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Continuation of Notebook # 706

Xihua He - XH

Brian K. Deeby - BKD

Project #: 06002.01.222

Initial Scientific Notebook Entry for Evolution of In-Package Chemistry from Type A516 Carbon Steel or Type 316L Stainless Steel Corrosion and Glass Dissolution

Title: Evolution of In-Package Chemistry from Type A516 Carbon Steel or Type 316L Stainless Steel Corrosion and Glass Dissolution

Tests Performed by: Xihua He, Vijay Jain, Div. 20; Brian Derby, Div. 18

Objectives: Determine the solution composition and pH as functions of time and temperature due to carbon steel or Type 316L Stainless Steel corrosion and glass dissolution to support in-package chemistry abstraction

Proposed approach for achieving the objectives: Immerse the carbon steel or Type 316L Stainless Steel and high level waste glass samples in simulated J-13 well water or pore water with fixed surface area to solution volume ratios at controlled temperatures, measure the solution pH periodically, analyze solution composition by ICP to determine corrosion/dissolution rate

Equipment: 300 mL glass test cell equipped with condenser, thermocouple, thermocouple meter, temperature controller, pH probe and pH meter, balance, caliper, ICP in Div. 1
Calibration and due dates are provided in data sheets for each test
Calibration and due dates are provided in data sheets for each test
Solution: simulated J-13 water or pore water, the composition is similar to what DOE used in Technical Basis Document No. 7, Page 15

Materials: A516 carbon steel, Type 316L Stainless Steel, high level waste glass (HLWG)

Specimen Specifications: A516 carbon steel or Type 316L Stainless Steel coupons and glass disks. Specific dimensions are listed in each test

Measurement Parameters: Temperature and time of exposure, pH of solution, chemical composition of solution, surface area, solution volume, corrosion/dissolution rate

Test Equipment Calibration: Thermocouple, thermometer, pH meter, ICP, weighing balance, caliper. The calibration and due dates are indicated in each test

Required Level of Accuracy: Temperature ±2°C, Time of exposure ±1 minute, pH of solution ±0.1, weight ±0.001 g, ICP ±10%

Uncertainty and Sources of Error: Simulated J-13 water or pore water composition varies with solution evaporates while opening ports for pH measurement. Solution volume changes while solution is drawn for ICP analysis. Temperature difference inside and outside of the pH probe

Xihua He 5/10/06

Chemical composition of 316L stainless steel

From Notebook 009 page# 56

CHEMICAL COMPOSITION IN WT% OF ALLOYS IN IMPE

used in test

MATERIAL	304L	304L	316L	316L	IN825	IN825	HA C-22	HA C-22	CDA 102	CDA 102	CDA 613	CDA 613	CDA 715	CDA 715
ORIGIN	G.O.CARLSON		EASTERN STAINLESS		INCO/METAL GOODS		HAYNES/CORR MATLS				AMPCO METAL		REVERE	
HEAT NO.	T0954		P80746		HH4371FG		2277-8-3175				M5459		7037-61326	
ELEMENTS	VENDOR	KAMIN	VENDOR	KAMIN	VENDOR	KAMIN	VENDOR	KAMIN	VENDOR	KAMIN	VENDOR	KAMIN	VENDOR	KAMIN
Ag												<0.01		
Al		<0.01		<0.01	0.07	0.05		0.18			6.66	7.05		
As												<0.01		<0.01
B														
C	0.022	0.029	0.014	0.019	0.010	0.013	0.004	0.015*				0.005	0.013	0.019
Cb														
Cd												<0.001		<0.001
Co			0.17				0.09	0.87						
Cr	18.27	18.44	16.35	16.64	22.09	22.98	21.40	21.97				<0.005		0.01
Cu		0.19	0.27	0.29	1.79	1.80			99.95 MIN.		90.61		69.20	BAL.
Fe	BAL.	BAL.	BAL.	BAL.	30.41	28.09	3.80	4.42			2.44	2.56	0.54	0.55
Mg														
Mn	1.46	1.38	1.58	1.56	0.35	0.33	0.12	0.13			<0.01	0.02	0.57	0.62
Mo		0.15	2.07	2.16	3.21	3.56	13.60	14.25						
N	0.07	0.07	0.06	0.06										
Ni	9.14	9.00	10.04	10.43	41.06	41.76	BAL.	BAL.			0.03	0.02	29.57	29.85
P	0.026	0.024	0.026	>25		0.008	0.008	0.005	~~0.001~~	0.001	0.006	0.001	0.004	0.001
Pb											<0.01	0.008	0.010	0.004
S	0.005	0.005	0.018	>.014	<0.001	0.003	<0.002	0.002	~~0.002~~	0.002		0.001	0.006	0.011
Sb												<0.01		<0.01
Si	0.47	0.44	0.49	>.5	0.19	0.13	0.03	0.06			<0.01	0.02		0.01
Sn											0.27	0.29		
Ta														
Ti		0.01			0.82	0.93		<0.01						
V		0.05				0.04	0.15	0.16						
W							3.00	2.98						
O									~~0.0041~~	0.0041				

Xihua He 6/13/06

X.H. 7/14/08

Xihua He 6/13/06

In-package Chemistry Test

Test ID: 3/6 LSSpore

Specimen: 316L stainless steel, Heat # P80746

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 stainless steel coupons used in the test: 3 for each test cell

Stainless steel coupon weight measured by balance	**Balance Model:** Sartorius Genius **Cal:** 11/14/05	**SN:** 12809099 **Due:** 5/12/06
Stainless steel coupon dimensions measured by caliper	**Caliper Model:** Starrett **Cal:** 3/3/06	**SN:** 03031512 **Due:** 3/2/07
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:** 2/21/06 **pH Probe:** 13-620-108	**SN: S001A** **Due:** 2/21/07 **SN:** 6100190 Gel Filled
Test Temperature: 60°C	**Measured with Thermocouple meter** **Cal:** 6/7/05 **Thermocouple** **Cal:** 4/28/06	**Fisher SN#** 41523645 **Due:** 6/7/06 **SN:** 334 **Due:** 10/27/06

Solution: Simulated Pore Water

Stock A=	$CaSO_4\ 2H_2O$	2.247 g	lot# 4300kbtr
	$Ca(NO_3)_2\ 4H_2O$	0.034 g	lot# 035087
	KCl	0.469 g	lot# 043820
	$MgCl_2\ 6H_2O$	1.128 g	lot# 050439
	$CaCl_2$	0.727 g	lot# 025259
	D.I. water to 1000 mL		
Stock B=	$NaHCO_3$	16.486g	lot# 054010
	NaF	0.544g	lot# 006679
	D.I. water to 1000 mL		

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

Specimen dimensions:

Cell#1 (1) 12.8x13.14x2.89 (2) 12.95x14.22x2.89 (3) 13.08x12.59x2.89 mm
Total Weight= 11.42427 g Total calculated surface area: 14.89 cm^2

Cell#2 (1) 13.55x12.10x2.89 (2) 13.13x12.08x2.88 (3)13.52x12.26x2.89 mm
Total Weight= 10.96661 g Total calculated surface area: 14.19 cm^2

Cell#3 Control cell no specimens

Solution Volume for each test cell Volume = 13.7 × specimen surface area

Cell #1 = 204.0 mL Cell #2 = 194.4 mL Cell #3 = 200 mL

Each test cell has 20 mL pore water outside of the Teflon insert

Test started at 5/11/06 at 11:00 a.m

Xihua He 5/12/06

Continued from Page 4

The thermocouple meter used was recalibrated on 5/23/06 (Fisher SN# 41523645) Due 5/23/07

pH record for Test cells #1, #2, and #3

Date / Time	Cell #1 Temperature(°C)	pH	Cell #2 Temperature(°C)	pH	Cell #3 Temperature(°C)	pH
5/11/06 10:05 a.m	60.8	8.41	60.6	8.45	61.2	8.37
5/11/06 12:35 p.m	60.4		60.3		60.6	
5/12/06 6:10 a.m	60.6	8.24	60.4	8.22	60.8	8.26
5/15/06 8:05 a.m	60.6	8.74	60.2	8.64	59.6	8.68

1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in.
Solution ID: SS1_1

1mL solution was drawn from cell #3 for ICP analysis, then 1 mL fresh original solution was added in.
Solution ID: PW3_1

		Temperature(°C)	pH	Temperature(°C)	pH		pH
5/16/06	9:30 am	60.6	8.73	60.4	8.69	60.2	8.77
5/17/06	8:10 am	60.4	8.72	59.8	8.67	60.2	8.76
5/18/06	8:00 am	60.4	8.71	60.2	8.63	60.4	8.77
5/19/06	8:50 am	60.4	8.82	60.4	8.85	60.2	8.88

1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in.
Solution ID: SS1_2

1mL solution was drawn from cell #3 for ICP analysis, then 1 mL fresh original solution was added in.
Solution ID: PW3_2

5/22/06	8:10 am	60.4	8.78	60.2	8.89	60.2	8.93
5/23/06	8:30 am	60.4	8.91	60.4	8.87	60.2	8.92
5/24/06	10:00 am		8.83		8.93		8.98
5/25/06	9:30 am		8.98		8.96		8.88

Thermometer : Fisher Sn# 41523645 Cal: 5/23/06 Due:5/23/07 (recalibrated)

5/26/06	9:15 am	60.2	9.02	60.4	8.89	59.8	8.94

1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in.
Solution ID: SS1_3

1mL solution was drawn from cell #3 for ICP analysis, then 1 mL fresh original solution was added in.
Solution ID: PW3_3

5/30/06	8:21 am	60.4	9.18	60.2	9.12	60.2	9.11
6/2/06	8:25 am	60.6	9.16	60.2	9.14	60.2	9.24

1mL solution was drawn from cell #1 for ICP analysis, then 1 mL fresh original solution was added in.
Solution ID: SS1_4

1mL solution was drawn from cell #3 for ICP analysis, then 1 mL fresh original solution was added in.
Solution ID: PW3_4

6/6/06	9:45 am	60.4	9.18	60.2	9.12	60.6	9.22
6/9/06	9:15 am	60.6	9.2	60.4	9.08	60.4	9.18
6/12/06	8:30 am	60.4	9.15	60.2	9.02	60.2	9.13

Xihua He 6/13/06

Date	Time	Cell #1 T(°C)	Cell #1 pH	Cell #2 T(°C)	Cell #2 pH	Cell #3 T(°C)	Cell #3 pH
6/16/06	8:30	60.4	9.14	60.3	9.08	60.2	9.16
6/19/06	8:25	60.2	9.17	60.4	9.09	60.2	9.15
6/22/06	8:30	60.2	9.22	60.2	9.16	60.4	9.21
6/27/06	9:05	60.4	9.18	60.4	9.11	60.6	9.17
6/30/06	8:30	60.2	9.19	60.2	9.08	60.4	9.15
7/6/06	1:30	60.4	9.11	60.2	9.16	60.2	9.15
						Xihua He 7/7/06	
7/10/06	9:30	60.4	9.16	60.2	9.19	60.2	9.13
7/14/06	7:00	60.4	9.16	60.4	9.18	60.4	9.14
7/17/06	9:10	60.4	9.18	60.4	9.15	60.2	9.12
7/21/06	8:30	60.2	9.23	60.4	9.12	60.4	9.08
7/24/06	9:10	60.2	9.11	60.4	9.13	60.2	9.12
7/31/06	9:53	60.2	9.05	60.2	9.11	60.2	9.09
						Xihua He 8/1/06	

Observation. solution remained at similar level. Most stainless steel specimens remained shiny. Minor surface staining on stainless steel surface.

8/4/06	10:05	60.2	9.09	60.1	9.12	60.2	9.11

1 ml solution from cell #1, add 1 ml fresh solution,

1 ml - - - - = cell #3, - - - - - -

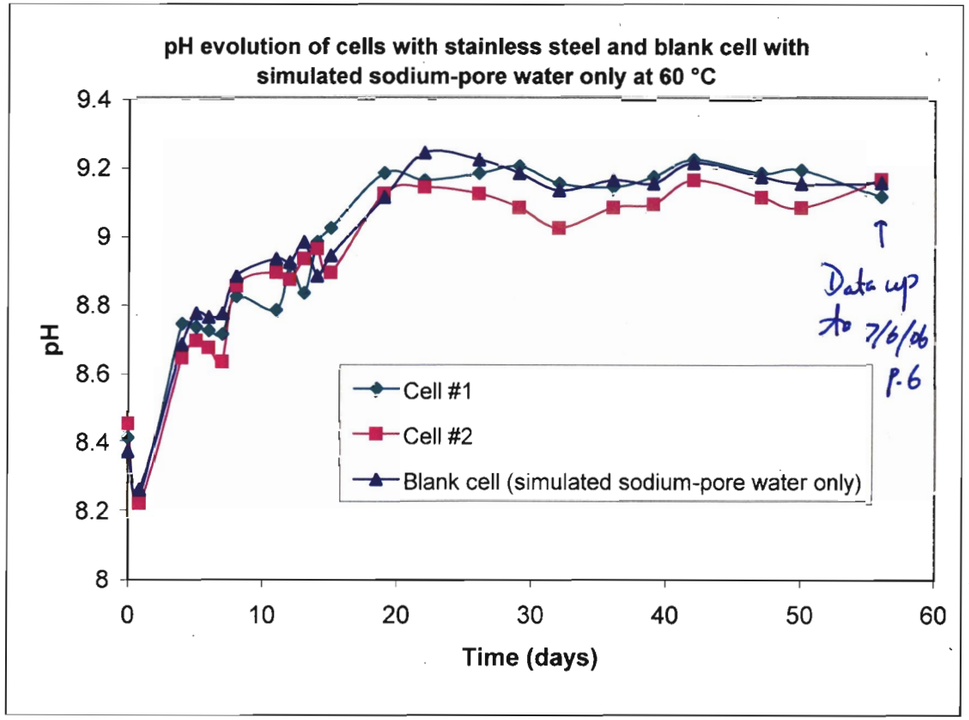
ID 551-5

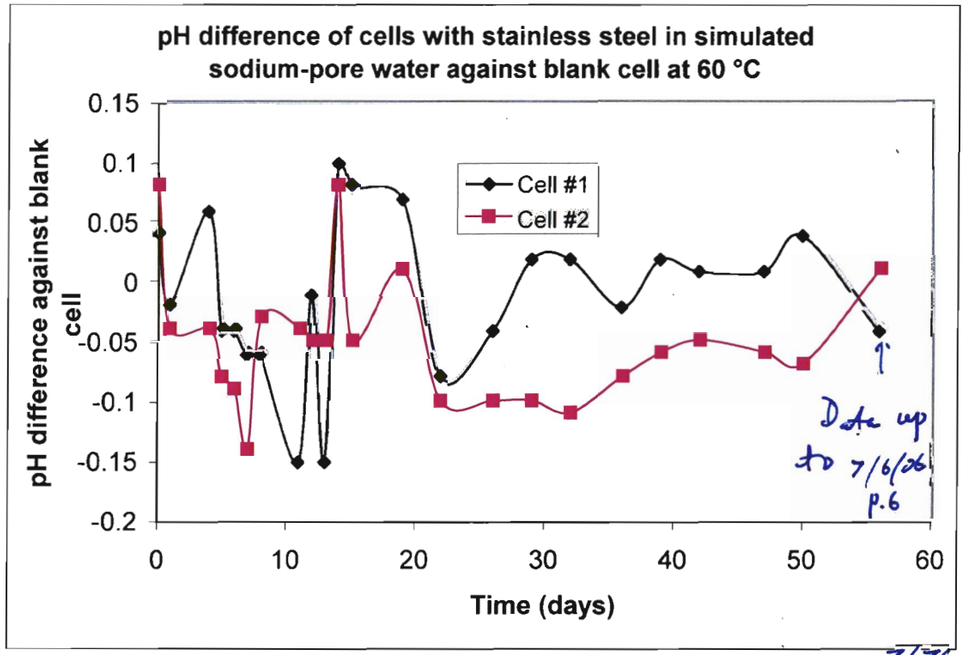
ID: PW3-5

8/9/06	8:30	60.2	9.1	60.1	9.13	60.4	9.09
8/11/06	12:30	60.4	9.14	60.2	9.08	60.2	9.09
8/14/06	9:10	60.2	9.11	60.4	9.03	60.4	9.06
8/18/06	9:48	60.4	9.11	60.2	9.05	60.4	9.08
8/21/06	9:50	60.2	9.08	60.2	9.09	60.4	9.06
						Xihua He 8/21/06	
8/25/06	9:10	60.4	9.11	60.4	9.08	60.2	9.1
8/28/06	8:20	60.4	9.09	60.2	9.09	60.4	9.12
9/1/06	8:42	60.4	8.99	60.2	9.15	60.4	9.25
9/5/06	9:15	60.2	9.15	60.4	9.12	60.4	9.05
9/8/06	9:15	60.2	9.11	60.2	9.05	60.2	9.1
9/11/06	8:25	60.4	9.07	60.4	9.16	60.4	9.12

continued on P.12

Xihua He 9/13/06





7/7/06 Xihua He

Discussion on pH changes : p8-9

-----Original Message-----
From: Paul Bertetti [mailto:pbertetti@cnwra.swri.edu]
Sent: Friday, July 07, 2006 2:50 PM
To: xhe@cnwra.swri.edu; dpickett@cnwra.swri.edu; 'Vijay Jain'
Subject: RE: update on stainless steel immersion tests

I believe there are a couple of contributors to the pH change in the test cells. Based on our analyses of the pore waters and chemical changes in the carbon steel test cells, it appears likely that calcite precipitates form solution as the solutions age. This is accompanied by an overall depletion of CO2 in the system. Even though the solutions are open to atmosphere, my calculations suggest that the partial pressure of CO2 is quite low (relative to atmosphere -- log fugacity -4.42 for the combined solution that had been opened and mixed for at least two hours -- so inside the test cells it may have been lower). The loss of CO2 and its incorporation into calcite is consistent with a pH increase. Moreover, the addition of fresh solution to replace samples continues to calcite precipitation process as more Ca is added. The small evaporation that does occur and the addition of original solution also tends to increase the pH. I might recommend addition of deionized water, diluted solution, or nothing to replace the water lost from sampling. Finally, the loss of SO4 and increase in S should be addressed. Based on analysis of the carbon steel solution samples, not all S is in the form of SO4 as one might predict from the redox (highly oxidizing for our sorption solutions at +500 mV Eh.

