45%	2.40%
60-11	265147	<2.00	26.0	3.21
Spike result	265147	26.5	124	100
Spike added	265147	25.0	100	100
Recovery	265147	106%	98.0%	96.8%
60-12	265148	<2.00	29.2	3.29
60-13	265149	3.49	20.0	4.47
60-14	265150	<2.00	26.8	4.18
60-15	265151	<2.00	23.9	4.08
60-9	265152	2.55	22.2	3.86
60-B	265154	<2.00	<1.00	5.88
60-c	265155	<2.00	<1.00	5.80
60-d	265156	<2.00	<1.00	6.05
60-e	265157	<2.00	<1.00	6.12
60-f	265158	<2.00	<1.00	6.39
60-g	265159	<2.00	<1.00	6.70
60-h	265160	<2.00	<1.00	7.39
90-10	265161	<2.00	62.3	19.2
90-11	265162	<2.00	82.9	23.2
90-12	265163	4.67	76.7	24.3
90-6	265164	<2.00	53.8	9.63
90-7	265165	<2.00	54.3	13.2
90-8	265166	<2.00	59.4	15.6
90-9	265167	<2.00	60.2	18.4
Reporting Limit:		2.00 mg/L	1.00 mg/L	0.750 mg/L

Test ID J13A51660C page. 7

From Test ID J13A51660H page 35

Test ID J13A51690C Page. 7

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Ha 8/9/05

In-package Chemistry Test

Test ID: J13A51660PHb

Specimen: A516 carbon steel, Heat # D84944
Specimen Preparation: Specimen machined to small coupons. Coupon surfaces polished to 600 Grit finish using SiC paper. Coupon rinsed in DI water and cleaned in acetone.

Number of carbon steel coupons used in the test: one

Initial total weight 2.37683 g — **Balance Model:** Sartorius Genius — **SN:** 12809099

Final total weight 2.32027 g — **Cal:** 05/11/05 — **Due:** 11/11/05

Carbon steel coupon dimensions: 2.40 mm × 11.3 mm × 11.24 mm — **Measured with caliper Model:** Starrett — **SN:** 03031512

Cal: 3/24/05 — **Due:** 3/24/06

Calculated carbon steel surface area of all test coupons: 3.62 cm²

Solution in Teflon vessel: * 25 mL solution A + 25 mL solution B + D.I water ↓ to 1000 mL — **Solution volume:** 49.6 mL

Reagents measured with — **Model:** OHAUS — **SN:** 2883
Cal: 7/12/05 — **Due:** 1/12/06

Initial pH: 7.17 — **Model:** Orion EA920 — **SN:** 5001A
Final pH: 10.07 — **Cal:** 2/10/05 — **Due:** 2/10/06
pH Probe: 13-620-296 — **SN:** 4079447p

Test Temperature: 60°c — **Measured with** thermocouple meter SN: 41523645
Cal: 6/7/05 — **Due:** 6/7/06

Thermocouple SN: ~~375~~ 331 X.H 9/6/05
Cal: ~~1/20/04~~ X.H 9/6/05 5/26/05 — Due: ~~7/20/04~~ X.H 9/6/05 11/25/05

* The vessel lid is closed. It opens for pH measurement

8/29/05 at 2:45 p.m add two glass disks into vessel

glass (page 12)	diameter, mm	thickness, mm	surface area (cm²)
	9.64	0.94	~~1.01~~ 2 X.H 7/21/06
	9.79	0.96	~~1.05~~ 2 X.H 7/21/06

combined weight 0.37249 g

Final combined weight 0.35813 g

Post-test examination.

Carbon steel coupon is corroded and there are lots of deposits at the bottom of the test cell. Glass is not corroded much. SEM and EDX results are on page 72 & 73.

Xihua He 9/29/05 * See pg #161 for final weight of specimen 5/24/06

Test record for Test J13A51660PHb (page 48)

Time for pH measurement		pH	ID for ICP analysis
8/2/05	11:30 a.m	7.58	60-bb
8/3/05	10:15 a.m	7.88	60-cb
8/4/05	9:45 a.m	8.06	60-db
8/8/05	9:15 a.m	8.36	60-eb
8/10/05	3:30 p.m	8.37	
8/12/05	11:00 a.m	8.48	60-fb
8/14/05	9:15 a.m	8.58	
8/18/05	9:00 a.m	8.65	60-gb
8/22/05	2:15 p.m	9.14	60-hb
8/29/05	11:45 a.m	9.16	60-ib
8/29/05	at 2:45 p.m	add glass in	
8/29/05	3:00 p.m	9.16	60-jb
8/29/05	3:55 p.m	9.24	60-kb
8/30/05	8:00 a.m	9.22	60-lb
8/30/05	3:00 p.m	9.24	60-mb
	glass is covered with Fe corrosion products		
8/31/05	8:00 a.m X.H 10/3/05	9.27	60-nb
8/31/05	3:30 p.m	9.16	
9/1/05	8:00 a.m	9.18	
9/2/05	8:00 a.m	9.19	
9/6/05	7:40 a.m	9.48	60-ob
9/7/05	9:15 a.m	9.44	60-pb solution is very cloudy
9/12/05	8:55 a.m	9.62	
9/14/05	1:30 p.m	1 ml solution pulled out for particle size distribution analysis	

continued on page 63

see X 10/3/05

Samples from Test T13A51660PH6 (page) 48 for ICP analysis

SAMPLE LIST/CHAIN OF CUSTODY

Southwest Research Institute®
Chemistry and Chemical Engineering Division
6220 Culebra Road
San Antonio, Texas 78238-5166

Shipper Name/Address:

Client: Div 20 Xhua He X5194

Client Purchase Order/Other ID:

Site/Zone ID:

Requested Turnaround:
- ☑ 2 Weeks
- ☐ 3 Weeks
- ☐ Other: thanks

SwRI Contact: Xhua He X5194 Div 20

Analyses Requested: QA Nuclear

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	ICP Analysis See Attached Sheet
60 - BB	9/1/05	2:00	L		2	
60 - CB	↓	↓	↓		2	
60 - DB					2	
60 - EB					2	
60 - FB					2	
60 - GB					2	
60 - HB					2	
60 - IB					2	
60 - JB					1	
60 - KB					1	

REMARKS
Preservation
- a = HCl to pH <2
- b = HNO_3 to pH <2
- c = H_2SO_4 to pH <2
- d = NaOH to pH >12
- e = Cool (4°C±2°C)
- f = Other (specify)

Matrix Types:
- **A** – Air
- **B** – Biota
- **D** - Dust
- **E** – Emission/Stack
- **L** - Liquid
- **P** – Product
- **Sd** - Solid
- **S** – Soil
- **SED** – Sediment
- **T** - Tissue
- **W** - Water
- **WP** - Wipe

Sample Types:
- **D** - Duplicate
- **ER** – Equipment Rinsate
- **ES** – Environmental Sample
- **FB** – Field Blank
- **FD** – Field Duplicate
- **MS** – Matrix Spike
- **MSD** – Matrix Spike Dup
- **TB** – Trip Blank

Temp: 27.0°C Therm #: 027

Comments: Rec'd Intact

Relinquished by (Print/Signature)	Date	Time
Brian Derby / [signature]	9/1/05	2:00
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time

SwRI Project#: 20.06002.01.222

Received by SwRI Lab: (Signature) [signature]

Date: 9/1/05 Time: 1505

Samples Disposed: Date: Time:

Samples Disposed by:

Div 01 COC Form 01-01-001, Rev 8/02

Page 1 of 1

[signature] 9/1/05

SAMPLE LIST/CHAIN OF CUSTODY

Southwest Research Institute®
Chemistry and Chemical Engineering Division
6220 Culebra Road
San Antonio, Texas 78238-5166

Shipper Name/Address:

Client: Div 20 Xhua He X5194

Client Purchase Order/Other ID:

Site/Zone ID:

Requested Turnaround:
- ☑ 2 Weeks
- ☐ 3 Weeks
- ☐ Other: Thanks

SwRI Contact: Div 20 Xhua He X5194

Analyses Requested: QA Nuclear

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	ICP Analysis See Attached Sheet
60 - LB	9/1/05	↓	L		1	
60 - MB	↓	↓	L		1	
60 - NB	↓	↓	L		1	

REMARKS
Preservation
- a = HCl to pH <2
- b = HNO_3 to pH <2
- c = H_2SO_4 to pH <2
- d = NaOH to pH >12
- e = Cool (4°C±2°C)
- f = Other (specify)

Matrix Types:
- **A** – Air
- **B** – Biota
- **D** - Dust
- **E** – Emission/Stack
- **L** - Liquid
- **P** – Product
- **Sd** - Solid
- **S** – Soil
- **SED** – Sediment
- **T** - Tissue
- **W** - Water
- **WP** - Wipe

Sample Types:
- **D** - Duplicate
- **ER** – Equipment Rinsate
- **ES** – Environmental Sample
- **FB** – Field Blank
- **FD** – Field Duplicate
- **MS** – Matrix Spike
- **MSD** – Matrix Spike Dup
- **TB** – Trip Blank

Temp: 27.0°C Therm #: 027

Comments: Rec'd Intact

Relinquished by (Print/Signature)	Date	Time
Brian K Derby / [signature]	9/1/05	2:00
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time

SwRI Project#: 20.06002.01.222

Received by SwRI Lab: (Signature) [signature]

Date: 9/1/05 Time: 1505

Samples Disposed: Date: Time:

Samples Disposed by:

Div 01 COC Form 01-01-001, Rev 8/02

Page 1 of 1

Xhua He 9/1/05

MEMORANDUM

TO: Xihua He
Division 20 Bldg. 189

FROM: Mike Dammann

RE: Project No.: 06002.01.222
Task Order: 050902-2
SRR: 27981
Samples Received: September 01, 2005

Analysis of liquid samples for metals by ICP.

Raw data and nuclear safety documentation for this project are archived in Division 20 records control and Division 01 QA.

DATE: September 26, 2005

Enclosed, please find the sample results for the analyses referenced above.

The analyses performed comply with the SwRI Program Quality Plan, Document No. PQP-Nuclear Rev. 1, 10CFR 50 Appendix B, 10CFR 21, and 01-QPP-015 Revision 5.

If there are any questions, please feel free to contact me by voice mail at 522-5428 or by fax at 522-3649. I look forward to our continued analytical support of your projects.

