ICP ANALYSIS #4 ✓

PROJ. NO.	PROJECT	TO#	DATE	MATRIX	LOGBK PG
06002.01.141	Div 20	030719-8	8-11-03	Water	SA 154

INSTRUMENT: Tracer FILENAME: B307148

INSTRUMENT DL:

Standardization Rpt. 08/11/03 10:03:32 AM page 1

Method: DAILY2 Standard: blk
Run Time: 08/11/03 09:59:03

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Avge	-.0000	.0004	-.0001	.0001	-.0000	-.0001	.0000
SDev	.0000	.0000	.0000	.0000	.0000	.0000	.0000
%RSD	15.66	1.881	85.08	13.58	18.78	1.479	135.3
#1	-.0000	.0004	-.0000	.0001	-.0000	-.0001	.0001
#2	-.0000	.0003	-.0001	.0001	-.0000	-.0001	.0000

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Avge	.0000	.0000	-.0000	.0000	.0004	.0000	.0002
SDev	.0000	.0000	.0000	.0000	.0000	.0000	.0000
%RSD	8.834	122.4	85.18	694.9	1.673	22.72	9.612
#1	.0000	.0000	-.0000	.0000	.0004	.0000	.0002
#2	.0000	.0000	-.0000	-.0000	.0004	.0000	.0002

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Avge	.0000	.0010	.0000	.0000	-.0000	-.0002	-.0114
SDev	.0000	.0000	.0000	.0000	.0000	.0000	.0002
%RSD	229.3	1.093	243.4	51.60	44.36	11.44	1.420
#1	-.0000	.0010	-.0000	.0000	-.0000	-.0002	-.0115
#2	.0000	.0010	.0000	.0000	-.0000	-.0002	-.0113

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Avge	.0000	.0000	.0001	-.0000	.0001	.0001	-.0014
SDev	.0000	.0000	.0000	.0000	.0000	.0000	.0001
%RSD	141.4	104.8	12.11	209.4	11.07	4.409	4.185
#1	.0000	.0000	.0001	.0000	.0001	.0001	-.0014
#2	.0000	.0000	.0001	-.0000	.0001	.0001	-.0013

Elem	Sc3613	1960/1	1960/2	Si2881	Sn1899	Sr4215	Th2837
Avge	88.35	-.0003	.0002	.0019	.0000	.0000	.0000
SDev	.46	.0002	.0000	.0001	.0000	.0000	.0000
%RSD	.5242	82.42	1.548	2.815	29.81	93.99	114.2
#1	88.03	-.0004	.0002	.0019	.0000	.0000	.0001
#2	88.68	-.0001	.0002	.0020	.0000	.0000	.0000

Elem	Ti3349	Tl1908	U_4090	V_2924	W_2079	Y_3710	Zn2062
Avge	-.0001	-.0002	-.0003	-.0000	.0002	.0000	.0001
SDev	.0001	.0000	.0000	.0000	.0000	.0000	.0000
%RSD	66.49	11.89	16.88	27.79	7.592	141.4	.3841
#1	-.0000	-.0002	-.0003	-.0000	.0002	.0000	.0001
#2	-.0001	-.0002	-.0002	-.0000	.0002	.0000	.0001

Elem	Zr3496
Avge	.0003
SDev	.0001
%RSD	26.78
#1	.0003
#2	.0004

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IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	883454	10000	--	--	--	--	--
SDev	4564.374	.0000000	--	--	--	--	--
%RSD	.5166507	.0000000	--	--	--	--	--
#1	880227	10000	--	--	--	--	--
#2	886682	10000	--	--	--	--	--

Standardization Rpt. 08/11/03 10:07:51 AM page 1

Method: DAILY2 Standard: clp_std4
Run Time: 08/11/03 10:03:44

Elem	Ag3280	As1890	2203/1	2203/2	Sb2068	1960/1	1960/2
Avge	.0815	.1383	.3733	.3172	.2047	.3118	.3097
SDev	.0000	.0003	.0014	.0013	.0002	.0017	.0010
%RSD	.0407	.2372	.3730	.4216	.0894	.5520	.3259
#1	.0815	.1380	.3743	.3181	.2046	.3130	.3104
#2	.0815	.1385	.3723	.3162	.2048	.3106	.3090

Elem	Tl1908
Avge	.2707
SDev	.0001
%RSD	.0466
#1	.2708
#2	.2706

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	903412	10000	--	--	--	--	--
SDev	480.8326	.0000000	--	--	--	--	--
%RSD	.0532241	.0000000	--	--	--	--	--
#1	903072	10000	--	--	--	--	--
#2	903752	10000	--	--	--	--	--

Standardization Rpt. 08/11/03 10:11:28 AM page 1

Method: DAILY2 Standard: clp_std1
Run Time: 08/11/03 10:08:03

Elem	Al3082	Ca3179	Fe2714	K_7664	Li6707	Mg2790	Na3302
Avge	.1136	.2113	.1074	.1780	2.915	.0918	.0095
SDev	.0003	.0001	.0000	.0003	.008	.0001	.0001
%RSD	.2840	.0668	.0032	.1880	.2837	.1223	.5021
#1	.1139	.2112	.1074	.1782	2.921	.0919	.0095
#2	.1134	.2114	.1074	.1777	2.910	.0918	.0094

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	894390	10000	--	--	--	--	--
SDev	4702.967	.0000000	--	--	--	--	--
%RSD	.5258293	.0000000	--	--	--	--	--
#1	897716	10000	--	--	--	--	--
#2	891065	10000	--	--	--	--	--

Standardization Rpt. 08/11/03 10:15:04 AM page 1

Method: DAILY2 Standard: clp_std5
Run Time: 08/11/03 10:11:39

Elem	B_2496	Bi2230	Mo2020	P_1782	Si2881	Sn1899	Sr4215
Avge	.1808	.0384	.4281	.0183	.1709	.1969	2.443
SDev	.0011	.0001	.0028	.0001	.0004	.0000	.003
%RSD	.6157	.1803	.6495	.4303	.2654	.0205	.1362
#1	.1800	.0385	.4261	.0183	.1713	.1969	2.441
#2	.1815	.0384	.4301	.0184	.1706	.1970	2.446

Elem	Ti3349
Avge	2.743
SDev	.001
%RSD	.0198
#1	2.743
#2	2.743

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	907555	10000	--	--	--	--	--
SDev	2207.587	.0000000	--	--	--	--	--
%RSD	.2432456	.0000000	--	--	--	--	--
#1	909116	10000	--	--	--	--	--
#2	905994	10000	--	--	--	--	--

Standardization Rpt. 08/11/03 10:18:18 AM page 1

Method: DAILY2 Standard: clp_std2
Run Time: 08/11/03 10:15:15

Elem	Ba4934	Be3130	Cr2677	Cu3247	Ni2316
Avge	1.074	1.346	.4476	.3120	.4004
SDev	.001	.006	.0001	.0005	.0008
%RSD	.1114	.4201	.0271	.1528	.1977
#1	1.075	1.342	.4475	.3123	.3999
#2	1.074	1.350	.4477	.3116	.4010

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	895846	10000	--	--	--	--	--
SDev	5501.291	.0000000	--	--	--	--	--
%RSD	.6140889	.0000000	--	--	--	--	--
#1	891956	10000	--	--	--	--	--
#2	899736	10000	--	--	--	--	--

Standardization Rpt. 08/11/03 10:21:54 AM page 1

Method: DAILY2 Standard: clp_std3
Run Time: 08/11/03 10:18:30

Elem	Cd2265	Co2286	Mn2576	V_2924	Zn2062
Avge	1.162	.2496	.9506	.2013	.3720
SDev	.000	.0002	.0006	.0002	.0001
%RSD	.0121	.0946	.0684	.0849	.0330
#1	1.162	.2495	.9501	.2015	.3719
#2	1.162	.2498	.9510	.2012	.3720

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	900383	10000	--	--	--	--	--
SDev	3360.171	.0000000	--	--	--	--	--
%RSD	.3731936	.0000000	--	--	--	--	--
#1	898007	10000	--	--	--	--	--
#2	902759	10000	--	--	--	--	--

Standardization Rpt. 08/11/03 10:25:52 AM page 1

Method: DAILY2 Standard: clp_std6
Run Time: 08/11/03 10:22:06

Elem	La3988	Na5889	Pd3404	S_1820	Th2837	U_4090	W_2079
Avge	.4757	.0473	.2110	.0377	.1182	.0749	.2150
SDev	.0006	.0000	.0001	.0001	.0002	.0001	.0001
%RSD	.1290	.0285	.0411	.4033	.1488	.1228	.0422
#1	.4752	.0473	.2110	.0376	.1184	.0748	.2150
#2	.4761	.0473	.2109	.0378	.1181	.0749	.2151

Elem	Y_3710	Zr3496
Avge	.7937	1.933
SDev	.0010	.002
%RSD	.1314	.0952
#1	.7945	1.931
#2	.7930	1.934

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	876066	10000	--	--	--	--	--
SDev	3892.623	.0000000	--	--	--	--	--
%RSD	.4443296	.0000000	--	--	--	--	--
#1	873314	10000	--	--	--	--	--
#2	878819	10000	--	--	--	--	--

Standardization Report 08/11/03 10:25:52 AM page 1

Method: DAILY2 Slope = Conc(SIR)/IR

Element	Wavelen	High std	Low std	Slope	Y-intercept	Date Standardized
Ag3280	328.068	clp_std4	blk	24.5242	.000778	08/11/03 10:22:06
Al3082	308.215	clp_std1	blk	441.350	-.155375	08/11/03 10:22:06
As1890	189.042	clp_std4	blk	72.2962	.004124	08/11/03 10:22:06
B_2496	249.678	clp_std5	blk	55.3627	-.007460	08/11/03 10:22:06
Ba4934	493.409	clp_std2	blk	9.30645	.000232	08/11/03 10:22:06
Be3130	313.042	clp_std2	blk	3.71564	.000309	08/11/03 10:22:06
Bi2230	223.061	clp_std5	blk	129.020	-.003371	08/11/03 10:22:06
Ca3179	317.933	clp_std1	blk	236.663	-.009110	08/11/03 10:22:06
Cd2265	226.502	clp_std3	blk	8.60560	-.000073	08/11/03 10:22:06
Co2286	228.616	clp_std3	blk	40.0574	.000227	08/11/03 10:22:06
Cr2677	267.716	clp_std2	blk	22.3410	-.000077	08/11/03 10:22:06
Cu3247	324.753	clp_std2	blk	32.0973	-.013334	08/11/03 10:22:06
Fe2714	271.441	clp_std1	blk	465.971	-.017659	08/11/03 10:22:06
K_7664	766.491	clp_std1	blk	281.284	-.064458	08/11/03 10:22:06
La3988	398.853	clp_std6	blk	21.0423	-.000308	08/11/03 10:22:06
Li6707	670.784	clp_std1	blk	3.43113	-.003334	08/11/03 10:22:06
Mg2790	279.078	clp_std1	blk	272.138	-.002143	08/11/03 10:22:06
Mn2576	257.610	clp_std3	blk	10.5210	-.000280	08/11/03 10:22:06
Mo2020	202.030	clp_std5	blk	23.3609	.000768	08/11/03 10:22:06
Na3302	330.232	clp_std1	blk	5173.80	1.00406	08/11/03 10:22:06
Na5889	588.991	clp_std6	blk	17.1200	.195720	08/11/03 10:22:06
Ni2316	231.604	clp_std2	blk	24.9754	-.000440	08/11/03 10:22:06
P_1782	178.287	clp_std5	blk	546.120	-.007128	08/11/03 10:22:06
2203/1	220.351	clp_std4	blk	26.7995	-.003396	08/11/03 10:22:06
2203/2	220.352	clp_std4	blk	31.5263	.000373	08/11/03 10:22:06
Pd3404	340.458	clp_std6	blk	48.6835	-.003693	08/11/03 10:22:06
S_1820	182.040	clp_std6	blk	265.362	-.016372	08/11/03 10:22:06
Sb2068	206.838	clp_std4	blk	48.5359	.065659	08/11/03 10:22:06
Sc3613	361.384	blk	dark	1.13183	.000000	08/11/03 10:22:06
1960/1	196.021	clp_std4	blk	32.0487	.008143	08/11/03 10:22:06
1960/2	196.022	clp_std4	blk	32.3088	-.005010	08/11/03 10:22:06
Si2881	288.158	clp_std5	blk	58.9495	-.114727	08/11/03 10:22:06
Pb220	220.353	NONE	NONE	1.00000	.000000	*NOT STANDARDIZED
Se196	196.026	NONE	NONE	1.00000	.000000	*NOT STANDARDIZED
Sn1899	189.989	clp_std5	blk	50.8133	-.000805	08/11/03 10:22:06
Sr4215	421.552	clp_std5	blk	4.09252	-.000014	08/11/03 10:22:06
Th2837	283.730	clp_std6	blk	88.3064	-.003108	08/11/03 10:22:06
Ti3349	334.941	clp_std5	blk	3.64554	.000305	08/11/03 10:22:06
Tl1908	190.864	clp_std4	blk	36.9057	.008331	08/11/03 10:22:06
U_4090	409.014	clp_std6	blk	140.761	.037857	08/11/03 10:22:06
V_2924	292.402	clp_std3	blk	49.6618	.001545	08/11/03 10:22:06
W_2079	207.914	clp_std6	blk	23.2651	-.004134	08/11/03 10:22:06
Y_3710	371.030	clp_std6	blk	12.5966	-.000028	08/11/03 10:22:06
Zn2062	206.200	clp_std3	blk	26.8927	-.002390	08/11/03 10:22:06
Zr3496	349.621	clp_std6	blk	5.65655	-.001792	08/11/03 10:22:06

Analysis Report QC Standard 08/11/03 10:30:34 AM page 1

Method: DAILY2 Sample Name: icv/ccv Operator:
Run Time: 08/11/03 10:26:04
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.9787	9.948	4.918	4.831	9.902	.9991	4.956
SDev	.0000	.008	.006	.017	.000	.0003	.006
%RSD	.0021	.0813	.1211	.3533	.0044	.0290	.1134
#1	.9787	9.954	4.914	4.819	9.902	.9989	4.960
#2	.9787	9.942	4.922	4.843	9.902	.9993	4.952
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	1.000	10.00	5.000	5.000	10.00	1.000	5.000
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	19.84	1.011	5.027	1.960	1.996	10.22	18.22
SDev	.01	.000	.004	.001	.002	.01	.01
%RSD	.0552	.0282	.0735	.0263	.0750	.1248	.0333
#1	19.85	1.012	5.024	1.960	1.995	10.21	18.22
#2	19.83	1.011	5.029	1.959	1.997	10.22	18.21
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	20.00	1.000	5.000	2.000	2.000	10.00	20.00
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.876	4.819	19.96	1.012	5.137	27.82	Q40.44
SDev	.007	.007	.00	.001	.016	.04	.07
%RSD	.1446	.1357	.0081	.0564	.3084	.1322	.1790
#1	4.871	4.824	19.96	1.011	5.126	27.85	Q40.49
#2	4.881	4.815	19.96	1.012	5.148	27.79	Q40.39
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Fail
Value	5.000	5.000	20.00	1.000	5.000	30.00	30.00
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.923	5.305	4.873	4.871	.9719	1.017	.9858
SDev	.008	.012	.030	.023	.0011	.016	.0011
%RSD	.1658	.2260	.6064	.4714	.1165	1.600	.1107
#1	4.929	5.314	4.852	4.887	.9727	1.006	.9850
#2	4.917	5.297	4.894	4.855	.9711	1.029	.9866
Errors	QC Pass	QC Pass	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass
Value	5.000	5.000			1.000	1.000	1.000
Range	10.00	10.00			10.00	10.00	10.00

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	99.61	5.104	5.141	4.975	4.872	5.128	4.909
SDev	.12	.019	.014	.000	.005	.003	.000
%RSD	.1213	.3638	.2777	.0024	.1120	.0649	.0003
#1	99.53	5.091	5.151	4.976	4.876	5.131	4.909
#2	99.70	5.117	5.130	4.975	4.868	5.126	4.909
Errors	NOCHECK	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass
Value				5.000	5.000	5.000	5.000
Range				10.00	10.00	10.00	10.00

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.988	.9895	4.809	5.136	.9568	4.954	1.063
SDev	.004	.0005	.001	.022	.0115	.005	.001
%RSD	.0846	.0499	.0198	.4242	1.197	.1059	.1233
#1	4.991	.9891	4.808	5.121	.9649	4.958	1.062
#2	4.985	.9898	4.810	5.151	.9487	4.950	1.064
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	5.000	1.000	5.000	5.000	1.000	5.000	1.000
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	4.949	1.008	4.850
SDev	.007	.001	.004
%RSD	.1319	.0765	.0721
#1	4.953	1.008	4.847
#2	4.944	1.007	4.852
Errors	QC Pass	QC Pass	QC Pass
Value	5.000	1.000	5.000
Range	10.00	10.00	10.00