> -----Original Message-----
> **From:** Xihua He [mailto:xhe@cnwra.swri.edu]
> **Sent:** Friday, July 07, 2006 2:10 PM
> **To:** dpickett@cnwra.swri.edu; 'Vijay Jain'; 'Paul Bertetti'
> **Subject:** RE: update on stainless steel immersion tests
>
> The evaporation should be very little. We used a water-cooled condenser to minimize evaporation. Unfortunately I didn't do the same blank comparison for the carbon steel tests. But the simulated pore water has the same composition as we used for previous tests.
>
> Xihua
>
> > -----Original Message-----
> > **From:** David Pickett [mailto:dpickett@cnwra.swri.edu]
> > **Sent:** Friday, July 07, 2006 1:54 PM
> > **To:** xhe@cnwra.swri.edu; 'Vijay Jain'; 'Paul Bertetti'
> > **Subject:** RE: update on stainless steel immersion tests
> >
> > Xihua,
> >
> > Thanks for the update. I assume the pH change, then, is an evaporation effect? Did you do the same blank comparison for the carbon steel tests? What was the result?
> >
> > David
> > -----Original Message-----
> > **From:** Xihua He [mailto:xhe@cnwra.swri.edu]
> > **Sent:** Friday, July 07, 2006 1:23 PM
> > **To:** David Pickett; Vijay Jain; Paul Bertetti
> > **Subject:** update on stainless steel immersion tests

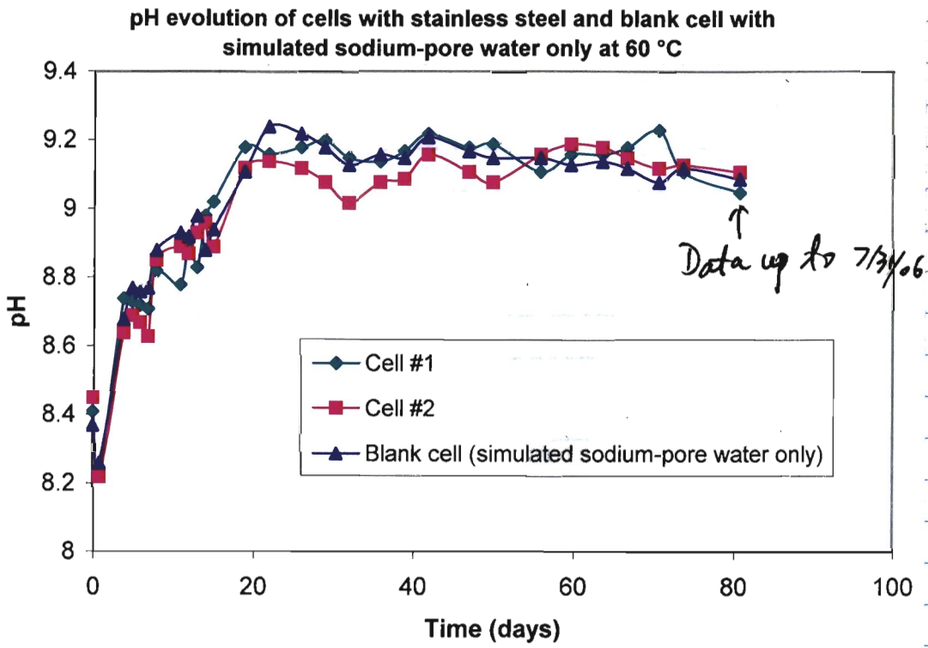
Xihua He 7/7/06

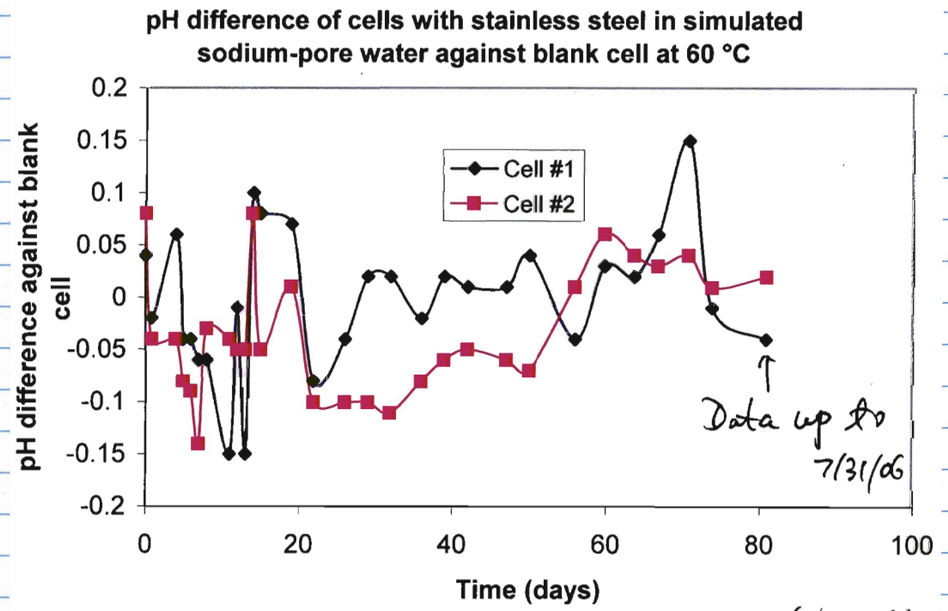
I immersed the stainless steel specimen in simulated sodium-pore water at 60°C as I did for carbon steel previously. In parallel there are three test cells, two with stainless steel and one with simulated pore water only as a blank cell. For these three test cells, the pH increased with time as I observed from the immersion of carbon steel. However, after I plot the pH difference against the blank cell. The pH remained relatively constant. The file on this is attached. I also drew some solution for chemical analysis, but I didn't send to ICP lab yet.
The pH increase that we reported in the report may be due to solution chemical species changes. I believe we need to do chemical speciation simulation.

Thanks,
Xihua

Xihua He 7/7/06

X. H. 7/14/06





Xihua He 8/4/06

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

Requested Turnaround: ☐ 2 Weeks ☐ 3 Weeks ☐ Other: ____
SwRI Contact: Xihua He
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)
SwRI Project#: 20.06002.01.222
Client: Xihua He Div 20
Client Purchase Order/Other ID
Site/Zone ID
Analyses Requested: Compl-te T.C.P. Analysis; QA Nuclear (Sample Mgt Fluids)
Shipper Name/Address

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers
PW 3-1	8/10/06	11:00a	L		2
PW 3-2					2
PW 3-3					2
PW 3-4					2
SS 1-1					2
SS 1-2					2
SS 1-3					2
SS 1-4			V		2
SS 1-5	V	V			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
Temp: 22.0°C Therm #: 027
Comments: Rec'd Turbid

Relinquished by (Print/Signature): Date 8/10/06 Time 1530
Received by (Print/Signature): Date Time
Relinquished by (Print/Signature): Date Time
Received by (Print/Signature): Date Time
Relinquished by (Print/Signature): Date Time
Samples Disposed: Date Time
Samples Disposed by:

Page 1 of 1

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

8/10/06

continued from p.6

		Cell #1		Cell #2		Cell #3	
9/25/06	8:00AM	60.2	9.11	60.2	9.13	60.4	9.14
10/2/06	9:00 AM	60.2	9.08	60.4	9.04	60.2	9.19
10/6/06	8:45	60.4	9.16	60.4	9.05	60.4	9.11
10/9/06	8:15	60.2	9.18	60.4	9.11	60.4	9.17
10/13/06	8:20	60.4	9.1	60.2	9.07	60.2	9.19
10/16/06	8:15	60.2	9.12	60.2	9.05	60.2	9.16
10/23/06	7:50	60.4	9.14	60.2	9.09	60.2	9.21
10/26/06	2:55	60.2	9.05	60.4	9.07	60.2	9.17
10/30/06	8:05	60.4	9.03	60.4	9.05	60.2	9.18
11/3/06	8:35	60.2	9.1	60.6	9.17	60.2	9.15
11/7/06	8:50	60.4	9.13	60.4	9.23	60.4	9.28
11/13/06	9:00	60.2	9.11	60.4	9.27	60.5	9.31
11/20/06	12:00	60.2	9.14	60.2	9.21	60.4	9.26

11/28/06 1 ml solution was drawn from cell #1 for ICP analysis, then 1 ml fresh original solution was added in. Solution ID: SS1_6
Also: cell #3 PW3-6

11/28/06	2:45	60.4	9.12	60.4	9.16	60.4	9.27

removed 1 ml of solution from cell #1 for particle size analysis

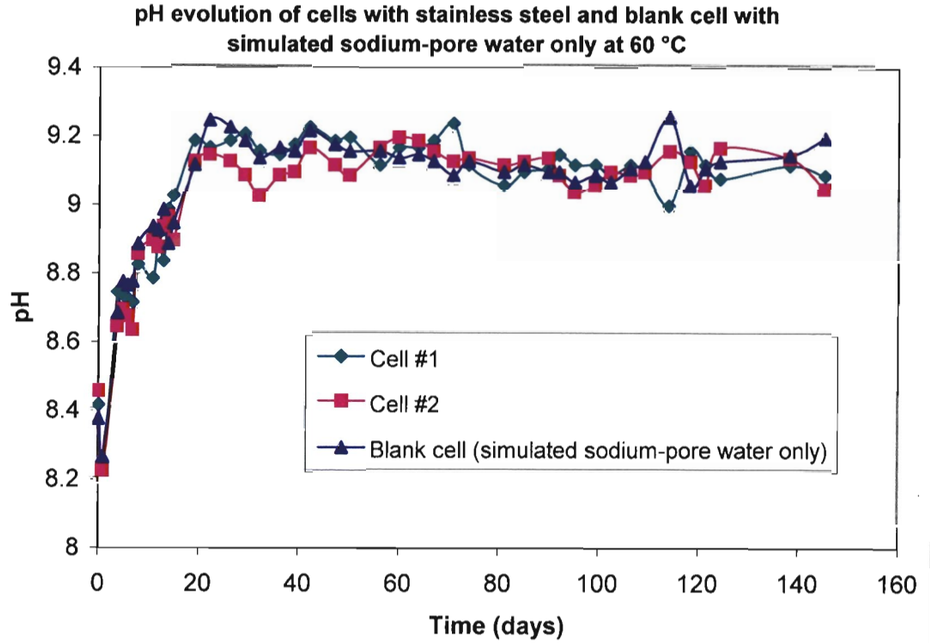
						CESEAN in Divs	
12/4/06	8:25	60.2	9.1	60	9.12	59.8	9.21
12/8/06	9:15	60.2	9.09	60.2	9.18	60.4	9.28
12/11/06	9:00	60.2	9.11	60.4	9.09	60.4	9.21
12/13/06	9:15	60.2	9.13	60.2	9.16	60.4	9.26
12/18/06	9:00	60.2	9.11	60.2	9.23	60.2	9.24
12/27/06	11:40	60.2	9.16	60.4	9.26	60.4	9.27
1/3/07	9:30	60.2	9.15	60.4	9.26	60.4	9.2
1/8/07	9:50	60.2	9.17	60.4	9.28	60.2	9.23
1/12/07	9:15	60.2	9.11	60.4	9.19	60.4	9.28
1/15/07	8:45	60.2	9.13	60.2	9.23	60.4	9.21
1/22/07	8:40	60.2	9.12	60.4	9.18	60.4	9.25

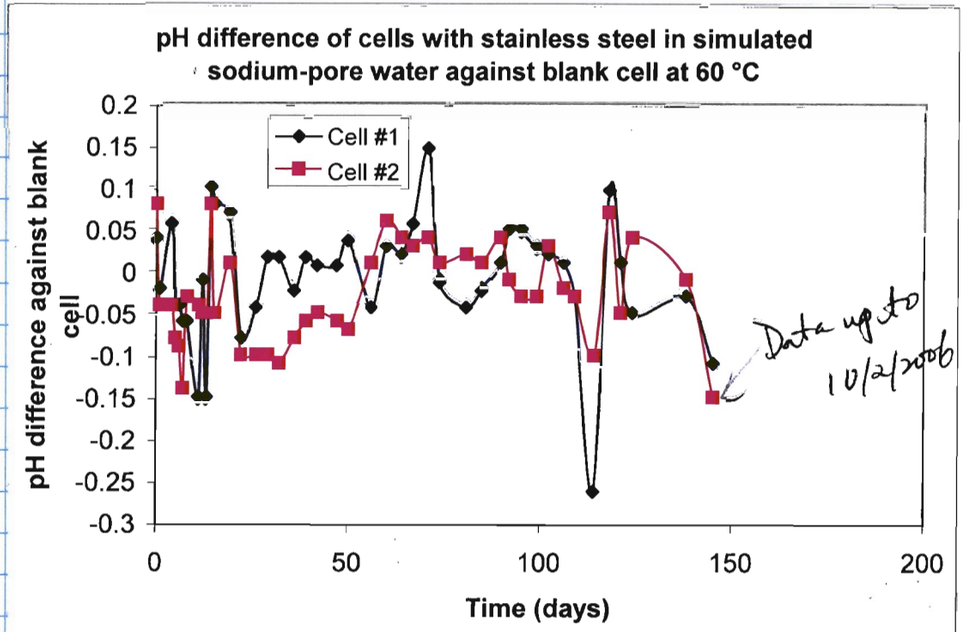
1/25/07 1 ml solution was drawn from cell #1 for ICP. ID: SS1_7
" " " #3 " " : PW3_7

1/26/07	10:00	60.2	9.15	60.2	9.22	60.2	9.25
1/29/07	9:10	60.3	9.33	60.4	9.32	60.2	9.3
2/2/07	9:15	60.2	9.42	60.4	9.4	602	9.48

continued on p.63

Xihua He 3/27/07





Xihua He 10/2/06

Sample ID
PW 3-1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284750

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	37.5	1
Fluoride	6.17	1
Nitrate-N	<1	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	37.3	1

Sample ID
PW 3-2

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284751

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	45.9	1
Fluoride	6.67	1
Nitrate-N	<1	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	38.4	1

Xithua He 10/6/06

Sample ID
PW 3-3

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284752

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	48.6	1
Fluoride	6.48	1
Nitrate-N	<1	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	38.7	1

Sample ID
PW 3-4

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284753

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	56.5	1
Fluoride	7.34	1
Nitrate-N	<1	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	41.9	1

Xithua He 10/6/06

Sample ID
SS 1-1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284754

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	36.6	1
Fluoride	6.06	1
Nitrate-N	<1	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	34.5	1

Sample ID
SS 1-2

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284755

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	55.2	1
Fluoride	6.10	1
Nitrate-N	<1	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	35.4	1

Xithera Ha 10/6/06

Sample ID
SS 1-3

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284756

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	72.9	1
Fluoride	7.31	1
Nitrate-N	1.13	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	37.8	1

Sample ID
SS 1-4

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284757

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	75.4	1
Fluoride	6.48	1
Nitrate-N	1.29	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	37.9	1

Xithera Ha 10/6/06

Sample ID: SS 1-5

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284758

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	134	1
Fluoride	6.76	1
Nitrate-N	1.45	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	39.9	1

Sample ID: PW 3-5

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284759

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	91.1	1
Fluoride	7.45	1
Nitrate-N	1.51	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	45.1	1

Xichun He 10/6/06

Sample ID: PB

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: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<0.1	0.1
Chloride	<0.1	0.1
Fluoride	<0.1	0.1
Nitrate-N	<0.1	0.1
Nitrite-N	<0.1	0.1
Phosphate-P	<0.1	0.1
Sulfate	<0.1	0.1

Sample ID: LCS

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: 29636

Task Order: 060810-15

Method: IC - EPA 300			
Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Bromide	405	400	101%
Chloride	202	200	101%
Fluoride	96.2	100	96.2%
Nitrate-N	87.6	90.4	96.9%
Nitrite-N	113	119	95.0%
Phosphate-P	193	196	98.5%
Sulfate	397	400	99.3%

Xichun He 10/6/06

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Sample ID
PB-filtered

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: IC - EPA 300		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Bromide	<1	1
Chloride	<1	1
Fluoride	<1	1
Nitrate-N	<1	1
Nitrite-N	<1	1
Phosphate-P	<1	1
Sulfate	<1	1

Xihua He 10/6/06

X.H 7/14/08

Sample ID
PW 3-1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284750

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	8.97	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	7.10	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	46.0	25
Selenium	<0.500	0.5
Silicon	<1.25	1.25
Silver	<0.250	0.25
Sodium	328	10
Strontium	<0.250	0.25
Sulfur	29.6	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	0.333	0.25
Zirconium	<0.250	0.25

X Guarte 10/25/06

Sample ID
PW 3-1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284750D

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B			
Analysis	Orig. Sample Result (mg/L)	Duplicate Result (mg/L)	RPD
Aluminum	<2.50	<2.50	0.00%
Antimony	<0.750	<0.750	0.00%
Arsenic	<0.500	<0.500	0.00%
Barium	<0.250	<0.250	0.00%
Beryllium	<0.250	<0.250	0.00%
Bismuth	<0.500	<0.500	0.00%
Boron	<1.00	<1.00	0.00%
Cadmium	<0.250	<0.250	0.00%
Calcium	8.97	9.12	1.66%
Chromium	<0.250	<0.250	0.00%
Cobalt	<0.250	<0.250	0.00%
Copper	<0.250	<0.250	0.00%
Iron	<3.50	<3.50	0.00%
Lanthanum	<0.250	<0.250	0.00%
Lead	<0.250	<0.250	0.00%
Magnesium	7.10	7.44	4.68%
Manganese	<0.250	<0.250	0.00%
Molybdenum	<0.250	<0.250	0.00%
Nickel	<0.250	<0.250	0.00%
Palladium	<1.00	<1.00	0.00%
Phosphorus	<1.25	<1.25	0.00%
Selenium	<0.500	<0.500	0.00%
Silicon	<1.25	<1.25	0.00%
Silver	<0.250	<0.250	0.00%
Strontium	<0.250	<0.250	0.00%
Sulfur	29.6	29.6	0.00%
Thallium	<0.500	<0.500	0.00%
Thorium	<1.50	<1.50	0.00%
Tin	<0.500	<0.500	0.00%
Titanium	<0.250	<0.250	0.00%
Tungsten	<0.500	<0.500	0.00%
Uranium	<5.00	<5.00	0.00%
Vanadium	<0.250	<0.250	0.00%
Yttrium	<0.250	<0.250	0.00%
Zinc	0.333	0.342	2.67%
Zirconium	<0.250	<0.250	0.00%

Xichun He 10/25/06

Sample ID
PW 3-2

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284751

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	6.01	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	6.03	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	51.5	25
Selenium	<0.500	0.5
Silicon	2.89	1.25
Silver	<0.250	0.25
Sodium	297	10
Strontium	<0.250	0.25
Sulfur	28.1	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	0.303	0.25
Zirconium	<0.250	0.25

Xichun He 10/25/06

Sample ID: PW 3-2

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284751S

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B				
Analysis	Orig. Sample Result (mg/L)	Spike Result (mg/L)	Spike Added (mg/L)	Recovery
Aluminum	<2.50	93.0	100.0	93.0%
Antimony	<0.750	24.4	25.0	97.6%
Arsenic	<0.500	102	100	102.0%
Barium	<0.250	101	100	101.0%
Beryllium	<0.250	2.41	2.50	96.4%
Bismuth	NA	NA	NA	NA
Boron	NA	NA	NA	NA
Cadmium	<0.250	2.47	2.50	98.8%
Calcium	6.01	964	1000	95.8%
Chromium	<0.250	9.51	10.00	95.1%
Cobalt	<0.250	25.0	25.0	100.0%
Copper	<0.250	11.9	12.5	95.2%
Iron	<3.50	55.6	50.0	111.2%
Lanthanum	NA	NA	NA	NA
Lead	<0.250	24.0	25.0	96.0%
Lithium	NA	NA	NA	NA
Magnesium	6.03	970	1000	96.4%
Manganese	<0.250	24.8	25.0	99.2%
Molybdenum	NA	NA	NA	NA
Nickel	<0.250	25.0	25.0	100.0%
Palladium	NA	NA	NA	NA
Phosphorus	NA	NA	NA	NA
Potassium	NA	NA	NA	NA
Selenium	<0.500	102	100	102.0%
Silicon	NA	NA	NA	NA
Silver	<0.250	2.37	2.50	94.8%
Sodium	NA	NA	NA	NA
Strontium	NA	NA	NA	NA
Sulfur	NA	NA	NA	NA
Thallium	<0.500	105	100	105.0%
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	<0.250	23.8	25.0	95.2%
Yttrium	NA	NA	NA	NA
Zinc	0.303	25.4	25.0	100.4%
Zirconium	NA	NA	NA	NA

NA- Not Applicable.

Joshua Ble 10/25/06

Sample ID: PW 3-3

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284752

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	2.98	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	2.64	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	40.5	25
Selenium	<0.500	0.5
Silicon	2.84	1.25
Silver	<0.250	0.25
Sodium	148	10
Strontium	<0.250	0.25
Sulfur	13.4	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	<0.250	0.25
Zirconium	<0.250	0.25

Joshua Ble 10/25/06

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284752D

Sample ID
PW 3-3

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B			
Analysis	Orig. Sample Result (mg/L)	Duplicate Result (mg/L)	RPD
Lithium	<0.750	<0.750	0.00%
Potassium	40.5	27.9	36.8%
Sodium	148	145	2.05%

X-ref 7/14/08

Xichen He 10/25/06

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284753

Sample ID
PW 3-4

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	4.92	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	5.45	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	60.9	25
Selenium	<0.500	0.5
Silicon	7.79	1.25
Silver	<0.250	0.25
Sodium	272	10
Strontium	<0.250	0.25
Sulfur	24.6	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	0.290	0.25
Zirconium	<0.250	0.25

Xichen He 10/25/06

Sample ID: PW 3-4

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284753S

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B				
Analysis	Orig. Sample Result (mg/L)	Spike Result (mg/L)	Spike Added (mg/L)	Recovery
Lithium	<0.750	380	400	95.0%
Potassium	60.9	1980	2000	96.0%
Sodium	272	2190	2000	95.9%

NA- Not Applicable.

Y.H 7/14/08

Xiluatte 10/25/06

Sample ID: SS 1-1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284754

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	5.98	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	6.05	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	53.9	25
Selenium	<0.500	0.5
Silicon	4.88	1.25
Silver	<0.250	0.25
Sodium	289	10
Strontium	<0.250	0.25
Sulfur	26.7	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	0.374	0.25
Zirconium	<0.250	0.25

Xiluatte 10/25/06 continued on P.35

Immersion of Carbon Steel in D.I. Water

DI water needed: 254 mL

Test ID: CSDI01

Temperature : 60 °C

X.H 5/12/08

pH monitoring: Once each day during the first week, at the same time draw 2-mL solution using 0.45 µm syringe filter every other day without compensation with DI water. After the first week, monitor pH twice each week and draw 2-mL solution once each week.