Mike Dammann
R Spier for
Manager, Inorganic Group

Jo Ann Boyd
Jo Ann Boyd
Manager, Div. 01 Quality Assurance

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 050902-2
SRR: 27981
SDG: 267053
CASE: CNWRA
VTSR: September 01, 2005
PROJECT#: 06002.01.222

He Lee 9/30/05

Icp analysis results for Test J13A51660PHb (page 48,49)

Sample ID P.1
60-BB

Lab Name: Southwest Research Institute
Client: Division 20
Lab Code: SwRI
Date Received: 09/01/05
Matrix: Liquid
Project No.: 06002.01.222
Lab System ID: 267053
SRR: 27981
Method: ICP SW846 6010B
Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.36	0.500

Sample ID P. 2
60-BB

Lab Name: Southwest Research Institute
Client: Division 20
Lab Code: SwRI
Date Received: 09/01/05
Matrix: Liquid
Project No.: 06002.01.222
Lab System ID: 267053
SRR: 27981
Method: ICP SW846 6010B
Task Order: 050902-2

Analysis	Original Sample Result (mg/L)	Duplicate Result (mg/L)	RPD
Boron	<0.250	<0.250	0.00%
Iron	<1.25	<1.25	0.00%
Silicon	<0.500	<0.500	0.00%
Sulfur	5.36	5.40	0.74%

Sample ID P.3
60-CB

Lab Name: Southwest Research Institute
Client: Division 20
Lab Code: SwRI
Date Received: 09/01/05
Matrix: Liquid
Project No.: 06002.01.222
Lab System ID: 267054
SRR: 27981
Method: ICP SW846 6010B
Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.73	0.500

Xihua He
9/30/05

Continued from p. 53

Sample ID p. 4
60-CB

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 09/01/05

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 267054

SRR: 27981

Method: ICP SW846 6010B

Task Order: 050902-2

Analysis	Original Sample Result (mg/L)	Spike Result (mg/L)	Spike Added (mg/L)	Recovery
Boron	<0.250	90.6	100	90.6%
Iron	<1.25	26.0	25.0	104%
Silicon	<0.500	91.2	100	91.2%
Sulfur	5.73	97.4	100	91.7%

Sample ID p. 5
60-DB

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 09/01/05

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 267055

SRR: 27981

Method: ICP SW846 6010B

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.46	0.500

Sample ID p. 6
60-EB

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 09/01/05

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 267056

SRR: 27981

Method: ICP SW846 6010B

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.41	0.500

Xihua He
9/30/05

Continued from p. 53

Sample ID p. 7
60-FB

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 09/01/05

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 267057

SRR: 27981

Method: ICP SW846 6010B

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.62	0.500

Sample ID 8
60-GB

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 09/01/05

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 267058

SRR: 27981

Method: ICP SW846 6010B

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.36	0.500

Sample ID 9
60-HB

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 09/01/05

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 267059

SRR: 27981

Method: ICP SW846 6010B

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.37	0.500

Xihua He
9/30/05

Continued from p.53

Sample ID 10
60-IB

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 267060

Method: ICP SW846 6010B

Client: Division 20

Date Received: 09/01/05

Project No.: 06002.01.222

SRR: 27981

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.38	0.500

Sample ID p. 11
60-JB

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 267061

Method: ICP SW846 6010B

Client: Division 20

Date Received: 09/01/05

Project No.: 06002.01.222

SRR: 27981

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.32	0.500

Sample ID p. 12
60-KB

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 267062

Method: ICP SW846 6010B

Client: Division 20

Date Received: 09/01/05

Project No.: 06002.01.222

SRR: 27981

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	5.26	0.500

Xihua He
9/30/05

Continued from p.53

Sample ID p.13
60-LB

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 267063

Method: ICP SW846 6010B

Client: Division 20

Date Received: 09/01/05

Project No.: 06002.01.222

SRR: 27981

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	0.318	0.250
Iron	<1.25	1.25
Silicon	1.55	0.500
Sulfur	5.22	0.500

Sample ID p.14
60-MB

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 267064

Method: ICP SW846 6010B

Client: Division 20

Date Received: 09/01/05

Project No.: 06002.01.222

SRR: 27981

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	0.403	0.250
Iron	<1.25	1.25
Silicon	2.02	0.500
Sulfur	5.22	0.500

Sample ID p.15
60-NB

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 267065

Method: ICP SW846 6010B

Client: Division 20

Date Received: 09/01/05

Project No.: 06002.01.222

SRR: 27981

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	0.611	0.250
Iron	<1.25	1.25
Silicon	2.94	0.500
Sulfur	5.26	0.500

Xihua He
9/30/05

Continued from P.53

Sample ID P.16
LCSW - J14H1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Method: ICP SW846 6010B

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 27981

Task Order: 050902-2

Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Boron	89.2	100	89.2%
Iron	24.7	25.0	98.8%
Silicon	90.8	100	90.8%
Sulfur	91.0	100	91.0%

Sample ID P.17
PBW - J14H1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Method: ICP SW846 6010B

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 27981

Task Order: 050902-2

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.250	0.250
Iron	<1.25	1.25
Silicon	<0.500	0.500
Sulfur	<0.500	0.500

Xiahua He 9/30/05

X.H 7/14/08

Particle size distribution analysis from 9/14/05 (page 49) from test J13A51660PHb

X.H 7/14/08

Objective: Determine size distribution of particles deposited in solution due to carbon steel corrosion and glass dissolution

Procedure: Tests performed in accordance with Test/Analytical Procedure TAP-01-0202-022 under Div 01's ISO 9002 program - Procedures for the Operation, Calibration Verification, and Maintenance of the Particle Sizing Systems Wet and Dry Particle Size Analyzers.

Specimen: 1 mL solution with particles was drawen from Teflon vessel from Test J13A51660PHb at 1:30 p.m on 9/14/05

Particle size distribution analyzer model: 770 AccuSizer

Equipment was calibrated before use with internal standards

Operator: Jack Trevino, Div. 1 **Supervisor:** Charles Baker, Div. 1

X.H 7/14/08

Observation. Most of the particles are less than < 20 um.

Xiahua He 9/30/05

X.H 9/30/05

X.H 7/14/08

Particle size distribution analysis results for solution retrieved on 9/14/05 (page 49) from Test J18A5460PHb

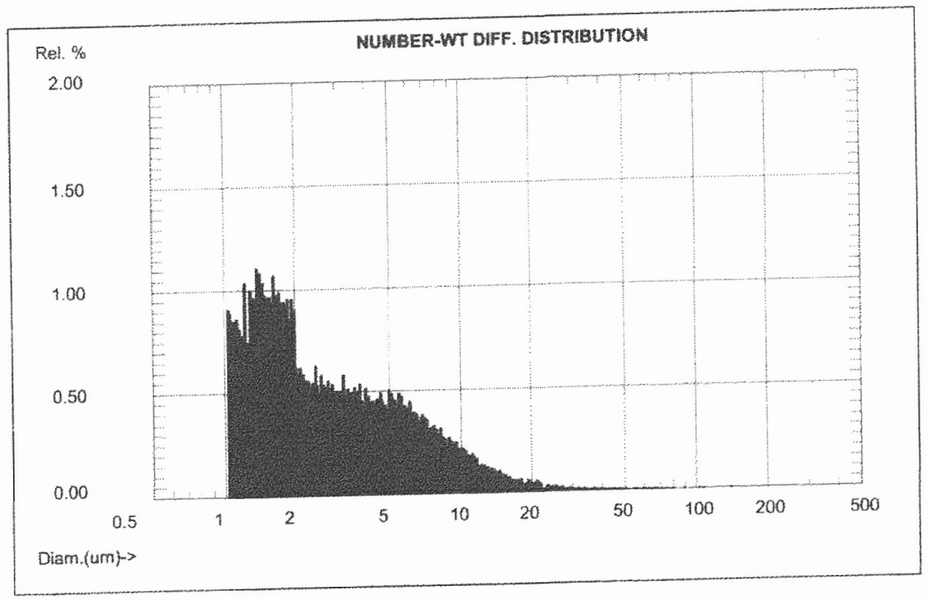
Particle Sizing Systems, Inc.
Santa Barbara, Calif., USA

Model 770 AccuSizer

Sample XH#2 50uL (9-16-05) iron particles repeat
File Name = IRON1.5 Time Date = 13:57:29 9/16/2005
Sensor Model: LE400-0.5 EXT S/N: 9911903 Cal. File: WETSUM~1.SNS

Elapsed Time of Data Collection = 120 Sec.
Background File = NONE
Total # Part. Sized (>=Thres. 1.05 um) = 126238
Calculated Total No. of Particles in Sample = 218924
Dilution Factor = 1.73
Fluid Volume Sampled = 120.0 ml No. of Channels = 512
NUM-WT Mean = 3.93 um Mode = 1.40 um Median = 2.40
VOL-WT Mean = 36.44 um Mode = 143.54 um Median = 24.79 (0.000 % Threshold)

Summary for the Indicated Size Range of 0.50 um to 493.30 um :
No. of Particles Sized = 126238 (Volume = 3.66E-005 cc)
X Dilution Factor of 1.734 Yields
Cal. Total # of Particles = 218924 (Volume = 6.347E-005 cc)
= 0.635 % of Total Particle Volume Inj. (1.000E+000 cc, Conc= 1.00 %)



Xiihua He 9/30/05

X.H 7/14/08

continued from page 60

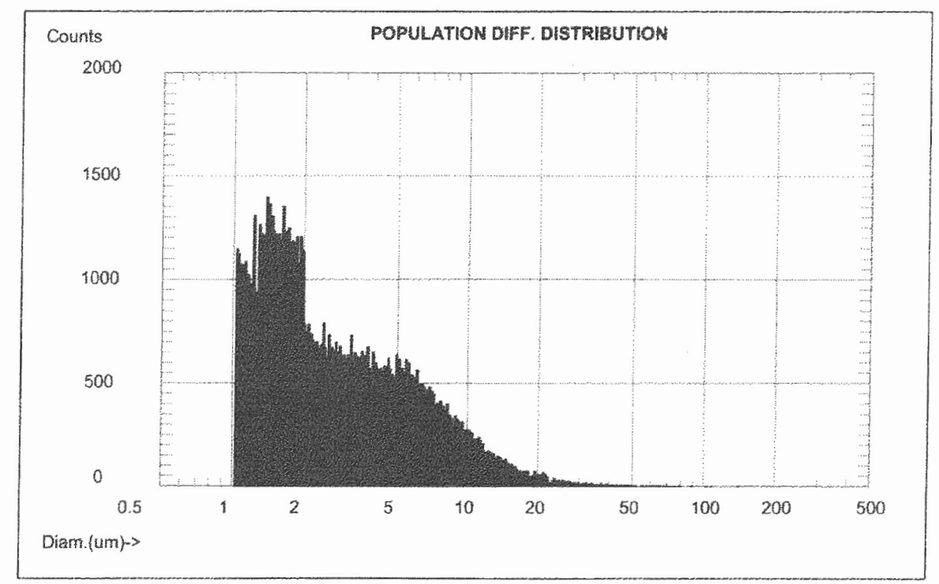
Particle Sizing Systems, Inc.
Santa Barbara, Calif., USA

Model 770 AccuSizer

Sample XH#2 50uL (9-16-05) iron particles repeat
File Name = IRON1.5 Time Date = 13:57:29 9/16/2005
Sensor Model: LE400-0.5 EXT S/N: 9911903 Cal. File: WETSUM~1.SNS