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	880039	10000	--	--	--	--	--
SDev	1042.275	.0000000	--	--	--	--	--
%RSD	.1184351	.0000000	--	--	--	--	--
#1	879302	10000	--	--	--	--	--
#2	880776	10000	--	--	--	--	--

Analysis Report Blank Sample 08/11/03 10:37:06 AM page 1

Method: DAILY2 Sample Name: icb/ccb Operator:
Run Time: 08/11/03 10:32:36
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0004	-.0056	.0007	.0115	.0002	.0000	-.0020
SDev	.0003	.0015	.0008	.0027	.0001	.0000	.0065
%RSD	81.72	26.73	125.3	23.91	44.24	139.3	329.7
#1	.0006	-.0045	.0001	.0134	.0002	.0000	.0026
#2	.0002	-.0066	.0012	.0095	.0001	.0000	L-.0066
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0500	.0050	.0500	.0050	.0050	.0050
Low	-.0050	-.0500	-.0050	-.0500	-.0050	-.0050	-.0050

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0002	.0000	-.0006	.0005	-.0002	-.0039	.0035
SDev	.0002	.0002	.0003	.0002	.0000	.0185	.0116
%RSD	110.8	414.0	47.24	41.06	16.69	469.5	330.0
#1	-.0000	.0002	-.0004	.0006	-.0002	.0092	.0117
#2	-.0004	-.0001	-.0009	.0004	-.0002	-.0170	-.0047
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0500	.0050	.0050	.0050	.0050	.0250	.1000
Low	-.0500	-.0050	-.0050	-.0050	-.0050	-.0250	-.1000

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0004	.0001	-.0016	-.0001	.0040	H.1259	.0074
SDev	.0004	.0001	.0070	.0000	.0001	.0823	.0024
%RSD	83.32	54.37	451.5	35.30	3.131	65.32	32.65
#1	-.0002	.0002	.0034	-.0000	.0039	H.1841	.0057
#2	-.0007	.0001	-.0065	-.0001	.0041	H.0678	.0091
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC High	LC Pass
High	.0050	.0050	.0500	.0050	.0050	.0500	.0500
Low	-.0050	-.0050	-.0500	-.0050	-.0050	-.0500	-.0500

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0019	.0033	.0022	-.0004	.0008	L-.0101	.0002
SDev	.0009	.0130	.0029	.0015	.0021	.0020	.0035
%RSD	48.24	395.9	130.9	406.2	255.1	20.03	1909.
#1	-.0012	H.0124	.0043	-.0015	.0023	-.0087	.0027
#2	-.0025	-.0059	.0002	.0007	-.0006	L-.0116	-.0023
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Low	LC Pass
High	.0050	.0100			.0050	.0100	.0100
Low	-.0050	-.0100			-.0050	-.0100	-.0100

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	99.25	.0021	-.0002	-.0013	.0005	.0006	-.0005
SDev	1.97	.0032	.0014	.0018	.0001	.0001	.0020
%RSD	1.988	152.5	603.8	136.9	12.52	23.97	430.2
#1	97.86	-.0002	.0008	-.0000	.0005	.0005	.0010
#2	100.6	.0043	-.0012	-.0026	.0005	.0006	-.0019
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				.0100	.0030	.0050	.0050
Low				-.0100	-.0030	-.0050	-.0050

Elem	Sr4215	Th2837	Ti3349	T11908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0001	-.0002	.0000	.0034	.0063	-.0003	.0042
SDev	.0001	.0018	.0000	.0008	.0212	.0002	.0014
%RSD	131.3	865.9	39.16	24.59	337.4	54.36	34.32
#1	.0001	.0010	.0000	.0028	.0212	-.0002	.0052
#2	.0000	-.0014	.0000	.0040	-.0087	-.0004	.0031
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0100	.0050	.0100	.1000	.0050	.0100
Low	-.0050	-.0100	-.0050	-.0100	-.1000	-.0050	-.0100

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0001	-.0005	-.0005
SDev	.0001	.0000	.0002
%RSD	64.93	7.671	29.76
#1	.0002	-.0005	-.0007
#2	.0001	-.0005	-.0004
Errors	LC Pass	LC Pass	LC Pass
High	.0050	.0050	.0050
Low	-.0050	-.0050	-.0050

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	876870	10000	--	--	--	--	--
SDev	17444.32	.0000000	--	--	--	--	--
%RSD	1.989386	.0000000	--	--	--	--	--
#1	864535	10000	--	--	--	--	--
#2	889205	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: pbw-H11W1 pg54-154 Operator:
Run Time: 08/11/03 10:37:18
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0001	.0134	-.0006	.0082	.0002	.0000	-.0001
SDev	.0004	.0017	.0033	.0001	.0000	.0000	.0033
%RSD	305.8	12.87	553.3	1.734	3.608	12.32	2680.
#1	.0002	.0122	-.0029	.0081	.0002	.0000	-.0024
#2	-.0004	.0146	.0017	.0083	.0002	.0000	.0022

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0332	-.0001	-.0007	.0006	.0006	.0080	.0197
SDev	.0004	.0002	.0005	.0007	.0000	.0118	.0105
%RSD	1.328	153.5	68.98	112.8	5.886	146.0	53.43
#1	.0328	-.0002	-.0010	.0011	.0005	.0164	.0122
#2	.0335	.0000	-.0003	.0001	.0006	-.0003	.0271

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0006	.0000	.0193	.0002	.0020	.0114	.0104
SDev	.0002	.0001	.0001	.0001	.0002	.0458	.0018
%RSD	26.36	2053.	.6659	55.71	9.413	402.2	17.40
#1	-.0007	.0001	.0194	.0003	.0022	.0438	.0117
#2	-.0005	-.0000	.0192	.0001	.0019	-.0210	.0091

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0010	.0092	-.0015	-.0006	-.0008	-.0058	.0043
SDev	.0001	.0045	.0012	.0019	.0004	.0024	.0037
%RSD	15.17	49.13	79.91	307.3	55.61	41.66	86.58
#1	-.0011	.0124	-.0006	-.0020	-.0011	-.0041	.0070
#2	-.0009	.0060	-.0023	.0007	-.0005	-.0075	.0017

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	94.65	.0036	.0008	.0465	-.0009	.0017	.0014
SDev	.59	.0045	.0009	.0032	.0009	.0021	.0020
%RSD	.6205	123.4	116.7	6.798	98.00	120.6	142.3
#1	95.06	.0005	.0001	.0443	-.0015	.0003	.0028
#2	94.23	.0068	.0014	.0488	-.0003	.0032	-.0000

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0002	.0008	.0008	-.0016	-.0059	.0000	.0021
SDev	.0000	.0016	.0000	.0007	.0050	.0002	.0004
%RSD	7.667	208.5	3.375	42.01	84.88	852.8	17.41
#1	.0001	.0019	.0008	-.0012	-.0024	-.0001	.0023
#2	.0002	-.0004	.0007	-.0021	-.0095	.0001	.0018

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0001	.0011	-.0007
SDev	.0000	.0002	.0000
%RSD	.6054	17.76	3.362
#1	.0001	.0010	-.0007
#2	.0001	.0013	-.0007

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	836222	10000	--	--	--	--	--
SDev	5154.809	.0000000	--	--	--	--	--
%RSD	.6164402	.0000000	--	--	--	--	--
#1	839867	10000	--	--	--	--	--
#2	832577	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: lcsw-H11W1 Operator:
Run Time: 08/11/03 10:41:59
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0509	1.996	2.034	.0063	2.061	.0510	-.0042
SDev	.0003	.002	.011	.0015	.005	.0001	.0005
%RSD	.6949	.1087	.5490	24.10	.2628	.1006	12.59
#1	.0507	1.995	2.027	.0074	2.057	.0510	-.0038
#2	.0512	1.998	2.042	.0052	2.065	.0510	-.0045

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	20.02	.0517	.5110	.2033	.2563	1.105	16.80
SDev	.04	.0004	.0008	.0001	.0006	.002	.04
%RSD	.2247	.7274	.1558	.0268	.2484	.1687	.2292
#1	20.05	.0520	.5105	.2032	.2559	1.106	16.78
#2	19.99	.0515	.5116	.2033	.2568	1.104	16.83

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0005	.0005	20.25	.5152	.0004	17.90	25.67
SDev	.0000	.0001	.00	.0002	.0004	.25	.08
%RSD	3.235	22.04	.0099	.0322	102.8	1.411	.3015
#1	-.0005	.0004	20.24	.5153	.0006	18.07	25.62
#2	-.0005	.0006	20.25	.5151	.0001	17.72	25.73

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.5085	-.0011	.5002	.5004	.0008	.0019	.4950
SDev	.0023	.0052	.0027	.0004	.0027	.0011	.0013
%RSD	.4514	456.4	.5459	.0782	355.2	60.56	.2525
#1	.5069	.0026	.5021	.5001	.0027	.0027	.4958
#2	.5101	-.0048	.4982	.5006	-.0012	.0011	.4941

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	93.38	2.078	2.078	.0534	.5003	2.078	.0009
SDev	1.20	.029	.005	.0053	.0006	.006	.0009
%RSD	1.282	1.408	.2355	9.861	.1296	.3125	108.3
#1	92.53	2.098	2.074	.0497	.5008	2.082	.0002
#2	94.22	2.057	2.081	.0571	.4998	2.073	.0015

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.031	-.0135	.0008	2.087	-.0362	.5100	.0008
SDev	.000	.0012	.0001	.005	.0026	.0001	.0001
%RSD	.0004	8.741	16.65	.2371	7.277	.0215	14.02
#1	4.031	-.0144	.0009	2.084	-.0381	.5099	.0008
#2	4.031	-.0127	.0007	2.091	-.0344	.5100	.0007

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0001	.5160	-.0006
SDev	.0001	.0004	.0006
%RSD	166.6	.0748	105.0
#1	.0000	.5163	-.0001
#2	-.0002	.5157	-.0010

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	824978	10000	--	--	--	--	--
SDev	10591.05	.0000000	--	--	--	--	--
%RSD	1.283797	.0000000	--	--	--	--	--
#1	817489	10000	--	--	--	--	--
#2	832467	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: 230260s Operator:
Run Time: 08/11/03 10:46:40
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0462	2.103	2.067	.1692	2.785	.0488	-.0047
SDev	.0035	.006	.004	.0012	.000	.0000	.0057
%RSD	7.508	.2906	.1838	.6876	.0070	.0369	122.8
#1	.0487	2.107	2.064	.1684	2.785	.0488	-.0087
#2	.0438	2.098	2.070	.1700	2.784	.0488	-.0006

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	312.0	.0506	.5069	.2011	.2617	1.108	28.40
SDev	.1	.0000	.0013	.0017	.0002	.001	.09
%RSD	.0192	.0166	.2532	.8340	.0660	.1178	.3320
#1	312.0	.0506	.5078	.2023	.2616	1.109	28.47
#2	311.9	.0506	.5060	.1999	.2618	1.107	28.33

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0015	-.0029	20.46	.5081	.0008	78.13	110.8
SDev	.0006	.0000	.01	.0001	.0003	.08	.7
%RSD	38.00	1.145	.0732	.0265	37.83	.1036	.5900
#1	-.0018	-.0029	20.48	.5080	.0010	78.19	111.2
#2	-.0011	-.0029	20.45	.5082	.0006	78.08	110.3

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.4974	.0280	.5044	.5089	.0028	.1336	.4994
SDev	.0031	.0084	.0040	.0024	.0020	.0016	.0028
%RSD	.6273	30.03	.7878	.4820	70.75	1.235	.5650
#1	.4996	.0220	.5072	.5106	.0014	.1324	.5014
#2	.4952	.0339	.5016	.5071	.0043	.1347	.4975

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	91.62	2.176	2.165	.4982	.5074	2.169	.0010
SDev	.73	.009	.003	.0001	.0030	.005	.0014
%RSD	.7927	.4186	.1158	.0236	.5835	.2170	137.7
#1	92.13	2.182	2.167	.4981	.5095	2.172	.0020
#2	91.10	2.169	2.164	.4983	.5053	2.165	.0000

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.039	-.0141	-.0004	2.121	-.0323	.5092	.0058
SDev	.003	.0022	.0001	.002	.0081	.0006	.0031
%RSD	.0780	15.76	18.65	.0933	25.10	.1091	52.21
#1	4.037	-.0156	-.0004	2.122	-.0266	.5096	.0080
#2	4.041	-.0125	-.0005	2.120	-.0381	.5088	.0037

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0003	.6212	-.0012
SDev	.0000	.0004	.0004
%RSD	4.247	.0673	32.39
#1	-.0003	.6209	-.0009
#2	-.0003	.6215	-.0014

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	809408	10000	--	--	--	--	--
SDev	6395.781	.0000000	--	--	--	--	--
%RSD	.7901806	.0000000	--	--	--	--	--
#1	813930	10000	--	--	--	--	--
#2	804885	10000	--	--	--	--	--

010366

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Method: DAILY2 Sample Name: 230270 Operator:
Run Time: 08/11/03 10:51:21
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0006	-.0016	.0031	.1026	.4256	.0001	-.0037
SDev	.0010	.0049	.0001	.0003	.0010	.0000	.0006
%RSD	161.4	299.7	4.141	.2806	.2443	27.71	17.47
#1	-.0013	-.0051	.0032	.1024	.4248	.0001	-.0032
#2	.0001	.0018	.0030	.1028	.4263	.0000	-.0042

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	291.9	.0001	-.0012	.0014	.0094	.0106	2.986
SDev	.4	.0003	.0004	.0003	.0003	.0056	.021
%RSD	.1270	401.9	33.70	19.24	3.125	52.82	.7160
#1	291.7	.0003	-.0015	.0016	.0096	.0145	2.971
#2	292.2	-.0001	-.0009	.0012	.0092	.0066	3.001

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0011	-.0030	.0167	.0009	.0006	49.52	71.65
SDev	.0011	.0000	.0025	.0000	.0003	.46	.23
%RSD	96.44	.1466	15.05	2.756	57.75	.9354	.3272
#1	-.0019	-.0030	.0185	.0009	.0004	49.19	71.48
#2	-.0004	-.0030	.0150	.0009	.0009	49.84	71.81

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0013	.0246	-.0009	.0018	.0004	.0838	-.0029
SDev	.0001	.0010	.0025	.0009	.0017	.0071	.0004
%RSD	8.883	4.252	270.0	49.53	400.5	8.486	12.67
#1	.0012	.0239	.0008	.0024	-.0008	.0788	-.0027
#2	.0013	.0254	-.0027	.0012	.0016	.0888	-.0032

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	95.32	.0055	-.0034	.4168	.0009	-.0004	.0013
SDev	.41	.0042	.0021	.0063	.0014	.0000	.0015
%RSD	.4250	76.87	61.44	1.515	157.4	.3732	116.9
#1	95.61	.0025	-.0019	.4124	.0019	-.0004	.0002
#2	95.03	.0085	-.0049	.4213	-.0001	-.0004	.0023

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0518	-.0003	-.0004	.0006	-.0037	.0001	.0015
SDev	.0001	.0033	.0000	.0026	.0128	.0000	.0011
%RSD	.1082	1039.	3.682	440.4	349.7	31.58	74.41
#1	.0518	.0020	-.0004	.0024	-.0127	.0001	.0007
#2	.0517	-.0026	-.0004	-.0012	.0054	.0001	.0022

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0004	.0948	-.0014
SDev	.0000	.0003	.0001
%RSD	2.103	.2972	6.002
#1	-.0004	.0946	-.0013
#2	-.0004	.0950	-.0015

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	842112	10000	--	--	--	--	--
SDev	3620.387	.0000000	--	--	--	--	--
%RSD	.4299175	.0000000	--	--	--	--	--
#1	844672	10000	--	--	--	--	--
#2	839552	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: 230270 df10 Operator:
Run Time: 08/11/03 10:56:02
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0003	.0099	.0018	.0137	.0430	.0000	-.0088
SDev	.0002	.0025	.0013	.0004	.0001	.0000	.0027
%RSD	93.49	24.83	70.16	2.708	.2254	54.36	30.35
#1	-.0004	.0082	.0027	.0134	.0430	.0000	-.0107
#2	-.0001	.0117	.0009	.0140	.0429	.0000	-.0069

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	29.84	-.0000	-.0012	-.0000	.0016	.0035	.1905
SDev	.03	.0000	.0004	.0003	.0003	.0054	.0096
%RSD	.0973	43.18	31.45	1238.	15.49	152.7	5.046
#1	29.82	-.0000	-.0014	.0002	.0014	-.0003	.1837
#2	29.87	-.0000	-.0009	-.0003	.0018	.0074	.1973

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0006	.0009	.0161	.0004	.0007	3.907	5.321
SDev	.0000	.0001	.0015	.0000	.0001	.018	.012
%RSD	7.962	8.665	9.452	8.517	18.44	.4539	.2308
#1	-.0006	.0010	.0172	.0003	.0008	3.894	5.330
#2	-.0006	.0009	.0150	.0004	.0006	3.919	5.313