1-mL solution needs to be preserved in nitric acid

Instructions to preserve the solution with nitric acid:

1. Make a 1+1 solution of HNO3 (trace metal grade from geochemistry lab) and D.I. water
2. Add 3 µL of 1+1 mix for 1 mL of solution to be preserved

Specimen: CS 516 HT# D84944 Total of 3 specimens

	Weight	Dimensions
#1 =	7.03362g	14.62 x 12.42 x 5.1 mm
#2 =	6.66849g	13.66 x 12.49 x 5.11 mm
#3 =	6.43070g	13.72 x 12.74 x 4.91 mm

> on Test Vessel with 254 mls DI

254 mls Measured with A graduated Cylinder

weight Measurement taken with Santoeious Scale SN# 12809099
Cal: 5/9/06 Due: 11/9/06

Dimension Measueement Taken with Starrett Calipers SN# 0303/512
Cal: 3/3/06 Due: 3/2/07

Started Test @ 3:00pm on 8/21/06

HNO_3 Acid Solution:
5mls of HNO_3 Lot# 1100040 (Trace Metal Grade)
Plus 5 mls of DI water

8/21/06

516 Cabon Steel + D.I water test
a sample= not filtered b sample= filtered + acid
Acid solution: 5ml. Trace Metal Grade HNO3 lot# 1100040
5ml. DI
SEE NB# 791 Pg# 30 for setup Info.

Started @ 3:00 pm on 8/21/06

	Time	TEMP	pH
8/21/2006	16:39	58	5.49
8/22/2006	8:00	60.4	5.54

pulled first solution sample @ 8:15 not filtered CSDI 01a

		Filtered+ acid	CSDI 01b
8/23/2006	8:30	60.5	5.57
8/24/2006	8:20	60.4	5.58
8/25/2006	9:10	60.4	5.62

pulled second solution sample @ 9:15 not filtered CSDI 02a

		Filtered+ acid	CSDI 02b
8/28/2006	8:10	60.2	5.89
8/29/2006	8:55	60.4	5.92
8/30/2006	9:00	60.2	5.88
8/31/2006	8:45	60.2	5.98
9/1/2006	8:30	60.2	6.13

pulled second solution sample @ 9:15 not filtered CSDI 03a

		Filtered+ acid	CSDI 03b
9/5/2006	9:05	60.2	6.42
9/6/2006	8:15	60.3	6.17
9/7/2006	8:00	60.2	6.22
9/8/2006	9:15	60.4	6.26
9/11/2006	8:25	60.2	6.18
9/12/2006	8:45	60.3	6.16
9/13/2006	9:16	60.2	6.46
9/14/2006	9:45	60.4	6.43
9/15/2006	9:20	60.4	6.51

pulled fourth solution sample @ 9:15 not filtered CSDI 04a

		Filtered+ acid	CSDI 04b
9/18/2006	9:15	60.2	6.88
9/19/2006	9:30	60.4	6.92
9/22/2006	9:45	60.2	6.62
9/25/2006	9:15	60.4	6.73
9/27/2006	9:45	60.2	6.64
10/2/2006	8:50	60.4	6.56
10/6/06	8:00	60.2	6.54
10/9/06	8:30	60.4	6.68
10/11/06	9:00	60.4	6.74
10/13/06	8:15	60.4	6.87
10/16/06	8:30	60.2	6.91
10/20/06	8:30	60.2	6.89

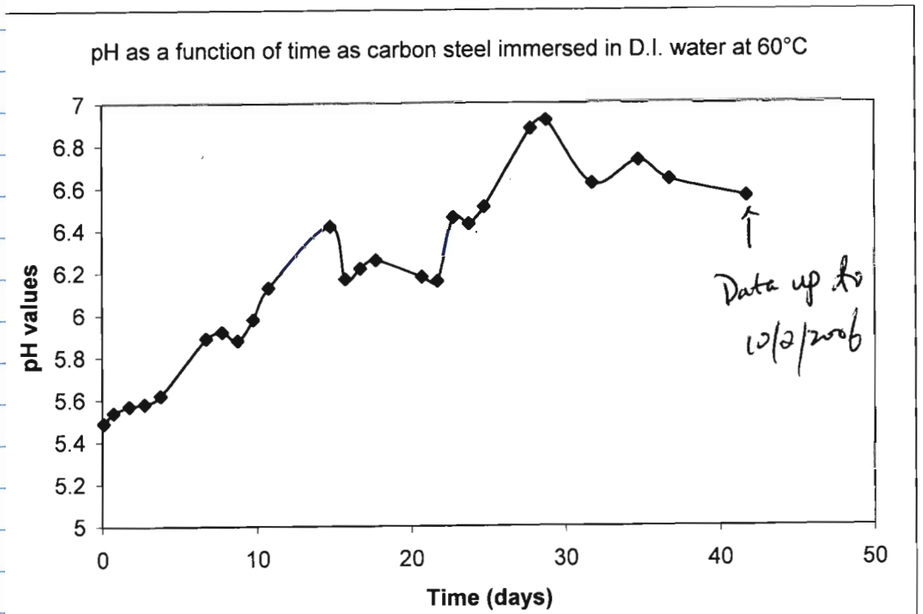
for anions

for cations

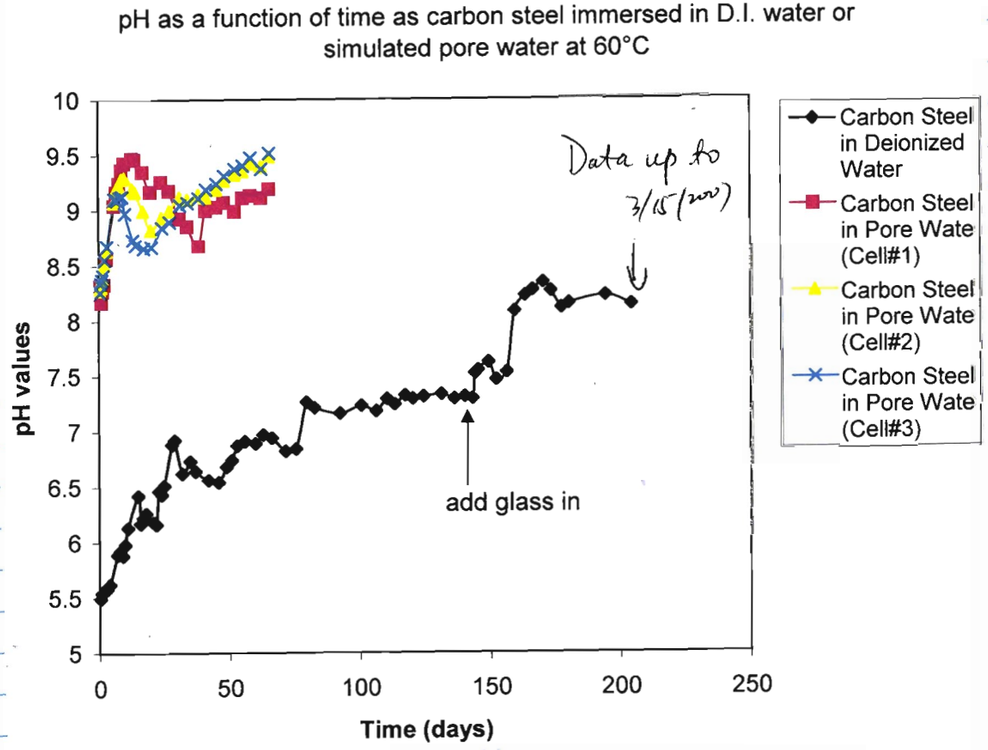
X-ihuan He 9/13/06

continued on p.33

X-ihuan He 10/30/06



Xihua He 10/2/06



continued from p. 31

		Temperature	pH
10/23/06	8:05	60.4	6.97
10/26/06	2:50	60.2	6.94
10/30/06	8:01	60.2	6.88 X2 X.41 10/30/06
11/3/06	8:36 a.m	60.4	6.89
11/7/06	8:45	60.2	7.26

pulled 4th solution sample @ 9:05 - not filtered CSDI05a
filtered + acid CSDI05b

11/10/06	8:50	60.4	7.21
11/20/06	9:00	60.2	7.16
11/28/06	pulled 5th solution sample @ 2:35 pm not filtered		CSDI06a
	filtered + acid		CSDI06b
11/28/06	2:50	60.4	7.23

pulled 3.5 mLs solution + particles out for ESEM and particle size analysis — Xihua He 11/28/06

12/4/2006	8:21	60.4	7.18
12/8/2006	9:21	60.2	7.29
12/11/2006	9:05	60.4	7.24
12/15/06	9:30	60.4	7.32
12/18/06	9:15	60.2	7.29
12/27/06	11:40	60.2	7.31
1/3/07	9:35	60.4	7.33
1/8/07	9:00	60.2	7.29
1/12/07	9:10	60.4	7.31
1/15/07	9:15	60.4	7.29
1/15/07	10:35	add 2 glass U23 & specimens	
		weight = 0.35445 g; dimensions: 9.84 mm x 9.84 mm x 0.89 mm	0.85 mm
1/16/2007	8:20	60.4	7.52
1/17/2007	11:00	60.4	7.55
1/19/2007	10:00	60.4	7.62
1/22/07	8:40	60.4	7.46

pulled seventh solution sample @ 9:05 not filtered CSDI07a
Filtered + acid CSDI07b

Xihua He 2/20/07

continued from P. 33

1/26/07	10:00	60.2	7.53
1/29/07	9:05	60.4	8.08
2/2/07	9:15	60.2	8.22
2/5/07	8:15	60.2	8.27
2/9/07	8:30	60.2	8.34
2/12/07	9:00	60.2	8.26
2/16/07	9:00	60.2	8.11
2/19/07	8:00	60.2	8.15 2/20/07 X.H

pulled eighth solution sample @ 9:05 not filtered CSD2088a
filtered + acid CSD1086
Xiuhua He 2/20/07

3/5/2007	8:30	60.4	8.22
3/15/2007	9:00	60.2	8.14

X.H 3/27/07

Thermometer Fisher SN# 5104603 Cal. 4/26/07 Due: 4/26/08

7/2/2007	8:40	60.4	10.36
7/3/2007	8:00	60.4	10.41
7/12/2007	8:40	60.2	10.29
8/27/2007	9:40	60.4	10.18
9/14/2007	8:40	60.2	10.23
10/11/2007	8:30	60.4	10.06
11/8/2007	8:00	60.6	9.87
1/8/2008	1:06	60.2	8.97
3/24/2008	8:05	60.4	9.21

X.H 4/16/08
Xiuhua He 4/16/08

4/23/08	8:15	60.2	9.33

5/12/08 end tests

Carbon steel corroded with rusts in solution
only 90 ml solution left
pH = 9.78
pH measured with Orion SN: 5001A, Cal. 2/26/08 Due 2/26/09

Weight of carbon steel: 17.59612 g
Weight of glass specimens 0.30645 g
Weighed with Sartorius balance SN# 28090099
Cal. 11/13/07 Due: 5/13/08

continued from P. 29

Sample ID
SS 1-2

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/10/06

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 284755

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	4.59	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	4.69	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	63.9	25
Selenium	<0.500	0.5
Silicon	5.89	1.25
Silver	<0.250	0.25
Sodium	242	10
Strontium	<0.250	0.25
Sulfur	21.9	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	0.294	0.25
Zirconium	<0.250	0.25

X.H 7/14/08

Xiuhua He 10/2/08

Sample ID: SS 1-3

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284756

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	30.3	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	5.53	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	101	25
Selenium	<0.500	0.5
Silicon	9.77	1.25
Silver	<0.250	0.25
Sodium	255	10
Strontium	<0.250	0.25
Sulfur	24.5	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	0.639	0.25
Zirconium	<0.250	0.25

Sample ID: SS 1-4

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 284757

Client: Division 20

Date Received: 08/10/06

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	5.85	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	5.73	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	126	25
Selenium	<0.500	0.5
Silicon	13.0	1.25
Silver	<0.250	0.25
Sodium	309	10
Strontium	<0.250	0.25
Sulfur	30.1	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	0.308	0.25
Zirconium	<0.250	0.25

Sample ID: SS 1-5

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/10/06

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 284758

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	3.21	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	<2.50	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	<2.50	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	180	25
Selenium	<0.500	0.5
Silicon	10.4	1.25
Silver	<0.250	0.25
Sodium	233	10
Strontium	<0.250	0.25
Sulfur	27.9	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	<0.250	0.25
Zirconium	<0.250	0.25

Xichun He 10/25/06

Sample ID: PW 3-5

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/10/06

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 284759

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<2.50	2.5
Antimony	<0.750	0.75
Arsenic	<0.500	0.5
Barium	<0.250	0.25
Beryllium	<0.250	0.25
Bismuth	<0.500	0.5
Boron	<1.00	1
Cadmium	<0.250	0.25
Calcium	2.84	2.5
Chromium	<0.250	0.25
Cobalt	<0.250	0.25
Copper	<0.250	0.25
Iron	<3.50	3.5
Lanthanum	<0.250	0.25
Lead	<0.250	0.25
Lithium	<0.750	0.75
Magnesium	<2.50	2.5
Manganese	<0.250	0.25
Molybdenum	<0.250	0.25
Nickel	<0.250	0.25
Palladium	<1.00	1
Phosphorus	<1.25	1.25
Potassium	127	25
Selenium	<0.500	0.5
Silicon	15.1	1.25
Silver	<0.250	0.25
Sodium	311	10
Strontium	<0.250	0.25
Sulfur	31.0	1.25
Thallium	<0.500	0.5
Thorium	<1.50	1.5
Tin	<0.500	0.5
Titanium	<0.250	0.25
Tungsten	<0.500	0.5
Uranium	<5.00	5
Vanadium	<0.250	0.25
Yttrium	<0.250	0.25
Zinc	0.303	0.25
Zirconium	<0.250	0.25

Xichun He 10/25/06

Sample ID
LCS-K12H1

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: 29636

Task Order: 060810-15

Method: ICP - 6010B			
Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Aluminum	1.85	2.00	92.5%
Antimony	0.484	0.500	96.8%
Arsenic	2.02	2.00	101.0%
Barium	2.01	2.00	100.5%
Beryllium	0.0480	0.050	96.0%
Bismuth	NA	NA	NA
Boron	NA	NA	NA
Cadmium	0.0497	0.050	99.4%
Calcium	19.2	20.0	96.0%
Chromium	0.189	0.200	94.5%
Cobalt	0.498	0.500	99.6%
Copper	0.238	0.250	95.2%
Iron	1.09	1.00	109.0%
Lanthanum	NA	NA	NA
Lead	0.479	0.500	95.8%
Lithium	7.65	8.00	95.6%
Magnesium	19.3	20.0	96.5%
Manganese	0.493	0.500	98.6%
Molybdenum	NA	NA	NA
Nickel	0.497	0.500	99.4%
Palladium	NA	NA	NA
Phosphorus	NA	NA	NA
Potassium	38.0	40.0	95.0%
Selenium	2.03	2.00	101.5%
Silicon	NA	NA	NA
Silver	0.0470	0.050	94.0%
Sodium	38.7	40.0	96.8%
Strontium	NA	NA	NA
Sulfur	NA	NA	NA
Thallium	2.09	2.00	104.5%
Thorium	NA	NA	NA
Tin	NA	NA	NA
Titanium	NA	NA	NA
Tungsten	NA	NA	NA
Uranium	NA	NA	NA
Vanadium	0.475	0.500	95.0%
Yttrium	NA	NA	NA
Zinc	0.496	0.500	99.2%
Zirconium	NA	NA	NA

NA- Not Applicable

Xithua He 10/25/06

Sample ID
FilterBlk

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: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<0.0500	0.05
Antimony	<0.0150	0.015
Arsenic	<0.0100	0.01
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	<0.0700	0.07
Lanthanum	<0.00500	0.005
Lead	<0.00500	0.005
Lithium	<0.0150	0.015
Magnesium	<0.0500	0.05
Manganese	<0.00500	0.005
Molybdenum	<0.00500	0.005
Nickel	<0.00500	0.005
Palladium	<0.0200	0.02
Phosphorus	<0.0250	0.025
Potassium	<0.500	0.5
Selenium	<0.0100	0.01
Silicon	<0.0250	0.025
Silver	<0.00500	0.005
Sodium	<0.200	0.2
Strontium	<0.00500	0.005
Sulfur	<0.0250	0.025
Thallium	<0.0100	0.01
Thorium	<0.0300	0.03
Tin	<0.0100	0.01
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

Xithua He 10/25/06

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Sample ID
PBW - K12H1

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 29636

Task Order: 060810-15

Method: ICP - 6010B		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<0.0500	0.05
Antimony	<0.0100	0.01
Arsenic	<0.0100	0.01
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	<0.0700	0.07
Lanthanum	<0.0500	0.05
Lead	<0.0250	0.025
Lithium	<0.00500	0.005
Magnesium	<0.00500	0.005
Manganese	<0.00500	0.005
Molybdenum	<0.0250	0.025
Nickel	<0.0250	0.025
Palladium	<0.00500	0.005
Phosphorus	<0.0150	0.015
Potassium	<0.00500	0.005
Selenium	<0.00500	0.005
Silicon	<0.0300	0.03
Silver	<0.00500	0.005
Sodium	<0.0200	0.02
Strontium	<0.0100	0.01
Sulfur	<0.01	0.01
Thallium	<0.0100	0.01
Thorium	<0.100	0.1
Tin	<0.00500	0.005
Titanium	<0.00500	0.005
Tungsten	<0.00500	0.005
Uranium	<0.00500	0.005
Vanadium	<0.00500	0.005
Yttrium	<0.500	0.5
Zinc	<0.0150	0.015
Zirconium	<0.200	0.2

NA- Not Applicable

Xihua He 10/25/06

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: Xihua He **Request Date:** 11/28/06
Project No.: **Phone No.:** 5194
Description of Work Requested: IC For Anion

F^-, NO_3^-, Cl^-, SO_4^{2-}

☐ 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
CSOI 01A	CS016A	Cl^-
CSOI 02A	SS16A } For Test	Not Filtered
CSOI 03A	PW36A } 316L SS pore	
CSOI 4A	p.12, this notebook	
CSOI 5A	x-rd 4/16/07	

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 12/05/06

QA Nuclear

SAMPLE LIST/CHAIN OF CUSTODY

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

Requested Turnaround: ✓ 2 Weeks ☐ 3 Weeks ☐ Other:

Client Purchase Order/Other ID | Site/Zone ID | SwRI Contact: X5194 Xihua He

Analyses Requested

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)

Div 20 | Xihua He

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	Analyses Requested / REMARKS
CSDI 01A	11/28/06	2:30	L		1	ICP Analysis for Anions, Cl, SO4, F + 20 Filtered
CSDI 02A						
CSDI 03A						
CSDI 4A						
CSDI 5A						
CSDI 6A						
SS1-6A						
PW 36A						

Shipper Name/Address

Client

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: | Therm #:
Comments:

SwRI Project#: 20.06002.01.222

Relinquished by (Print/Signature)	Date	Time
Brian K. Dealy	11/28/06	2:30p
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 FRM-010 (Rev 1/Nov 05)

Xihua He 12/15/06

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: Xihua He **Request Date:** 11/28/06
Project No.: 20 **Phone No.:** 5194
Description of Work Requested: ICP Analysis Complete

☐ 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
CSDI 01B	CSDI 6B	Cl⁻ F Filtered
CSDI 02B	SS16B	
CSDI 03B	PW36B	
CSDI 4B		
CSDI 5B		

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 12/15/06

QA Nuclear

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

Client: Xihua He Div 20

Shipper Name/ Address

Requested Turnaround: ✓ 2 Weeks | 3 Weeks | Other:

SwRI Contact: X 5194 Xihua He

SwRI Project#: 20.06002.01.222

Page ___ of ___

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	Analyses Requested: Comp Analysis	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)
CS01 01B	11/22/06	2:30	W		1	✓	0.45µm Filtered
CS01 02B					1	✓	
CS01 03B					1	✓	
CS01 04B					1	✓	
CS01 5B					1	✓	
CS01 6B					1	✓	
SS16B 7					1	✓	
PW36B	↓	↓	↓	↓	1	✓	
				Spare Test	3	316 SS plate (1 of 3)	x-sectioned

Relinquished by (Print/Signature): Brian K. Dealy — Date: 11/24/06 — Time: 2:30

Received by (Print/Signature) — Date — Time

Relinquished by (Print/Signature) — Date — Time

Received by (Print/Signature) — Date — Time

Relinquished by (Print/Signature) — Date — Time

Samples Disposed: Date — Time

Samples Disposed by:

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: | Therm #:

Comments:

Div 01 COC FRM-010 (Rev 1/Nov 05)

ESEM Analysis Request Form

Complete Charge No.:	20.06002.01.222	**Date:**	11/30/06
Client:	SwRI Div. 20		
Requestor Name:	Xihua He	**Phone:**	5194
Need Results By:	December 15, 2006	**Number of Samples:**	2

Sample and Analysis Descriptions:

☒ **Standard ESEM analysis**[1] ☐ **Return sample after analysis**[2]

☐ Wet analysis[3] Humidity:_____ ☐ Special Temperature[4] (-30 – 50°C): room temperature

☐ Video capture ☐ STEM analysis

Expected feature size: nm-2 µm Special Magnifications[1]: _____

Sample Names/Numbers: CSteelCorr, SStellCorr

Reason for ESEM Analysis:Observe particles in solution

Comments and Special Handling/Disposal Considerations:

Solution is benign. So no special handling is needed.