Elapsed Time of Data Collection = 120 Sec.
Background File = NONE
Total # Part. Sized (>=Thres. 1.05 um) = 126238
Calculated Total No. of Particles in Sample = 218924
Dilution Factor = 1.73
Fluid Volume Sampled = 120.0 ml No. of Channels = 512
NUM-WT Mean = 3.93 um Mode = 1.40 um Median = 2.40
VOL-WT Mean = 36.44 um Mode = 143.54 um Median = 24.79 (0.000 % Threshold)

Summary for the Indicated Size Range of 0.50 um to 493.30 um :
No. of Particles Sized = 126238 (Volume = 3.66E-005 cc)
X Dilution Factor of 1.734 Yields
Cal. Total # of Particles = 218924 (Volume = 6.347E-005 cc)
= 0.635 % of Total Particle Volume Inj. (1.000E+000 cc, Conc= 1.00 %)



IRON1.5

Xiihua He 9/30/05

X.H 7/14/08

Continued from page 60

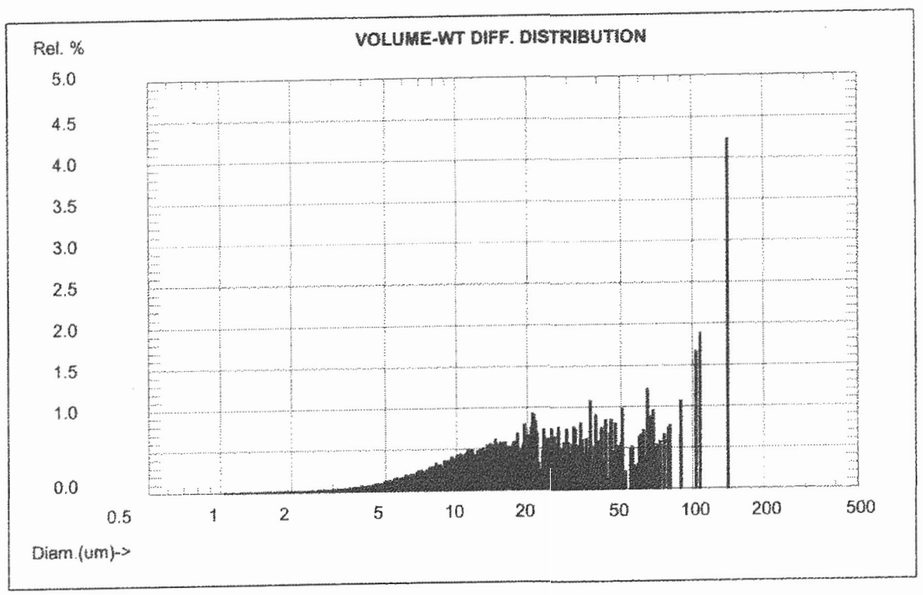
Particle Sizing Systems, Inc.
Santa Barbara, Calif., USA

Model 770 AccuSizer

Sample XH#2 50uL (9-16-05) iron particles repeat
File Name = IRON1.5 Time Date = 13:57:29 9/16/2005
Sensor Model: LE400-0.5 EXT S/N: 9911903 Cal. File: WETSUM~1.SNS

Elapsed Time of Data Collection = 120 Sec.
Background File = NONE
Total # Part. Sized (>=Thres. 1.05 um) = 126238
Calculated Total No. of Particles in Sample = 218924
Dilution Factor = 1.73
Fluid Volume Sampled = 120.0 ml No. of Channels = 512
NUM-WT Mean = 3.93 um Mode = 1.40 um Median = 2.40
VOL-WT Mean = 36.44 um Mode = 143.54 um Median = 24.79 (0.000 % Threshold)

Summary for the Indicated Size Range of 0.50 um to 493.30 um :
No. of Particles Sized = 126238 (Volume = 3.66E-005 cc)
X Dilution Factor of 1.734 Yields
Cal. Total # of Particles = 218924 (Volume = 6.347E-005 cc)
= 0.635 % of Total Particle Volume Inj. (1.000E+000 cc, Conc= 1.00 %)



IRON1.5

Xihua He 9/30/05

X.H 7/14/08

~~Continued from page 49~~

~~Time for pH measurement~~		~~pH~~	~~ID for ICP analysis~~
~~9/16/05~~	~~3:30 p.m~~	~~9.71~~	
~~9/22/05~~	~~8:40 a.m~~	~~9.89~~	~~60-Rb~~
~~9/26/05~~	~~8:40 a.m~~	~~9.97~~	~~60-Rb~~
~~9/29/05~~	~~11:00 a.m~~	~~9.82~~	

X.H 10/17/05

Continued from page 49

Time for pH measurement		pH	ID for ICP analysis
9/16/05	3:30 p.m	9.71	
9/22/05	8:40 a.m	9.89	60-Rb
9/26/05	8:40 a.m	9.97	60-Rb
10/5/05	10:25 a.m	10.11	
10/10/05	9:20 a.m	10.08	
10/10/05	4:20 pm	draw 0.5 ml solution for particle size distribution analysis	
10/14/05	8:30 a.m	10.05	
10/17/05	2:00 p.m	10.07	60-Sb
	stop test		

Solution and particles were drawn for particle size distribution analysis
Carbon steel and glass samples were cleaned and dried for SEM analysis.

Xihua He 10/17/05

X.H 7/14/08

Samples for ICP analysis from Test J13A51660PH6 (pages 48, 49, & 63)

SAMPLE LIST/CHAIN OF CUSTODY
Southwest Research Institute®
Chemistry and Chemical Engineering Division
6220 Culebra Road
San Antonio, Texas 78238-5166

Client Purchase Order/Other ID: Site/Zone ID

Requested Turnaround: ☐ 2 Weeks ☐ 3 Weeks ☐ Other: 10 days - 2 wks

SwRI Contact: Xihua He X5194

Client: Div 20 Xihua He X5194

Shipper Name/Address:

Analyses Requested: ICP Analysis See additional sheet; Metals 40

REMARKS
Preservation
a = HCl to pH <2
b = HNO_3 to pH <2
c = H_2SO_4 to pH <2
d = NaOH to pH >12
e = Cool (4°C±2°C)
f = Other (specify)

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers
60-OS	10/21/05	10:00	L		1
60-PB					1
60-QB					1
60-RB					1
60-SB					2

Matrix Types:
A – Air
B – Biota
D - Dust
E – Emission/Stack
L - Liquid
P – Product
Sd - Solid
S – Soil
SED – Sediment
T - Tissue
W - Water
WP - Wipe

Sample Types:
D - Duplicate
ER – Equipment Rinsate
ES – Environmental Sample
FB – Field Blank
FD – Field Duplicate
MS – Matrix Spike
MSD – Matrix Spike Dup
TB – Trip Blank

Therm #:
Temp:
Comments:

SwRI Project#: 20.06062.01.222

	Date	Time
Relinquished by (Print/Signature): Brian K. Debay	10/21/05	10:00
Received by (Print/Signature):	Date	Time
Relinquished by (Print/Signature):	Date	Time
Received by (Print/Signature):	Date	Time
Relinquished by (Print/Signature):	Date	Time

Received by SwRI Lab: (Signature)

Samples Disposed: Date Time

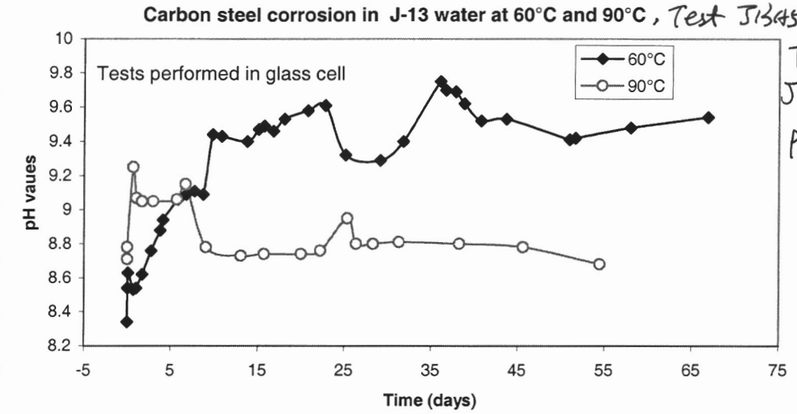
Samples Disposed by:

Page ____ of ____

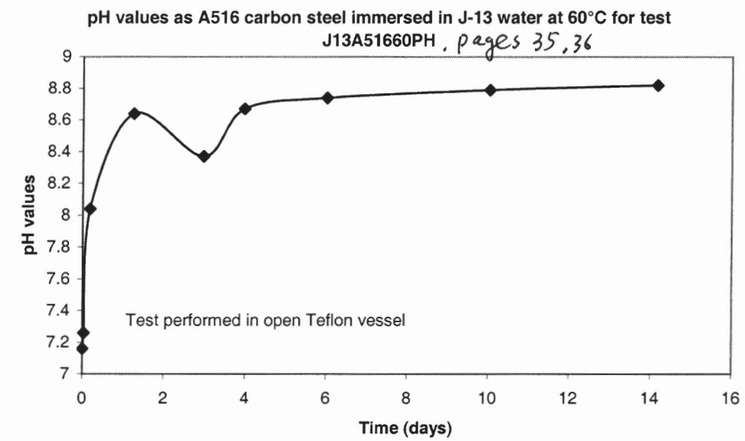
Div 01 COC Form 01-01-001, Rev 8/02

Xihua He 10/21/05

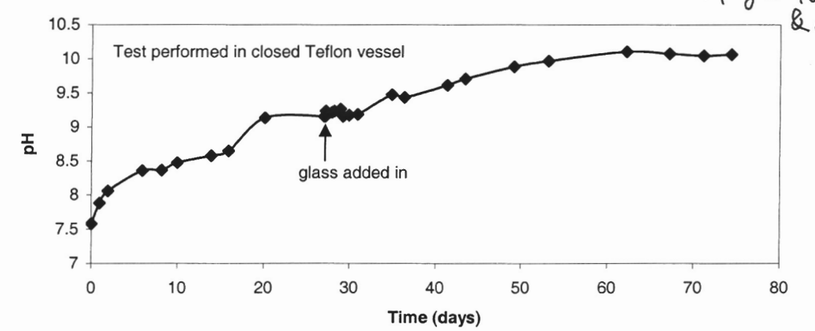
pH as a function of time



Test J13A51660C & Test J13A51690C, Pages 7 & 10



, pages 35, 36



, pages 48, 49 & 63

Xihua He 10/28/05

Particle size distribution analysis for Test J13A51660PHb, solution and particles drawn on 10/10/05, page 63.