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0000	.0142	.0000	.0005	-.0021	.0141	.0033
SDev	.0002	.0047	.0054	.0015	.0014	.0108	.0029
%RSD	527.9	32.88	13880.	290.7	67.97	76.62	86.60
#1	-.0002	.0109	.0039	.0016	-.0031	.0065	.0054
#2	.0001	.0175	-.0038	-.0006	-.0011	.0217	.0013

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	95.65	.0037	.0007	.0861	.0004	.0017	-.0012
SDev	.43	.0013	.0017	.0035	.0028	.0007	.0003
%RSD	.4449	34.56	227.5	4.070	749.0	40.47	29.21
#1	95.95	.0046	-.0005	.0836	.0024	.0012	-.0014
#2	95.35	.0028	.0019	.0886	-.0016	.0022	-.0009

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0054	-.0001	.0005	-.0046	.0009	.0001	.0012
SDev	.0000	.0003	.0001	.0013	.0084	.0001	.0012
%RSD	.1202	232.0	22.95	28.80	962.1	49.85	96.17
#1	.0054	-.0004	.0006	-.0037	.0068	.0001	.0021
#2	.0054	.0001	.0004	-.0056	-.0051	.0002	.0004

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0002	.0109	-.0007
SDev	.0000	.0001	.0001
%RSD	26.25	1.171	13.67
#1	-.0001	.0108	-.0008
#2	-.0002	.0110	-.0006

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	845048	10000	--	--	--	--	--
SDev	3782.314	.0000000	--	--	--	--	--
%RSD	.4475860	.0000000	--	--	--	--	--
#1	847722	10000	--	--	--	--	--
#2	842373	10000	--	--	--	--	--

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Analysis Report 08/11/03 11:05:13 AM page 1

Method: DAILY2 Sample Name: 230279 Operator:
Run Time: 08/11/03 11:00:43
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0007	-.0006	-.0005	.0122	.0159	.0000	-.0012
SDev	.0006	.0034	.0014	.0013	.0001	.0000	.0022
%RSD	81.21	536.0	269.4	10.91	.6344	264.0	180.2
#1	-.0003	.0018	.0005	.0131	.0160	-.0000	-.0028
#2	-.0011	-.0031	-.0015	.0112	.0159	.0000	.0003

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	79.46	-.0001	.0011	.0041	.0081	.0111	.2285
SDev	.01	.0002	.0006	.0003	.0008	.0044	.0123
%RSD	.0102	346.2	57.87	7.603	10.37	40.20	5.400
#1	79.47	.0001	.0015	.0039	.0075	.0142	.2372
#2	79.46	-.0002	.0006	.0043	.0087	.0079	.2197

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0006	-.0025	.0227	.0512	.0002	19.19	27.16
SDev	.0004	.0001	.0023	.0001	.0008	.09	.02
%RSD	61.73	2.572	9.913	.0884	454.3	.4757	.0782
#1	-.0004	-.0025	.0243	.0511	.0008	19.13	27.15
#2	-.0009	-.0025	.0212	.0512	-.0004	19.26	27.18

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0033	.0047	.0045	.0052	-.0031	.3588	.0001
SDev	.0006	.0077	.0023	.0000	.0013	.0007	.0047
%RSD	16.44	164.7	51.35	.8517	40.86	.1997	4083.
#1	.0037	.0101	.0062	.0052	-.0022	.3593	.0034
#2	.0029	-.0008	.0029	.0053	-.0041	.3583	-.0032

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	97.07	.0040	-.0021	1.311	.0050	-.0001	.0007
SDev	.25	.0012	.0023	.003	.0008	.0019	.0013
%RSD	.2544	30.57	108.8	.2066	14.87	3080.	182.5
#1	96.90	.0048	-.0005	1.313	.0055	.0013	-.0002
#2	97.25	.0031	-.0037	1.309	.0045	-.0014	.0016

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0190	.0000	.0007	-.0005	-.0018	.0001	.0025
SDev	.0001	.0020	.0000	.0007	.0078	.0005	.0005
%RSD	.2875	4585.	5.059	147.4	435.2	495.5	19.07
#1	.0190	-.0014	.0007	-.0010	.0037	-.0002	.0029
#2	.0189	.0014	.0007	.0000	-.0073	.0004	.0022

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0002	.3947	-.0009
SDev	.0001	.0006	.0004
%RSD	43.43	.1418	45.81
#1	-.0001	.3951	-.0012
#2	-.0002	.3943	-.0006

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	857541	10000	--	--	--	--	--
SDev	2167.990	.0000000	--	--	--	--	--
%RSD	.2528146	.0000000	--	--	--	--	--
#1	856008	10000	--	--	--	--	--
#2	859074	10000	--	--	--	--	--

Analysis Report 08/11/03 11:09:54 AM page 1

Method: DAILY2 Sample Name: 230282 Operator:
Run Time: 08/11/03 11:05:25
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0005	.0098	.0018	.0129	.0039	.0000	-.0024
SDev	.0004	.0029	.0015	.0001	.0001	.0000	.0012
%RSD	72.90	29.81	79.72	.6143	1.308	3.308	48.44
#1	-.0008	.0077	.0029	.0128	.0039	.0000	-.0016
#2	-.0002	.0119	.0008	.0129	.0039	.0000	-.0032

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	37.88	.0000	.0002	.0023	.0049	-.0026	.2239
SDev	.04	.0002	.0000	.0005	.0001	.0081	.0117
%RSD	.0950	805.0	15.11	19.94	1.202	313.8	5.235
#1	37.86	.0002	.0003	.0020	.0048	-.0084	.2156
#2	37.91	-.0001	.0002	.0027	.0049	.0032	.2322

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0007	-.0031	.0051	.0038	.0004	35.30	48.39
SDev	.0005	.0000	.0021	.0001	.0006	.28	.10
%RSD	68.45	.7373	42.12	2.649	142.3	.8072	.2141
#1	-.0010	-.0031	.0036	.0037	.0008	35.10	48.31
#2	-.0004	-.0032	.0066	.0038	-.0000	35.50	48.46

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0012	.0060	.0008	.0015	-.0024	.0811	.0015
SDev	.0002	.0049	.0014	.0015	.0008	.0087	.0012
%RSD	13.24	82.72	175.0	105.0	33.51	10.73	79.57
#1	.0011	.0025	-.0002	.0025	-.0030	.0750	.0023
#2	.0013	.0094	.0017	.0004	-.0018	.0873	.0007

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	96.83	.0051	-.0016	.7877	.0012	.0007	.0018
SDev	.27	.0034	.0006	.0038	.0006	.0007	.0024
%RSD	.2824	65.71	39.57	.4802	45.83	104.7	139.3
#1	96.64	.0027	-.0011	.7904	.0016	.0002	.0035
#2	97.02	.0075	-.0020	.7850	.0008	.0012	.0000

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0143	.0011	.0003	-.0020	-.0045	.0001	.0012
SDev	.0001	.0003	.0001	.0012	.0077	.0001	.0007
%RSD	.5149	28.97	29.76	61.67	171.5	187.0	55.23
#1	.0142	.0013	.0002	-.0011	-.0099	.0002	.0017
#2	.0143	.0009	.0004	-.0029	.0010	-.0000	.0007

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0002	.0725	-.0008
SDev	.0000	.0006	.0000
%RSD	5.512	.8061	5.172
#1	-.0002	.0721	-.0008
#2	-.0002	.0729	-.0009

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	855452	10000	--	--	--	--	--
SDev	2473.459	.0000000	--	--	--	--	--
%RSD	.2891406	.0000000	--	--	--	--	--
#1	853703	10000	--	--	--	--	--
#2	857201	10000	--	--	--	--	--

010374

Analysis Report QC Standard 08/11/03 11:14:36 AM page 1

Method: DAILY2 Sample Name: icv/ccv Operator:
Run Time: 08/11/03 11:10:06
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.9774	9.909	4.886	4.805	9.893	.9885	4.942
SDev	.0009	.019	.010	.013	.004	.0008	.003
%RSD	.0917	.1874	.2014	.2610	.0406	.0762	.0586
#1	.9767	9.896	4.893	4.796	9.891	.9890	4.940
#2	.9780	9.923	4.879	4.814	9.896	.9879	4.944
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	1.000	10.00	5.000	5.000	10.00	1.000	5.000
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	19.50	.9976	4.965	1.945	2.000	10.08	18.33
SDev	.01	.0017	.001	.002	.000	.00	.04
%RSD	.0314	.1678	.0189	.0871	.0236	.0378	.2352
#1	19.50	.9965	4.966	1.944	2.000	10.08	18.29
#2	19.51	.9988	4.965	1.946	2.001	10.08	18.36
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	20.00	1.000	5.000	2.000	2.000	10.00	20.00
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.876	4.823	19.74	1.005	5.108	27.95	Q40.43
SDev	.004	.001	.01	.001	.019	.16	.05
%RSD	.0879	.0120	.0751	.0761	.3724	.5736	.1142
#1	4.873	4.824	19.73	1.005	5.095	27.84	Q40.40
#2	4.879	4.823	19.76	1.006	5.122	28.07	Q40.47
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Fail
Value	5.000	5.000	20.00	1.000	5.000	30.00	30.00
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.839	5.099	4.810	4.838	.9715	1.010	.9872
SDev	.001	.003	.010	.016	.0019	.000	.0031
%RSD	.0121	.0524	.2011	.3287	.1910	.0457	.3158
#1	4.838	5.097	4.817	4.827	.9702	1.010	.9894
#2	4.839	5.101	4.803	4.849	.9728	1.009	.9850
Errors	QC Pass	QC Pass	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass
Value	5.000	5.000			1.000	1.000	1.000
Range	10.00	10.00			10.00	10.00	10.00

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	98.11	5.078	5.125	4.962	4.828	5.110	4.862
SDev	.07	.017	.021	.006	.007	.009	.004
%RSD	.0764	.3339	.4153	.1217	.1528	.1671	.0743
#1	98.16	5.090	5.110	4.966	4.823	5.103	4.859
#2	98.05	5.066	5.140	4.957	4.834	5.116	4.864
Errors	NOCHECK	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass
Value				5.000	5.000	5.000	5.000
Range				10.00	10.00	10.00	10.00

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.991	.9824	4.798	5.105	.9651	4.919	1.055
SDev	.002	.0008	.002	.015	.0086	.007	.001
%RSD	.0330	.0773	.0345	.3005	.8961	.1333	.0962
#1	4.990	.9829	4.797	5.094	.9713	4.924	1.055
#2	4.993	.9819	4.799	5.116	.9590	4.914	1.056
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	5.000	1.000	5.000	5.000	1.000	5.000	1.000
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	4.937	.9896	4.869
SDev	.001	.0011	.000
%RSD	.0240	.1138	.0033
#1	4.937	.9888	4.869
#2	4.936	.9904	4.869
Errors	QC Pass	QC Pass	QC Pass
Value	5.000	1.000	5.000
Range	10.00	10.00	10.00

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	866684	10000	--	--	--	--	--
SDev	679.5296	.0000000	--	--	--	--	--
%RSD	.0784056	.0000000	--	--	--	--	--
#1	867165	10000	--	--	--	--	--
#2	866204	10000	--	--	--	--	--

Analysis Report Blank Sample 08/11/03 11:21:08 AM page 1

Method: DAILY2 Sample Name: icb/ccb Operator:
Run Time: 08/11/03 11:16:38
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0003	-.0059	-.0014	.0079	.0001	.0001	.0011
SDev	.0005	.0064	.0000	.0019	.0001	.0000	.0001
%RSD	147.3	108.0	1.639	23.77	50.24	6.876	8.601
#1	.0000	-.0014	-.0014	.0092	.0002	.0001	.0010
#2	-.0007	-.0104	-.0015	.0066	.0001	.0001	.0011
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0500	.0050	.0500	.0050	.0050	.0050
Low	-.0050	-.0500	-.0050	-.0500	-.0050	-.0050	-.0050

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0044	.0000	-.0005	-.0005	-.0004	-.0056	.0088
SDev	.0020	.0002	.0002	.0004	.0005	.0273	.0213
%RSD	44.28	1410.	39.16	66.16	146.2	485.8	243.0
#1	.0030	.0002	-.0004	-.0003	.0000	.0137	.0238
#2	.0058	-.0001	-.0007	-.0008	-.0007	-.0249	-.0063
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0500	.0050	.0050	.0050	.0050	.0250	.1000
Low	-.0500	-.0050	-.0050	-.0050	-.0050	-.0250	-.1000

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0007	.0008	-.0046	-.0001	.0043	H.1410	.0103
SDev	.0011	.0002	.0065	.0000	.0008	.2346	.0022
%RSD	159.9	26.00	140.3	8.532	19.84	166.4	21.84
#1	.0001	.0009	-.0000	-.0001	.0049	H.3070	.0087
#2	-.0015	.0007	-.0092	-.0001	.0037	-.0249	.0119
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC High	LC Pass
High	.0050	.0050	.0500	.0050	.0050	.0500	.0500
Low	-.0050	-.0050	-.0500	-.0050	-.0050	-.0500	-.0500

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0008	.0033	.0000	.0010	-.0013	.0000	.0009
SDev	.0005	.0016	.0005	.0008	.0049	.0049	.0003
%RSD	70.46	48.78	1056.	72.56	390.9	23990.	37.00
#1	-.0011	.0044	-.0003	.0016	.0022	.0035	.0011
#2	-.0004	.0021	.0004	.0005	-.0048	-.0035	.0006
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High	.0050	.0100			.0050	.0100	.0100
Low	-.0050	-.0100			-.0050	-.0100	-.0100

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	98.41	.0055	-.0022	-.0046	.0007	.0004	-.0017
SDev	2.49	.0011	.0001	.0038	.0003	.0005	.0019
%RSD	2.526	20.83	5.736	83.00	47.43	131.6	113.5
#1	96.66	.0047	-.0023	-.0019	.0010	.0000	-.0003
#2	100.2	.0064	-.0022	-.0074	.0005	.0007	-.0030
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				.0100	.0030	.0050	.0050
Low				-.0100	-.0030	-.0050	-.0050

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0000	-.0017	-.0003	.0033	-.0063	-.0008	.0041
SDev	.0001	.0008	.0004	.0034	.0069	.0002	.0005
%RSD	140.5	48.24	142.6	104.1	110.0	27.69	12.58
#1	.0001	-.0023	.0000	.0056	-.0014	-.0009	.0037
#2	.0000	-.0012	-.0006	.0009	-.0111	-.0006	.0044
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0100	.0050	.0100	.1000	.0050	.0100
Low	-.0050	-.0100	-.0050	-.0100	-.1000	-.0050	-.0100

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0001	.0014	-.0007
SDev	.0001	.0017	.0000
%RSD	114.5	119.6	1.248
#1	.0001	.0002	-.0008
#2	.0000	.0027	-.0007
Errors	LC Pass	LC Pass	LC Pass
High	.0050	.0050	.0050
Low	-.0050	-.0050	-.0050

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	869476	10000	--	--	--	--	--
SDev	21930.92	.0000000	--	--	--	--	--
%RSD	2.522316	.0000000	--	--	--	--	--
#1	853968	10000	--	--	--	--	--
#2	884983	10000	--	--	--	--	--

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 030714-8
SRR: 24618
SDG: 230259
CASE: CNWRA
VTSR: July 14, 2003
PROJECT#: 06002.01.141

Certificates of Analysis

010380

FISHER SCIENTIFIC
TRACEMETAL GRADE NITRIC ACID

CERTIFICATE OF ANALYSIS

Catalog No. A509 Lot No: 1103030
Date: March, 2003

Tests	Units	Value
Assay	%	70%
Color	APHA	<10
Aluminum	ppb	<0.2
Antimony	ppb	<0.1
Arsenic	ppb	<0.1
Barium	ppb	<0.1
Beryllium	ppb	<0.1
Bismuth	ppb	<0.1
Boron	ppb	<1
Cadmium	ppb	<0.1
Calcium	ppb	<0.5
Chromium	ppb	<0.1
Cobalt	ppb	<0.1
Copper	ppb	<0.1
Iron	ppb	<0.5
Lead	ppb	<0.1
Lithium	ppb	<0.1
Magnesium	ppb	<0.2
Manganese	ppb	<0.1
Mercury	ppb	<0.2
Molybdenum	ppb	<0.1
Nickel	ppb	<0.1
Potassium	ppb	<0.2
Selenium	ppb	<0.1
Silver	ppb	<0.1
Sodium	ppb	<0.2
Strontium	ppb	<0.1
Thorium	ppb	<0.1
Tin	ppb	<0.1
Titanium	ppb	<0.1
Uranium	ppb	<0.1
Vanadium	ppb	<0.1
Zinc	ppb	<0.2
Zirconium	ppb	<0.1

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 5/22/03
DATE EXPIRED: 5/22/03
DATE OPENED: 5/22/03
INORG: 4992->4997 PO: F53352

Element concentrations are at the point of bottling. Concentrations of some elements in particular, Ca, Si, K, Na, B, Al, Mg & Mn will increase due to storage in glass bottles.