[1]Standard imaging at 100x, 500x, 1000x, and 5000x.
[2]Provide disposal procedure if unchecked.
[3]100% humidity only available below 20°C. *Note: Lower resolution limit with higher humidity.*
[4]Standard imaging temperature is 20-25°C if unchecked.

This form must be completed and returned to James Oxley (james.oxley@swri.org) prior to sample submission and analysis.

FRM-394 (Rev 0/Nov 06)

Xihua He

Xihua He

From: James Oxley [james.oxley@swri.org]
Sent: Tuesday, December 05, 2006 4:33 PM
To: Xihua He
Subject: ESEM and Particle Size Analysis Data

Xihua,

The particle size analysis data is attached. One chart contains the entire size distribution graph, and the second has a blow up of the region below 1 µm. I barely had enough sample for good analysis. 6 mL of sample is preferred with similar particle concentration. Also, this technique is sensitive to the refractive index of the material for particles below 10 µm. I chose a RI of 2.98 based on the standard refractive index for Fe_2O_3. Let me know if I should use something different. I doubt it would change the data much in this case.

The ESEM images are located on the O: drive using the following link:

\\swri-filer.swri.edu\odrive\Div01\ESEM\06002 120506 Div20

Let me know if you have any questions.

Regards,

Jamie

James Oxley, Ph.D.
Research Scientist
Microencapsulation & Drug Delivery
ext. 2913, *Building* T46

The analysis results are on p. 49 – 52.

X. Hua He 12/15/06

V. H 3/27/07

Particle size analysis results for particles & solution drawn from test cell on p.30

MASTERSIZER 2000

carbon steel + D.I. water

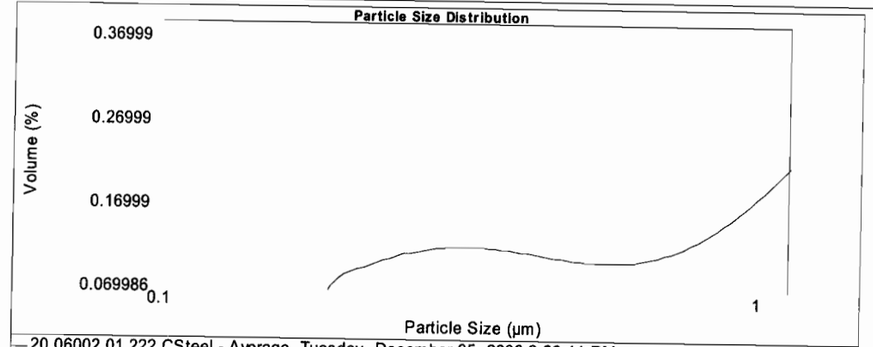
Result Analysis Report

Sample Name: 20.06002.01.222 CSteel - Average
Sample Source & type: Supplier = Division 20
Sample bulk lot ref:
SOP Name:
Measured by: joxley
Result Source: Averaged
Measured: Tuesday, December 05, 2006 2:26:11 PM
Analysed: Tuesday, December 05, 2006 2:26:12 PM

Particle Name: Iron III Oxide 2.98
Particle RI: 2.980
Dispersant Name: Water
Accessory Name: Hydro 2000S (A)
Absorption: 1
Dispersant RI: 1.330
Analysis model: General purpose
Size range: 0.020 to 2000.000 um
Weighted Residual: 0.899 %
Sensitivity: Normal
Obscuration: 8.54 %
Result Emulation: Off

Concentration: 0.0128 %Vol
Specific Surface Area: 0.518 m²/g
Span : 1.964
Surface Weighted Mean D[3,2]: 11.576 um
Uniformity: 0.674
Vol. Weighted Mean D[4,3]: 26.101 um
Result units: Volume

d(0.1): 7.985 um **d(0.5):** 20.406 um **d(0.9):** 48.058 um



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.00	0.105	0.00	1.096	0.12	11.482	5.87	120.226	0.06	1258.925	0.00
0.011	0.00	0.120	0.00	1.259	0.14	13.183	6.83	138.038	0.03	1445.440	0.00
0.013	0.00	0.138	0.00	1.445	0.18	15.136	7.55	158.489	0.04	1659.587	0.00
0.015	0.00	0.158	0.00	1.660	0.22	17.378	7.98	181.970	0.06	1905.461	0.00
0.017	0.00	0.182	0.00	1.905	0.26	19.953	8.06	208.930	0.09	2187.762	0.00
0.020	0.00	0.209	0.00	2.188	0.30	22.909	7.80	239.883	0.12	2511.886	0.00
0.023	0.00	0.240	0.00	2.512	0.34	26.303	7.25	275.423	0.13	2884.032	0.00
0.026	0.00	0.275	0.01	2.884	0.38	30.200	6.48	316.228	0.11	3311.311	0.00
0.030	0.00	0.316	0.08	3.311	0.44	34.674	5.60	363.078	0.06	3801.894	0.00
0.035	0.00	0.363	0.09	3.802	0.54	39.811	4.66	416.869	0.01	4365.158	0.00
0.040	0.00	0.417	0.10	4.365	0.72	45.709	3.73	478.630	0.00	5011.872	0.00
0.046	0.00	0.479	0.11	5.012	0.99	52.481	2.84	549.541	0.00	5754.399	0.00
0.052	0.00	0.550	0.11	5.754	1.42	60.256	2.00	630.957	0.00	6606.934	0.00
0.060	0.00	0.631	0.10	6.607	2.02	69.183	1.23	724.436	0.00	7585.776	0.00
0.069	0.00	0.724	0.10	7.586	2.82	79.433	0.55	831.764	0.00	8709.636	0.00
0.079	0.00	0.832	0.09	8.710	3.76	91.201	0.24	954.993	0.00	10000.000	0.00
0.091	0.00	0.955	0.09	10.000	4.82	104.713	0.15	1096.478	0.00		
0.105	0.00	1.096	0.10	11.482		120.226		1258.925	0.00		

Operator notes:

Malvern Instruments Ltd.
Malvern, UK

Mastersizer 2000 Ver. 5.22
Serial Number : MAL102158

File name: Div20 06002
Record Number: 4

X. Hua He 12/15/06

MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
20.06002.01.222 CSteel - Average

SOP Name:

Measured:
Tuesday, December 05, 2006 2:26:11 PM

Sample Source & type:
Supplier = Division 20

Measured by:
joxley

Analysed:
Tuesday, December 05, 2006 2:26:12 PM

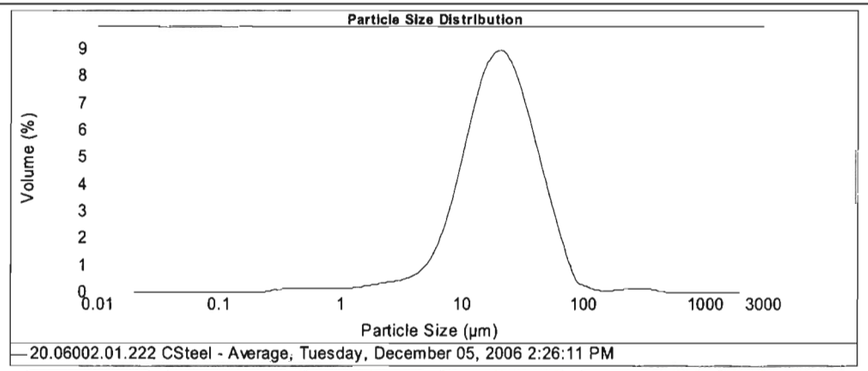
Sample bulk lot ref:

Result Source:
Averaged

Particle Name:	Accessory Name:	Analysis model:	Sensitivity:
Iron III Oxide 2.98	Hydro 2000S (A)	General purpose	Normal
Particle RI:	**Absorption:**	**Size range:**	**Obscuration:**
2.980	1	0.020 to 2000.000 um	8.54 %
Dispersant Name:	**Dispersant RI:**	**Weighted Residual:**	**Result Emulation:**
Water	1.330	0.899 %	Off

Concentration:	Span :	Uniformity:	Result units:
0.0128 %Vol	1.964	0.674	Volume
Specific Surface Area:	**Surface Weighted Mean D[3,2]:**	**Vol. Weighted Mean D[4,3]:**	
0.518 m²/g	11.576 um	26.101 um	

d(0.1): 7.985 um **d(0.5):** 20.406 um **d(0.9):** 48.058 um



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	0.00

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.01
0.275	0.08
0.316	0.09
0.363	0.10
0.417	0.11
0.479	0.11
0.550	0.10
0.631	0.10
0.724	0.09
0.832	0.09
0.955	0.10
1.096	

Size (µm)	Volume In %
1.096	0.12
1.259	0.14
1.445	0.18
1.660	0.22
1.905	0.26
2.188	0.30
2.512	0.34
2.884	0.38
3.311	0.44
3.802	0.54
4.365	0.72
5.012	0.99
5.754	1.42
6.607	2.02
7.586	2.82
8.710	3.76
10.000	4.82
11.482	

Size (µm)	Volume In %
11.482	5.87
13.183	6.83
15.136	7.55
17.378	7.98
19.953	8.06
22.909	7.80
26.303	7.25
30.200	6.48
34.674	5.60
39.811	4.66
45.709	3.73
52.481	2.84
60.256	2.00
69.183	1.23
79.433	0.55
91.201	0.24
104.713	0.15
120.226	

Size (µm)	Volume In %
120.226	0.06
138.038	0.03
158.489	0.04
181.970	0.06
208.930	0.09
239.883	0.12
275.423	0.13
316.228	0.11
363.078	0.06
416.869	0.01
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

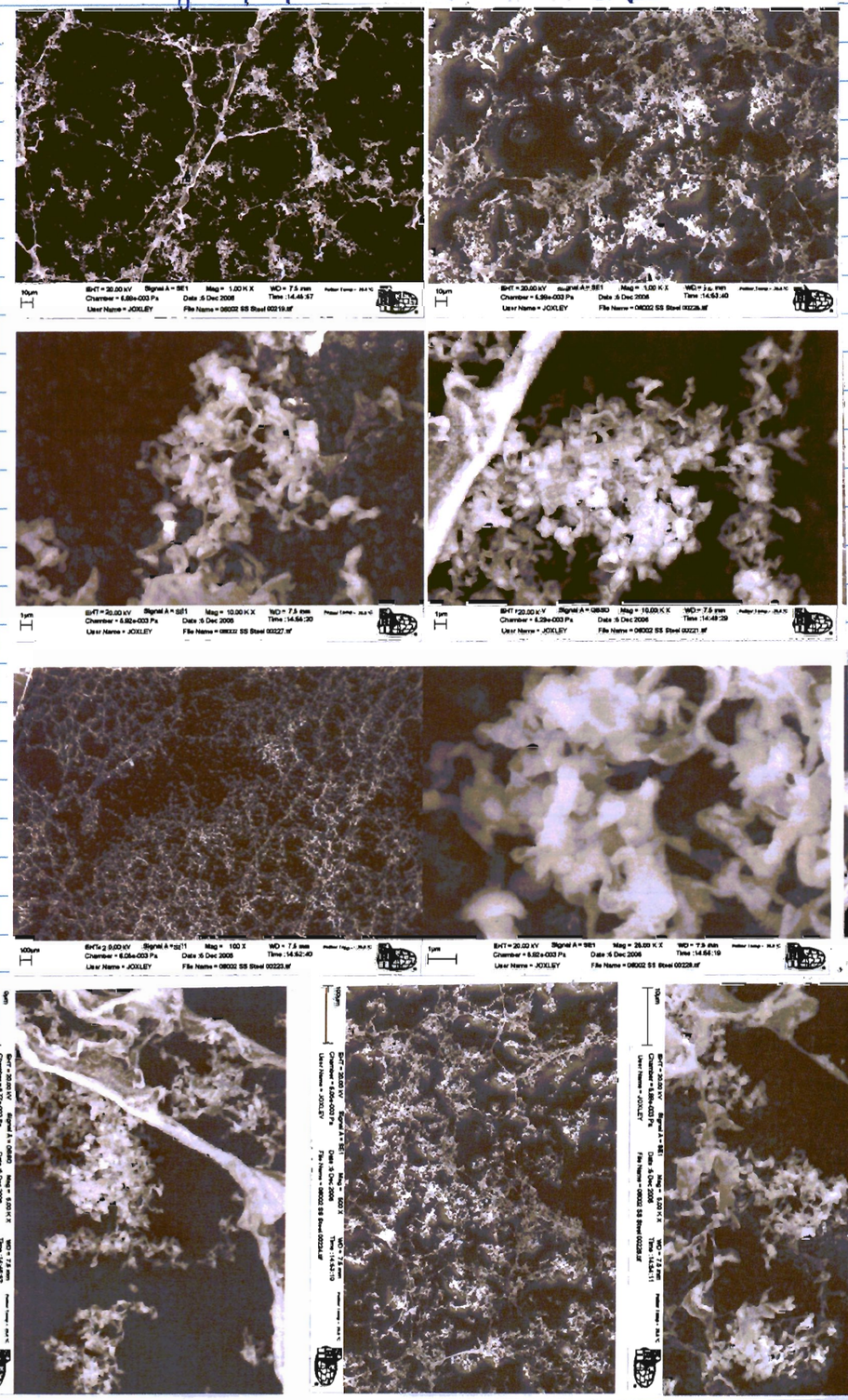
Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Operator notes:

Xiuhua He 12/5/06

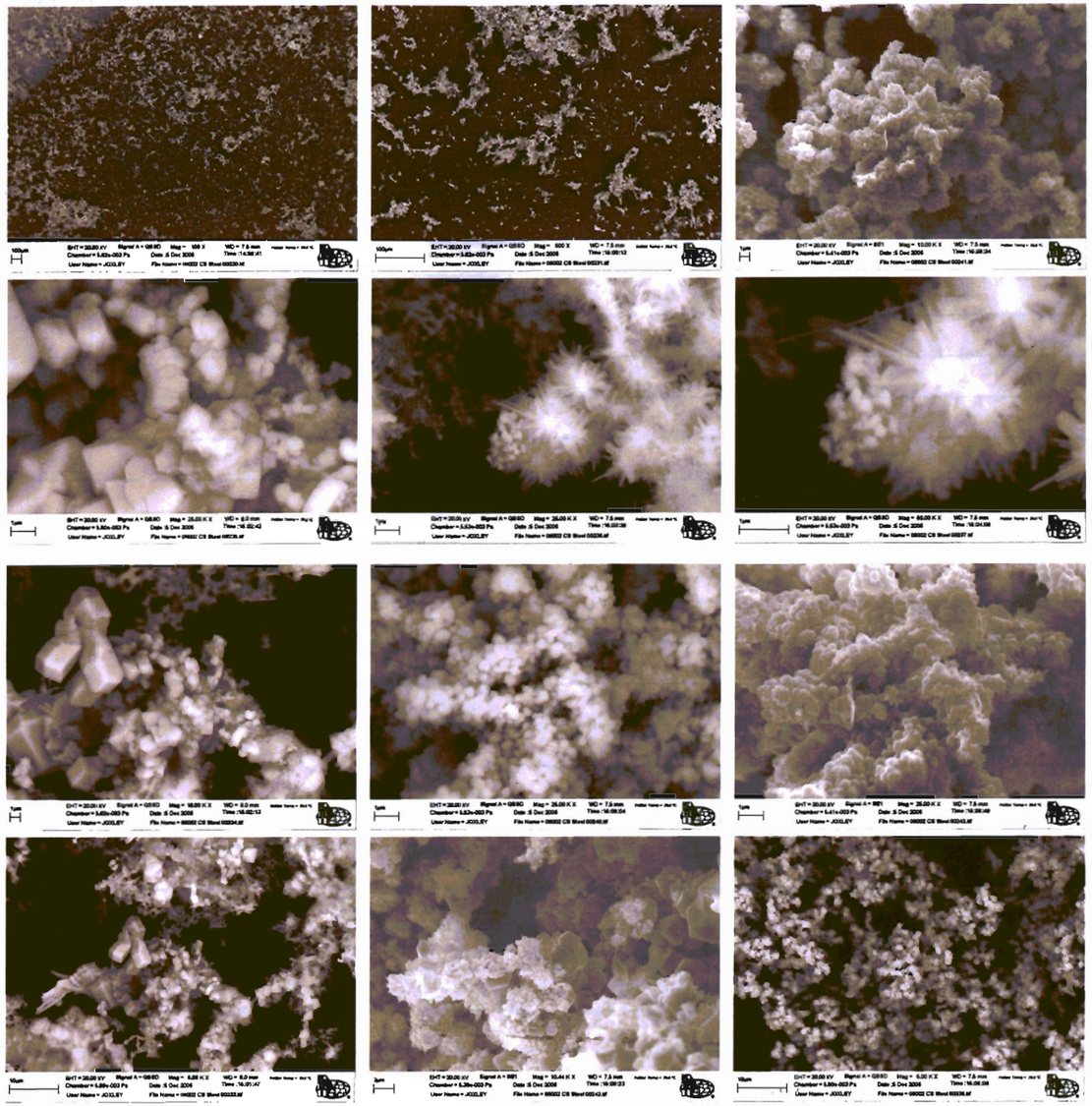
ESEM analysis for particles & solution drawn from stainless steel + pore water

P.4



Xiuhua He 12/5/06

ESEM analysis results for test: carbon steel + D.I water p. 30



Xihua He 12/15/06

The ICP order form is on page 85 this notebook

Sample ID
CSDI 01B

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 11/28/06

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 290147

SRR: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	1.02	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.00	1
Lanthanum	<0.125	0.125
Lead	<0.100	0.1
Lithium	<0.125	0.125
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.125	0.125
Nickel	<0.100	0.1
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	7.08	0.05
Selenium	<0.125	0.125
Silicon	<1.00	1
Silver	<0.100	0.1
Sodium	1.69	0.1
Strontium	<0.100	0.1
Sulfur	<0.500	0.5
Thallium	<0.250	0.25
Thorium	<0.250	0.25
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	0.116	0.1
Zirconium	<0.125	0.125

Note: No sample QC (Duplicates and matrix spikes) was performed due to insufficient sample volumes received.

Xihua He 1/26/07

Sample ID
CSDI 02B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290149

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1	1
Lanthanum	<0.125	0.125
Lead	<0.100	0.1
Lithium	<0.125	0.125
Magnesium	<1.00	1
Manganese	0.120	0.1
Molybdenum	<0.125	0.125
Nickel	<0.100	0.1
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	18.5	0.1
Selenium	<0.125	0.125
Silicon	1.42	1
Silver	<0.100	0.1
Sodium	2.60	0.2
Strontium	<0.100	0.1
Sulfur	<0.500	0.5
Thallium	<0.250	0.25
Thorium	<0.250	0.25
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	0.125	0.1
Zirconium	<0.125	0.125

Note: No sample QC (Duplicates and matrix spikes) was performed due to insufficient sample volumes received.

X. Chuanhe 1/26/07

Sample ID
CSDI 03B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290151

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.00	1
Lanthanum	<0.125	0.125
Lead	<0.100	0.1
Lithium	<0.125	0.125
Magnesium	<1.00	1
Manganese	0.131	0.1
Molybdenum	<0.125	0.125
Nickel	<0.100	0.1
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	52.5	0.5
Selenium	<0.125	0.125
Silicon	3.51	1
Silver	<0.100	0.1
Sodium	1.99	0.2
Strontium	<0.100	0.1
Sulfur	0.542	0.5
Thallium	<0.250	0.25
Thorium	<0.250	0.25
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.125	0.125

Note: No sample QC (Duplicates and matrix spikes) was performed due to insufficient sample volumes received.

X. Chuanhe 1/26/07

Sample ID
CSDI 04B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290152

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.00	1
Lanthanum	<0.125	0.125
Lead	<0.100	0.1
Lithium	<0.125	0.125
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.125	0.125
Nickel	<0.100	0.1
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	90.4	1
Selenium	<0.125	0.125
Silicon	<1.00	1
Silver	<0.100	0.1
Sodium	3.69	0.1
Strontium	<0.100	0.1
Sulfur	1.67	0.5
Thallium	<0.250	0.25
Thorium	<0.250	0.25
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.125	0.125

Note: No sample QC (Duplicates and matrix spikes) was performed due to insufficient sample volumes received.