BECKMAN COULTER PCS Submicron Particle Size Analyzer

Page 1 of 1
Sample: XH2.1 101005

Sample Name: XH2.1 101005

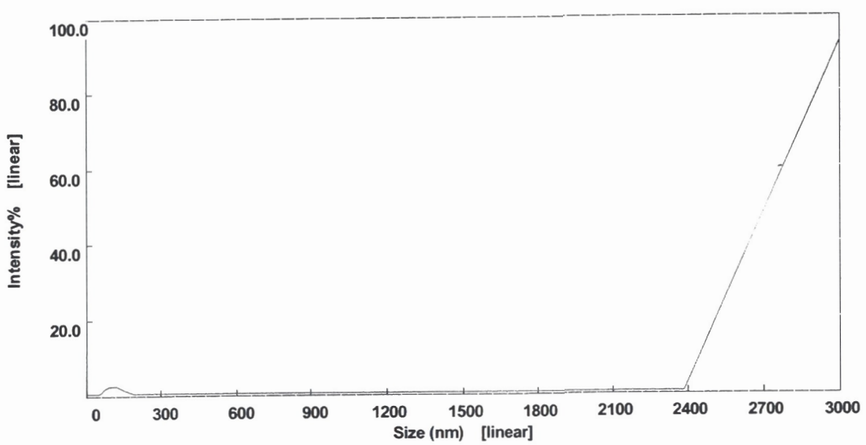
Comments: Iron Particles 5ul/2ml
Operator: jdt
Temperature: 20.0°C
Start Time: 10-Oct-05 06:39:21 PM
Auto SDP: Yes
Angle: 90.0 °
Run Time(manual): 180s
Sample Time(auto): 13.5 us
Prescale(auto): 16

SOM / SOP Name: InAHurry - water.som
Diluent: WATER
End Time: 10-Oct-05 06:44:54 PM

90.0°, Repetition 1 SDP Set 1 Intensity Analysis

SDP Results Summary

Angle	Parameter	Calculated Results					
	SDP Range (nm)	Size (nm)	%amt (nm)	Std.Dev (nm)	Mean Size (nm)	Mean SD (nm)	%Dust
90.0°	3.0-3000.0	102.9	6.39	30.2	2815.0	850.1	16.149
		3000.0	93.61	205.5			



C:\Program Files\PCSControl\Data\XH2.1 101005.dat Printed on: Oct-10-2005 18:46:05 Software Version 3.02

Xihua He 10/21/05

Particle size distribution analysis for Test J13A51660PHb, solution and particles were drawn on 10/10/05. page 63

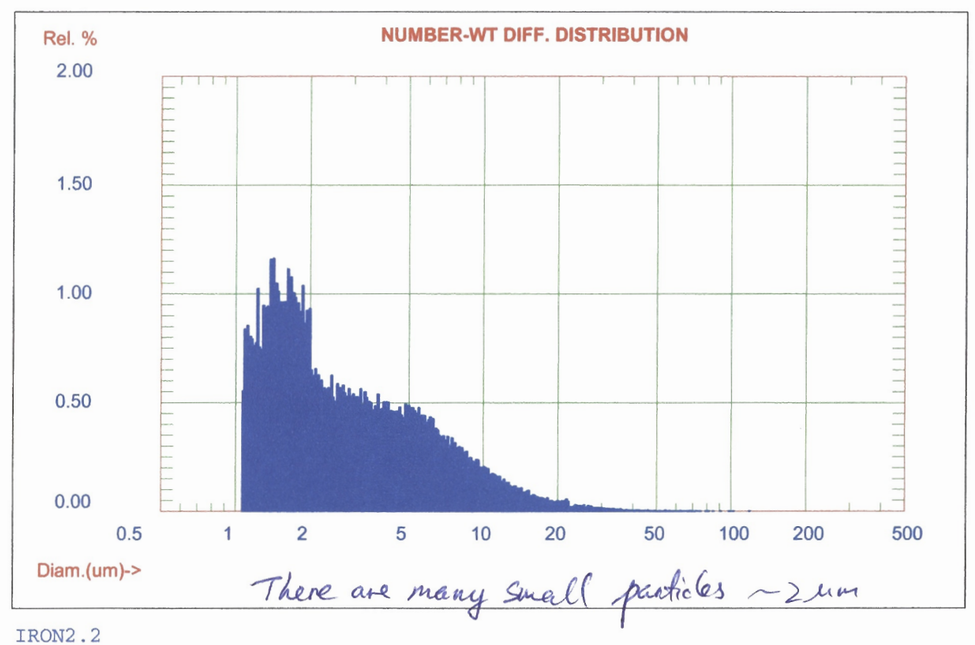
Particle Sizing Systems, Inc.
Santa Barbara, Calif., USA

Model 770 AccuSizer

```
XH#2 50ul (10-11-05) iron particles
File Name = IRON2.2    Time Date = 18:35:48 10/11/2005
Sensor Model: LE400-0.5 EXT    S/N: 9911903    Cal. File: WETSUM~1.SNS

Elapsed Time of Data Collection = 120 Sec.
Background File = NONE
Total # Part. Sized (>=Thres. 1.08 um ) = 218295
Calculated Total No. of Particles in Sample = 378347
Dilution Factor = 1.73
Fluid Volume Sampled = 120.0 ml       No. of Channels = 512
NUM-WT Mean =   3.98 um  Mode =   1.44 um Median = 2.45
VOL-WT Mean =  32.22 um  Mode = 120.45 um Median = 24.75 (0.000 % Threshold)

Summary for the Indicated Size Range of 0.50 um to 493.30 um :
No. of Particles Sized = 218295 (Volume = 6.48E-005 cc)
 X Dilution Factor of 1.733 Yields
Cal. Total # of Particles = 378347 (Volume = 1.123E-004 cc)
= 1.123 % of Total Particle Volume Inj. (1.000E+000 cc, Conc= 1.00 %)
```



IRON2.2

Xihua He 10/21/05

Continued from page 67.

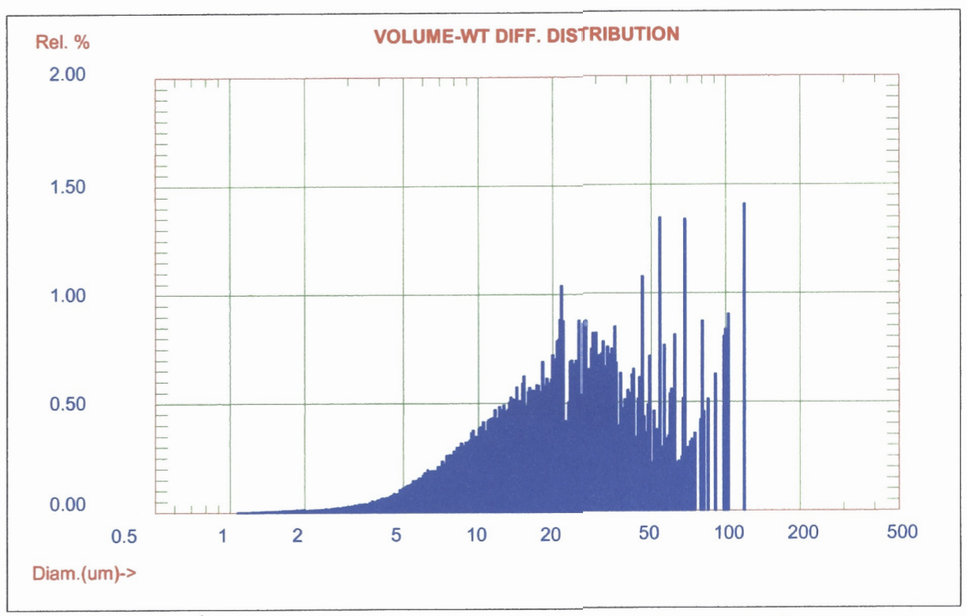
Particle Sizing Systems, Inc.
Santa Barbara, Calif., USA

Model 770 AccuSizer

```
XH#2 50ul (10-11-05) iron particles
File Name = IRON2.2    Time Date = 18:35:48 10/11/2005
Sensor Model: LE400-0.5 EXT    S/N: 9911903    Cal. File: WETSUM~1.SNS

Elapsed Time of Data Collection = 120 Sec.
Background File = NONE
Total # Part. Sized (>=Thres. 1.08 um ) = 218295
Calculated Total No. of Particles in Sample = 378347
Dilution Factor = 1.73
Fluid Volume Sampled = 120.0 ml       No. of Channels = 512
NUM-WT Mean =   3.98 um  Mode =   1.44 um Median = 2.45
VOL-WT Mean =  32.22 um  Mode = 120.45 um Median = 24.75 (0.000 % Threshold)

Summary for the Indicated Size Range of 0.50 um to 493.30 um :
No. of Particles Sized = 218295 (Volume = 6.48E-005 cc)
 X Dilution Factor of 1.733 Yields
Cal. Total # of Particles = 378347 (Volume = 1.123E-004 cc)
= 1.123 % of Total Particle Volume Inj. (1.000E+000 cc, Conc= 1.00 %)
```



IRON2.2

Large particles ~~occupies~~ occupy large volume. X.H 10/21/05

Xihua He 10/21/05

Particle size distribution analysis for Test J13B5166OPHb, solution and particles drawn after test 10/17/05 final solution, page 63

BECKMAN COULTER

PCS Submicron Particle Size Analyzer

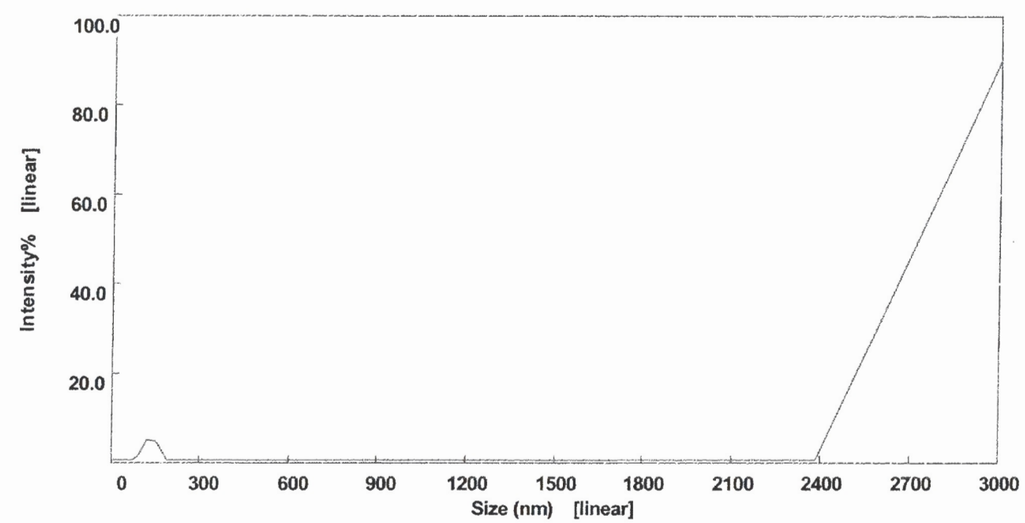
Sample Name: XH3.1 101805

Comments: iron particles J13
Operator: jdt
Temperature: 20.0°C
Start Time: 18-Oct-05 07:18:20 PM
Auto SDP: Yes
Angle: 90.0 °
Run Time(manual): 180s
Sample Time(auto): 11 us
Prescale(auto): 16