B McKelvey

Dr. B. McKelvey
QA/QC Manager

Fisher Scientific Chemical Division
Pittsburgh, PA., 15275 Phone (412) 490-8300

Fisher Chemical
A Fisher Scientific Company

FISHER SCIENTIFIC
TRACEMETAL GRADE NITRIC ACID

CERTIFICATE OF ANALYSIS

Catalog No. A509 **Lot No: 1103030**

Date: March, 2003

Tests	Units	Value
Assay	%	70%
Color	APHA	<10
Aluminum	ppb	<0.2
Antimony	ppb	<0.1
Arsenic	ppb	<0.1
Barium	ppb	<0.1
Beryllium	ppb	<0.1
Bismuth	ppb	<0.1
Boron	ppb	<1
Cadmium	ppb	<0.1
Calcium	ppb	<0.5
Chromium	ppb	<0.1
Cobalt	ppb	<0.1
Copper	ppb	<0.1
Iron	ppb	<0.5
Lead	ppb	<0.1
Lithium	ppb	<0.1
Magnesium	ppb	<0.2
Manganese	ppb	<0.1
Mercury	ppb	<0.2
Molybdenum	ppb	<0.1
Nickel	ppb	<0.1
Potassium	ppb	<0.2
Selenium	ppb	<0.1
Silver	ppb	<0.1
Sodium	ppb	<0.2
Strontium	ppb	<0.1
Thorium	ppb	<0.1
Tin	ppb	<0.1
Titanium	ppb	<0.1
Uranium	ppb	<0.1
Vanadium	ppb	<0.1
Zinc	ppb	<0.2
Zirconium	ppb	<0.1

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 4/3/03
DATE EXPIRED: 6/3/03
DATE OPENED: 4/3/03 DK
INORG: 4164-4169 PO: F52359

Element concentrations are at the point of bottling. Concentrations of some elements in particular, Ca, Si, K, Na, B, Al, Mg & Mn will increase due to storage in glass bottles.

B McKelvey

Dr. B. McKelvey
QA/QC Manager

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Fisher Chemical

010382

FISHER SCIENTIFIC
TRACEMETAL GRADE HYDROCHLORIC ACID

CERTIFICATE OF ANALYSIS

Catalog No. A508 **Lot No: 4102110**
Date: December, 2002

Tests	Units	Value
Assay	%	36%
Color	APHA	<10
Aluminum	ppb	<0.5
Antimony	ppb	<0.1
Arsenic	ppb	<0.1
Barium	ppb	<0.1
Beryllium	ppb	<0.1
Bismuth	ppb	<0.1
Boron	ppb	<1
Cadmium	ppb	<0.1
Calcium	ppb	<0.5
Chromium	ppb	<0.1
Cobalt	ppb	<0.1
Copper	ppb	<0.1
Iron	ppb	<0.5
Lead	ppb	<0.1
Lithium	ppb	<0.1
Magnesium	ppb	<0.5
Manganese	ppb	<0.1
Mercury	ppb	<0.2
Molybdenum	ppb	<0.1
Nickel	ppb	<0.1
Potassium	ppb	<0.1
Selenium	ppb	<0.1
Silver	ppb	<0.1
Sodium	ppb	<0.5
Strontium	ppb	<0.1
Thorium	ppb	<0.1
Tin	ppb	<0.1
Titanium	ppb	<0.1
Uranium	ppb	<0.1
Vanadium	ppb	<0.1
Zinc	ppb	<0.5
Zirconium	ppb	<0.1

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 5/9/03
DATE EXPIRED: 5/9/2003 OK
DATE OPENED: 5/9/03
INORG: 4082-7 4082 PO: F52161

Element concentrations are at the point of bottling. Concentrations of some elements in particular, Ca, Si, K, Na, B, Al, Mg & Mn will increase due to storage in glass bottles.

B McKelvey

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Fisher Chemical
A Fisher Scientific Company

010383

FISHER SCIENTIFIC
TRACEMETAL GRADE HYDROCHLORIC ACID

CERTIFICATE OF ANALYSIS

Catalog No. A508 **Lot No: 4102110**
Date: December, 2002

Tests	Units	Value
Assay	%	36%
Color	APHA	<10
Aluminum	ppb	<0.5
Antimony	ppb	<0.1
Arsenic	ppb	<0.1
Barium	ppb	<0.1
Beryllium	ppb	<0.1
Bismuth	ppb	<0.1
Boron	ppb	<1
Cadmium	ppb	<0.1
Calcium	ppb	<0.5
Chromium	ppb	<0.1
Cobalt	ppb	<0.1
Copper	ppb	<0.1
Iron	ppb	<0.5
Lead	ppb	<0.1
Lithium	ppb	<0.1
Magnesium	ppb	<0.5
Manganese	ppb	<0.1
Mercury	ppb	<0.2
Molybdenum	ppb	<0.1
Nickel	ppb	<0.1
Potassium	ppb	<0.1
Selenium	ppb	<0.1
Silver	ppb	<0.1
Sodium	ppb	<0.5
Strontium	ppb	<0.1
Thorium	ppb	<0.1
Tin	ppb	<0.1
Titanium	ppb	<0.1
Uranium	ppb	<0.1
Vanadium	ppb	<0.1
Zinc	ppb	<0.5
Zirconium	ppb	<0.1

Element concentrations are at the point of bottling. Concentrations of some elements in particular, Ca, Si, K, Na, B, Al, Mg & Mn will increase due to storage in glass bottles.

B McKelvey

Dr. B. McKelvey
QA/QC Manager

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INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 06/10/03
DATE EXPIRED: 06/10/2013
DATE OPENED: 06/25/03
INORG: 4156-4161 PO: F52368

Certificate of Analysis

010384

CUSTOM-GRADE SOLUTION 10,000 µg/mL Scandium IN 5% HNO_3 (abs)

Catalog Number: CGSC10-1and CGSC10-5

Lot Number: **T-QSC01104**

Starting Material:	Sc_2O_3
Starting Material Purity:	99.999%
Starting Material Lot No:	632-5721

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 9/4/02
DATE EXPIRED: 10/1/2003
DATE OPENED: 9/4/02
INORG: 3683 PO: F52048

CERTIFIED VALUE: 10,056 µg/mL

The certified value is the average of the classical wet assay and instrument analysis unless otherwise specified. All standards are accurate to a relative precision of ± 0.5% at the 95% confidence level for a period of 1 year. (See expiration date below)

Classical Wet Assay: 10,040 µg/mL

Method: EDTA Titration vs NIST SRM 928 Lead Nitrate

Sufficient number of sample measurements were made to give a minimum relative precision of ± 0.3% at the 95% confidence level.

Instrument Analysis: 10,071 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3148a

Sufficient number of sample measurements were made to give a minimum relative precision of ± 0.5% at the 95% confidence level.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room**.
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	<0.07	M	Dy	<0.006	M	Li	<0.01	M	Pr	<0.0003	M	Te	<0.03
M	Sb	<0.0005	M	Er	<0.005	M	Lu	<0.0004	M	Re	<0.001	M	Tb	<0.0003
M	As	<0.01	M	Eu	<0.003	M	Mg	<0.03	M	Rh	<0.001	M	Tl	<0.001
M	Ba	<0.01	M	Gd	<0.001	M	Mn	<0.004	M	Rb	<0.001	M	Th	0.028
M	Be	<0.0005	M	Ga	<0.001	O	Hg	i	M	Ru	<0.002	M	Tm	<0.0004
M	Bi	0.043	M	Ge	<0.006	M	Mo	<0.002	M	Sm	<0.001	M	Sn	<0.005
O	B	<0.034	M	Au	<0.003	M	Nd	<0.002	s	Sc		n	Ti	
M	Cd	<0.003	M	Hf	0.03	O	Ni	<0.084	O	Se	<0.67	M	W	<0.01
O	Ca	0.17	M	Ho	<0.0005	M	Nb	<0.0005	O	Si	<0.034	M	U	<0.002
M	Ce	<0.005	M	In	<0.001	n	Os		M	Ag	0.005	M	V	<0.002
M	Cs	<0.0003	M	Ir	<0.005	M	Pd	<0.005	O	Na	<0.16	M	Yb	<0.001
M	Cr	<0.005	O	Fe	<0.16	O	P	i	M	Sr	<0.0005	M	Y	<0.04
M	Co	<0.003	M	La	<0.0005	M	Pt	<0.002	n	S		M	Zn	0.075
M	Cu	<0.006	M	Pb	0.005	O	K	<5.01	M	Ta	<0.007	M	Zr	0.32

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.062 g/mL

QA:KL Rev.050302DN

(over)

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
Orders: 800-669-6799 • FAX (732) 901-1903
Technical Support: 800-569-6799

Paul R. Haines
Quality Assurance Manager

EXPIRES 1°2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION

1000 µg/mL Scandium IN 5% HNO_3 (abs)

Catalog Number: CGSC1-1and CGSC1-5

010385

Lot Number: **W-SC02055**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 06/20/03
DATE EXPIRED: 07/01/2004
DATE OPENED: 06/23/03
INORG: 4151 PO: F52370

Starting Material:	Sc_2O_3
Starting Material Purity:	99.99%
Starting Material Lot No:	632-5721

CERTIFIED CONCENTRATION: 1000 ± 5 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1000 ± 5 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 995 ± 5 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3148a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	<0.070	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	<0.0030	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	0.0028
M	Be	<0.000050	M	Ga	<0.00010	O	Hg	i	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	0.0043	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
O	B	<0.020	M	Au	<0.00030	M	Nd	<0.00020	s	Sc		M	Ti	<0.0050
M	Cd	<0.00030	M	Hf	0.0030	O	Ni	<0.084	O	Se	<0.67	M	W	<0.0010
O	Ca	0.016	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.034	M	U	<0.00020
M	Ce	<0.00050	M	In	<0.00010	n	Os		M	Ag	0.0050	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.16	M	Yb	<0.00010
M	Cr	<0.00050	O	Fe	<0.16	O	P	i	M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	n	S		M	Zn	0.0075
M	Cu	<0.00060	M	Pb	0.00050	O	K	<5.01	M	Ta	<0.00070	M	Zr	0.032

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.038 g/mL **(over)**

QA:KL Rev.031303JTS

Paul R Haines

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
Orders: 800-669-6799 • FAX (732) 901-1903
Technical Support: 800-569-6799

Quality Assurance Manager

EXPIRES
01/2004

SPEXertificate™

010386

Certificate of Reference Material

Catalog Number: SPIKE-1 **Lot No.:** 22-93AS
Description: **Spike Sample Standard 1**
Matrix: 5% Nitric Acid/tr Tartaric Acid - HF

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 7/16/02
DATE EXPIRED: 7/31/2003 DK
DATE OPENED: 8/7/02
INORG: 3609 PO: F51911

This **ASSURÅNCE** ®certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM	Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
Al	200	199.51	3101a	Pb	50	49.98	3128
As	200	199.89	3103a	Sb	50	50.02	3102a
Ba	200	199.68	3104a	V	50	49.95	3165
Se	200	200.10	3149	Zn	50	50.02	3168a
TL	200	200.07	3158	Cu	25	25.34	3114
Fe	100	99.91	3126a	Cr	20	20.04	3112a
Co	50	50.25	3113	Ag	5	5.00	3151
Mn	50	49.98	3132	Be	5	5.00	3105a
Ni	50	50.11	3136	Cd	5	4.99	3108

Spex Reference Multi: Lot #2-61BD, 17-55AS, 19-85ASREF

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/- 0.5% on the average of all the certified concentrations with no single component exceeding +/- 2%. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: JL -- '02 Certifying Officer: N. Kocherlakota

SPEXertificate™ 010387

Certificate of Reference Material

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 05/15/03
DATE EXPIRED: 05/15/2004
DATE OPENED: 05/15/03
INORG: 4074 PO: F52351

Catalog Number: SPIKE-1 **Lot No.:** 25-23AS
Description: **Spike Sample Standard 1**
Matrix: 5% Nitric Acid/tr Tartaric Acid - HF

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM	Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
Al	200	199.51	3101a	Pb	50	49.98	3128
As	200	199.89	3103a	Sb	50	50.02	3102a
Ba	200	199.68	3104a	V	50	49.95	3165
Se	200	200.10	3149	Zn	50	50.02	3168a
TL	200	200.07	3158	Cu	25	25.34	3114
Fe	100	99.91	3126a	Cr	20	20.04	3112a
Co	50	50.25	3113	Ag	5	5.00	3151
Mn	50	49.98	3132	Be	5	5.00	3105a
Ni	50	50.11	3136	Cd	5	4.99	3108

Spex Reference Multi: Lot #2-61BD, 17-55AS, 19-85ASREF

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/- 0.5% on the average of all the certified concentrations with no single component exceeding +/- 2%. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: MAY '03 Certifying Officer: N. Kocherlakota

010388

SPEXertificate™

Certificate of Reference Material

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 05/09/03
DATE EXPIRED: 05/15/2004
DATE OPENED: 05/13/03
INORG: 4070 PO: F52180

Catalog Number: ICAL-1 **Lot No.:** 6-104VY
Description: **Instrument Calibration Standard 1**
Matrix: 5% Nitric Acid

This **ASSURANCE** ®certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
Ca	5,000	4,984.92	3109a
K	5,000	4,990.26	3141a
Mg	5,000	4,991.82	3131a
Na	5,000	4,998.07	3152a

Spex Reference Multi: Lot #10-100AS, 12-113AS, 5-198VY, 6-28VY-REF

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/- 0.5% on the average of all the certified concentrations with no single element exceeding +/-2%. This includes uncertainty of measurements and other effects, such as transpiration losses. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: MAY '03 Certifying Officer: N. Kocherlakota

SPEXertificate™

Certificate of Reference Material

010389

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 06/20/03
DATE EXPIRED: 06/30/2004
DATE OPENED: 06/23/03
INORG: 4139 PO: F52370

Catalog Number: PLB9-2X/2Y/2T **Lot No.** 9-143B
Description: 1000 mg/L Boron
Matrix: H2O

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 999.5 mg/L
Uncertainty Associated with Measurement: +/-3.0mg/L
Certified Value is Traceable to: NIST SRM 3107

The CRM is prepared gravimetrically using high purity (NH4)2(B4O7)-4H2O Lot# 08001E. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1001 mg/L

Method: Titration with Sodium Hydroxide using Phenolphthalein as indicator. Sodium Hydroxide standardized against Potassium Biphthalate NIST SRM #84K.

Instrumentation Analysis By ICP spectrometer: 998 mg/L

Uncertified Properties:

Density: 1.000 @ 23.7 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.06	Cu	<0.001	Pb	<0.001
As	<0.001	Fe	0.001	Re	<0.001
Ag	<0.002	Ga	<0.001	Rb	<0.001
Ba	<0.001	In	<0.001	Sr	<0.001
Be	<0.001	K	<0.01	Sb	<0.001
Bi	<0.001	Li	<0.001	Sn	<0.001
Cd	<0.001	Mn	<0.001	Ti	<0.001
Co	<0.001	Mo	<0.001	Tl	<0.001
Ca	0.003	Mg	<0.001	V	0.004
Cr	<0.003	Na	0.026	Zr	<0.001
		Ni	<0.001	Zn	<0.007

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: JUN '03 Certifying Officer: N. Kocherlakota

SPEXertificate™

010390

Certificate of Reference Material

Catalog Number: PLLI2-2X/2Y **Lot No.** 9-102LI

Description: 1000 mg/L Lithium

Matrix: 2% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1002 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3129a

The CRM is prepared gravimetrically using high purity Lithium Carbonate Lot# 03021A . The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1002 mg/L

Method: Evaporate to dryness. Fume with Sulfuric Acid. Ignite and weigh as Li2SO4.