Xihua He 1/26/07

Sample ID
CSDI 5B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290155

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.00	1
Lanthanum	<0.125	0.125
Lead	<0.100	0.1
Lithium	<0.125	0.125
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.125	0.125
Nickel	<0.100	0.1
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	121	1
Selenium	<0.125	0.125
Silicon	<1.00	1
Silver	<0.100	0.1
Sodium	6.82	0.2
Strontium	<0.100	0.1
Sulfur	3.44	0.5
Thallium	<0.250	0.25
Thorium	<0.250	0.25
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.125	0.125

Note: No sample QC (Duplicates and matrix spikes) was performed due to insufficient sample volumes received.

Xihua He 1/26/07

Sample ID
CSDI 6B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290157

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	0.501	0.5
Cadmium	<0.100	0.1
Calcium	1.18	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.00	1
Lanthanum	<0.125	0.125
Lead	<0.100	0.1
Lithium	<0.125	0.125
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.125	0.125
Nickel	<0.100	0.1
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	188	1
Selenium	<0.125	0.125
Silicon	1.02	1
Silver	<0.100	0.1
Sodium	6.34	0.2
Strontium	<0.100	0.1
Sulfur	3.72	0.5
Thallium	<0.250	0.25
Thorium	<0.250	0.25
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.125	0.125

Note: No sample QC (Duplicates and matrix spikes) was performed due to insufficient sample volumes received.

Xihua He 11/26/07

Sample ID PW3-6
PW 36B

from p.12 this notebook

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290159

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-8

X.H 12/16/07

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	0.748	0.5
Cadmium	<0.100	0.1
Calcium	1.15	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.00	1
Lanthanum	<0.125	0.125
Lead	<0.100	0.1
Lithium	<0.125	0.125
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.125	0.125
Nickel	<0.100	0.1
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	115	1
Selenium	<0.125	0.125
Silicon	12.7	1
Silver	<0.100	0.1
Sodium	213	4
Strontium	<0.100	0.1
Sulfur	20.5	0.5
Thallium	<0.250	0.25
Thorium	<0.250	0.25
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	0.148	0.1
Zirconium	<0.125	0.125

Note: No sample QC (Duplicates and matrix spikes) was performed due to insufficient sample volumes received.

Xihua He 11/26/07

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290161

Sample ID SS1-6
SS1 6B

Client: Division 20 from p.12 this notebook K.H 4/16/07

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	0.700	0.5
Cadmium	<0.100	0.1
Calcium	1.59	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.00	1
Lanthanum	<0.125	0.125
Lead	<0.100	0.1
Lithium	<0.125	0.125
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.125	0.125
Nickel	<0.100	0.1
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	163	1
Selenium	<0.125	0.125
Silicon	9.92	1
Silver	<0.100	0.1
Sodium	150	2
Strontium	<0.100	0.1
Sulfur	21.3	0.5
Thallium	<0.250	0.25
Thorium	<0.250	0.25
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.125	0.125

Note: No sample QC (Duplicates and matrix spikes) was performed due to insufficient sample volumes received.

Xihua He 11/26/07

Sample ID
LCSW

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: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020			
Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Aluminum	1.86	2.00	93.0%
Antimony	0.475	0.500	95.0%
Arsenic	1.95	2.00	97.5%
Barium	1.91	2.00	95.5%
Beryllium	0.0483	0.050	96.6%
Bismuth	NA	NA	NA
Boron	NA	NA	NA
Cadmium	0.0480	0.050	96.0%
Calcium	19.2	20.0	96.0%
Chromium	0.186	0.200	93.0%
Cobalt	0.482	0.500	96.4%
Copper	0.233	0.250	93.2%
Iron	1.13	1.00	113.0%
Lanthanum	NA	NA	NA
Lead	0.474	0.500	94.8%
Lithium	3.51	4.00	87.8%
Magnesium	19.1	20.0	95.5%
Manganese	0.481	0.500	96.2%
Molybdenum	NA	NA	NA
Nickel	0.468	0.500	93.6%
Palladium	NA	NA	NA
Phosphorus	NA	NA	NA
Potassium	0.0231	0.020	115.5%
Selenium	2.00	2.00	100.0%
Silicon	NA	NA	NA
Silver	0.0478	0.050	95.6%
Sodium	0.0209	0.020	104.5%
Strontium	NA	NA	NA
Sulfur	NA	NA	NA
Thallium	1.99	2.00	99.5%
Thorium	NA	NA	NA
Tin	NA	NA	NA
Titanium	NA	NA	NA
Tungsten	NA	NA	NA
Uranium	NA	NA	NA
Vanadium	0.471	0.500	94.2%
Yttrium	NA	NA	NA
Zinc	0.483	0.500	96.6%
Zirconium	NA	NA	NA

NA- Not Applicable.

Xihua He 11/26/07

Sample ID: PBW

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: 30107

Task Order: 061129-8

Method: ICP - 6010B/ ICPMS-6020		
Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1.00
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.100	0.100
Beryllium	<0.100	0.100
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.100	0.100
Calcium	<1.00	1.00
Chromium	<0.100	0.100
Cobalt	<0.100	0.100
Copper	<0.100	0.100
Iron	<1.00	1.00
Lanthanum	<0.125	0.125
Lead	<0.100	0.100
Lithium	<0.125	0.125
Magnesium	<1.00	1.00
Manganese	<0.100	0.100
Molybdenum	<0.125	0.125
Nickel	<0.100	0.100
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	<0.00100	0.00100
Selenium	<0.125	0.125
Silicon	<1.00	1.00
Silver	<0.100	0.100
Sodium	<0.00200	0.00200
Strontium	<0.100	0.100
Sulfur	<0.500	0.500
Thallium	<0.250	0.250
Thorium	<0.250	0.250
Tin	<0.125	0.125
Titanium	<0.100	0.100
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.100	0.100
Yttrium	<0.100	0.100
Zinc	<0.100	0.100
Zirconium	<0.125	0.125

NA- Not Applicable.

Xihua He 1/24/07

continued from p. 12

2/5/07	8:15	60.2	9.55	60.4	9.46	60.4	9.52
2/9/07	8:30	60.2	9.29	60.4	9.38	60.2	9.50
2/12/07	9:00	60.2	9.25	60.4	9.31	60.4	9.33
2/16/07	8:15	60.4	9.16	60.2	9.28	60.2	9.26
2/19/07	1 mL solution was drawn from Cell #1 for ICP analysis. ID: SS1-9						
				#3			ID: pw3-9
2/19/07	8:00	60.4	9.09	60.4	9.18	60.2	9.23
3/5/07	8:15	60.2	9.11	60.2	9.26	60.2	9.17
3/15/07	8:30	60.2	9.17	60.4	9.2	60.4	9.16

Xihua He 3/27/07

Thermometer Fisher SN# 5104603 Cal: 4/26/07 Due 4/26/08

7/2/07	8:25	60.4	9.23	60.4	9.19	60.2	9.3
7/12/07	8:30	60.2	9.18	60.2	9.16	60.2	9.24
8/27/07	9:45	60.2	9.28	60.4	9.31	~~60.2~~ X.H 4/14/08	9.38
9/14/07	8:30	60.4	9.31	60.2	9.28	60.4	9.63
10/11/07	8:25	60.6	9.29	60.4	9.5-1	60.2	9.68
11/9/07	8:05	60.4	9.58	60.4	9.72	60.2	9.78
12/7/07	3:46pm	60.4	9.26			X X.H 1/7/08	
1/7/08	1:02	60.2	9.02	60.4	9.21	60.4	9.18
3/24/08	8:00	60.2	9.25	60.2	9.45	60.2	9.36
4/23/08	8:20	60.4	9.1	60	9.31	60.2	9.11
5/12/08	turn off heater. stop tests						

Cell #1 150 mL solution left
solution clear with some white flakes
pH = 9.71
Final weight = 11.42423 g
pH was measured with Orion SN001A Cal: 2/26/08 Due: 2/26/09

Cell #2 114 mL solution
pH = 9.79
Final Weight = 10.96706 g

Cell #3 120 mL solution
pH = 9.81

Measured with balance Sartorius SN: 1280755 Cal: 11/13/07 Due: 5/13/08

Observation: Stainless steel surface is still shiny. No evidence of corrosion.

7/14/08

K.H 7/

Sample ID
CSDI 01A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290146

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	7.95	1	mg/L	EPA 300
Fluoride	<1	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	<1	1	mg/L	EPA 300

Sample ID
CSDI 02A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290148

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	18.9	1	mg/L	EPA 300
Fluoride	<1	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	<1	1	mg/L	EPA 300

Xihua He 4/16/07

Sample ID
CSDI 03A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290150

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	46.2	1	mg/L	EPA 300
Fluoride	<1	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	<1	1	mg/L	EPA 300

Sample ID
CSDI 04A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290153

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	80.0	1	mg/L	EPA 300
Fluoride	<1	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	<1	1	mg/L	EPA 300

Xichuan He 4/6

Sample ID
CSDI 5A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290154

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	110	1	mg/L	EPA 300
Fluoride	<1	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	<1	1	mg/L	EPA 300

Sample ID
CSDI 6A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290156

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	115	1	mg/L	EPA 300
Fluoride	<1	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	<1	1	mg/L	EPA 300

Xichuan He
4/16/07

Sample ID: PW 36A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290158

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	129	1	mg/L	EPA 300
Fluoride	9.42	1	mg/L	EPA 300
Nitrate-N	2.38	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	56.4	1	mg/L	EPA 300

Sample ID: SS1 6A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 290160

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 11/28/06

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	159	1	mg/L	EPA 300
Fluoride	6.94	1	mg/L	EPA 300
Nitrate-N	1.82	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	39.6	1	mg/L	EPA 300

Xichuette 4/16/07

Sample ID: PB 02/01/07

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Date Analyzed: 02/01/07

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 30107

Task Order: 061129-7

Analysis	Sample Result	Reporting Limit	Units
Bromide	<1	1	mg/L
Chloride	<1	1	mg/L
Fluoride	<1	1	mg/L
Nitrate-N	<1	1	mg/L
Nitrite-N	<1	1	mg/L
Phosphate-P	<1	1	mg/L
Sulfate	<1	1	mg/L

Sample ID: LCS 02/01/07

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Date Analyzed: 02/01/07

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 30107

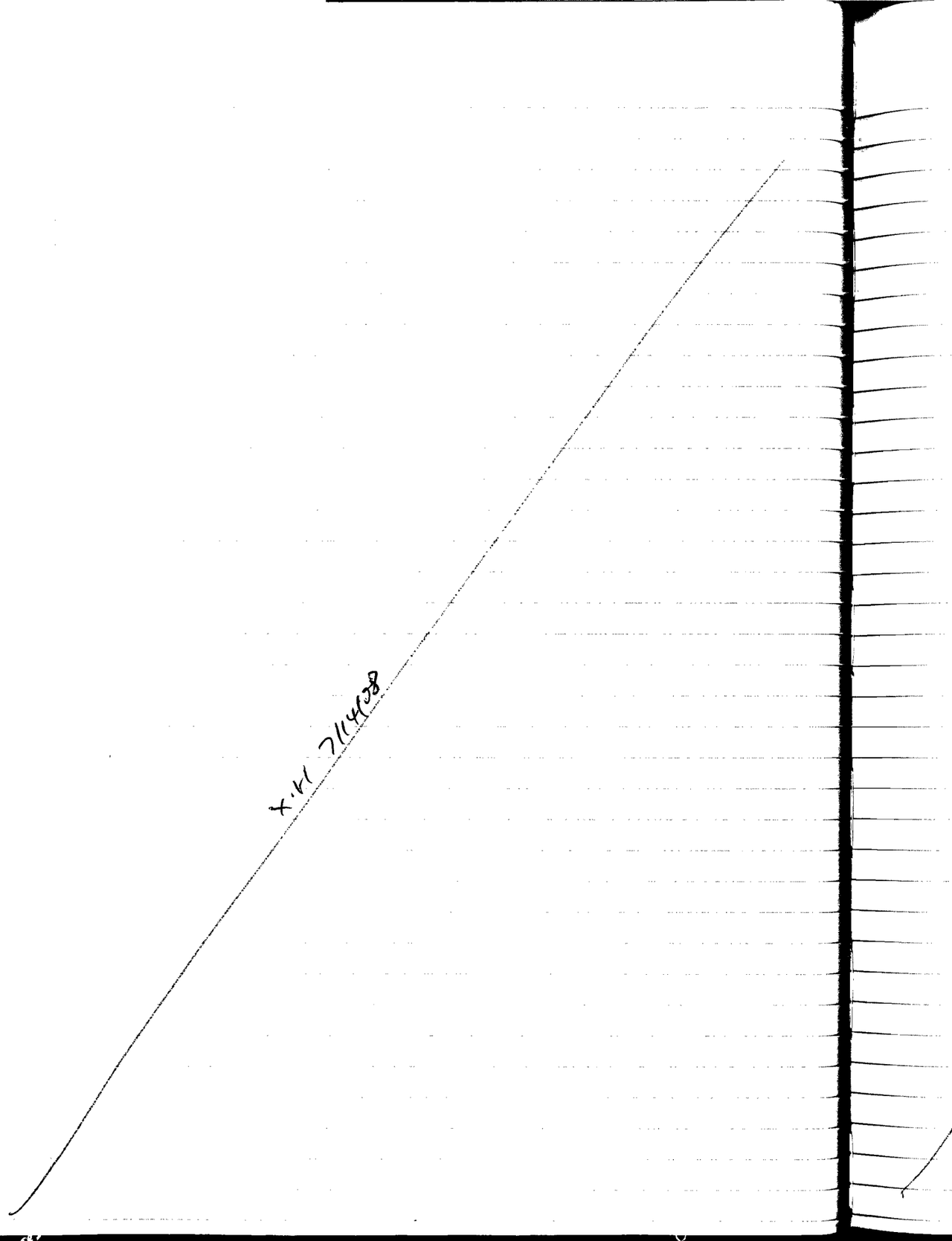
Task Order: 061129-7

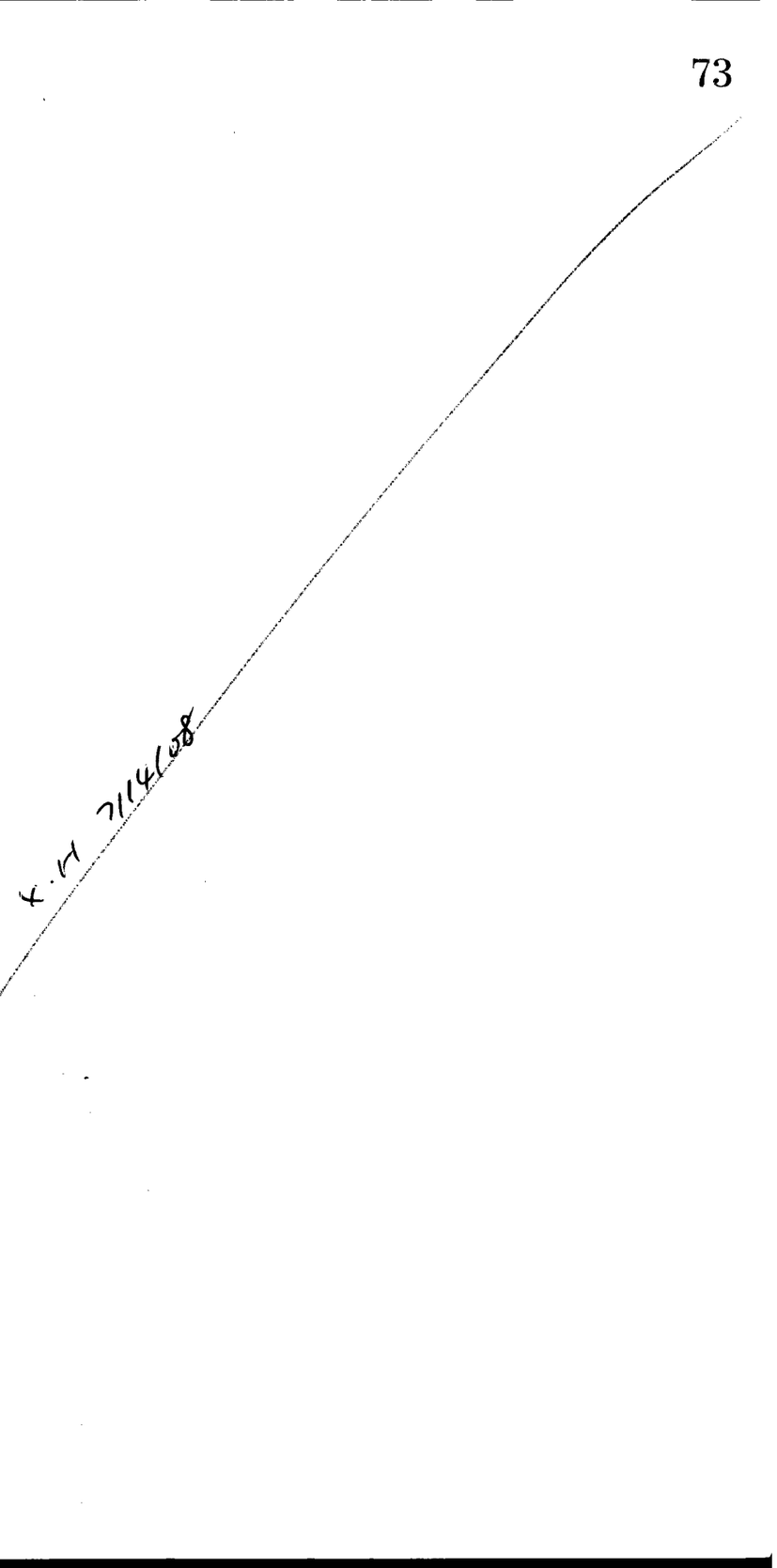
Analysis	Sample Result	True Value	Recovery	Units
Bromide	396	400	99.0%	mg/L
Chloride	200	200	100%	mg/L
Fluoride	98.8	100	98.8%	mg/L
Nitrate-N	89.9	90.4	99.4%	mg/L
Nitrite-N	120	118	102%	mg/L
Phosphate-P	191	196	97.4%	mg/L
Sulfate	401	400	100%	mg/L

Xichuette 4/16/07

K.H 7/14/08

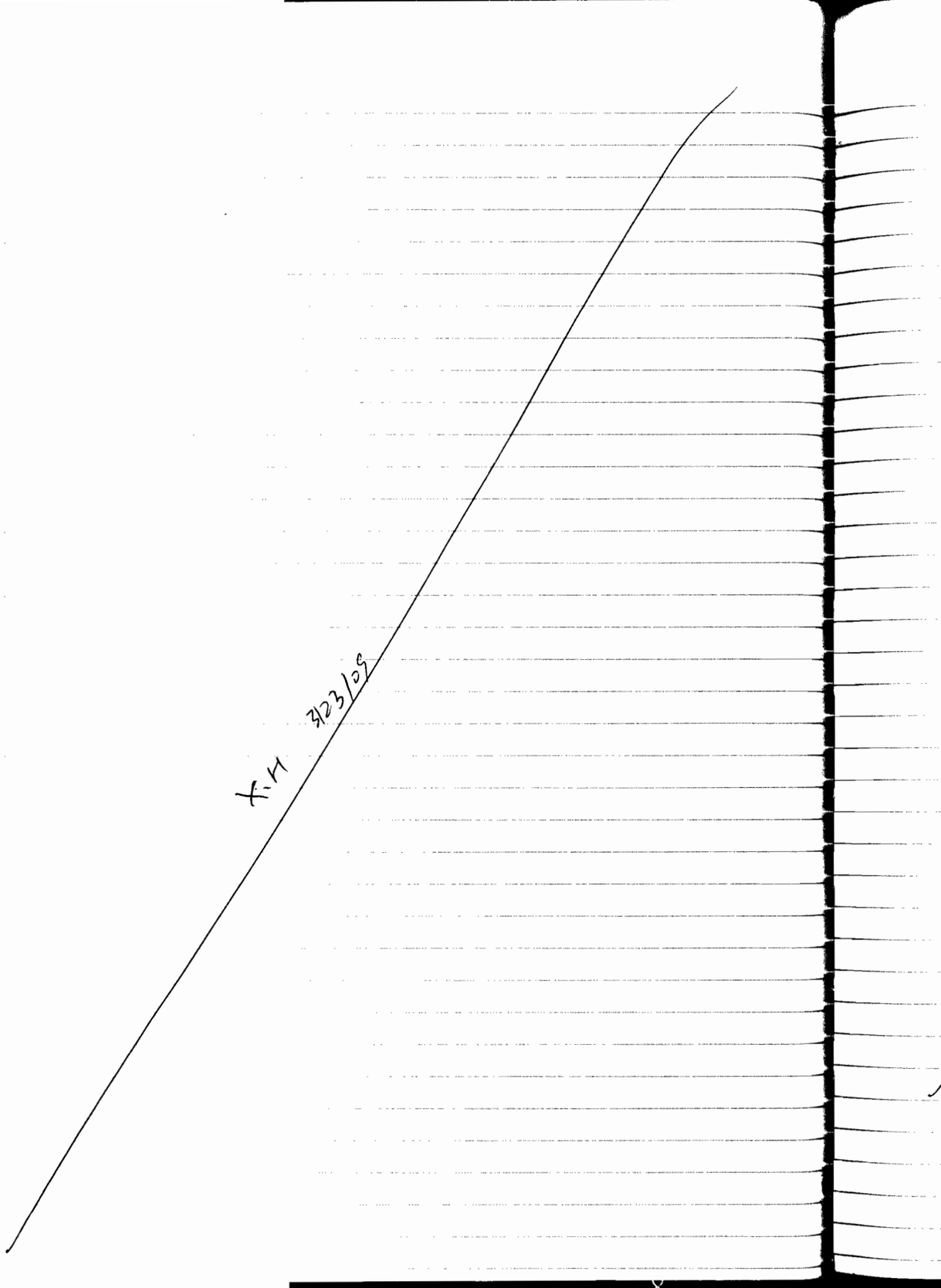
K.H 7/14/08


X.H 7/14/08


X.H 7/14/08

x·H 7/14/08

x·H 7/14/08


X.H 3123123


X.H 3123123

Modified simulated sodium Pore Water to remove calcium from solution

Calculation			mol/L	mol/L	mg/L	mg/L	Original stock solution (g/L) (40 fold)
	g/L	mol/L	Na	SO4	Na	SO4	
Na2SO4	0.04615	0.0003249	0.00065	0.0003249	14.9388252	31.211175	1.846
			Na	NO3	Na	NO3	
NaNO3	0.000569	6.695E-06	6.7E-06	6.6945E-06	0.15390602	0.415094	0.02276
			K	Cl	K	Cl	
KCl	0.0117	0.0001569	0.00016	0.00015694	6.13604471	5.5639553	0.468
			Mg	Cl	Mg	Cl	
MgCl2-6H2O	0.028	0.0001377	0.00014	0.00027545	3.34743057	9.7656002	1.12
			Na	HCO3	Na	HCO3	
NaHCO3	0.336	0.0039997	0.004	0.00399967	91.9516468	244.04835	13.44
			Na	F	Na	F	
NaF	0.0134	0.0003191	0.00032	0.00031914	7.33690227	6.0630977	0.536
			Na	Cl	Na	Cl	
NaCl	0.01426	0.000244	0.00024	0.000244	5.60949421	0.0086505	0.5704