SOM / SOP Name: InAHurry - water.som
Diluent: WATER
End Time: 18-Oct-05 07:23:53 PM

90.0°, Repetition 1 SDP Set 1 Intensity Analysis
SDP Results Summary

Angle	Parameter	Calculated Results					
	SDP Range (nm)	Size (nm)	%amt (nm)	Std.Dev (nm)	Mean Size (nm)	Mean SD (nm)	%Dust
90.0°	3.0-3000.0	130.0	9.64	20.9	2723.4	1016.4	1.284
		3000.0	90.36	205.5			



Xihua He 10/28/05

continued from page 69

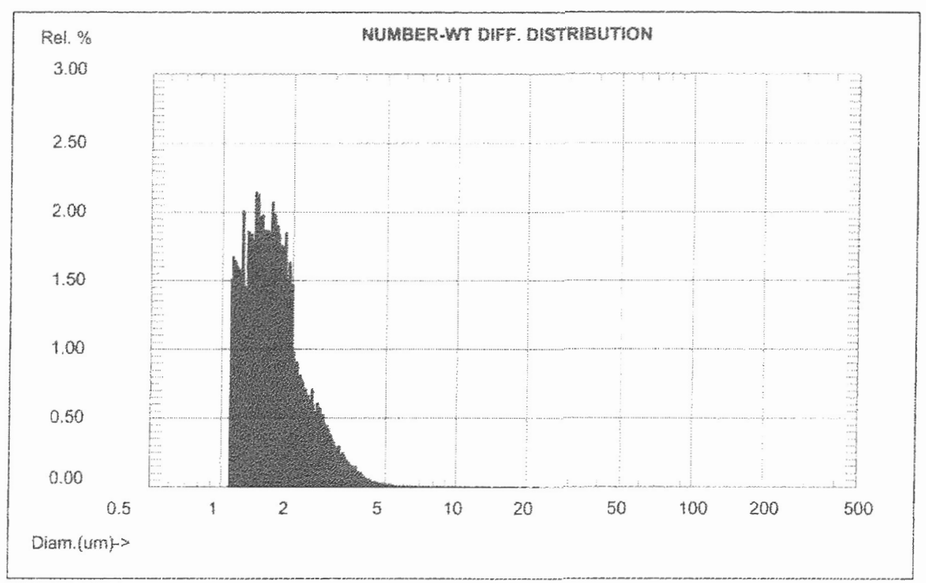
Particle Sizing Systems, Inc.
Santa Barbara, Calif., USA

Model 770 AccuSizer

2micron in ipa 10/2705
File Name = IRONSTD.31 Time Date = 10:39: 1 10/27/2005
Sensor Model: LE400-0.5 EXT S/N: 9911903 Cal. File: WETSUM~1.SNS

Elapsed Time of Data Collection = 120 Sec.
Background File = NONE
Total # Part. Sized (>=Thres. 1.11 um) = 486953
Calculated Total No. of Particles in Sample = 2725279
Dilution Factor = 5.60
Fluid Volume Sampled = 120.0 ml No. of Channels = 512
NUM-WT Mean = 1.81 um Mode = 1.40 um Median = 1.63
VOL-WT Mean = 5.20 um Mode = 49.44 um Median = 2.69 (0.000 % Threshold)

Summary for the Indicated Size Range of 0.50 um to 493.30 um :
No. of Particles Sized = 486953 (Volume = 2.46E-006 cc)
X Dilution Factor of 5.597 Yields
Cal. Total # of Particles = 2725279 (Volume = 1.380E-005 cc)
= 0.138 % of Total Particle Volume Inj. (1.000E+000 cc, Conc= 1.00 %)



Xihua He 10/28/05

Continued from page 69

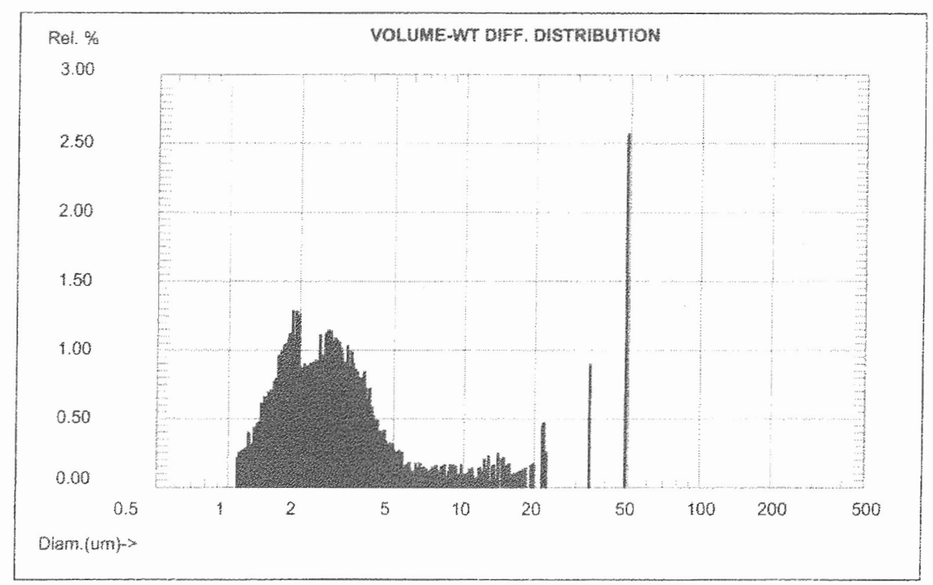
Particle Sizing Systems, Inc.
Santa Barbara, Calif., USA

Model 770 AccuSizer

2micron in ipa 10/2705
File Name = IRONSTD.31 Time Date = 10:39: 1 10/27/2005
Sensor Model: LE400-0.5 EXT S/N: 9911903 Cal. File: WETSUM~1.SNS

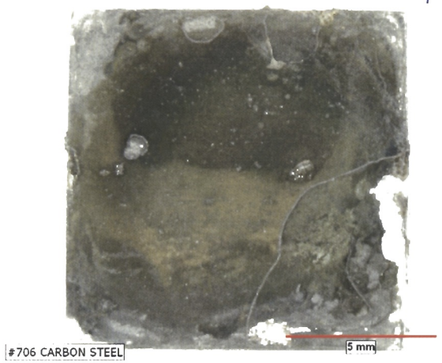
Elapsed Time of Data Collection = 120 Sec.
Background File = NONE
Total # Part. Sized (>=Thres. 1.11 um) = 486953
Calculated Total No. of Particles in Sample = 2725279
Dilution Factor = 5.60
Fluid Volume Sampled = 120.0 ml No. of Channels = 512
NUM-WT Mean = 1.81 um Mode = 1.40 um Median = 1.63
VOL-WT Mean = 5.20 um Mode = 49.44 um Median = 2.69 (0.000 % Threshold)

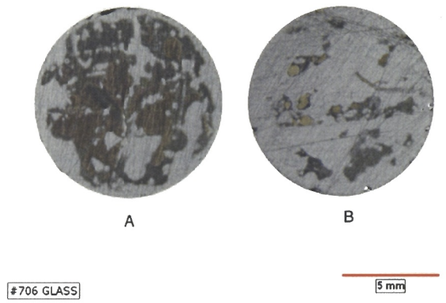
Summary for the Indicated Size Range of 0.50 um to 493.30 um :
No. of Particles Sized = 486953 (Volume = 2.46E-006 cc)
X Dilution Factor of 5.597 Yields
Cal. Total # of Particles = 2725279 (Volume = 1.380E-005 cc)
= 0.138 % of Total Particle Volume Inj. (1.000E+000 cc, Conc= 1.00 %)