Instrumentation Analysis By ICP spectrometer: 1002 mg/L

Uncertified Properties:

Density: 1.014 @ 24.5 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.009	Cu	0.01	Pb	0.001
As	0.004	Fe	0.045	Re	0.002
Ag	<0.001	Ga	<0.001	Rb	<0.001
B	<0.004	In	<0.001	Sr	0.001
Ba	0.004	K	0.05	Sb	0.002
Be	0.002	Mn	<0.001	Sn	<0.001
Bi	<0.001	Mo	0.002	Ti	0.005
Ca	0.03	Mg	0.003	Tl	<0.001
Cr	<0.001	Na	0.02	V	<0.001
Cd	<0.001	Ni	<0.001	Zr	<0.001
Co	0.002			Zn	0.20

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: MAY '03 Certifying Officer: N. Kocherlakota

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Catalog Number: PLMO9-2X/2Y/2T **Lot No.** 9-49MO

Description: 1000 mg/L Molybdenum

Matrix: H2O

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1000 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3134

The CRM is prepared gravimetrically using high purity Ammonium Molybdate Lot# 03011C. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 999 mg/L

Method: Precipitation using 8-Hydroxyquinoline. Filter, dry, and weigh as MoO2(C9H6NO)2

Instrumentation Analysis By ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 0.9987 @ 24.6 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.001	Cu	0.004	Pb	0.001
As	0.04	Fe	<0.01	Re	0.03
Ag	<0.001	Ga	<0.001	Rb	<0.001
B	<0.003	In	<0.001	Sr	<0.001
Ba	<0.001	K	0.02	Sb	<0.001
Be	<0.001	Li	<0.001	Sn	<0.001
Bi	<0.001	Mg	0.007	Ti	0.004
Ca	0.006	Mn	<0.001	Tl	<0.001
Cr	<0.005	Na	0.009	V	0.004
Cd	<0.05	Ni	<0.001	Zr	<0.001
Co	<0.001			Zn	<0.001

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

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Catalog Number: PLP9-2X/2Y/2T **Lot No.** 9-29P

Description: 1000 mg/L Phosphorus

Matrix: H2O

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1003.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3139a

The CRM is prepared gravimetrically using high purity (NH4)H2(PO4) Lot# A158. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1004 mg/L

Method: Precipitation using Magnesia mixture. Filter, ignite, and weigh as Mg2O2.

Instrumentation Analysis By ICP spectrometer: 1003 mg/L

Uncertified Properties:

Density: 0.9997 @ 22.9 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.05	Cu	<0.001	Pb	<0.001
As	<0.001	Fe	0.019	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.005	In	<0.001	Sn	0.006
Ba	<0.001	K	0.17	Sr	0.004
Be	<0.001	Li	0.004	Sb	0.01
Bi	<0.001	Mg	0.3	Ti	0.016
Ca	0.65	Mn	<0.001	Tl	<0.001
Cr	<0.001	Mo	<0.001	V	<0.001
Cd	<0.001	Na	0.5	Zr	<0.001
Co	<0.001	Ni	<0.001	Zn	6.7

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

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Certificate of Reference Material

Catalog Number: PLSI9-2X/2Y/2T **Lot No.** 9-66SI

Description: 1000 mg/L Silicon

Matrix: H2O / Tr HF

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1001.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3150

The CRM is prepared gravimetrically using high purity Ammonium HexafluorosiliLot# 02021D. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1003 mg/L

Method: Precipitation using Ammonium Molybdate and 8-Hydroxy Quinoline. Filter, dry, and weigh as (C9H7ON)4(H4)[Si(Mo12O40)]

Instrumentation Analysis By ICP spectrometer: 1000 mg/L

Uncertified Properties:

Density: 1.001 @ 24.5 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.002	Cu	0.01	Pb	<0.001
As	<0.001	Fe	0.006	Rb	<0.001
Ag	0.009	Ga	<0.001	Re	<0.001
B	<0.05	In	<0.001	Sn	<0.001
Ba	<0.001	K	0.014	Sr	<0.001
Be	<0.001	Li	<0.001	Sb	<0.001
Bi	<0.001	Mg	<0.001	Ti	<0.002
Ca	0.004	Mn	<0.001	Tl	<0.001
Cr	<0.002	Mo	<0.001	V	<0.001
Cd	<0.001	Na	0.006	Zr	0.008
Co	<0.001	Ni	<0.001	Zn	0.02

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: DEC -- '02 Certifying Officer: N. Kocherlakota

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Certificate of Reference Material

Catalog Number: PLTI9-2X/2Y/2T **Lot No.** 9-52TI

Description: 1000 mg/L Titanium

Matrix: H2O

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 995.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3162a

The CRM is prepared gravimetrically using high purity (NH4)2TiF6 Lot# 02021E. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 996 mg/L

Method: Precipitation using Ammonium Hydroxide. Filter, ignite, and weigh as TiO2.

Instrumentation Analysis By ICP spectrometer: 995 mg/ L

Uncertified Properties:

Density: 1.000 @ 23.9 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.01	Cu	0.35	Pb	0.002
As	<0.001	Fe	0.01	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.005	In	<0.001	Sn	<0.001
Ba	<0.001	K	<0.05	Sr	<0.001
Be	<0.002	Li	<0.001	Sb	0.005
Bi	0.008	Mg	0.008	Tl	<0.001
Ca	0.095	Mn	0.001	V	<0.001
Cr	<0.001	Mo	<0.001	Zr	0.20
Cd	<0.001	Na	0.009	Zn	0.030
Co	<0.001	Ni	0.001		

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: DEC - - '02 Certifying Officer: N. Kocherlakota

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Certificate of Reference Material

Catalog Number: PLSR2-2X/2Y/2T **Lot No.** 9-166SR

Description: 1000 mg/L Strontium in 2% HNO3

Matrix: 2% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1002.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3153a

The CRM is prepared gravimetrically using high purity Strontium Carbonate Lot# 02001B. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1002 mg/L

Method: EDTA titration using Methyl Thymol Blue as indicator. EDTA standardized against Pb(NO3)2 NIST SRM #928.

Instrumentation Analysis By ICP spectrometer: 1003 mg/L

Uncertified Properties:

Density: 1.010 @ 22.7 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.02	Cu	<0.001	Pb	<0.001
As	<0.001	Fe	0.001	Rb	<0.001
Ag	<0.002	Ga	<0.001	Re	<0.001
B	<0.003	In	<0.001	Si	0.043
Ba	0.008	K	0.10	Sb	<0.001
Be	<0.001	Li	0.007	Ti	<0.002
Bi	<0.001	Mg	<0.003	Tl	<0.001
Ca	0.014	Mn	<0.001	V	<0.001
Cr	0.001	Mo	<0.001	Zr	<0.001
Cd	<0.001	Na	0.01	Zn	0.04
Co	<0.001	Ni	<0.001		

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: FEB -- '03 Certifying Officer: N. Kocherlakota

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Certificate of Reference Material

Catalog Number: PLSN5-2X/2Y/2T **Lot No.** 9-62SN

Description: 1000 mg/L Tin

Matrix: 20% HCL

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1000 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3161a

The CRM is prepared gravimetrically using high purity Tin Metal Lot# 02891N. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 999 mg/L

Method: Precipitation using Ammonium Hydroxide. Filter, ignite, and weigh as SnO2.

Instrumentation Analysis By ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 1.034 @ 24.8 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.007	Cu	<0.001	Pb	0.001
As	0.01	Fe	0.02	Rb	<0.001
Ag	0.002	Ga	<0.001	Re	<0.001
B	<0.03	In	<0.001	Sr	<0.001
Ba	<0.001	K	0.10	Sb	0.002
Be	<0.001	Li	<0.001	Ti	<0.001
Bi	<0.001	Mg	<0.001	Tl	<0.001
Ca	0.004	Mn	<0.001	V	<0.001
Cr	<0.005	Mo	<0.001	Zr	<0.001
Cd	<0.001	Na	0.02	Zn	0.03
Co	0.008	Ni	<0.01		

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: JUN '03 Certifying Officer: N. Kocherlakota

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Certificate of Reference Material

Catalog Number: PLBI4-2X/2Y **Lot No.** 9-36BI
Description: 1000 mg/L Bismuth
Matrix: 10% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1001 mg/L
Uncertainty Associated with Measurement: +/- 3 mg/L
Certified Value is Traceable to: NIST SRM 3106

The CRM is prepared gravimetrically using high purity Bismuth Metal Lot# 04941B. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1001 mg/L

Method: EDTA titration using Xylenol Orange as indicator. EDTA standardized against Pb(NO3)2 NIST SRM #928.

Instrumentation Analysis By ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 1.052 @ 23.1 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.002	Cu	0.034	Pb	0.006
As	<0.001	Fe	0.001	Re	<0.001
Ag	0.002	Ga	<0.001	Rb	<0.001
B	<0.04	In	<0.001	Sr	<0.001
Ba	<0.001	K	0.001	Sb	<0.001
Be	<0.001	Li	<0.001	Sn	<0.001
Cd	<0.001	Mn	<0.001	Ti	<0.001
Co	<0.001	Mo	<0.001	Tl	<0.001
Ca	0.006	Mg	<0.001	V	<0.002
Cr	<0.005	Na	0.005	Zr	<0.001
		Ni	<0.001	Zn	0.02

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: JUN '03 Certifying Officer: N. Kocherlakota

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Certificate of Reference Material

Catalog Number: PLLA2-2X/2Y **Lot No.** 10-17LA

Description: 1000 mg/L Lanthanum

Matrix: 2% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 996.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3127a

The CRM is prepared gravimetrically using high purity Lanthanum Oxide Lot# 06981D. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 998 mg/L

Method: EDTA titration using Methyl Thymol Blue as indicator. EDTA standardized against Pb(NO3)2 NIST SRM #928.

Instrumentation Analysis By ICP spectrometer: 995 mg/L

Uncertified Properties:

Density: 1.010 @ 23.8 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Ce	0.009	Lu	<0.001	Tm	<0.001
Ca	0.05	Mn	<0.001	Ti	<0.001
Dy	<0.001	Mo	<0.001	Tb	<0.001
Er	<0.001	Nd	<0.001	Ta	<0.001
Eu	<0.001	Ni	<0.001	Tl	<0.001
Fe	0.006	Na	0.006	V	<0.001
Gd	<0.2	Pr	<0.001	W	<0.001
Ga	<0.001	Rb	<0.001	Y	<0.001
Hf	<0.001	Sc	<0.003	Yb	<0.001
Ho	<0.001	Sm	<0.001	Zr	<0.001
In	<0.001	Th	<0.001		

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: MAY '03 Certifying Officer: N. Kocherlakota

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Catalog Number: PLY2-2X/2Y/2T **Lot No.** 9-152Y

Description: 1,000 mg/L Yttrium

Matrix: 2% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1001.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3167a.

The CRM is prepared gravimetrically using high purity Yttrium Oxide Lot# 08001A. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1002 mg/L

Method: EDTA titration using Methyl Thymol Blue as indicator. EDTA standardized against Pb(NO3)2 NIST SRM #928.

Instrumentation Analysis By ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 1.010 @ 24.8 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Ce	<0.001	La	<0.001	Tb	<0.001
Ca	0.007	Lu	<0.001	Tm	<0.001
Dy	<0.001	Mn	<0.001	Tl	<0.001
Er	<0.001	Mo	<0.001	Th	<0.001
Eu	<0.001	Nd	<0.001	Ta	<0.001
Fe	0.003	Ni	<0.001	Ti	<0.001
Gd	<0.001	Na	0.005	V	<0.001
Ga	<0.001	Pr	<0.001	W	<0.001
Hf	<0.001	Rb	<0.001	Yb	<0.001
Ho	<0.001	Sc	<0.001	Zr	0.003
In	<0.001	Sm	<0.001		

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: MAY '03 Certifying Officer: N. Kocherlakota

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Certificate of Reference Material

Catalog Number: PLPD3-2X/2Y **Lot No.** 9-74PD

Description: 1000 mg/L Palladium

Matrix: 10% HCl

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 995 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3138

The CRM is prepared gravimetrically using high purity Palladium Powder Lot# 07991E. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 990 mg/L

Method: Precipitation using dimethyl glyoxime,filter,dry and weigh as Pd(C4H702N2)2.

Instrumentation Analysis By ICP spectrometer: 1000 mg/L

Uncertified Properties:

Density: 1.025 @ 26.3 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	<0.004	Cr	<0.009	Pt	<0.004
Au	0.03	Fe	0.02	Re	<0.001
Ag	0.007	Ga	<0.001	Rh	0.002
B	<0.05	Ir	<0.001	Rb	<0.001
Be	<0.002	In	<0.001	Ru	<0.001
Bi	<0.001	Mg	<0.005	Sn	0.08
Ca	0.02	Mn	<0.001	Te	<0.001
Cd	<0.001	Na	<0.03	Ti	<0.001
Co	<0.001	Ni	0.004	W	<0.001
Cu	<0.006	Pb	<0.04	Zr	<0.001
				Zn	0.16

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: JAN -- '03 Certifying Officer: N. Kocherlakota

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Certificate of Reference Material

Catalog Number: PLS9-2X/2Y/2T **Lot No.** 8-74S

Description: 1000 mg/L Sulfur

Matrix: H2O

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1003 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3154

The CRM is prepared gravimetrically using high purity Ammonium Sulfate Lot# 05891M. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1003 mg/L

Method: Precipitation using barium chloride,filter,ignite and weigh as BaS04.

Instrumentation Analysis By ICP spectrometer: 1003 mg/L

Uncertified Properties:

Density: 1.007 @ 23.6 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	<0.001	Cu	<0.001	Pb	0.002
As	<0.001	Fe	0.008	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.004	In	<0.001	Sn	<0.001
Ba	<0.001	K	<0.001	Sr	<0.001
Be	<0.001	Li	<0.001	Sb	<0.001
Bi	<0.001	Mg	0.005	Ti	<0.002
Ca	0.009	Mn	<0.001	Tl	<0.001
Cr	<0.004	Mo	<0.001	V	<0.001
Cd	<0.001	Na	0.02	Zr	<0.001
Co	<0.001	Ni	<0.001	Zn	0.0075

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: JUN '03 Certifying Officer: N. Kocherlakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 06/20/03
DATE EXPIRED: 06/30/2004
DATE OPENED: 06/23/03
INORG: 4140 PO: 152370

010402

SPEXertificate™

Certificate of Reference Material

Catalog Number: PLTH2-2X/2Y **Lot No.** 9-95TH

Description: 1000 mg/Lthorium

Matrix: 2% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1000 mg/L +/- 3 mg/L

Uncertainty Associated with Measurement:

Certified Value is Traceable to: NIST SRM 3159

The CRM is prepared gravimetrically using high purity Th(NO3)4-4H2O Lot# 01851R. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1001 mg/L

Method: EDTA titration using Xylenol Orange as indicator. EDTA standardized against Pb(NO3)2 NIST SRM #928.

Instrumentation Analysis By ICP spectrometer: 999 mg/L

Uncertified Properties:

Density: 1.043 @ 25.2 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Ce	0.008	La	0.002	Tb	<0.001
Ca	0.01	Lu	<0.001	Tm	<0.001
Dy	<0.001	Mn	<0.001	Ti	<0.002
Er	<0.001	Mo	<0.001	Ta	<0.001
Eu	<0.001	Nd	0.002	Tl	<0.001
Fe	<0.01	Ni	<0.001	V	<0.001
Gd	<0.001	Na	0.03	W	<0.001
Ga	<0.001	Pr	<0.001	Y	0.001
Hf	<0.001	Rb	<0.001	Yb	<0.001
Ho	<0.001	Sc	0.002	Zr	0.002
In	<0.001	Sm	<0.001		

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: SEP -- '02 Certifying Officer: N. Kocherlakota

010403

SPEXertificate™

Certificate of Reference Material

Catalog Number: PLU2-2X/2Y **Lot No.** 9-179U

Description: 1000 mg/L Uranium

Matrix: 2% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 999.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3164.

The CRM is prepared gravimetrically using high purity Uranium Oxide Lot# 04001D. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 999 mg/L

Method: Evaporate to dryness. Ignite and weigh as U3O8.

Instrumentation Analysis By ICP spectrometer: 1000 mg/L

Uncertified Properties:

Density: 1.010 @ 23.6 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.005	Cu	0.02	Pb	0.004
As	0.06	Fe	0.011	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.005	In	<0.001	Si	<0.10
Ba	0.004	K	0.008	Sr	0.003
Be	<0.001	Li	<0.001	Sb	0.003
Bi	<0.001	Mg	0.003	Ti	<0.001
Ca	0.012	Mn	0.003	Tl	<0.001
Cr	<0.010	Mo	0.006	V	<0.003
Cd	<0.001	Na	0.10	Zr	<0.001
Co	<0.001	Ni	<0.001	Zn	0.008

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: JUN '03 Certifying Officer: N. Kocherlakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 06/20/03
DATE EXPIRED: 06/30/2004
DATE OPENED: 06/23/03
INORG: 4442 PO: F52370

SPECertificate™

010404

Certificate of Reference Material

Catalog Number: PLW9-2X/2Y **Lot No.** 8-135W

Description: 1000 mg/L Tungsten

Matrix: H2O

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 999.5 mg/L +/- 3 mg/L

Traceable to: NIST SRM 3163

The CRM is prepared gravimetrically using high purity Ammonium Tungstate Lot# 02001H. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis.

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 997 mg/L

Method: Fume with Sulfuric Acid to dryness, ignite and weigh as WO3.