					TBD#7, Page3-7, Table 3-2, sodium pore water		
		totals	mol/L	mg/L	DOE, mg/L	DOE, mol/L	DOE, mmol/L
		Ca	0	0	41	0.001023	1.02300514
		SO4	0.00032	31.2111748	31	0.0003227	0.322702876
		NO3	6.7E-06	0.41509398	0.41	6.612E-06	0.006612381
		K	0.00016	6.13604471	6.1	0.000156	0.156017014
		Cl	0.00068	23.9800613	24	0.000677	0.676952585
		Mg	0.00014	3.34743057	3.3	0.0001358	0.135774532
		Na	0.00522	119.990775	120	0.0052197	5.219706131
		F	0.00032	6.06309773	6	0.0003158	0.315816069
		HCO3	0.004	244.048353	362	0.0059328	5.932763111
							1.015273089

Xuhua He 12/15/06

X.H 7/14/08

Carbon Steel Immersion in Simulated Sodium Pore Water Without Calcium					
Stock solution #1					
Na2SO4 1.850g lot# 03541					
NaNO3 0.023g lot# 050093					
KCl 0.471g lot# 043820	plus D.I water to 1 L				
MgCl2-6H2O 1.125g lot# 054378					
NaCl 0.571g lot# 054171					
Stock solution #2					
NaHCO3 13.446g Lot# 054010	plus D.I. water to 1 L				
NaF 0.541g Lot# 006679					
Combined 50mls of each stock solution					
plus D.I. H2O to 2 L					
pH = 7.98 at room temperature					
Measurements taken with a Ohaus Sn# 2883 Cal:7/5/06			Due:1/5/07		
Orion pH Meter Sn#2330	Cal:7/6/06		7//6/07		
pH Probe 13-620-296 sn#5003095					
Test ID: CsteelPoreRev					
Test start Date 12/14/06 @ 10:00 am					
Cell #1 specimens A516 Carbon Steel Heat# D84944		**Dimensions**			
specimen #1 wt=3.4813g		6.32x13.78x5.22 mm			
specimen #2 wt= 7.41259g		12.47x14.84x5.31 mm			
specimen #3 wt= 7.49948g		12.41x13.77x5.86 mm			
Cell #2 specimens A516 Carbon Steel Heat# D84944		**Dimensions**			
specimen #4 wt= 7.40381g		12.46x13.88x5.56 mm			
specimen #5 wt= 8.57229g		12.45x14.74x6.15 mm			
specimen #6 wt= 4.33774g		6.59x13.81x6.65 mm			
Weight measurements taken with Sartorious Scale Sn#1209099 Cal: 11/8/06 Due: 5/8/07					
Dimension Measurements taken with Starrett Calipers sn# 03031512 Cal: 3/3/06 Due: 3/2/07					
Temperature measured with Omega Sn# t-94140 Cal: 11/13/06 Due: 5/13/07					
Thermocouple #335 Cal: 10/25/06 Due: 4/25/07					

Cell Tempurature set points		**Solution Volume Calculated from surface area**				
Cell #1 =	60	Cell #1 = 61	231.9mls	(Carbon Steel + Solution)		
Cell #2 =	60	Cell #2 = 62	245.7mls	(Carbon Steel + Solution)		
Cell#3=	60	Cell#3	245 mls	Solution only		

		CELL#1		CELL#2		CELL#3	
DATE TIME		TEMP	pH	TEMP	pH	TEMP	pH
12/14/2006	10:55	60.4	8.21	61.2	8.26	60.8	8.32
	3:41	60.4	8.23	60.6	8.31	60.3	8.36
12/15/2006	8:55	60.4	8.43	60.3	8.52	60.4	8.46

continued on P.82

Xuhua He 12/15/06

Date / Time		Cell #1 T	Cell #1 pH	Cell #2 T	Cell #2 pH	Cell #3 T	Cell #3 pH
12/18/2006	8:50	60.2	8.4	60.2	8.48	60.4	8.5
12/19/2006	8:00	60.2	8.8	60.4	8.91	60.4	8.76
12/19/2006	pulled first solution sample @ 8:15 not filtered CSsNa1-1a						
			Filtered+ acid	CSsNa1-1b			
	pulled first solution sample @ 8:15 not filtered CSsNa2-1a						
			Filtered+ acid	CSsNa2-1b			
	pulled first solution sample @ 8:15 not filtered CSsNa3-1a						
12/20/2006	8:15	60.2	8.83	60.4	8.93	60.2	8.74
12/21/2006	8:30	60.4	8.9	60.4	8.86	60.4	8.79
12/22/2006	8:20	60.2	8.92	60.4	8.79	60.4	8.83
	pulled first solution sample @ 8:15 not filtered CSsNa1-2a						
			Filtered+ acid	CSsNa1-2b			
	pulled first solution sample @ 8:15 not filtered CSsNa2-2a						
			Filtered+ acid	CSsNa2-2b			
	pulled first solution sample @ 8:15 not filtered CSsNa3-2a						
12/27/2006	11:30	60.2	9.063	60.2	9.022	60.4	8.736
1/3/2007	9:30	60.4	8.971	60.4	9.15	60.2	8.875
1/8/2007	9:10	60.2	9.026	60.4	9.183	60.4	8.841
1/12//07	9:30	60.4	9.125	60.4	9.143	60.2	8.89
1/15/2007	9:00	60.4	9.143	60.4	9.138	60.2	9.085

Xiehua He 1/15/07

1/19/2007	10:15	60.4	9.137	60.4	9.146	60.4	9.112
1/22/2007	9:00	60.2	9.129	60.2	9.117	60.4	9.039
1/23/2007	pulled first solution sample @ 8:15 not filtered CSsNa1-3a						
			Filtered+ acid	CSsNa1-3b			
	pulled first solution sample @ 8:15 not filtered CSsNa2-3a						
			Filtered+ acid	CSsNa2-3b			
	pulled first solution sample @ 8:15 not filtered CSsNa3-3a						
1/26/2007	10:00	60.4	9.132	60.4	9.116	60.4	9.085
1/29/2007	8:50	60.4	9.211	60.2	9.301	60.4	9.029
2/3/2007	9:30	60.4	9.235	60.2	9.316	60.4	9.114
2/5/2007	8:15	60.2	9.256	60.2	9.268	60.2	9.175
2/9/2007	8:30	60.4	9.313	60.2	9.232	60.4	9.211
2/12/2007	9:10	60.2	9.309	60.4	9.235	60.4	9.198
2/16/2007	8:30	60.2	9.28	60	9.31	60.2	9.243
2/19/2007	8:15	60.2	9.338	60.2	9.257	60.2	9.017
2/19/2007	pulled first solution sample @ 8:15 not filtered CSsNa1-4a						
			Filtered+ acid	CSsNa1-4b			
	pulled first solution sample @ 8:15 not filtered CSsNa2-4a						
			Filtered+ acid	CSsNa2-4b			
	pulled first solution sample @ 8:15 not filtered CSsNa3-4a						

Xiehua He 2/19/07

3/5/2007 8:35 60.2 9.311 60.1 9.235 60.2 9.163
3/15/2007 8:45 60.2 60.2 60
3/20/2007 2:18 It was found that a lot of evaporation occurred in cells #1 & 3, so we didn't take pH readings

Stopped all tests

3/26/07 combine solution in test cells #1 & 2

- cell #1 ~28 ml solution with corrosion products left
- cell #2 ~78 ml solution with corrosion products left

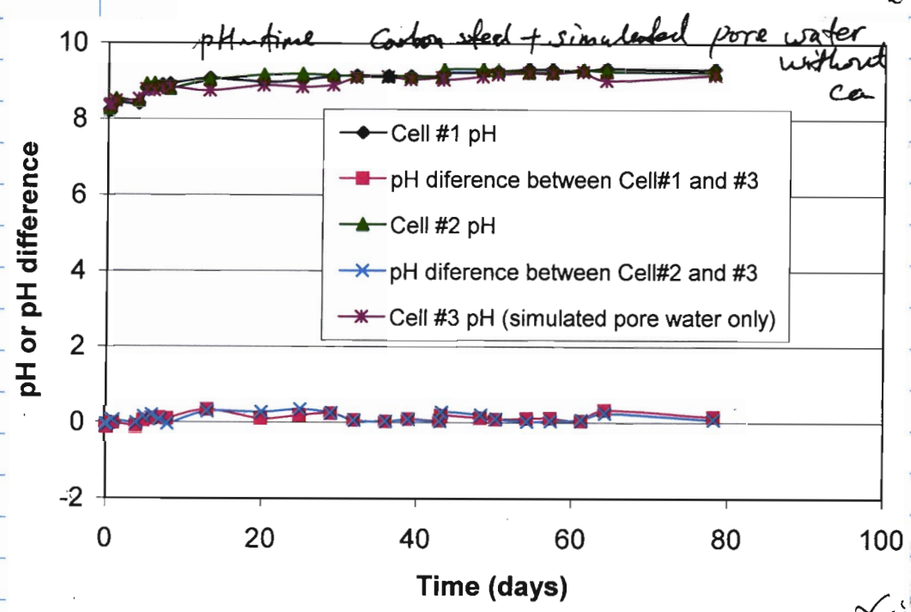
106 ml solution for sorption tests

Two solutions were drawn for chemical analysis

1. from test cell #3, remaining solution was placed in a container total of 5-2 mls
2. from space between the liner and glass cell (not filtered CSsNa1-outside)

Carbon steel specimens were cleaned in acetone and then dried under forced air dryer

Xiehua He 3/27/07



Xiehua He 4/16/07

A516 Carbon steel microstructure characterization

Steps to observe A516 carbon steel microstructure

1. Prepare Nital etchant: 2 mL HNO_3 and 98 mL ethanol or methanol (95% or absolute) (Reference: Metals Handbook, 9th edition, Volume 9 Metallography and Microstructures)
2. Polish carbon steel coupon down to 2000 grit (1 µm) with sand paper and paste
3. Clean it with D.I water and acetone
4. Immediately immerse in etching solution for a few seconds to 1 minute
5. Rinse it with acetone
6. Observe it with microscope and take pictures

Ethanol Used In Solution Preparation And Specimen Prep

Used Precision International 3M SIC Sand paper Polished Specimen To 2000 Grit Finish - Then Used High Purity Alumina Suspension Paste 1 micron on A Polishing Cloth - then Cleaned Surface with Acetone And Immediatly Started Started Etching

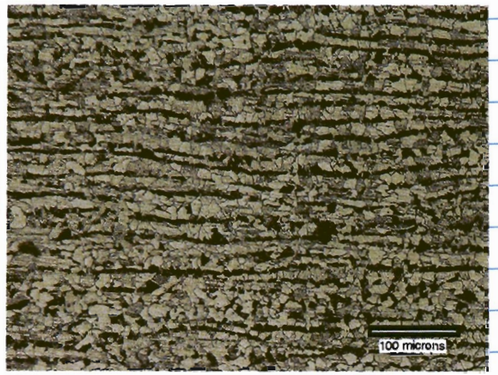
Reagent/solution Used

Alfa Aesar
Ethanol CH_3CH_2OH Lot# K10J06
90% Ethanol
5% Methanol
5% Isopropanol
plus 98 mls Total Volume
Added To 2 mls of HNO_3 Lot# 023958

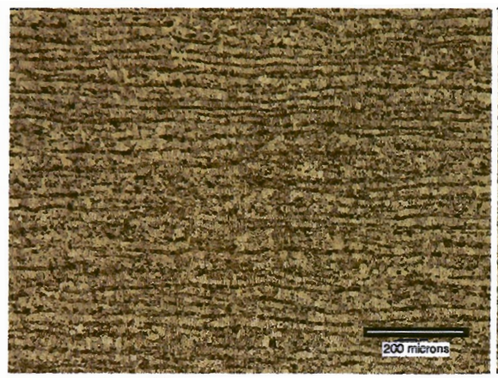
K-M 7/14/08

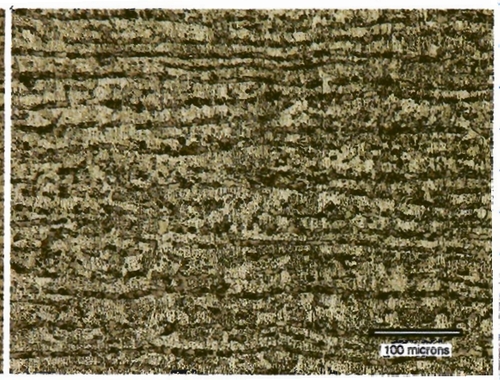
1/26/07

A516 Carbon steel, 1 minute etching

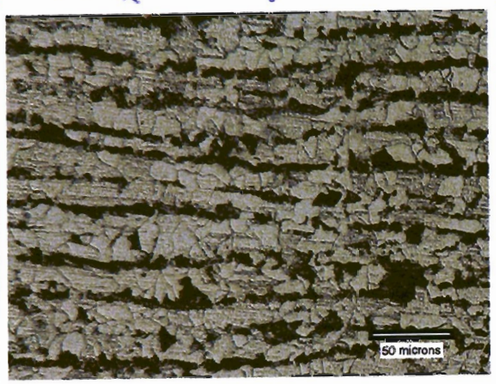


A516 Carbon steel, 30 seconds etching

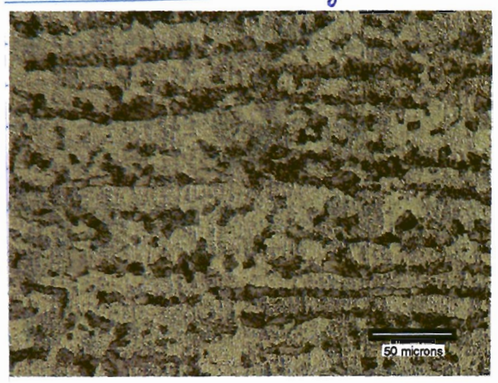




1 minte etching



30 seconds etching



Xihua He 1/26/07

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: Xihua He Request Date: 1/23/07
Project No.: 20.06002.01.222 Phone No.: x5154
Description of Work Requested: ICP / IC Analysis Complete But To Include F^-, NO_3^-, SO_4^{2-}, Cl^-, HCO_3^- Anions

Ca^{2+}, K^+, Mg^{2+}, Na^+, Fe^{2+}, Cations

☐ 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
SS1-7	CSSNA2-1A to CSSNA2-5A	Pore Water Solution
PW3-7	CSSNA3-1A – CSSNA3-5A	DI Solution
CS01-01A		
CS02-01A		
CSSNA1-1A thru CSSNA1-3A&B		

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.

1/26/07

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: [redacted] Xihua He Div 20 X5194

Client Purchase Order/Other ID:

Site/Zone ID:

Requested Turnaround:
- 2 Weeks
- ✓ 3 Weeks
- Other: K

SwRI Contact: Xihua He X5194

Analyses Requested

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	See Analysis Sheet	QA Nuclear
CSSNA1-1A	1/23/07	9:00	L		1	✓	
CSSNA1-1B					1		
CSSNA1-2A					1		
CSSNA1-2B					1		
CSSNA2-1A					1		
CSSNA2-1B					1		
CSSNA2-2A					1		
CSSNA2-2B					1		
CSSNA3-2A					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: Therm #:

Comments:

	Date	Time
Relinquished by (Print/Signature): Brian K. Peaby / [signature]	1/26/07	9:30
Received by (Print/Signature):		
Relinquished by (Print/Signature):		
Received by (Print/Signature):		
Relinquished by (Print/Signature):		

SwRI Project#: 20.06002.01.222

Received by SwRI Lab: (Signature)

Samples Disposed: Date / Time

Samples Disposed by:

Div 01 COC FRM-010 (Rev 1/Nov 05)

Page ____ of ____

1/26/07

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: Xihua He Div 20 X5194

Client Purchase Order/Other ID:

Site/Zone ID:

Requested Turnaround:
- 2 Weeks
- ✓ 3 Weeks
- Other: K

SwRI Contact: Xihua He X5194

Analyses Requested

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	See Analysis Sheet	QA Nuclear
SS1-7	1/23/07	9:00	L		1	✓	
PW3-7					1		
CSDI-07B					1		
CSDI-07A					1		
CSSNA1-3A					1		
CSSNA1-3B					1		
CSSNA2-3A					1		
CSSNA2-3B					1		
CSSNA3-3A					1		
CSSNA3-1A					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: Therm #:

Comments:

	Date	Time
Relinquished by (Print/Signature): Brian K. Peaby / [signature]	1/23/07	9:30
Received by (Print/Signature):		
Relinquished by (Print/Signature):		
Received by (Print/Signature):		
Relinquished by (Print/Signature):		

SwRI Project#: 20.06002.01.222

Received by SwRI Lab: (Signature)

Samples Disposed: Date / Time

Samples Disposed by:

Div 01 COC FRM-010 (Rev 1/Nov 05)

Page ____ of ____

1/26/07

Sample ID
CSDI-07A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292486

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	0.998	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	156	12.5
Selenium	<0.150	0.15
Silicon	1.10	0.5
Silver	<0.100	0.1
Sodium	8.50	6.25
Strontium	<0.125	0.125
Sulfur	8.73	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/21/07

Sample ID
CSDI-07B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292487

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	0.959	0.5
Cadmium	<0.100	0.1
Calcium	1.15	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	160	12.5
Selenium	<0.150	0.15
Silicon	1.15	0.5
Silver	<0.100	0.1
Sodium	7.19	6.25
Strontium	<0.125	0.125
Sulfur	8.99	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/21/07

Sample ID
CSSNA1-1A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292488

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	1.59	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	3.33	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	20.5	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	140	6.25
Strontium	<0.125	0.125
Sulfur	11.8	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

Sample ID
CSSNA1-1B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292489

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	1.32	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.375	0.375
Magnesium	3.35	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	18.7	15.6
Selenium	<0.150	0.15
Silicon	1.10	0.5
Silver	<0.100	0.1
Sodium	289	7.81
Strontium	<0.125	0.125
Sulfur	12.2	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292490

Method: 6010B MOD, 6020 MOD

Sample ID
CSSNA1-2A

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

X-ref 4116(07

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	2.97	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	12.9	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	139	6.25
Strontium	<0.125	0.125
Sulfur	11.7	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