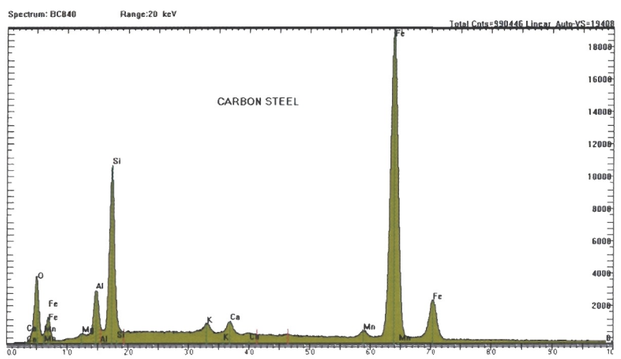


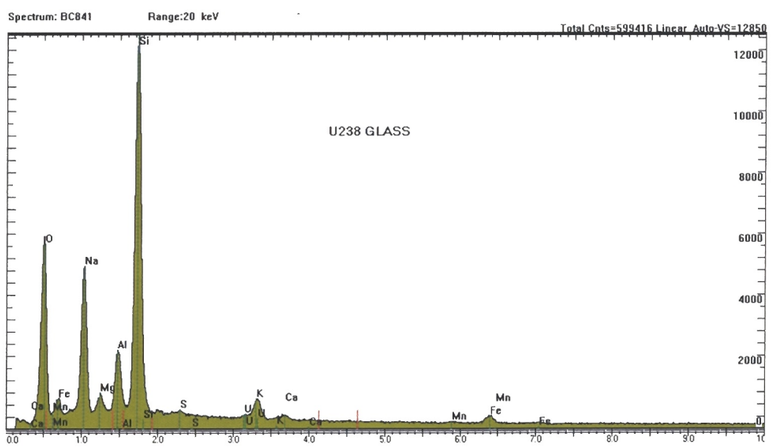
Xihua He 10/28/05

Corroded carbon steel and glass specimens from Test J13A51660PHb, page 48



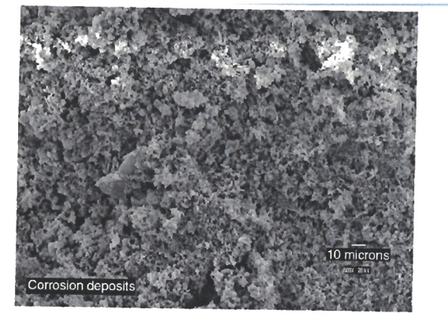


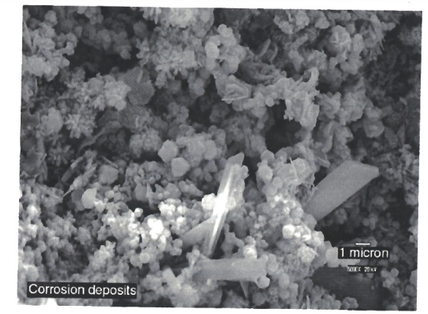


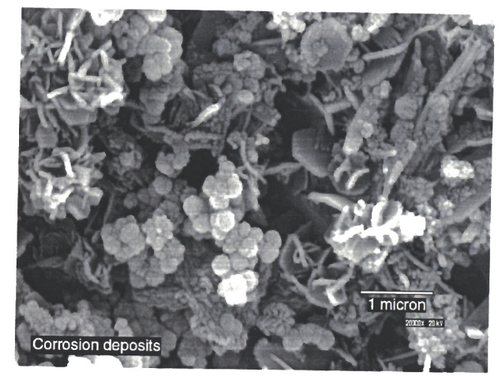


Xihua He 10/28/05

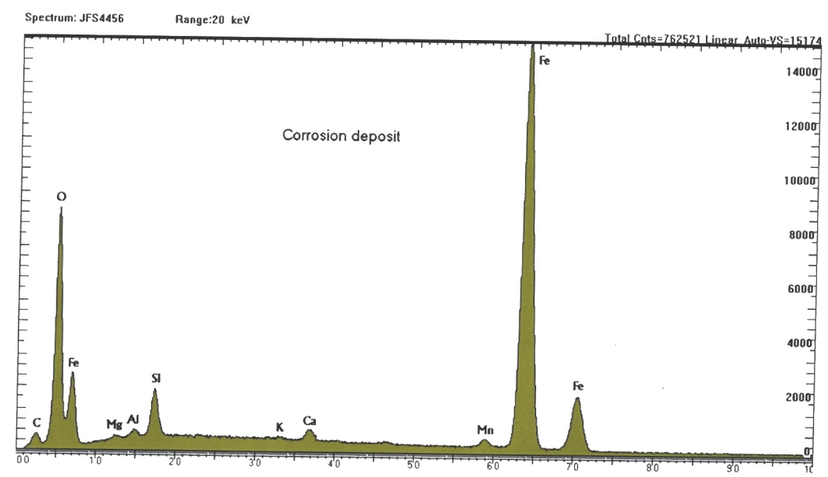
SEM and EDX of corrosion deposits in solution after test J13A51660PHb, page 48







Note:
The corrosion deposits are primarily iron oxides with small amount of Si.



Xihua He 10/28/05

ICP analysis results for solutions drawn from Test J13B51660PMb, page 48, 49 & 63.

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

Sample ID P.1
60-OB

Lab Name: Southwest Research Institute
Client: Division 20
Lab Code: SwRI
Date Received: 10/21/05
Matrix: Liquid
Project No.: 06002.01.222
Lab System ID: 268844
SRR: 28178
Method: ICP SW846 6010B
Task Order: 051021-5

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	2.18	0.500
Iron	1.04	1.00
Silicon	5.99	1.00
Sulfur	6.30	0.500

Most of the liquid samples contained some solid residue. Only the liquid portions were analyzed as per Xihua He's request on October 24, 2005. Prior to analysis, the samples were centrifuged for 10 minutes at 2000rpm to remove any solids.

Sample ID
60-PB

Lab Name: Southwest Research Institute
Client: Division 20
Lab Code: SwRI
Date Received: 10/21/05
Matrix: Liquid
Project No.: 06002.01.222
Lab System ID: 268845
SRR: 28178
Method: ICP SW846 6010B
Task Order: 051021-5

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	2.76	0.500
Iron	<1.00	1.00
Silicon	6.64	1.00
Sulfur	5.91	0.500

Xihua He 11/1/05

continued from page 74

K.H 11/4/08

Sample ID
60-QB

Lab Name: Southwest Research Institute
Client: Division 20
Lab Code: SwRI
Date Received: 10/21/05
Matrix: Liquid
Project No.: 06002.01.222
Lab System ID: 268846
SRR: 28178
Method: ICP SW846 6010B
Task Order: 051021-5

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	5.54	0.500
Iron	1.37	1.00
Silicon	10.4	1.00
Sulfur	5.30	0.500

Sample ID
60-RB

Lab Name: Southwest Research Institute
Client: Division 20
Lab Code: SwRI
Date Received: 10/21/05
Matrix: Liquid
Project No.: 06002.01.222
Lab System ID: 268847
SRR: 28178
Method: ICP SW846 6010B
Task Order: 051021-5

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	6.34	0.500
Iron	1.47	1.00
Silicon	11.2	1.00
Sulfur	5.16	0.500

Xihua He 11/1/05

 Continued from page 74

Sample ID
60-SB

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 268848

Method: ICP SW846 6010B

Client: Division 20

Date Received: 10/21/05

Project No.: 06002.01.222

SRR: 28178

Task Order: 051021-5

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	10.5	0.500
Iron	5.63	1.00
Silicon	16.8	1.00
Sulfur	4.21	0.500

Sample ID
PBW - K25H1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Method: ICP SW846 6010B

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 28178

Task Order: 051021-5

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Boron	<0.500	0.500
Iron	<1.00	1.00
Silicon	<1.00	1.00
Sulfur	<0.500	0.500

Sample ID
LCSW - K25H1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Method: ICP SW846 6010B

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

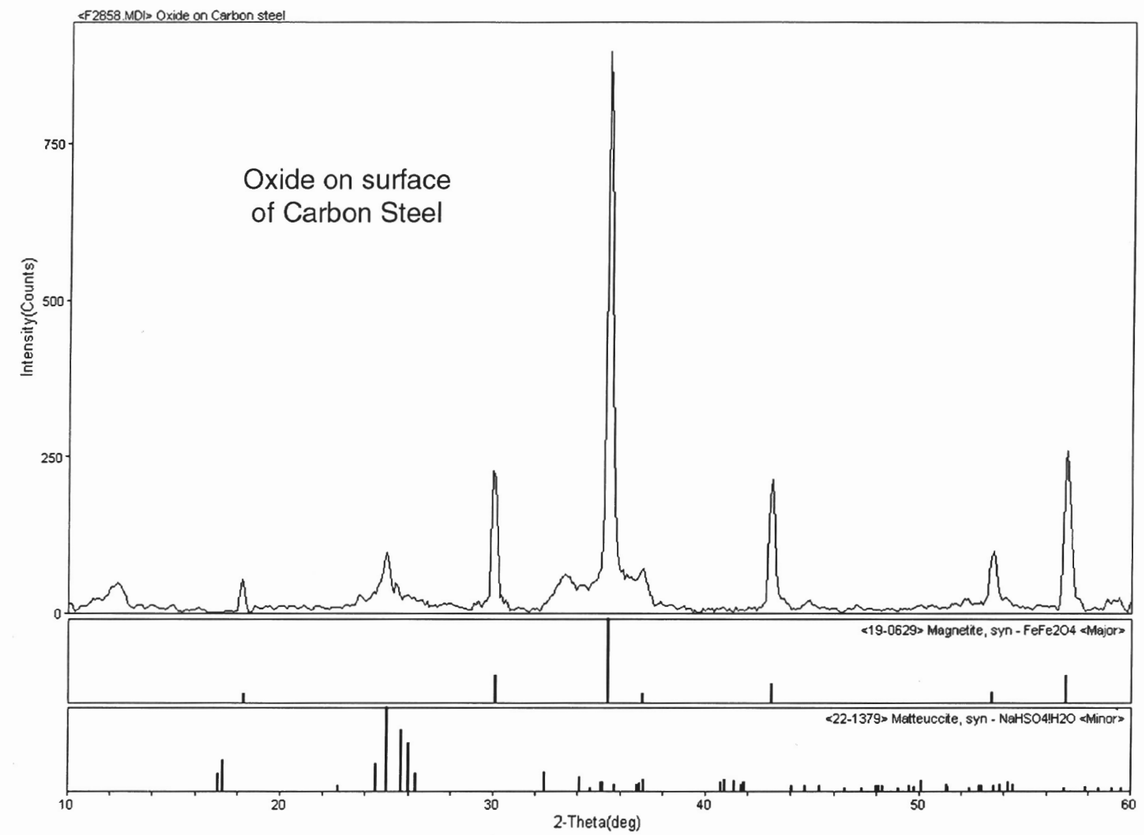
SRR: 28178

Task Order: 051021-5

Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Boron	102	100	102%
Iron	27.6	25.0	110%
Silicon	102	100	102%
Sulfur	102	100	102%

Xihua He
11/1/05

XRD of post-test specimen
Test J13A51660PHb, page 48
The picture of the sample is on page 72.



The main corrosion product on surface is magnetite.

X.H 7/14/08

Xihua He 1/26/06

In-package Chemistry Test

Test ID: CSPOREH201 Test time: 1/17/2006 ~

Specimen: A516 carbon steel, Heat # D84944

Specimen Preparation: Specimen machined to small coupons. Coupon surfaces polished to 600 Grit finish using SiC paper. Coupon rinsed in DI water and cleaned in acetone.

Number of carbon steel coupons used in the test: 3 for each test cell

Caron steel coupon weight measured by balance	**Balance Model:** Sartorius Genius **Cal:** 11/14/05	**SN:** 12809099 **Due:** 5/12/06
Carbon steel coupon dimensions measured by caliper	**Caliper Model:** Starrett **Cal:** 3/24/05	**SN:** 03031512 **Due:** 3/24/06
Reagents measured with balance	**Balance Model:** OHAUS **Cal:** 1/5/06	**SN:** 2883 **Due:** 7/5/06
pH measured with pH meter	**Model:** ORION EA 920 **Cal:** 2/10/05 **pH Probe:** 13-620-296	**SN: S001A** **Due:** 2/10/06 **SN:** 4079147 p
Test Temperature: 60°C	**Measured with Thermometer** **Cal:** 6/7/05 **Thermocouple** **Cal:** 1/12/06	**Fisher SN#** 41523645 **Due:** 6/7/06 **SN:** 333 **Due:** 7/12/06
Potentiostat for OCP measurement:	**SI1480** **Cal:** 12/21/05	**SN:** 00238265 **Due:** 6/21/06

Solution: Simulated Pore Water

Stock A=	$CaSO_4\ 2H_2O$	2.245 g	lot# 4300kbtr
	$Ca(NO_3)_2\ 4H_2O$	0.032 g	lot# 027190
	KCl	0.47 g	lot# 043820
	$MgCl_2\ 6H_2O$	1.129 g	lot# 050439
	$CaCl_2$	0.726 g	lot# 025259
	D.I. water to 1000 mL		
Stock B=	$NaHCO_3$	16.487g	lot# 052751
	NaF	0.544g	lot# 006679
	D.I. water to 1000 mL		

Test cell: 250-ml glass test cell lined with Teflon. Condenser was used to minimize evaporation.

~12-mL of deionized water was put in the gap between the glass and Teflon liner.