Instrumentation Analysis By ICP spectrometer: 1002 mg/L

Uncertified Properties:

Density: 1.006 @ 25.2 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.005	Cu	<0.001	Pb	<0.008
As	0.006	Fe	0.003	Rb	<0.001
Ag	<0.004	Ga	<0.001	Re	0.009
B	<0.004	In	<0.001	Sn	0.001
Ba	<0.001	K	0.07	Sr	<0.001
Be	<0.001	Li	0.04	Sb	0.002
Bi	<0.001	Mg	0.006	Ti	<0.002
Ca	0.008	Mn	<0.001	Tl	<0.001
Cr	<0.005	Mo	0.005	V	<0.001
Cd	<0.001	Na	0.03	Zr	<0.001
Co	<0.001	Ni	<0.001	Zn	<0.2

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: AUG -- '02

Certifying Officer: N. Kocherlakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 8/20/02
DATE EXPIRED: 8/31/03
DATE OPENED: 8/22/02
INORG: 3648 PO: F32032

SPEXertificate™ 010405

Certificate of Reference Material

Catalog Number: PLZR2-2X/2Y/2T **Lot No.** 9-07ZR
Description: 1000 mg/L Zirconium
Matrix: 2% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 997 mg/L
Uncertainty Associated with Measurement: +/- 3 mg/L
Certified Value is Traceable to: NIST SRM 3169

The CRM is prepared gravimetrically using high purity Zirconyl Nitrate Lot# 11011C. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 996 mg/L

Method: Fume with Sulfuric Acid to dryness,ignite and weigh as ZrO2.

Instrumentation Analysis By ICP spectrometer: 998 mg/L

Uncertified Properties:

Density: 1.009 @ 25.0 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.02	Cu	<0.001	Pb	<0.001
As	<0.002	Fe	0.039	Rb	<0.001
Ag	0.2	Ga	<0.001	Re	<0.001
B	<0.05	In	<0.001	Sn	<0.001
Ba	<0.001	K	<0.08	Sr	<0.001
Be	<0.001	Li	<0.005	Sb	<0.001
Bi	<0.001	Mg	<0.002	Ti	<0.002
Ca	0.04	Mn	<0.001	Tl	<0.001
Cr	<0.005	Mo	<0.001	V	<0.001
Cd	0.004	Na	<0.03	Zn	0.005
Co	<0.001	Ni	<0.001		

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: AUG -- '02 Certifying Officer: N. Kocherlakota

SPEXertificate™ 010406

Certificate of Reference Material

Catalog Number: PLNA2-3X/3Y **Lot No.** T8-73NA

Description: 10,000 mg/L Sodium

Matrix: 5% HNO3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 10,036.5 mg/L

Uncertainty Associated with Measurement: +/- 30 mg/L

Certified Value is Traceable to: NIST SRM 3152a

The CRM is prepared gravimetrically using high purity Sodium Carbonate Lot# 02021A. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 10,039 mg/L

Method: Evaporate to dryness. Fume with Sulfuric Acid. Ignite and weigh as Na2SO4.

Instrumentation Analysis By ICP spectrometer: 10,034 mg/ L

Uncertified Properties:

Density: 1.048 @ 23.9 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.02	Cu	<0.002	Pb	<0.001
As	<0.08	Fe	0.03	Re	<0.001
Ag	<0.02	Ga	<0.001	Rb	<0.001
B	<0.1	In	<0.001	Sr	<0.001
Ba	0.008	K	1.36	Sb	<0.001
Be	<0.01	Li	<0.002	Sn	<0.001
Bi	<0.001	Mg	0.60	Ti	<0.03
Ca	0.60	Mn	<0.02	Tl	<0.001
Cr	0.002	Mo	<0.001	V	<0.001
Cd	<0.01	Ni	<0.003	Zr	<0.001
Co	<0.001			Zn	<0.05

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: FEB -- '03 Certifying Officer: N. Kocherlakota

010407

SPECertificate™

Certificate of Reference Material

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/19/02
DATE EXPIRED: 11/30/2003
DATE OPENED: 11/19/02
INORG: 3923 PO: F52064

Catalog Number: ICV-2A **Lot No.:** 22-12AS
Description: **Initial Calibration Verification Standard II**
Matrix: 5% Nitric Acid

This **ASSURANCE** ®certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM	Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
Ca	2,000	2,005.40	3109a	Ni	500	500.58	3136
K	2,000	1,997.89	3141a	V	500	504.23	3165
Mg	2,000	1,992.26	3131a	Cr	200	203.21	3112a
Na	2,000	1,992.99	3152a	Cu	200	199.75	3114
Al	1,000	1,005.90	3101a	Ag	100	100.46	3151
Ba	1,000	1,001.51	3104a	Be	100	100.04	3105a
Fe	1,000	1,003.17	3126a	Mn	100	100.64	3132
Co	500	505.10	3113	Zn	100	100.52	3168a

Spex Reference Multi: Lot #4-63BD, 14-125AS

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/- 0.5% on the average of all the certified concentrations with no single component exceeding +/- 2%. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: NOV -- '02 Certifying Officer: N. Kocherlakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/19/02
DATE EXPIRED: 11/30/2003 DC
DATE OPENED: 11/19/02
INORG: 3224 PO: F52064

SPECertificate™

010408

Certificate of Reference Material

Catalog Number: PLSB7-2X/2Y/2T **Lot No.:** 8-175SB-X/Y/T
Description: 1000 mg/L Antimony
Matrix: Water/0.6% Tartaric Acid/tr HNO_3

This **ASSURANCE** ® certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

Certified Value: Antimony(Sb): 999 mg/L ± 3 mg/L
Traceable to: NIST SRM 3102a

The CRM is prepared gravimetrically using high purity Antimony Metal (Sb) Lot#R1198A. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis.
Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 998 mg/L
Method: Gravimetric analysis by evaporating to dryness, fuming with Nitric Acid, igniting and weighing as Sb_2O_4.
Instrumental Analysis by ICP spectrometer: 1000 mg/L
Uncertified Properties:
Density: 1.007 at 24.0°C

Trace Metallic Impurities in the Actual Solution via ICP Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Ag	<0.001	Cu	<0.001	Pb	<0.001
Al	0.030	Fe	0.013	Rb	<0.001
As	0.001	Ga	<0.001	Re	<0.001
B	<0.001	In	<0.001	Sn	<0.001
Ba	<0.001	K	0.030	Sr	<0.001
Be	<0.001	Li	<0.001	Ti	0.001
Bi	<0.001	Mg	0.003	Tl	<0.001
Ca	0.012	Mn	<0.001	V	<0.001
Cd	<0.001	Mo	<0.001	Zn	<0.010
Co	<0.001	Na	0.005	Zr	<0.001
Cr	<0.001	Ni	<0.001		

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable to +/- 0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: NOV -- '02 Certifying Officer: N. Kocherlakota

010409

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/14/02
DATE EXPIRED: 11/30/2003
DATE OPENED: 11/19/02
INORG: 3275 PO: F53064

SPECertificate™

Certificate of Reference Material

Catalog Number: ICV-2C **Lot No.:** 22-13AS
Description: **Initial Calibration Verification Standard II**
Matrix: 5% Nitric Acid

This **ASSURANCE** ®certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
As	500	497.85	3103a
Pb	500	495.41	3128
Se	500	501.98	3149
TL	500	501.89	3158
Cd	100	99.77	3108

Spex Reference Multi: Lot #4-51BDREF, 15-39AS, 11-173AS

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/- 0.5% on the average of all the certified concentrations with no single element exceeding +/- 2%. This includes uncertainty of measurements and other effects, such as transpiration losses. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

Date of Certification: NOV -- '02 Certifying Officer: N. Kocherlakota

Certificate of Analysis

010410

CUSTOM-GRADE SOLUTION 10,000 µg/mL Aluminum in 5% HNO_3 (abs)

Catalog Number: CGAL10-1and CGAL10-5

Lot Number: **S-AL03136 (Revised 06/10/02)**

Starting Material:	Aluminum Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	607116

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 08/23/02
DATE EXPIRED: 09/01/2003
DATE OPENED: 08/26/02
INORG: 3649 PO: F52042

CERTIFIED CONCENTRATION: 10,041 ± 25 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value $(\bar{x}) = \frac{\sum x_i}{n}$ Uncertainty $(\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 10,041 ± 25 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 10,017 ± 102 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3101a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom Grade solutions tested for trace metallic impurities by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

s	Al	M	Dy	<0.028	M	Li	<0.047	M	Pr	<0.0014	M	Te	<0.14
M	Sb	<0.0024	M	Er	<0.024	M	Lu	<0.0019	M	Re	<0.0047	M	Tb	<0.0014
M	As	<0.047	M	Eu	<0.014	O	Mg	0.0050	M	Rh	<0.0047	M	Tl	<0.0047
M	Ba	<0.047	M	Gd	<0.0047	M	Mn	<0.019	M	Rb	<0.0047	M	Th	<0.0047
O	Be	<0.00017	M	Ga	<0.0047	O	Hg	<0.0070	M	Ru	<0.0094	M	Tm	<0.0019
M	Bi	<0.0019	M	Ge	<0.028	M	Mo	<0.0094	M	Sm	<0.0047	M	Sn	<0.024
O	B	0.012	M	Au	<0.014	M	Nd	<0.0094	M	Sc	<0.047	M	Ti	<0.24
M	Cd	<0.014	M	Hf	<0.0094	O	Ni	<0.0060	M	Se	<0.036	M	W	<0.047
O	Ca	0.0084	M	Ho	<0.0024	M	Nb	<0.0024	O	Si	0.052	M	U	<0.0094
M	Ce	<0.024	O	In	<0.030	n	Os		M	Ag	<0.0094	M	V	<0.0094
M	Cs	<0.0014	M	Ir	<0.024	M	Pd	<0.024	O	Na	<0.10	M	Yb	<0.0047
O	Cr	0.0026	O	Fe	0.018	O	P	<0.030	M	Sr	<0.0024	M	Y	<0.19
M	Co	<0.014	M	La	<0.0024	M	Pt	<0.0094	O	S	0.086	M	Zn	<0.094
M	Cu	<0.028	M	Pb	<0.014	O	K	<0.0060	M	Ta	<0.033	M	Zr	<0.024

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.061 g/mL

QA:KL Rev.061002DN

(over)

Inorganic Ventures, Inc.
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Paul R. Haines
Quality Assurance Manager

EXPIRES
1 SEP 2003

inorganic ventures / iv labs

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010411

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

2.0 **DESCRIPTION OF CRM** Custom-Grade **10000 µg/mL Calcium in 1.4% (abs) HNO_3**

Catalog Number:	CGCA10-1 AND CGCA10-5
Lot Number:	**T-CA03010**
Starting Material:	CaO
Starting Material Purity (%):	99.9981
Starting Material Lot No	C27L01
Matrix:	1.4% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 01/09/03
DATE EXPIRED: 02/01/2004
DATE OPENED: 01/10/03
INORG: 3900 PO: F52071

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 10,007 ± 22 µg/mL

Certified Density: 1.037 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
$\sum S$ = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **10,034 ± 25 µg/mL**
ICP Assay NIST SRM 3109a Lot Number: 000622

Assay Method #2 **10,007 ± 22 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

4.2 BALANCE CALIBRATION - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	0.00064	M	Dy	< 0.02560	O	Li	< 0.00002	M	Pr	< 0.00128	M	Te	< 0.12798
M	Sb	< 0.00213	M	Er	< 0.02133	M	Lu	< 0.00171	M	Re	< 0.00427	M	Tb	< 0.00128
M	As	< 0.04266	M	Eu	< 0.01280	O	Mg	0.07143	M	Rh	< 0.00427	M	Tl	< 0.00427
O	Ba	0.00071	M	Gd	< 0.00427	O	Mn	0.00041	M	Rb	< 0.00427	M	Th	< 0.00427
O	Be	< 0.00009	M	Ga	< 0.00427	O	Hg	< 0.01100	M	Ru	< 0.00853	M	Tm	< 0.00171
M	Bi	< 0.00171	M	Ge	< 0.02560	M	Mo	< 0.00853	M	Sm	< 0.00427	M	Sn	< 0.02133
O	B	< 0.00054	M	Au	< 0.01280	M	Nd	< 0.00853	O	Sc	< 0.00002	M	Ti	< 0.21329
O	Cd	< 0.00450	M	Hf	< 0.00853	O	Ni	< 0.00230	O	Se	< 0.00620	M	W	< 0.04266
S	Ca		M	Ho	< 0.00213	M	Nb	< 0.00213	O	Si	0.00214	M	U	< 0.00853
M	Ce	< 0.02133	O	In	< 0.00200	n	Os		O	Ag	< 0.04000	O	V	< 0.00090
M	Cs	< 0.00128	M	Ir	< 0.02133	M	Pd	< 0.02133	O	Na	0.00571	M	Yb	< 0.00427
O	Cr	0.00238	O	Fe	< 0.00110	O	P	< 0.00480	O	Sr	0.08095	M	Y	< 0.17064
O	Co	< 0.00120	M	La	< 0.00213	M	Pt	< 0.00853	O	S	0.04048	O	Zn	0.07381
O	Cu	0.00405	M	Pb	< 0.01280	O	K	< 0.00170	M	Ta	< 0.02986	M	Zr	< 0.02133

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010412

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 40.078; +2; 6; $Ca(H_2O)_6^{+2}$

Chemical Compatibility - Soluble in HCl and HNO_3. Avoid H_2SO_4, HF, H_3PO_4 and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate and tungstate in neutral aqueous media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-10% HNO_3 / LDPE container.

Ca Containing Samples (Preparation and Solution) - Metal (best dissolved in diluted HNO_3); Ores (Carbonate fusion in Pt* followed by HCl dissolution); Organic Matrices (dry ash and dissolution in dilute HCl. Do not heat when dissolving to avoid precipitation of SiO_2) .The oxide, hydroxide, carbonate, phosphate, and fluoride of calcium are soluble in % levels of HCl or HNO_3. The sulfates (gypsum, anhydrite, etc.), certain silicates and complex compounds require fusion with Na_2CO_3 followed by HCl / water dissolution. Contamination is a very real problem when analyzing for trace levels.

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at= concs.)
ICP-OES	393.366 nm	0.0002 / 0.00004 µg/mL	1	ion	U, Ce
ICP-OES	396.847 nm	0.0005 / 0.00006 µg/mL	1	ion	Th
ICP-OES	422.673 nm	0.01 / 0.001 µg/mL	1	atom	Ge
ICP-MS	44 amu	1200 ppt	n/a	M+	$^{16}O_2$, ^{12}C, $^{28}Si^{16}O$, $^{88}Sr^{++}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

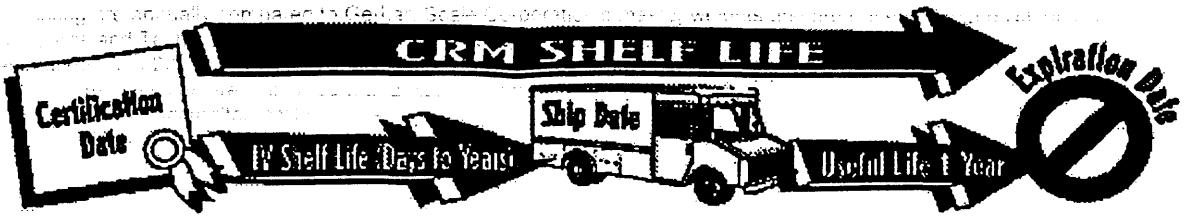
10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 01/09/03
DATE EXPIRED: 02/01/2004
DATE OPENED: 01/10/03
INORG: 3900 PO: F52071

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: August 26, 2002

Expiration Date: EXPIRES 1 FEB 2004

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Debbie Newman, QA Administrator
Certificate Approved By:	Katalin Le, QC Supervisor
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director

inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa
phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

010413

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

2.0 **DESCRIPTION OF CRM** Custom-Grade **10000 µg/mL Iron in 3.5% (abs) HNO_3**

Catalog Number:	CGFE10-1 and CGFE10-5
Lot Number:	**T-FE03028**
Starting Material:	Fe metal
Starting Material Purity (%):	99.9992
Starting Material Lot No	23024
Matrix:	3.5% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 2/28/03
DATE EXPIRED: 3/01/2004
DATE OPENED: 2/28/03
INORG: 3963 PO: E52064

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 9920 ± 22 µg/mL

Certified Density: 1.037 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
$\sum S_i$ = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

- "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)
- This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **9920 ± 22 µg/mL**
ICP Assay NIST SRM 3126a Lot Number: 000606