 2/4/07

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292491

Method: 6010B MOD, 6020 MOD

Sample ID
CSSNA1-2B

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	3.21	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	12.9	12.5
Selenium	<0.150	0.15
Silicon	0.666	0.5
Silver	<0.100	0.1
Sodium	138	6.25
Strontium	<0.125	0.125
Sulfur	11.7	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

 2/21/07

Sample ID
CSSNA1-3A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292492

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

X-R1 4/16/07

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	22.8	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	179	6.25
Strontium	<0.125	0.125
Sulfur	13.6	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/2/07

Sample ID
CSSNA1-3B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292493

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	17.1	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	181	6.25
Strontium	<0.125	0.125
Sulfur	14.0	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/2/07

Sample ID
CSSNA2-1A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/24/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 292494

SRR: 30286

Method: 6010B MOD, 6020 MOD

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	3.39	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	<12.5	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	152	6.25
Strontium	<0.125	0.125
Sulfur	11.6	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

X-H 2/16/07

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Sample ID
CSSNA2-1B

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/24/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 292495

SRR: 30286

Method: 6010B MOD, 6020 MOD

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	1.08	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	3.46	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	<12.5	12.5
Selenium	<0.150	0.15
Silicon	1.51	0.5
Silver	<0.100	0.1
Sodium	138	6.25
Strontium	<0.125	0.125
Sulfur	11.7	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/21/07

Sample ID
CSSNA3-2A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/24/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 292496

SRR: 30286

Method: 6010B MOD, 6020 MOD

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	1.70	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	4.13	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	<12.5	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	140	6.25
Strontium	<0.125	0.125
Sulfur	12.7	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/21/07

Sample ID
CSSNA2-2A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/24/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 292497

SRR: 30286

Method: 6010B MOD, 6020 MOD

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	3.30	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	<12.5	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	139	6.25
Strontium	<0.125	0.125
Sulfur	11.9	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/21/07

Sample ID: CSSNA2-2B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292498

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	3.18	1
Manganese	<0.1	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	<12.5	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	142	6.25
Strontium	<0.125	0.125
Sulfur	12.0	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/21/07

Sample ID: CSSNA2-3A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292499

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	<1.00	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	1.41	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	34.3	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	229	6.25
Strontium	<0.125	0.125
Sulfur	14.1	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

K.H 4/16/07

2/21/07

Sample ID
CSSNA2-3B

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292500

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	1.01	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	13.5	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	2.31	1
Manganese	3.38	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	27.6	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	195	6.25
Strontium	<0.125	0.125
Sulfur	13.7	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/2/07

Sample ID
CSSNA3-1A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292501

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	1.60	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	4.14	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	<12.5	12.5
Selenium	<0.150	0.15
Silicon	<0.500	0.5
Silver	<0.100	0.1
Sodium	138	6.25
Strontium	<0.125	0.125
Sulfur	12.4	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

2/2/07

Sample ID: CSSNA3-3A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292502

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	<0.500	0.5
Cadmium	<0.100	0.1
Calcium	2.64	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	5.74	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	23.7	12.5
Selenium	<0.150	0.15
Silicon	0.776	0.5
Silver	<0.100	0.1
Sodium	207	6.25
Strontium	<0.125	0.125
Sulfur	18.6	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

4/16/07

Sample ID: PW3-7

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292503

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	1.04	0.5
Cadmium	<0.100	0.1
Calcium	1.10	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	122	12.5
Selenium	<0.150	0.15
Silicon	13.1	0.5
Silver	<0.100	0.1
Sodium	217	6.25
Strontium	<0.125	0.125
Sulfur	21.2	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

Sample ID
SS1-7

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292504

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.100	0.1
Beryllium	<0.100	0.1
Bismuth	<0.250	0.25
Boron	1.14	0.5
Cadmium	<0.100	0.1
Calcium	1.70	1
Chromium	<0.100	0.1
Cobalt	<0.100	0.1
Copper	<0.100	0.1
Iron	<1.25	1.25
Lanthanum	<0.100	0.1
Lead	<0.100	0.1
Lithium	<0.300	0.3
Magnesium	<1.00	1
Manganese	<0.100	0.1
Molybdenum	<0.100	0.1
Nickel	<0.100	0.1
Palladium	<0.200	0.2
Phosphorus	<0.500	0.5
Potassium	176	12.5
Selenium	<0.150	0.15
Silicon	12.1	0.5
Silver	<0.100	0.1
Sodium	165	6.25
Strontium	<0.125	0.125
Sulfur	24.7	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.1
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.100	0.1
Yttrium	<0.100	0.1
Zinc	<0.100	0.1
Zirconium	<0.100	0.1

Sample ID
LCS

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: NA

Project No.: 06002.01.242

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Aluminum	1.94	2.00	97.0%
Antimony	0.493	0.500	98.6%
Arsenic	2	2.00	100%
Barium	2	2.00	100%
Beryllium	0.0488	0.0500	97.6%
Bismuth	NA	NA	NA
Boron	NA	NA	NA
Cadmium	0.0486	0.0500	97.2%
Calcium	19.9	20.0	99.5%
Chromium	0.191	0.200	95.5%
Cobalt	0.49	0.500	98.0%
Copper	0.245	0.250	98.0%
Iron	1.14	1.00	114.0%
Lanthanum	NA	NA	NA
Lead	0.482	0.500	96.4%
Lithium	4.03	4.00	101%
Magnesium	20.3	20.0	102%
Manganese	0.49	0.500	98.0%
Molybdenum	NA	NA	NA
Nickel	0.481	0.500	96.2%
Palladium	NA	NA	NA
Phosphorus	NA	NA	NA
Potassium	20.2	20.0	101%
Selenium	2.05	2.00	103%
Silicon	NA	NA	NA
Silver	0.0486	0.0500	97.2%
Sodium	20.4	20.0	102%
Strontium	NA	NA	NA
Sulfur	NA	NA	NA
Thallium	2.05	2.00	103%
Thorium	NA	NA	NA
Tin	NA	NA	NA
Titanium	NA	NA	NA
Tungsten	NA	NA	NA
Uranium	NA	NA	NA
Vanadium	0.483	0.500	96.6%
Yttrium	NA	NA	NA
Zinc	0.481	0.500	96.2%
Zirconium	NA	NA	NA

NA- Not Applicable.

Sample ID
PB

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Method: 6010B MOD, 6020 MOD

Client: Division 20

Date Received: NA

Project No.: 06002.01.242

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.00	1.00
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.100	0.100
Beryllium	<0.100	0.100
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.100	0.100
Calcium	<1.00	1.00
Chromium	<0.100	0.100
Cobalt	<0.100	0.100
Copper	<0.100	0.100
Iron	<1.25	1.25
Lanthanum	<0.100	0.100
Lead	<0.100	0.100
Lithium	<0.300	0.300
Magnesium	<1.00	1.00
Manganese	<0.100	0.100
Molybdenum	<0.100	0.100
Nickel	<0.100	0.100
Palladium	<0.200	0.200
Phosphorus	<0.500	0.500
Potassium	<12.5	12.5
Selenium	<0.150	0.150
Silicon	<0.500	0.500
Silver	<0.100	0.100
Sodium	<6.25	6.25
Strontium	<0.125	0.125
Sulfur	<0.500	0.500
Thallium	<0.250	0.250
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.100	0.100
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.100	0.100
Yttrium	<0.100	0.100
Zinc	<0.100	0.100
Zirconium	<0.100	0.100

NA- Not Applicable.

2/21/07

Sample ID
CSDI-07A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292486

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	150	1	mg/L	EPA 300
Fluoride	<1	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	1.19	1	mg/L	EPA 300

Sample ID
CSSNA1-1A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292488

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	39.7	1	mg/L	EPA 300
Fluoride	7.18	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	35.3	1	mg/L	EPA 300

Xihe He 4/16/07

Sample ID
CSSNA1-2A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292490

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	40.7	1	mg/L	EPA 300
Fluoride	7.23	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	35.9	1	mg/L	EPA 300

Sample ID
CSSNA1-3A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292492

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	54.9	1	mg/L	EPA 300
Fluoride	6.33	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	42.2	1	mg/L	EPA 300

Xchwalbe 4/16/07

Sample ID
CSSNA2-1A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292494

Date Analyzed: 02/01/07

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	37.9	1	mg/L	EPA 300
Fluoride	6.24	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	36.1	1	mg/L	EPA 300

Sample ID
CSSNA3-2A

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292496

Date Analyzed: 01/31/07

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	45.5	1	mg/L	EPA 300
Fluoride	7.48	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	36.6	1	mg/L	EPA 300

Xchwalbe 4/16/07

Sample ID
CSSNA2-3A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/24/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 292499

SRR: 30286

Date Analyzed: 01/31/07

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	66.5	1	mg/L	EPA 300
Fluoride	7.89	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	42.6	1	mg/L	EPA 300

Sample ID
CSSNA2-2A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/24/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 292497

SRR: 30286

Date Analyzed: 01/31/07

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	42.9	1	mg/L	EPA 300
Fluoride	6.63	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	36.2	1	mg/L	EPA 300

Xiuhua He 4/16/07

Sample ID
CSSNA3-1A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/24/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 292501

SRR: 30286

Date Analyzed: 01/31/07

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	43.5	1	mg/L	EPA 300
Fluoride	6.70	1	mg/L	EPA 300
Nitrate-N	<1	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	36.8	1	mg/L	EPA 300

Sample ID
CSSNA3-3A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/24/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 292502

SRR: 30286

Date Analyzed: 01/31/07

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	75.4	1	mg/L	EPA 300
Fluoride	11.7	1	mg/L	EPA 300
Nitrate-N	1.89	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	53.8	1	mg/L	EPA 300

X. Hua He 4/16/07

Sample ID: PW3-7

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292503

Date Analyzed: 01/31/07

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	149	1	mg/L	EPA 300
Fluoride	9.40	1	mg/L	EPA 300
Nitrate-N	2.49	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA 300
Sulfate	56.7	1	mg/L	EPA 300

Sample ID: SS1-7

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 292504

Date Analyzed: 01/31/07

Client: Division 20

Date Received: 01/24/07

Project No.: 06002.01.222

SRR: 30286

Task Order: 070125-1

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<1	1	mg/L	EPA 300
Chloride	182	1	mg/L	EPA 300
Fluoride	7.54	1	mg/L	EPA 300
Nitrate-N	2.01	1	mg/L	EPA 300
Nitrite-N	<1	1	mg/L	EPA 300
Phosphate-P	<1	1	mg/L	EPA.300
Sulfate	41.5	1	mg/L	EPA 300

Xihua He 4/16/07

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: Xihua He **Request Date:** 4/20/07
Project No.: 20.06002.01.322 **Phone No.:** x5154
Description of Work Requested: IC For Anions
F^-, NO_3^-, Cl^-, SO_4^{2-}

☐ 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
Pore H_2O A 55 ← solution	prepared on 5/11/06 as recorded on P.4
Pore H_2O A CS1 ← solution	prepared on 12/14/06 as recorded on P.81

The solution was drawn for analysis on 4/20/07

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 4/27/07

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: X.hua He
Div 20

Client Purchase Order/Other ID:

Site/Zone ID:

SwRI Contact: X.hua He X5194

Requested Turnaround:
- ✓ 2 Weeks
- 3 Weeks
- Other:

Analyses Requested

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	Ic Fe Anion F, NO_2^-, Cl, SO_4^{2-}, Acetate, Formate, Sheet					QA Nuclear					
Pure H_2O ASS	4/20/07	10:00am	L		1	✓										
Pure H_2O ACS	↓	↓	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:	***Sample Types:***
A – Air	**D** - Duplicate
B – Biota	**ER** – Equipment Rinsate
D - Dust	**ES** – Environmental Sample
E – Emission/Stack	**FB** – Field Blank
L - Liquid	**FD** – Field Duplicate
P – Product	**MS** – Matrix Spike
Sd - Solid	**MSD** – Matrix Spike Dup
S – Soil	**TB** – Trip Blank
SED – Sediment	
T - Tissue	
W - Water	
WP - Wipe	

Temp: Therm #:

Comments:

Relinquished by (Print/Signature): Brian K. Deeby — Date: 4/20/07 — Time: 1:50

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#: 20.06002.01.322

Received by SwRI Lab: (Signature) — Date — Time

Samples Disposed: Date — Time

Samples Disposed by:

Div 01 COC FRM-010 (Rev 1/Nov 05)

Page ____ of ____

X.hua He 4/20/07

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: X.hua He

Client Purchase Order/Other ID:

Site/Zone ID:

SwRI Contact: X.hua He X5194

Requested Turnaround:
- 2 Weeks ✓
- 3 Weeks
- Other:

Analyses Requested

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	Complete ICP Analysis					QA Nuclear					
Pure H_2O ASS	4/20/07	10:00AM	L		1	✓										
Pure H_2O ACS	↓	↓	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:	***Sample Types:***
A – Air	**D** - Duplicate
B – Biota	**ER** – Equipment Rinsate
D - Dust	**ES** – Environmental Sample
E – Emission/Stack	**FB** – Field Blank
L - Liquid	**FD** – Field Duplicate
P – Product	**MS** – Matrix Spike
Sd - Solid	**MSD** – Matrix Spike Dup
S – Soil	**TB** – Trip Blank
SED – Sediment	
T - Tissue	
W - Water	
WP - Wipe	

Temp: Therm #:

Comments:

Relinquished by (Print/Signature): Brian K. Deeby — Date: 4/20/07 — Time: 1:50

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#: 20.06002.01.322

Received by SwRI Lab: (Signature) — Date — Time

Samples Disposed: Date — Time

Samples Disposed by:

Div 01 COC FRM-010 (Rev 1/Nov 05)

Page ____ of ____

X.hua He 4/20/07

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: Xihua He Request Date: 4/20/07
Project No.: 20-06002-01 322 Phone No.: x 5194
Description of Work Requested: Complete ICP Analysis

☐ 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
Pore H_2O B SS	
Pore H_2O B CS	

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 4/27/07

MEMORANDUM

The requesting forms for the ICP results are in p. 117–120

TO: Xihua He
Division 20 Bldg. 189

FROM: Mike Dammann

RE: Project No.: 06002.01.222
Task Order: 070423-4
SRR: 30622
Samples Received: April 20, 2007

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: June 4, 2007

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

Manager, Inorganic Group

Jo Ann Boyd

Manager, Div. 01 Quality Assurance

Xihua He 7/2/07

Sample ID
Pore Water BCS

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 04/20/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 295397

SRR #: 30622

Method: 6010B

Task Order #: 070423-4

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.25
Boron	1.49	0.5
Cadmium	<0.125	0.125
Calcium	7.66	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	<0.250	0.25
Magnesium	3.08	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	<12.5	12.5
Selenium	<0.125	0.125
Silicon	6.87	1.25
Silver	<0.125	0.125
Sodium	122	6.25
Strontium	<0.125	0.125
Sulfur	10.9	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

The calcium and sodium concentration is higher that than calculated. The could be due to glass leach out during solution storage.

See p80 for calculated composition

Xihua He 7/2/07

Sample ID
Pore Water BCS

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 04/20/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 295397D

SRR #: 30622

Method: 6010B

Task Order #: 070423-4

Analysis	Orig. Sample Result (mg/Kg)	Duplicate Result (mg/Kg)	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	1.49	1.50	0.67%
Cadmium	<0.125	<0.125	0.00%
Calcium	7.66	7.66	0.00%
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	<0.250	<0.250	0.00%
Magnesium	3.08	3.10	0.65%
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	<12.5	<12.5	0.00%
Selenium	<0.125	<0.125	0.00%
Silicon	6.87	6.80	1.02%
Silver	<0.125	<0.125	0.00%
Sodium	122	128	4.80%
Strontium	<0.125	<0.125	0.00%
Sulfur	10.9	10.9	0.00%
Thallium	<0.250	<0.250	0.00%
Thorium	<0.375	<0.375	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%

Xihua He 7/2/07

Sample ID
Pore Water BSS

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 04/20/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 295398

SRR #: 30622

Method: 6010B

Task Order #: 070423-4

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.25
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.25
Boron	2.73	0.5
Cadmium	<0.125	0.125
Calcium	11.3	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	<0.250	0.25
Magnesium	3.60	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.25
Phosphorus	<0.500	0.5
Potassium	<12.5	12.5
Selenium	<0.125	0.125
Silicon	9.38	1.25
Silver	<0.125	0.125
Sodium	129	6.25
Strontium	<0.125	0.125
Sulfur	11.7	0.5
Thallium	<0.250	0.25
Thorium	<0.375	0.375
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.25
Uranium	<2.50	2.5
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	0.475	0.125
Zirconium	<0.125	0.125

The calcium and sodium concentration is higher that than calculated. This could be due to glass leach out during solution storage.

See p. 4 for solution composition.

Xihua He 7/2/07

Sample ID
Pore Water BSS

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 04/20/07

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 295398S

SRR #: 30622

Method: 6010B

Task Order #: 070423-4

Analysis	Orig. Sample Result (mg/L)	Spike Result (mg/L)	Spike Added (mg/L)	Recovery
Aluminum	<1.25	48.9	50.0	97.8%
Antimony	<0.250	12.5	12.5	100.0%
Arsenic	<0.125	51.2	50.0	102.4%
Barium	<0.125	50.8	50.0	101.6%
Beryllium	<0.125	1.26	1.25	100.8%
Bismuth	NA	NA	NA	NA
Boron	NA	NA	NA	NA
Cadmium	<0.125	1.24	1.25	99.2%
Calcium	11.3	498	500	97.3%
Chromium	<0.125	4.87	5	97.4%
Cobalt	<0.125	12.6	12.5	100.8%
Copper	<0.125	6.29	6.25	100.6%
Iron	<1.25	29.2	25.0	116.8%
Lanthanum	NA	NA	NA	NA
Lead	<0.125	12.4	12.5	99.2%
Lithium	<0.250	101	100	101.0%
Magnesium	3.60	497	500	98.7%
Manganese	<0.125	12.5	12.5	100.0%
Molybdenum	NA	NA	NA	NA
Nickel	<0.125	12.2	12.5	97.6%
Palladium	NA	NA	NA	NA
Phosphorus	NA	NA	NA	NA
Potassium	<12.5	497	500	99.4%
Selenium	<0.125	53.2	50.0	106.4%
Silicon	NA	NA	NA	NA
Silver	<0.125	1.30	1.25	104.0%
Sodium	129	627	500	99.6%
Strontium	NA	NA	NA	NA
Sulfur	NA	NA	NA	NA
Thallium	<0.250	52.8	50.0	105.6%
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	12.4	12.5	99.2%
Yttrium	NA	NA	NA	NA
Zinc	0.475	12.8	12.5	98.6%
Zirconium	NA	NA	NA	NA

NA - Not Applicable.

Xihua He 7/2/07

Sample ID
Prep Blank

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: PBW-D25H1 / D27H1

Method: 6010B

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR #: 30622

Task Order #: 070423-4

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	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.250	0.250
Magnesium	<1.25	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	<12.5	12.5
Selenium	<0.125	0.125
Silicon	<1.25	1.25
Silver	<0.125	0.125
Sodium	<6.25	6.25
Strontium	<0.125	0.125
Sulfur	<0.500	0.500
Thallium	<0.250	0.250
Thorium	<0.375	0.375
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.

Xichuan He 7/2/07

Sample ID
Lab Control

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: LCSW-D25H1

Method: 6010B

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR #: 30622

Task Order #: 070423-4

Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Aluminum	1.96	2.00	98.0%
Antimony	0.503	0.500	100.6%
Arsenic	2.04	2.00	102.0%
Barium	2.04	2.00	102.0%
Beryllium	0.0504	0.0500	100.8%
Bismuth	NA	NA	NA
Boron	NA	NA	NA
Cadmium	0.0494	0.0500	98.8%
Calcium	19.7	20.0	98.5%
Chromium	0.194	0.200	97.0%
Cobalt	0.502	0.500	100.4%
Copper	0.249	0.250	99.6%
Iron	1.17	1.00	117.0%
Lanthanum	NA	NA	NA
Lead	0.490	0.500	98.0%
Lithium	4.01	4.00	100.3%
Magnesium	20.0	20.0	100.0%
Manganese	0.500	0.500	100.0%
Molybdenum	NA	NA	NA
Nickel	0.493	0.500	98.6%
Palladium	NA	NA	NA
Phosphorus	NA	NA	NA
Potassium	19.5	20.0	97.5%
Selenium	2.07	2.00	103.5%
Silicon	NA	NA	NA
Silver	0.0501	0.0500	100.2%
Sodium	20.0	20.0	100.0%
Strontium	NA	NA	NA
Sulfur	NA	NA	NA
Thallium	2.11	2.00	105.5%
Thorium	NA	NA	NA
Tin	NA	NA	NA
Titanium	NA	NA	NA
Tungsten	NA	NA	NA
Uranium	NA	NA	NA
Vanadium	0.496	0.500	99.2%
Yttrium	NA	NA	NA
Zinc	0.499	0.500	99.8%
Zirconium	NA	NA	NA

NA - Not Applicable.