Stock C= 50 mL of Stock A + 50 mL of stock B +D.I water to 2000 mL

(stock C solution was used for tests) pH = 8.48

Specimen dimensions:

Cell#1 (1) 4.99x12.91x12.36 (2) 5.02X12.37X12.84 (3) 5.43X12.65X12.33 mm^3
Total Weight= 18.58157 g Total calculated surface area: 17.25 cm^2

Cell#2 (1) 4.23x12.41x12.63 (2) 5.21x12.33x12.81 (3) 5.27x12.76x12.41 mm^3
Total Weight= 17.53542 g Total calculated surface area: 17.10 cm^2

Cell#3 (1) 4.77x12.55x12.27 (2) 5.40x12.57x12.36 (3) 4.03x12.75x12.38 mm^3
Total Weight= 16.76215 g Total calculated surface area: 16.42 cm^2

Cell#4 (1) 5.33x12.22x12.59 (2) 5.00x12.31x12.55 **(3)** 4.75x12.18x12.49 mm^3
Total Weight= ~~11~~ 11.95898g x.H 3/22/06 Total calculated surface area: 16.68 cm^2

Threaded specimen= 5.31531g #3 specimen for open circuit measurement

Solution Volume for each test cell Volume (mL) = 13.7 × specimen surface area (cm^2)

Cell #1 = 236mL Cell #2 = 234mL Cell #3 = 225mL Cell #4 = 229mL

Xihua He 1/19/06

Chemical composition in Solution C (page 78)

	Actual amount in test(before dilute), g/L	Actual amount in test, g/L	Actual amount in test, mol/L		Total amount in tests, mg/L	Total amount in tests, mol/L
CaSO4-2H2O	2.245	0.056125	0.000326	Ca^{2+}	18.14841	0.00045283
Ca(NO3)2-4H2O	0.032	0.0008	3.388E-06	SO_4^{2-}	31.31502	0.00032598
KCl	0.47	0.01175	0.0001576	NO_3^-	0.420108	6.7754E-06
MgCl2-6H2O	1.129	0.028225	0.0001388	K^+	6.162267	0.00015761
NaHCO3	16.487	0.412175	0.0049064	Cl^-	24.18567	0.00068219
NaF	0.544	0.0136	0.0003239	Mg^{2+}	3.37433	0.00013883
CaCl2-2H2O	0.726	0.01815	0.0001235	Na^+	120.2445	0.00523034
				F^-	6.153592	0.0003239
				HCO_3^-	299.3769	0.00490644

Test ID: CSPOREH2O1
Carbon Steel Immersed in Simulated Pore Water

		CELL#1		CELL#2		CELL#3		CELL#4	
DATE TIME		TEMP	pH	TEMP	pH	TEMP	pH	TEMP	pH
1/17/2006	13:30	58	8.33	57	8.29	58	8.26	57	8.17
1/17/2006	16:50	60	8.25	59	8.28	59	8.34	60	8.24
1/18/2006	7:50	59	8.17	59	8.31	60	8.37	60	8.43
1/18/2006	17:00		8.27		8.39		8.41		8.51
1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in. Solution ID: PORECS1									
1/19/2006	8:00	60.2	8.33	59.7	8.51	60.3	8.55	59.8	8.62
1/20/2006	8:30	60.1	8.56	59.8	8.63	60.1	8.67	60	9.03
1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in. Solution ID: PORECS2									
1/23/2006	8:30		9.04		9.07		9.1		9.15
1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in. Solution ID: PORECS3									
1/24/2006	8:30	60.3	9.16	60.2	9.19	59.8	9.09	60.1	9.14
1/25/2006	8:10		9.24		9.22		9.11		9.16
1/26/2006	8:00		9.36		9.28		9.12		9.18
1/27/2006	9:30		9.42		9.29		8.97		9.19
1/30/2006	8:05	59.5	9.46	59.8	9.19	60.2	8.73	59.6	9.18
1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in. Solution ID: PORECS4									
1/31/2006	8:30		9.45		9.16		8.68		9.13
WILL LEAVE UNTIL FRIDAY TO TAKE pH READINGS and TEMP.									
2/3/2006	8:15	60.4	9.34	59.8	8.99	60.6	8.65	59.8	9.02
2/6/2006	9:00	59.7	9.16	60.2	8.82	59.8	8.66	60.3	8.92
2/10/2006	10:00	60.1	9.25	59.8	8.93	60.3	8.84	60.1	8.89

Test is still in progress. Continued at next page

Xihua He 2/6/06

		CELL#1		CELL#2		CELL#3		CELL#4	
DATE TIME		TEMP	pH	TEMP	pH	TEMP	pH	TEMP	pH
1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in. Solution ID: PORECS5									
2/13/2006	9:00	60.2	9.17	60.1	8.99	59.8	8.89	60.2	8.99
2/17/2006	8:00	61.5	8.92	60.8	9.11	61.1	9.04	61.4	8.95
2/20/2006	8:00	61.4	8.85	61.6	9.09	62.1	9.06	61.6	8.82
1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in. Solution ID: PORECS6									
2/21/2006	pH meter went to Cal Lab			Cal: 2/21/06		Due: 2/21/07			
2/24/2006	12:00	60.6	8.67	61.2	9.13	61.4	9.1	60.8	8.86
2/27/2006	9:00	61.2	8.99	61	9.11	60.8	9.18	61.2	8.78
3/3/2006	8:30	60.8	9.02	61.2	9.18	61.2	9.23	60.6	8.83
3/6/2006	8:00	60.7	9.06	60.6	9.26	59.8	9.3	60.4	8.89
3/10/2006	7:30	60.4	8.98	61.2	9.31	60.4	9.36	60.2	8.93
1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in. Solution ID: PORECS7									
3/13/2006	9:00	60.6	9.1	60.8	9.34	60.4	9.39	60.4	8.94
3/16/2006	9:30	61.2	9.12	60.8	9.41	60.2	9.46	60.1	8.99
3/20/2006	9:30	61	9.1	60.6	9.38	60.4	9.36	60.4	8.87
3/22/2006	9:00	60.6	9.18	60.6	9.47	60.6	9.5	60.2	9.06
1mL solution was drawn from cell #1 for ICP analysis. Solution ID: PORECS8									
1mL solution was drawn from cell #2 for ICP analysis Solution ID: CELL2-60									
1mL solution was drawn from cell #3 for ICP analysis Solution ID: CELL3-60									
1mL solution was drawn from cell #4 for ICP analysis Solution ID: CELL4-60									
At 9:22 a.m, 3/22/06 SHUTDOWN HEAT CONTROLLERS FOR TEST CELLS 1, 2, and 3									
3/22/2006	10.44a.m	31.3	9.51	32.3	9.83	32.1	9.86	60.2	9.06
1mL solution was drawn from cell #1 for ICP analysis, Solution ID: PORECS9									
1mL solution was drawn from cell #2 for ICP analysis Solution ID: CELL2-25									
1mL solution was drawn from cell #3 for ICP analysis Solution ID: CELL3-25									
11:30 a.m pH of combined solution: 9.72 (Cell 1+2+3) at room temperature									

Solutions from cells 1, 2, and 3 were combined for Np-sorption tests.

pH of cell # 4 continued on Page 100

Final weight of corroded carbon steel (cleaned with D.I water and acetone)

cell#1: 18.41756 g
cell#2: 17.36888 g
cell#3: 16.64150 g

After cleaning with 25% HCl and brush:
cell#1: 18.39223 g
cell#2: 17.35127 g
cell#3: 16.62659 g 0600

X.H 5/16/06

Observation of test cells 1, 2, & 3: Lots of corrosion product deposited at bottom of test cell. carbon steel specimens were covered with black corrosion products.

Xihua He 3/22/06

* Note See pg #161 for New Cleaning Procedure Ano wts 5/24/06

Test cell #3 appeared ~~doubt~~ cloudy. There are some solution accumulated between glass and Teflon liner.

X.H 3/22/06

Solution for ICP and IC analysis:

① 5, 6, 7, 8, and 9 from Test cell 1

Solution ID's: PORECS5 drawn on 2/6/06
PORECS6 drawn on 2/20/06
PORECS7 drawn on 3/10/06
PORECS8 drawn on 3/22/06
} at 60°C

PORECS9 drawn on 3/22/06 at 25°C (room temperature)

② 2-60 drawn on 3/22/06 from cell 2 at 60°C
3-60 drawn on 3/22/06 from cell 3 at 60°C

③ 2-25 drawn on 3/22/06 from cell 2 at room temperature
3-25 drawn on 3/22/06 from cell 3 at room temperature

④ gap solution drawn from gap between glass and Liner

⑤ 25 original stock solution C (page 78)

X.H 3/22/06

On 3/22/06 add U238 Glass specimens into test cell #4 1:30pm at 2:00p.m 1ml solution was drawn for ICP analysis, solution ID: G1

	Dimensions	Diameter		thickness	measured with Caliper
	#1	9.77	× 0.85	mm × mm	Model Starrett
	#2	9.79	× 0.98	mm × mm	SN# 03031512
	#3	9.79	× 0.90	mm × mm	Cal: 3/3/06, Due 3/2/07
	#4	9.78	× 0.87	mm × mm	

Total weight: 0.73473 g measured with blance Sartorius Genius SN: 12809099 Cal: 11/14/05, Due: 5/13/06

Xihua He 3/22/06

ICP analysis for test CSPOREH201 (P. 78)

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: Xihua He **Request Date:** 1/31/06
Project No.: 20.06002.01.222 **Phone No.:** x5194
Description of Work Requested: Complete ICP Analysis of All Solution Base then #4

☐ Optical Microscopy ☐ SEM ☐ Hardness ☐ Profilometer ☐ Auger ☐ Other

***QUALITY REQUIREMENTS:** The work requested is governed by the CNWRA Quality Assurance Program which addresses requirements of 10CFR50, Appendix B. Personnel performing this work shall be qualified under the CNWRA QA program or equivalently under the SwRI Nuclear QA program. Test and analysis methods shall be documented by approved procedures or recognized, standard methods. Measuring and test equipment shall be calibrated and controlled according to CNWRA and SwRI Nuclear QA program requirements.*

Sample Identification	Description
Base	Cl^- Solution pH 8.48
#1	↓
#2	
#3	
#4	

B. TO BE COMPLETED BY DIVISION PERFORMING WORK[1]

☐ Optical Microscopy ☐ SEM ☐ Hardness ☐ Profilometer ☐ Auger ☐ Other

Person Assigned: _____ **Signature:** _____
Division: _____ **Date:** _____

Make, Model & Serial No. of Equipment Used (*attach list if necessary*): _____

Software Used (If any): _____

Standards Used (If any): _____

Photographic Negative Numbers (If Applicable): _____

[1] Please sign and date any hardcopy of analysis or list of photographs (The photographs themselves need not be signed). If error occurred during entry, do not erase or overwrite, but strikeout with single line, initial and date, and then reenter correct information.