Assay Method #2 **9962 ± 41 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	< 0.00270	M	Dy	< 0.02421	O	Li	< 0.00003	M	Pr	< 0.00121	M	Te	< 0.12103
M	Sb	< 0.00202	M	Er	< 0.02017	M	Lu	< 0.00161	M	Re	< 0.00403	M	Tb	< 0.00121
M	As	< 0.04034	M	Eu	< 0.01210	O	Mg	< 0.00006	M	Rh	< 0.00403	M	Tl	< 0.00403
M	Ba	< 0.04034	M	Gd	< 0.00403	O	Mn	< 0.05000	M	Rb	< 0.00403	M	Th	< 0.00403
O	Be	< 0.00005	M	Ga	0.00394	O	Hg	< 0.01100	M	Ru	< 0.00807	M	Tm	< 0.00161
M	Bi	< 0.00161	i	Ge		M	Mo	< 0.00807	M	Sm	< 0.00403	M	Sn	0.04920
O	B	< 0.00090	M	Au	< 0.01210	M	Nd	< 0.00807	M	Sc	< 0.04034	M	Ti	< 0.20172
M	Cd	< 0.01210	M	Hf	< 0.00807	O	Ni	< 0.00230	M	Se	< 0.03228	M	W	< 0.04034
O	Ca	0.00707	M	Ho	< 0.00202	M	Nb	< 0.00202	O	Si	0.00781	M	U	< 0.00807
M	Ce	< 0.02017	M	In	< 0.04034	n	Os		M	Ag	< 0.00807	M	V	< 0.00807
M	Cs	< 0.00121	M	Ir	< 0.02017	M	Pd	< 0.02017	O	Na	0.00756	M	Yb	< 0.00403
M	Cr	0.00541	s	Fe		i	P		M	Sr	< 0.00202	M	Y	< 0.16138
O	Co	< 0.00110	M	La	< 0.00202	M	Pt	< 0.00807	O	S	< 0.07200	M	Zn	0.03739
M	Cu	< 0.02421	M	Pb	< 0.01210	O	K	< 0.00170	M	Ta	< 0.02824	M	Zr	< 0.02017

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010414

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 55.847; +3; 6; $Fe(H_2O)_6^{3+}$
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, HF and H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.
Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.
Fe Containing Samples (Preparation and Solution) - Metal (Soluble in HCl); Oxides (If the oxide has been at a high temperature then Na_2CO_3 fusion in Pt^0 followed by HCl dissolution otherwise dissolve in dilute HCl); Ores (See Oxides above using only the fusion approach).
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≈ concs.)
ICP-OES	238.204 nm	0.005 / 0.001 µg/mL	1	ion	Ru, Co
ICP-OES	239.562 nm	0.005 / 0.001 µg/mL	1	ion	Co, W, Cr
ICP-OES	259.940 nm	0.006 / 0.001 µg/mL	1	ion	Hf, Nb
ICP-MS	56 amu	970 ppt	n/a	M^+	$^{40}Ar^{15}N^1H$, $^{40}Ar^{16}O$, $^{36}Ar^{17}O^1H$, $^{38}Ar^{18}O$, $^{37}Cl^{16}O^1H$, $^{40}Ca^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

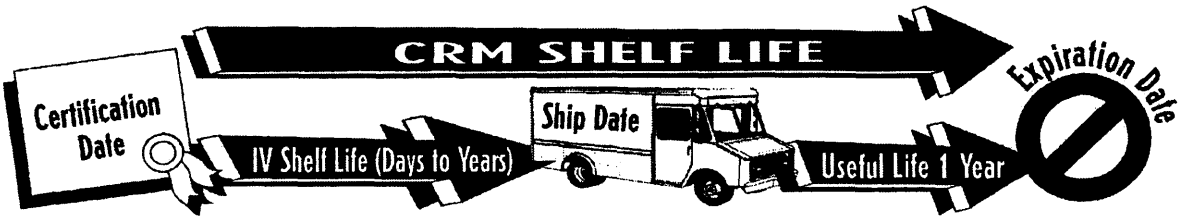
10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 2/28/03
DATE EXPIRED: 3/01/2004
DATE OPENED: 2/28/03
INORG: 3963 PO: F52064

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: October 11, 2002

Expiration Date: EXPIRES 1 MAR 2004

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Debbie Newman, QA Administrator
Certificate Approved By:	Katalin Le, QC Supervisor
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director

Certificate of Analysis

CUSTOM-GRADE SOLUTION — 10,000 µg/mL Potassium in 1.4% HNO_3 (abs)

010415

Catalog Number: CGK10-1and CGK10-5

Lot Number: **T-K02102**

Starting Material:	Potassium Nitrate
Starting Material Purity:	99.996%
Starting Material Lot No:	K18J19

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/22/02
DATE EXPIRED: 11/01/2003
DATE OPENED: 10/23/02
INORG: 3738 PO: F52057

CERTIFIED CONCENTRATION: 9999 ± 7 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 9999 ± 7 µg/mL
Method: Gravimetric as the Sulfate vs NIST weights #822/254143-94.

Instrument Analysis: 10,002 ± 27 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3141a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	<0.00090	M	Dy	<0.0060	O	Li	<0.000030	M	Pr	<0.00030	M	Te	<0.030
M	Sb	<0.00050	M	Er	<0.0050	M	Lu	<0.00040	M	Re	<0.0010	M	Tb	<0.00030
M	As	<0.010	M	Eu	<0.0030	O	Mg	0.00015	M	Rh	<0.0010	M	Tl	<0.0010
M	Ba	<0.010	M	Gd	<0.0010	O	Mn	<0.000030	M	Rb	0.50	M	Th	<0.0010
O	Be	<0.00020	M	Ga	<0.0010	O	Hg	<0.015	M	Ru	<0.0020	M	Tm	<0.00040
M	Bi	<0.00040	O	Ge	<0.0015	M	Mo	<0.0020	M	Sm	<0.0010	M	Sn	<0.0050
O	B	<0.00060	O	Au	<0.0030	M	Nd	<0.0020	O	Sc	<0.000020	O	Ti	<0.00070
M	Cd	<0.0030	M	Hf	<0.0020	O	Ni	<0.0023	O	Se	<0.05	M	W	<0.0010
O	Ca	0.0016	M	Ho	<0.00050	M	Nb	<0.00050	O	Si	0.0025	M	U	<0.0020
M	Ce	<0.0050	M	In	<0.0010	n	Os		M	Ag	<0.0020	O	V	<0.00090
M	Cs	<0.00030	M	Ir	<0.0050	M	Pd	<0.0050	O	Na	0.61	M	Yb	<0.0010
M	Cr	<0.0050	O	Fe	0.0024	O	P	<0.0025	M	Sr	<0.00050	M	Y	<0.040
M	Co	<0.0030	M	La	<0.00050	M	Pt	<0.0020	O	S	0.021	O	Zn	0.0021
M	Cu	<0.0060	M	Pb	<0.0030	s	K		M	Ta	<0.0070	M	Zr	<0.0050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.023 g/mL

(over)

QA:KL Rev.032702DN

Paul R. Haines
Quality Assurance Manager

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195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
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EXPIRES 1/2003

Certificate of Analysis

010416

CUSTOM-GRADE SOLUTION

10,000 µg/mL Magnesium in 1.4% HNO_3 (abs)

Catalog Number: CGMG10-1and CGMG10-5

Lot Number: **T-MG02151**

Starting Material:	Magnesium Metal	
Starting Material Purity:	99.999%	
Starting Material Lot No:	91191	

PREPARED LABEL/PRODUCT LABEL
DATE RECEIVED 7/12/02
DATE EXPIRES 8/01/2003
DATE PREP 7/15/02
LOT NO. 3564 F51959

CERTIFIED CONCENTRATION: 10,016 ± 22 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 10,016 ± 22 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 10,016 ± 52 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3131a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.** An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	0.050	M	Dy	<0.025	O	Li	0.0063	M	Pr	<0.0013	M	Te	<0.13
M	Sb	0.0031	M	Er	<0.021	M	Lu	<0.0017	M	Re	<0.0041	M	Tb	<0.0013
M	As	<0.041	M	Eu	<0.013	s	Mg		M	Rh	<0.0041	M	Tl	<0.0041
M	Ba	<0.041	M	Gd	<0.0041	M	Mn	<0.017	M	Rb	<0.0041	M	Th	<0.0041
O	Be	<0.00017	M	Ga	<0.0041	O	Hg	<0.0090	M	Ru	<0.0082	M	Tm	<0.0017
M	Bi	<0.0017	M	Ge	<0.025	M	Mo	<0.0082	M	Sm	<0.0041	M	Sn	<0.021
O	B	0.013	M	Au	<0.013	M	Nd	<0.0082	M	Sc	<0.041	O	Ti	0.17
M	Cd	<0.013	M	Hf	<0.0082	O	Ni	0.015	M	Se	<0.033	M	W	<0.041
O	Ca	0.050	M	Ho	<0.0021	M	Nb	<0.0021	O	Si	0.040	M	U	<0.0082
M	Ce	<0.021	M	In	<0.041	n	Os		M	Ag	<0.0082	M	V	<0.0082
M	Cs	<0.0013	M	Ir	<0.021	M	Pd	<0.021	O	Na	0.025	M	Yb	<0.0041
O	Cr	0.027	O	Fe	0.069	O	P	<0.016	M	Sr	<0.0021	M	Y	<0.17
M	Co	<0.013	M	La	<0.0021	M	Pt	<0.0082	n	S		O	Zn	0.0065
O	Cu	0.0088	O	Pb	0.034	O	K	<0.050	M	Ta	<0.029	M	Zr	<0.021

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.050 g/mL

(over)

QA:KSL Rev.022202DN

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Paul R. Haines
Quality Assurance Manager

EXPIRES 1 Dec 2003

Certificate of Analysis

010417

CUSTOM-GRADE SOLUTION 10,000 µg/mL Sodium in 1.4% HNO_3 (abs)

Catalog Number: CGNA10-1and CGNA10-5

Lot Number: **T-NA02144**

Starting Material:	Na_2CO_3
Starting Material Purity:	99.999%
Starting Material Lot No:	41355

ANDPACKED DATE: 7/12/02
DATE RECEIVED: 8/01/2003
DATE ORDERED: 7/15/02
PACKED: 3565 PO: E51959

CERTIFIED CONCENTRATION: 10,029 ± 8 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value $(\bar{x}) = \frac{\sum x_i}{n}$ Uncertainty $(\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 10,029 ± 8 µg/mL
Method: Gravimetric as the Sulfate vs NIST weights #822/254143-94.

Instrument Analysis: 10,035 ± 40 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3152a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom Grade solutions tested for trace metallic impurities by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	<0.00090	M	Dy	<0.026	O	Li	<0.000030	M	Pr	<0.0013	M	Te	<0.13
M	Sb	<0.0022	M	Er	<0.022	M	Lu	<0.0018	M	Re	<0.0044	M	Tb	<0.0013
M	As	<0.044	M	Eu	<0.013	O	Mg	0.00019	M	Rh	<0.0044	M	Tl	<0.0044
M	Ba	<0.044	M	Gd	<0.0044	O	Mn	<0.000030	M	Rb	<0.0044	M	Th	<0.0044
O	Be	<0.00020	M	Ga	<0.0044	O	Hg	<0.015	M	Ru	<0.0087	M	Tm	<0.0018
M	Bi	<0.0018	O	Ge	<0.0015	M	Mo	<0.0087	M	Sm	<0.0044	M	Sn	<0.022
O	B	0.00040	O	Au	<0.0030	M	Nd	<0.0087	O	Sc	<0.000020	O	Ti	<0.00070
M	Cd	<0.013	M	Hf	<0.0087	O	Ni	<0.0023	O	Se	<0.050	M	W	<0.044
O	Ca	0.0026	M	Ho	<0.0022	M	Nb	<0.0022	O	Si	<0.0034	M	U	<0.0087
M	Ce	<0.022	M	In	<0.044	n	Os		M	Ag	<0.0087	O	V	<0.00090
M	Cs	0.021	M	Ir	<0.022	M	Pd	<0.022	s	Na		M	Yb	<0.0044
M	Cr	<0.022	O	Fe	<0.0011	O	P	0.0014	M	Sr	<0.0022	M	Y	<0.18
M	Co	<0.013	M	La	<0.0022	M	Pt	<0.0087	O	S	<0.072	O	Zn	<0.00020
O	Cu	<0.0014	M	Pb	<0.013	O	K	0.22	M	Ta	<0.031	M	Zr	<0.022

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.030 g/mL

(over)

QA:KL Rev.032702DN

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Paul R. Haines
Quality Assurance Manager

EXPIRES
1 Aug 2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Lithium in 0.1% HNO_3 (abs) 010418

Catalog Number: CGLI1-1, CGLI1-2 and CGLI1-5

Lot Number: **T-LI02059**

Starting Material:	Li_2CO_3
Starting Material Purity:	99.999%
Starting Material Lot No:	1053

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/22/02
DATE EXPIRED: 11/01/2003
DATE OPENED: 10/23/02
INORG: 3736 PO: F52057

CERTIFIED CONCENTRATION: 997 ± 1 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value $(\bar{x}) = \frac{\sum x_i}{n}$ Uncertainty $(\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 997 ± 1 µg/mL
Method: Gravimetric as the Sulfate vs NIST weights #822/254143-94.

Instrument Analysis: 998 ± 2 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3129a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.010	M	Dy	<0.00060	s	Li		M	Pr	<0.000030	O	Te	<0.0090
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
O	As	<0.044	M	Eu	<0.00030	O	Mg	<0.00010	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	O	Mn	<0.00020	M	Rb	<0.00010	M	Th	<0.00010
O	Be	<0.000050	M	Ga	<0.00010	O	Hg	<0.0070	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
O	B	<0.0060	O	Au	<0.010	M	Nd	<0.00020	M	Sc	<0.0010	O	Ti	<0.00030
O	Cd	<0.0018	M	Hf	<0.00020	O	Ni	<0.0040	O	Se	<0.020	M	W	<0.0010
O	Ca	0.051	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	0.023	M	U	<0.00020
M	Ce	<0.00050	O	In	<0.030	n	Os		O	Ag	<0.0040	O	V	<0.0010
M	Cs	0.0018	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.10	M	Yb	<0.00010
O	Cr	<0.0020	O	Fe	<0.0020	O	P	<0.030	O	Sr	<0.0010	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	O	S	<0.050	O	Zn	<0.030
M	Cu	<0.00060	M	Pb	<0.00030	O	K	0.0070	M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.004 g/mL

(over)

QA:KL Rev.032702DN

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Paul R. Haines
Quality Assurance Manager

EXPIRES 1 Y 2003

Certificate of Analysis

010419

CUSTOM-GRADE SOLUTION 1000 µg/mL Barium in 0.1% HNO_3 (abs)

Catalog Number: CGBA1-1, CGBA1-2, and CGBA1-5

Lot Number: **T-BA02021**

Starting Material:	$Ba(NO_3)_2$
Starting Material Purity:	99.999%
Starting Material Lot No:	21879

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 3/03/03
DATE EXPIRED: 3/01/2004
DATE OPENED: 3/04/03
INORG: 3971 PO: E52064

CERTIFIED CONCENTRATION: 1003 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1003 ± 2 µg/mL
Method: Gravimetric as the Sulfate vs NIST weights #822/254143-94.

Instrument Analysis: 1002 ± 3 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3104a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.** An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	<0.040	M	Dy	<0.00060	M	Li	<0.0010	n	Pr		i	Te	
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	<0.0030	M	Rh	<0.00010	M	Tl	<0.00010
s	Ba		M	Gd	0.0020	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	<0.00010	i	Hg		M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	0.0010	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
M	B	<0.0070	M	Au	<0.00030	M	Nd	0.0020	M	Sc	<0.0010	M	Ti	<0.0050
M	Cd	<0.00030	M	Hf	<0.00020	i	Ni		O	Se	<0.40	M	W	<0.0010
O	Ca	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.020	M	U	<0.00020
n	Ce		i	In		n	Os		M	Ag	<0.00020	M	V	<0.00020
n	Cs		M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.090	M	Yb	<0.00010
M	Cr	<0.00050	O	Fe	<0.050	O	P	<0.050	M	Sr	0.0040	M	Y	<0.0040
M	Co	<0.00030	n	La		M	Pt	<0.00020	n	S		O	Zn	<0.030
M	Cu	<0.00060	M	Pb	<0.00030	n	K		M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.000 g/mL

(over)

QA:KL Rev.112702DN

Paul R. Haines

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Quality Assurance Manager

EXPIRES 1 MAR 2004

inorganic ventures / iv labs

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e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

010420

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Beryllium in 2% (abs) HNO_3**

Catalog Number:	CGBE1-1, CGBE1-2, and CGBE1-5
Lot Number:	**W-BE01100**
Starting Material:	$Be(OOCCH_3)_2$
Starting Material Purity (%):	99.999897
Starting Material Lot No	01-10-01
Matrix:	2% (abs) HNO_3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 991 ± 3 µg/mL

Certified Density: 1.022 g/mL (measured at 22° C)

The Certified Value is the instrument analysis value. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ($\bar{x}$) = $\frac{\Sigma x_i}{n}$

Uncertainty (±) = $\frac{2[(\Sigma s_i)^2]^{1/2}}{(n)^{1/2}}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
Σs_i = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

☐ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

☐ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **991 ± 3 µg/mL (Avg 2 runs)**

ICP Assay NIST SRM 3105a Lot Number: 892707

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 05/09/03
DATE EXPIRED: 06/01/2004
DATE OPENED: 05/12/03
INORG: 4CX02 PO: F52181