Xichuan He 7/2/07

Sample ID: Pore Water ACS

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 295395

Date Analyzed: 05/15/07

Client: Division 20

Date Received: 04/20/07

Project No.: 06002.01.322

SRR #: 30621

Task Order #: 070423-3

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<0.1	0.1	mg/L	EPA 300
Chloride	25.4	0.2	mg/L	EPA 300
Fluoride	5.72	0.1	mg/L	EPA 300
Nitrate-N	0.124	0.1	mg/L	EPA 300
Nitrite-N	<0.1	0.1	mg/L	EPA 300
Phosphate-P	<0.1	0.1	mg/L	EPA 300
Sulfate	32.2	0.2	mg/L	EPA 300

Sample ID: Pore Water ASS

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 295396

Date Analyzed: 05/15/07

Client: Division 20

Date Received: 04/20/07

Project No.: 06002.01.322

SRR #: 30621

Task Order #: 070423-3

Analysis	Sample Result	Reporting Limit	Units	Method
Bromide	<0.1	0.1	mg/L	EPA 300
Chloride	26.5	0.2	mg/L	EPA 300
Fluoride	5.92	0.1	mg/L	EPA 300
Nitrate-N	<0.1	0.1	mg/L	EPA 300
Nitrite-N	<0.1	0.1	mg/L	EPA 300
Phosphate-P	<0.1	0.1	mg/L	EPA 300
Sulfate	36.2	0.2	mg/L	EPA 300

Xihuata 7/6/07

Sample ID: LCS

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Date Analyzed: 05/15/07

Client: Division 20

Date Received: NA

Project No.: 06002.01.322

SRR #: 30621

Task Order #: 070423-3

Analysis	Sample Result	True Value	Recovery	Units
Bromide	404	400	101%	mg/L
Chloride	205	200	103%	mg/L
Fluoride	95.8	100	95.8%	mg/L
Nitrate-N	88.8	90.4	98.2%	mg/L
Nitrite-N	120	124	96.8%	mg/L
Phosphate-P	189	196	96.4%	mg/L
Sulfate	403	400	101%	mg/L

Sample ID: Pore Water ASS

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 295396D

Date Analyzed: 05/15/07

Client: Division 20

Date Received: 04/20/07

Project No.: 06002.01.322

SRR #: 30621

Task Order #: 070423-3

Analysis	Orig. Sample Result	Duplicate Result	RPD	Units
Bromide	<0.1	<0.1	0.00%	mg/L
Chloride	26.5	26.5	0.00%	mg/L
Fluoride	5.92	5.93	0.17%	mg/L
Nitrate-N	<0.1	<0.1	0.00%	mg/L
Nitrite-N	<0.1	<0.1	0.00%	mg/L
Phosphate-P	<0.1	0.112	200%	mg/L
Sulfate	36.2	36.1	0.28%	mg/L

Xihuata 7/6/07

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Date Analyzed: 05/15/07

Sample ID
PB

Client: Division 20

Date Received: NA

Project No.: 06002.01.322

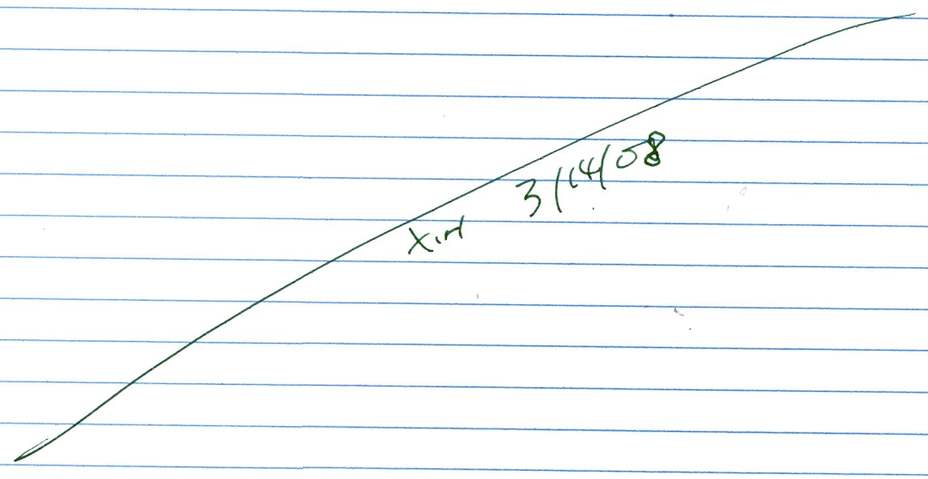
SRR #: 30621

Task Order #: 070423-3

Analysis	Sample Result	Reporting Limit	Units
Bromide	<0.1	0.1	mg/L
Chloride	<0.1	0.1	mg/L
Fluoride	<0.1	0.1	mg/L
Nitrate-N	<0.1	0.1	mg/L
Nitrite-N	<0.1	0.1	mg/L
Phosphate-P	<0.1	0.1	mg/L
Sulfate	<0.1	0.1	mg/L

NA- Not applicable

Xihua He 7/6/07



In-situ Raman Spectroscopy Measurement of Carbon steel Immersed in Simulated sodium pore water

Test ID. CSRaman

1. Simulated Sodium-pore water

Stock A		Stock B	
$CaSO_4 \cdot 2H_2O$	= 2.249g Lot# 4300Kbtz	$NaHCO_3$	= 16.488g Lot# 063014
$Ca(NO_3)_2 \cdot 4H_2O$	= 0.040g Lot# 035087	NaF	= 0.549g Lot# 006679
KCl	= 0.471g Lot# 043820	+ DI to 1000 mls	
$MgCl_2 \cdot 6H_2O$	= 1.129g Lot# 05-0438		
$CaCl_2$	= 0.731g Lot# 063682		
+ DI to 1000mls			

Stock C: (Base Solution) 50 mls of Stock A + 50 mls Stock B + DI To 2000mls

pH = 6.90

Measurements Taken with OHAUS Scale SN# 2883 cal 7/5/07 due 1/5/08

Orion EA940 SN# 2330 probe# 5003095 cal: 7/6/07 due: 7/6/08 (pH meter) 7/12/07

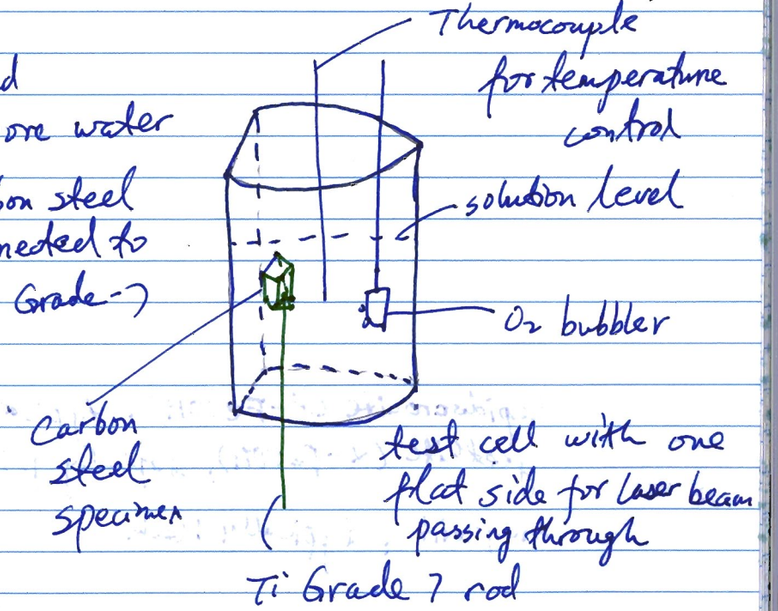
2. Test cell

Solution: simulated sodium pore water

Specimen: A516 Carbon steel cube connected to a titanium Grade-7 rod through the bottom of the test cell

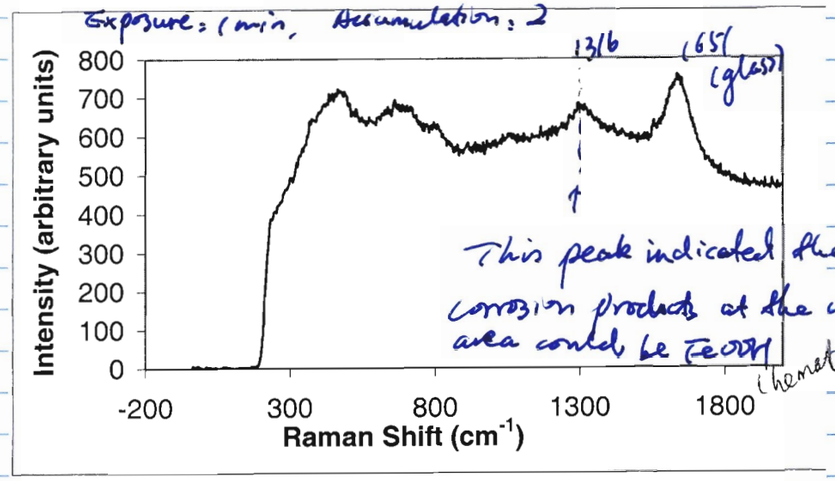
Temperature: 60°C

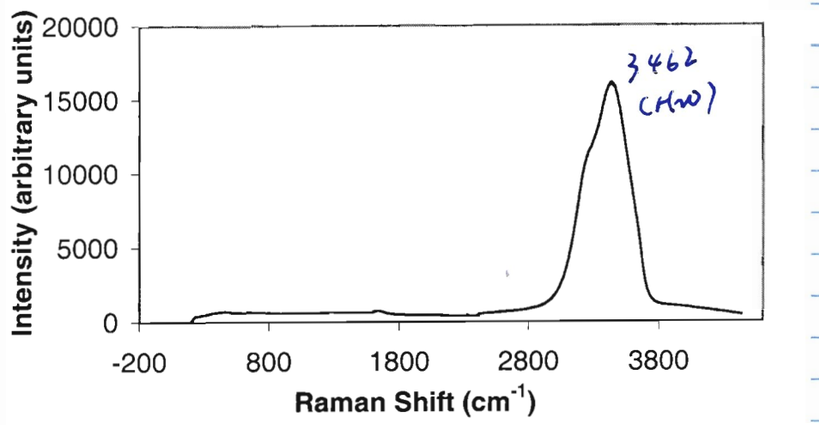
Heating was provided by a heating pad at the bottom.



Xihua He 7/17/07

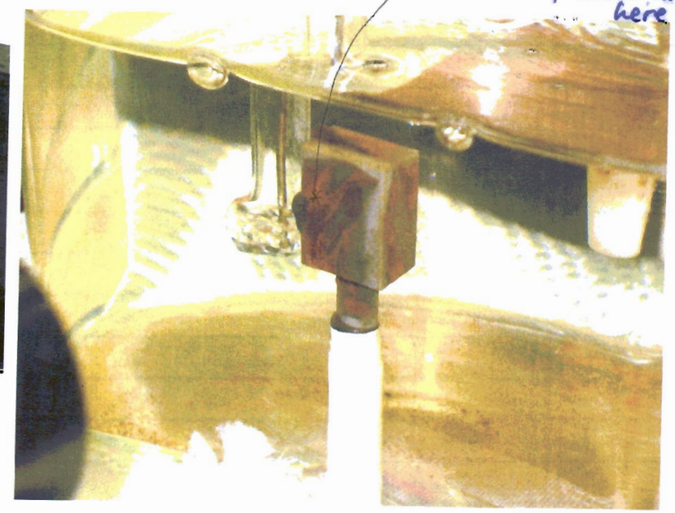
7/12/07 4 pm Raman spectroscopy measurement
File: 7124.PRN (laser beam was focused on the orange area



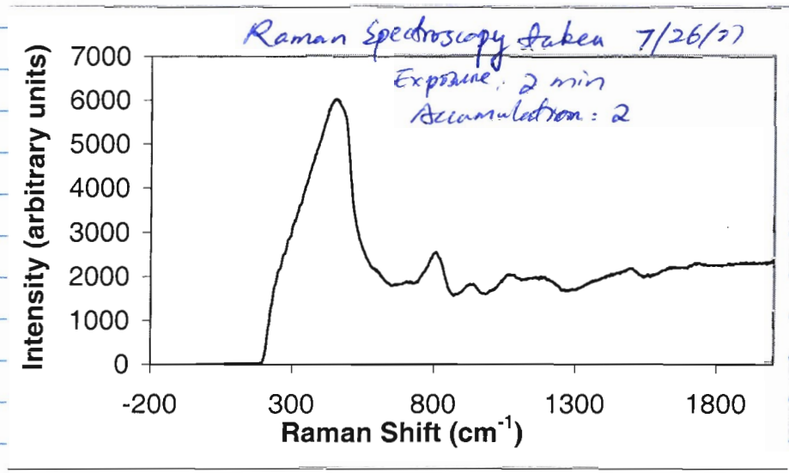


Lepidocrocite (γ-FeOOH): typically red, most intensive bands 1311 cm⁻¹
goethite (α-FeOOH): typically yellow
magnetite: typically black

K. Lwarke 7/13/07



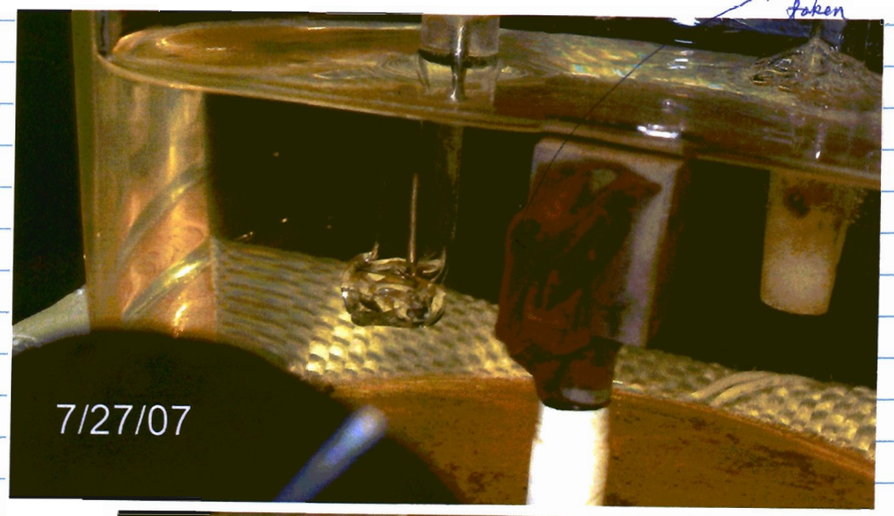
7/13/2007

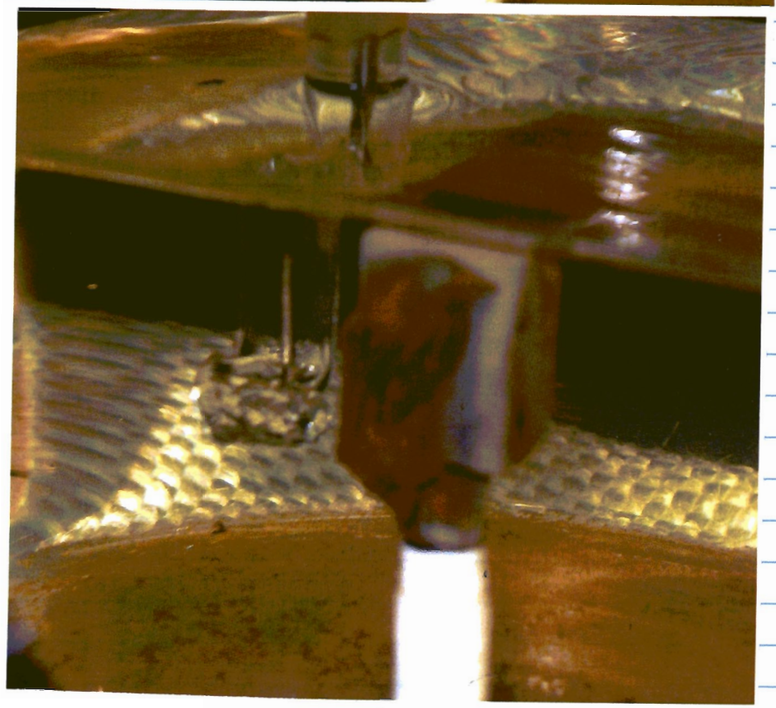


7/26/07 Added 100mls of Simulated Pore Water See pg #131
To Test Cell And took More photo's of Corrosion on Surface of Specimen

7/27/07

Raman taken



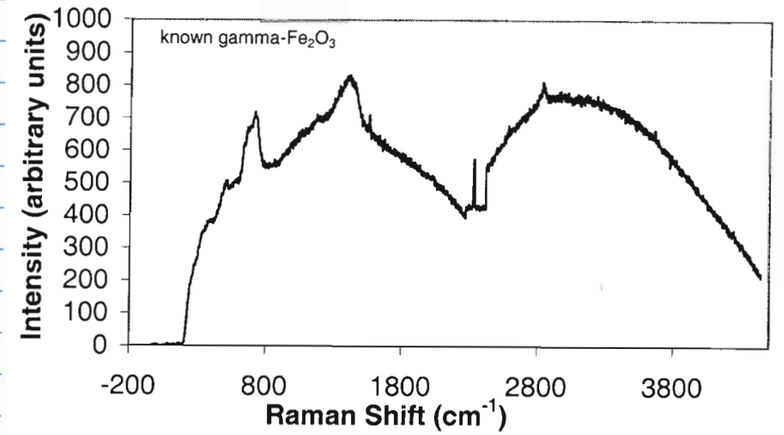


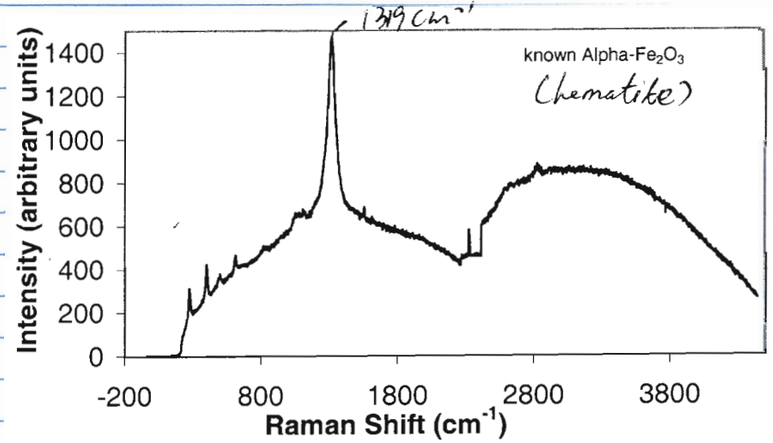
Xinhua He 7/27/07

X.H. 7/14/08

X.H 7/14/08

Accum: 2 Exposure: 2 min



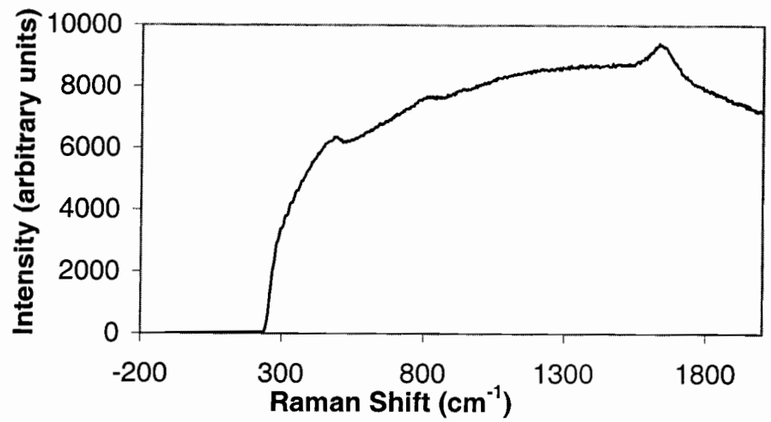


Xinhua He 8/29/07

Part of the solution has evaporated. Top up solution with ~200 ml simulated pore water made on 7/9/2007.

X.H 1/7/08

Raman spectroscopy on 2/11/08 on corrosion products



2/19/08 ~~stop test~~ Xihua He 2/11/08

A516 Carbon steel

initial weight 25.40205 g — measured with Sartorius balance SN: 1080-3099 Cal. 7/13/07 Due: 5/13/08

Final weight: 25.4243 g

pH initial = 6.90 — measured with pH probe 13-620-298 SN 5003095P

pH final = 9.50

pH meter SN: 2330 Cal: 7/6/07 Due: 7/6/08

T: 60C measured with thermocouple SN: 333 Cal: 8/14/07 Due: 2/14/08

thermocouple meter SN: 51046103 Cal: 4/26/07 Due: 4/26/08

~~X~~ Hehua 2/20/08