Xihua He 1/31/06

SAMPLE LIST/CHAIN OF CUSTODY
Southwest Research Institute®
Chemistry and Chemical Engineering Division
6220 Culebra Road
San Antonio, Texas 78238-5166

Client Purchase Order/Other ID: CNWRA
Site/Zone ID:
Requested Turnaround: ☑ 2 Weeks ☐ 3 Weeks ☐ Other:
SwRI Contact: Xihua He x5194
SwRI Project#: 20.06002.01.222

Client: By 20 Xihua He x5194
Shipper Name/Address:

Analyses Requested: Complete ICP Analysis See Additional Page

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	REMARKS
Base	1/31/06	9:00 am	L		1	0.45 μm filter
#1					2	
#2					2	
#3					2	
#4					2	

Preservation: a = HCl to pH <2; b = HNO_3 to pH <2; c = H_2SO_4 to pH <2; d = NaOH to pH >12; e = Cool (4°C±2°C); f = Other (specify)

Matrix Types: A – Air; B – Biota; D – Dust; E – Emission/Stack; L – Liquid; P – Product; Sd – Solid; S – Soil; SED – Sediment; T – Tissue; W – Water; WP – Wipe

Sample Types: D - Duplicate; ER – Equipment Rinsate; ES – Environmental Sample; FB – Field Blank; FD – Field Duplicate; MS – Matrix Spike; MSD – Matrix Spike Dup; TB – Trip Blank

	Date	Time
Relinquished by (Print/Signature): Xihua He	1/31/06	10:00
Received by (Print/Signature):	Date	Time
Relinquished by (Print/Signature):	Date	Time
Received by (Print/Signature):	Date	Time
Relinquished by (Print/Signature):	Date	Time

Received by SwRI Lab (Signature): Xihua He — Date 1/31/06 Time 1055
Samples Disposed: Date ____ Time ____
Samples Disposed by:

Temp: 22.0°C Therm #: OL
Comments: Acid Filled

Div 01 COC Form 01-01-001, Rev 8/02

Page 1 of 1

ICP analysis results are shown in pages 84-92.

Xihua He 1/31/06

ICP analysis results for test CSPOREH201 (P.78)

SOUTHWEST RESEARCH INSTITUTE
SAMPLE ANALYSIS DATA SHEET

Sample ID
Base

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273124

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Calculated (p.79) (mg/L)

	Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
	Aluminum	<1.25	1.25
	Antimony	<0.250	0.250
	Arsenic	<0.125	0.125
	Barium	<0.125	0.125
	Beryllium	<0.125	0.125
	Bismuth	<0.250	0.250
→	Boron	3.17	0.500
	Cadmium	<0.125	0.125
18.15	Calcium	17.3	1.25
	Chromium	<0.125	0.125
	Cobalt	<0.125	0.125
	Copper	<0.125	0.125
	Iron	<1.25	1.25
	Lanthanum	<0.125	0.125
	Lead	<0.125	0.125
	Lithium	<0.375	0.375
3.37 →	Magnesium	3.32	1.25
	Manganese	<0.125	0.125
	Molybdenum	<0.125	0.125
	Nickel	<0.125	0.125
	Palladium	<0.250	0.250
	Phosphorus	<0.500	0.500
6.16 →	Potassium	<7.50	7.50
	Selenium	<0.125	0.125
→	Silicon	5.90	0.500
	Silver	<0.125	0.125
120 →	Sodium	119	6.25
	Strontium	<0.125	0.125
10.4 →	Sulfur	10.0	0.500
	Thallium	<0.250	0.250
	Thorium	<0.750	0.750
	Tin	<0.125	0.125
	Titanium	<0.125	0.125
	Tungsten	<0.250	0.250
	Uranium	<2.50	2.50
	Vanadium	<0.125	0.125
	Yttrium	<0.125	0.125
	Zinc	<0.125	0.125
	Zirconium	<0.125	0.125

① The calculated results (p.79) are consistent with analysis results.

② Some glass dissolved into solution due to contact with glassware.

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Xihua He 2/10/06

SOUTHWEST RESEARCH INSTITUTE
DUPLICATE SUMMARY

Sample ID
Base

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273124

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Duplicate Result (mg/L)	RPD
Aluminum	<1.25	<1.25	0.00%
Antimony	<0.250	<0.250	0.00%
Arsenic	<0.125	<0.125	0.00%
Barium	<0.125	<0.125	0.00%
Beryllium	<0.125	<0.125	0.00%
Bismuth	<0.250	<0.250	0.00%
Boron	3.17	3.18	0.31%
Cadmium	<0.125	<0.125	0.00%
Calcium	17.3	17.4	0.58%
Chromium	<0.125	<0.125	0.00%
Cobalt	<0.125	<0.125	0.00%
Copper	<0.125	<0.125	0.00%
Iron	<1.25	<1.25	0.00%
Lanthanum	<0.125	<0.125	0.00%
Lead	<0.125	<0.125	0.00%
Lithium	<0.375	<0.375	0.00%
Magnesium	3.32	3.24	2.44%
Manganese	<0.125	<0.125	0.00%
Molybdenum	<0.125	<0.125	0.00%
Nickel	<0.125	<0.125	0.00%
Palladium	<0.250	<0.250	0.00%
Phosphorus	<0.500	<0.500	0.00%
Potassium	<7.50	<7.50	0.00%
Selenium	<0.125	<0.125	0.00%
Silicon	5.90	5.95	0.84%
Silver	<0.125	<0.125	0.00%
Sodium	119	117	1.69%
Strontium	<0.125	<0.125	0.00%
Sulfur	10.0	10.2	1.98%
Thallium	<0.250	<0.250	0.00%
Thorium	<0.750	<0.750	0.00%
Tin	<0.125	<0.125	0.00%
Titanium	<0.125	<0.125	0.00%
Tungsten	<0.250	<0.250	0.00%
Uranium	<2.50	<2.50	0.00%
Vanadium	<0.125	<0.125	0.00%
Yttrium	<0.125	<0.125	0.00%
Zinc	<0.125	<0.125	0.00%
Zirconium	<0.125	<0.125	0.00%

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Xihua He 2/10/06

SOUTHWEST RESEARCH INSTITUTE
MATRIX SPIKE SUMMARY

Sample ID: Base

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273124

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Spike Result (mg/L)	Spike Added (mg/L)	Recovery
Aluminum	<1.25	46.8	50.0	93.6%
Antimony	<0.250	11.7	12.5	93.6%
Arsenic	<0.125	48.6	50.0	97.2%
Barium	<0.125	48.0	50.0	96.0%
Beryllium	<0.125	1.17	1.25	93.6%
Bismuth	NA	NA	NA	NA
Boron	NA	NA	NA	NA
Cadmium	<0.125	1.19	1.25	95.2%
Calcium	17.3	495	500	95.5%
Chromium	<0.125	4.66	5.00	93.2%
Cobalt	<0.125	12.0	12.5	96.0%
Copper	<0.125	5.92	6.25	94.7%
Iron	<1.25	27.4	25.0	109.6%
Lanthanum	NA	NA	NA	NA
Lead	<0.125	11.7	12.5	93.6%
Lithium	<0.375	93.4	100	93.4%
Magnesium	3.32	483	500	95.9%
Manganese	<0.125	11.9	12.5	95.2%
Molybdenum	NA	NA	NA	NA
Nickel	<0.125	11.7	12.5	93.6%
Palladium	NA	NA	NA	NA
Phosphorus	NA	NA	NA	NA
Potassium	<7.50	477	500	95.4%
Selenium	<0.125	50.5	50.0	101.0%
Silicon	NA	NA	NA	NA
Silver	<0.125	1.21	1.25	96.8%
Sodium	119	585	500	93.2%
Strontium	NA	NA	NA	NA
Sulfur	NA	NA	NA	NA
Thallium	<0.250	49.2	50.0	98.4%
Thorium	NA	NA	NA	NA
Tin	NA	NA	NA	NA
Titanium	NA	NA	NA	NA
Tungsten	NA	NA	NA	NA
Uranium	NA	NA	NA	NA
Vanadium	<0.125	11.8	12.5	94.4%
Yttrium	NA	NA	NA	NA
Zinc	<0.125	11.9	12.5	95.2%
Zirconium	NA	NA	NA	NA

NA- Not Applicable.

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SOUTHWEST RESEARCH INSTITUTE
SAMPLE ANALYSIS DATA SHEET

Sample ID: Sample #1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273125

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Base soln. (mg/L) (p. 84)

	Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
	Aluminum	<1.25	1.25
	Antimony	<0.250	0.250
	Arsenic	<0.125	0.125
	Barium	<0.125	0.125
	Beryllium	<0.125	0.125
	Bismuth	<0.250	0.250
→	Boron	<0.500	0.500
	Cadmium	<0.125	0.125
17.3 →	Calcium	5.05	1.25
	Chromium	<0.125	0.125
	Cobalt	<0.125	0.125
	Copper	<0.125	0.125
→	Iron	<1.25	1.25
	Lanthanum	<0.125	0.125
	Lead	<0.125	0.125
	Lithium	<0.375	0.375
3.32 →	Magnesium	3.11	1.25
	Manganese	<0.125	0.125
	Molybdenum	<0.125	0.125
	Nickel	<0.125	0.125
	Palladium	<0.250	0.250
	Phosphorus	<0.500	0.500
<7.50 →	Potassium	<7.50	7.50
	Selenium	<0.125	0.125
5.90 →	Silicon	<0.500	0.500
	Silver	<0.125	0.125
119 →	Sodium	121	6.25
	Strontium	<0.125	0.125
10.0 →	Sulfur	10.1	0.500
	Thallium	<0.250	0.250
	Thorium	<0.750	0.750
	Tin	<0.125	0.125
	Titanium	<0.125	0.125
	Tungsten	<0.250	0.250
	Uranium	<2.50	2.50
	Vanadium	<0.125	0.125
	Yttrium	<0.125	0.125
	Zinc	<0.125	0.125
	Zirconium	<0.125	0.125

(1) Negligible amount of Fe in solution

(2) The amount of Ca^{2+} decreased

(3) Other elements didn't change much.

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SOUTHWEST RESEARCH INSTITUTE
SAMPLE ANALYSIS DATA SHEET

Sample ID
Sample #2

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273126

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Base Soln. (mg/L) (P.84)

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	2.33	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.375	0.375
Magnesium	3.26	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	<7.50	7.50
Selenium	<0.125	0.125
Silicon	<0.500	0.500
Silver	<0.125	0.125
Sodium	120	6.25
Strontium	<0.125	0.125
Sulfur	10.4	0.500
Thallium	<0.250	0.250
Thorium	<0.750	0.750
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

17.3 → Calcium
<1.25 → Iron
3.32 → Magnesium
<7.50 → Potassium
→ Silicon
119 → Sodium
10.0 → Sulfur

① Negligible amount of Fe in solution
② Ca^{2+} content decreased

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SOUTHWEST RESEARCH INSTITUTE
SAMPLE ANALYSIS DATA SHEET

Sample ID
Sample #3

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273127

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Base Soln. (mg/L) (P.84)

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	1.30	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.375	0.375
Magnesium	3.23	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	11.1	7.50
Selenium	<0.125	0.125
Silicon	<0.500	0.500
Silver	<0.125	0.125
Sodium	123	6.25
Strontium	<0.125	0.125
Sulfur	10.8	0.500
Thallium	<0.250	0.250
Thorium	<0.750	0.750
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

17.3 → Calcium
<1.25 → Iron
3.32 → Magnesium
<7.50 → Potassium
→ Silicon
119 → Sodium
10.0 → Sulfur

① Negligable amount of Fe in solution
② Ca^{2+} content decreased

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