4.2 BALANCE CALIBRATION - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	< 0.00800	M	Dy	< 0.01305	O	Li	< 0.00002	M	Pr	< 0.00065	M	Te	< 0.06525
M	Sb	< 0.00109	M	Er	< 0.01087	M	Lu	< 0.00087	M	Re	< 0.00218	M	Tb	< 0.00065
M	As	< 0.02175	M	Eu	< 0.00652	O	Mg	< 0.00003	M	Rh	< 0.00218	M	Tl	< 0.00218
M	Ba	< 0.02175	M	Gd	< 0.00218	O	Mn	< 0.00002	M	Rb	< 0.00218	M	Th	< 0.00218
s	Be		M	Ga	< 0.00218	O	Hg	< 0.01500	M	Ru	< 0.00435	M	Tm	< 0.00087
M	Bi	< 0.00087	M	Ge	< 0.01305	M	Mo	< 0.00435	M	Sm	< 0.00218	M	Sn	< 0.01087
O	B	< 0.01200	M	Au	< 0.00652	M	Nd	< 0.00435	O	Sc	< 0.00009	M	Ti	< 0.10874
M	Cd	< 0.00652	M	Hf	< 0.00435	M	Ni	< 0.65245	M	Se	< 0.01740	M	W	< 0.02175
O	Ca	0.00164	M	Ho	< 0.00109	M	Nb	< 0.00109	O	Si	0.00649	M	U	< 0.00435
M	Ce	< 0.01087	M	In	< 0.02175	n	Os		M	Ag	< 0.00435	M	V	< 0.00435
M	Cs	< 0.00065	M	Ir	< 0.01087	M	Pd	< 0.01087	O	Na	0.00368	M	Yb	< 0.00218
O	Cr	< 0.00900	O	Fe	0.00268	n	P		M	Sr	< 0.00109	M	Y	< 0.08699
M	Co	< 0.00652	M	La	< 0.00109	M	Pt	< 0.00435	i	S		M	Zn	< 0.04350
M	Cu	< 0.01305	M	Pb	< 0.00652	O	K	< 0.10000	M	Ta	< 0.01522	M	Zr	< 0.01087

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 9.01218; +2; 4; $Be'(H_2O)_4'^2$
Chemical Compatibility - Soluble in HCl, HNO_3, H_2SO_4 and HF aqueous matrices. Stable with all metals and inorganic anions.
Stability - 2-100 ppb levels stable for months in 1 % HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 5-10 % HNO_3 / LDPE container.
Be Containing Samples (Preparation and Solution) - Metal (is best dissolved in diluted H_2SO_4); BeO (boiling nitric, hydrochloric, or sulfuric acids or $KHSO_4$ fusion); Ores (H_2SO_4/HF digestion or carbonate fusion in $Pt^{[3]}$); Organic Matrices (sulfuric/peroxide digestion or nitric/sulfuric/perchloric acid decomposition, or dry ash and dissolution according to the BeO procedure above).
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≤ppm concs.)
ICP-OES	313.042 nm	0.0003 / 0.00009 µg/mL	1	ion	V, Ce, U
ICP-OES	234.861 nm	0.0003 / 0.00016 µg/mL	1	atom	Fe, Ta, Mo
ICP-OES	313.107 nm	0.0007 / 0.0005 µg/mL	1	ion	Ce, Th, Tm
ICP-MS	9 amu	4 ppt	n/a	M'	

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

010421

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: April 14, 2003

Expiration Date: EXPIRES 1 JAN 2004

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 05/09/03
DATE EXPIRED: 06/01/2004
DATE OPENED: 05/12/03
INORG: 4062 PO: F52181

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	JoAnn Struthers, QA Administrative Assistant	JoAnn Struthers
Certificate Approved By:	Katalin Le, QC Supervisor	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Chromium^{+3} in 1.4% HNO_3 (abs) 010422

Catalog Number: CGCR(3)1-1, CGCR(3)1-2 and CGCR(3)1-5

Lot Number: **T-CR02125**

Starting Material:	Chromium Metal
Starting Material Purity:	99.995%
Starting Material Lot No:	F16I22

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/22/02
DATE EXPIRED: 11/01/2003
DATE OPENED: 10/23/02
INORG: 3732 PO: F52057

CERTIFIED CONCENTRATION: 995 ± 3 µg/mL

The Certified Value is the instrument analysis value. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Instrument Analysis: 995 ± 3 µg/mL (Avg of 3 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3112a.

Calculated Value: 1002 µg/mL
Method: Calculated, based on starting material.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	0.0028	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	O	Mg	<0.010	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	O	Mn	<0.050	M	Rb	0.0066	M	Th	<0.00010
M	Be	<0.000050	M	Ga	0.00070	O	Hg	<0.10	M	Ru	0.017	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
M	B	<0.0070	M	Au	<0.00030	M	Nd	<0.00020	M	Sc	<0.0010	M	Ti	<0.0050
M	Cd	<0.00030	M	Hf	<0.00020	O	Ni	<0.10	i	Se		M	W	<0.0010
O	Ca	0.0011	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.10	M	U	<0.00020
M	Ce	<0.00050	O	In	<0.10	n	Os		M	Ag	0.00070	i	V	
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	0.016	M	Yb	<0.00010
s	Cr		O	Fe	<0.10	i	P		M	Sr	<0.000050	M	Y	<0.0040
O	Co	<0.10	M	La	<0.000050	M	Pt	<0.00020	n	S		O	Zn	<0.10
M	Cu	<0.00060	M	Pb	0.00039	n	K		M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.010 g/mL

(over)

QA:KSL Rev. 092502DN

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
Orders: 800-669-6799 • FAX (732) 901-1903
Technical Support: 800-569-6799

Paul R. Haines
Quality Assurance Manager

EXPIRES
1 Nov 2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Copper in 2% HNO_3 (abs)

Catalog Number: CGCU1-1, CGCU1-2 and CGCU1-5

010423

Lot Number: **T-CU02060**

Starting Material:	Copper Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	K09C13

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 02/13/03
DATE EXPIRED: 03/01/2004
DATE OPENED: 03/13/03
INORG: 3955 PO: F52060

CERTIFIED CONCENTRATION: 1005 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1005 ± 2 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 1003 ± 5 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3114.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room**.
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.010	M	Dy	<0.00060	O	Li	<0.0050	M	Pr	<0.000030	O	Te	<0.031
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.00004	M	Re	<0.00010	M	Tb	<0.000030
O	As	<0.044	M	Eu	<0.00030	O	Mg	0.00080	M	Rh	0.0010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	O	Mn	<0.00020	M	Rb	<0.00010	M	Th	<0.00010
O	Be	<0.00020	O	Ga	<0.0070	O	Hg	<0.0070	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	0.000090	O	Ge	<0.010	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	0.0013
O	B	<0.0060	O	Au	<0.010	M	Nd	<0.00020	M	Sc	<0.0010	O	Ti	<0.00030
O	Cd	<0.0018	M	Hf	<0.00020	O	Ni	<0.0060	O	Se	<0.020	M	W	<0.0010
O	Ca	0.00058	M	Ho	<0.000050	M	Nb	<0.00005	O	Si	<0.0033	M	U	<0.00020
M	Ce	<0.00050	O	In	<0.030	n	Os		O	Ag	<0.0040	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	0.0024	O	Na	<0.10	M	Yb	<0.00010
O	Cr	<0.0020	O	Fe	<0.0020	O	P	<0.030	M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	O	S	<0.050	O	Zn	i
s	Cu		M	Pb	0.0029	O	K	<0.0060	M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.015 g/mL

QA:KSL Rev.070302DN

(over)

Paul R. Haines
Quality Assurance Manager

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
Orders: 800-669-6799 • FAX (732) 901-1903
Technical Support: 800-569-6799

EXPIRES 1 MAR 2004

inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa
phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

010424

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Nickel in 1.4% (abs) HNO_3**

Catalog Number:	CGNI1-1, CGNI1-2, and CGNI1-5
Lot Number:	**T-NI02028**
Starting Material:	Ni pieces
Starting Material Purity (%):	99.9994
Starting Material Lot No	L06L02
Matrix:	1.4% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 02/13/03
DATE EXPIRED: 03/01/2004
DATE OPENED: 02/13/03
INORG: 3957 PO: E52060

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 998 ± 2 µg/mL

Certified Density: 1.011 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
$\sum S_i$ = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

- "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)
- This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **1002 ± 3 µg/mL**
ICP Assay NIST SRM 3136 Lot Number: 000612

Assay Method #2 **998 ± 2 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

4.2 BALANCE CALIBRATION - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O Al < 0.00938	M Dy < 0.06577	O Li < 0.00006	M Pr < 0.00329	M Te < 0.32886
M Sb < 0.00548	M Er < 0.05481	M Lu < 0.00439	M Re < 0.01096	M Tb < 0.00329
O As < 0.01689	M Eu < 0.03289	O Mg 0.00002	M Rh < 0.01096	M Tl < 0.01096
M Ba < 0.10962	M Gd < 0.01096	M Mn < 0.04385	M Rb < 0.01096	M Th < 0.01096
O Be < 0.00626	M Ga < 0.01096	O Hg < 0.03441	M Ru < 0.02192	M Tm < 0.00439
M Bi < 0.00439	M Ge < 0.06577	M Mo < 0.02192	M Sm < 0.01096	M Sn < 0.05481
O B < 0.03097	M Au < 0.03289	M Nd < 0.02192	M Sc < 0.10962	M Ti < 0.54811
M Cd < 0.03289	M Hf < 0.02192	S Ni	O Se < 0.01877	M W < 0.10962
O Ca < 0.01157	M Ho < 0.00548	M Nb < 0.00548	O Si 0.00188	M U < 0.02192
M Ce < 0.05481	M In < 0.10962	n Os	M Ag < 0.02192	M V < 0.02192
M Cs < 0.00329	M Ir < 0.05481	M Pd < 0.05481	O Na 0.00102	M Yb < 0.01096
M Cr < 0.05481	O Fe 0.00156	O P < 0.31280	M Sr < 0.00548	M Y < 0.43849
O Co 0.00182	M La < 0.00548	M Pt < 0.02192	O S < 0.07820	M Zn 0.00189
M Cu < 0.06577	M Pb < 0.03289	O K 0.00043	M Ta < 0.07674	M Zr < 0.05481

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 58.69; +2; 6; $Ni(H_2O)_6^{2+}$
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, HF, H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.
Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.
Ni Containing Samples (Preparation and Solution) - Metal (Soluble in HNO_3); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO_3).
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≈ concs.)
ICP-OES	221.647 nm	0.01 / 0.0009 µg/mL	1	ion	Si
ICP-OES	232.003 nm	0.02 / 0.006 µg/mL	1	atom	Cr, Re, Os, Nb, Ag, Pt, Fe
ICP-OES	231.604 nm	0.02 / 0.002 µg/mL	1	ion	Sb, Ta, Co
ICP-MS	60 amu	100 ppt	n/a	M^+	$^{43}Ca^{16}O^1H$, $^{44}Ca^{16}O$, $^{23}Na^{37}Cl$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

010425

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

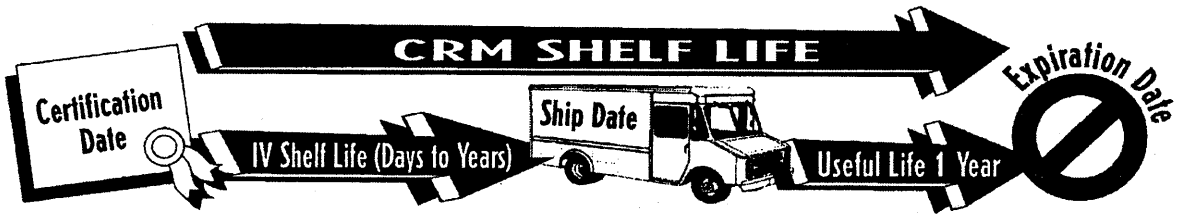
10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: October 11, 2002

Expiration Date: EXPIRES 1 MAR 2004

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 02/13/03
DATE EXPIRED: 03/01/2004
DATE OPENED: 02/13/03
INORG: 3957 PO: F52060

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Debbie Newman, QA Administrator	Debbie Newman
Certificate Approved By:	Katalin Le, QC Supervisor	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

Certificate of Analysis

010426

CUSTOM-GRADE SOLUTION 1000 µg/mL Cadmium in 2% HNO_3 (abs)

Catalog Number: CGCD1-1, CGCD1-2 and CGCD1-5

Lot Number: **T-CD01125**

Starting Material:	Cadmium Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	H02K40A

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 3/03/03
DATE EXPIRED: 3/01/2004
DATE OPENED: 3/04/03
INORG: 3972 PO: F52064

CERTIFIED CONCENTRATION: 1003 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1003 ± 3 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 1003 ± 3 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3108.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.00030	M	Dy	<0.00060	O	Li	<0.0050	M	Pr	<0.000030	O	Te	<0.031
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
O	As	<0.12	M	Eu	<0.00030	O	Mg	<0.00010	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	O	Mn	<0.00020	M	Rb	<0.00010	M	Th	<0.00010
O	Be	<0.000050	M	Ga	<0.00010	O	Hg	<0.0070	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
O	B	<0.0060	O	Au	<0.010	M	Nd	<0.00020	M	Sc	<0.0010	O	Ti	<0.00030
s	Cd		M	Hf	<0.00020	O	Ni	<0.0060	O	Se	<0.020	M	W	<0.0010
O	Ca	0.0018	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.010	M	U	<0.00020
M	Ce	<0.00050	O	In	<0.030	n	Os		O	Ag	<0.27	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	O	Pd	<0.053	O	Na	<0.10	M	Yb	<0.00010
O	Cr	<0.0040	O	Fe	<0.0020	O	P	<0.030	M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	O	S	<0.020	O	Zn	<0.030
M	Cu	<0.00060	M	Pb	<0.00030	O	K	<0.0060	M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.015 g/mL

(over)

QA:KL Rev.080102DN

Paul R. Haines

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EXPIRES 1 MAR 2004

inorganic ventures / iv labs

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010427

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Cobalt in 2% (abs) HNO_3**

Catalog Number:	CGCO1-1, CGCO1-2, and CGCO1-5
Lot Number:	**T-CO01120**
Starting Material:	Co powder
Starting Material Purity (%):	99.9957
Starting Material Lot No	22897
Matrix:	2% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 3/03/03
DATE EXPIRED: 3/01/2004
DATE OPENED: 3/04/03
INORG: 3973 PO: E52064

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1002 ± 3 µg/mL

Certified Density: 1.016 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value $(\bar{x}) = \frac{\sum x_i}{n}$

Uncertainty $(\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
$\sum S_i$ = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

- "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)
- This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **998 ± 4 µg/mL**
ICP Assay NIST SRM 3181 Lot Number: 000630

Assay Method #2 **1002 ± 3 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

4.2 BALANCE CALIBRATION - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	0.00025	M	Dy < 0.02419	O	Li 0.00001	M	Pr < 0.00121	M	Te < 0.12097
M	Sb < 0.00202		M	Er < 0.02016	M	Lu < 0.00161	M	Re < 0.00403	M	Tb < 0.00121
O	As < 0.10000		M	Eu < 0.01210	O	Mg 0.00045	M	Rh < 0.00403	M	Tl < 0.00403
M	Ba < 0.04032		M	Gd < 0.00403	O	Mn 0.00003	M	Rb < 0.00403	M	Th < 0.00403
M	Be < 0.00202		M	Ga < 0.00403	O	Hg < 0.05000	M	Ru < 0.00807	M	Tm < 0.00161
M	Bi < 0.00161		M	Ge < 0.02419	M	Mo < 0.00807	M	Sm < 0.00403	M	Sn < 0.02016
O	B < 0.04000		M	Au < 0.01210	M	Nd < 0.00807	M	Sc < 0.04032	M	Ti < 0.20162
M	Cd < 0.01210		M	Hf < 0.00807	O	Ni < 0.02000	M	Se < 0.03226	M	W < 0.04032
O	Ca 0.00325		M	Ho < 0.00202	M	Nb < 0.00202	O	Si < 0.00400	M	U < 0.00807
M	Ce < 0.02016		M	In < 0.04032	n	Os	M	Ag < 0.00807	M	V < 0.00807
M	Cs < 0.00121		M	Ir < 0.02016	M	Pd < 0.02016	O	Na 0.00138	M	Yb < 0.00403
M	Cr < 0.02016		O	Fe 0.00875	n	P	M	Sr < 0.00202	M	Y < 0.16129
s	Co		M	La < 0.00202	M	Pt < 0.00807	n	S	M	Zn < 0.08065
M	Cu < 0.02419		M	Pb < 0.01210	O	K 0.03000	M	Ta < 0.02823	M	Zr < 0.02016

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4° C. Do not pipet from container. Do not return portions removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 58.9332; +2; 6; $Co(H_2O)_6^{2+}$
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, HF, H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.
Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.
Co Containing Samples (Preparation and Solution) - Metal (soluble in HNO_3); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO_3).
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≈ concs.)
ICP-OES	238.892 nm	0.01/.002 µg/mL	1	ion	Fe, W, Ta
ICP-OES	228.616 nm	0.01/.001µg/mL	1	ion	
ICP-OES	237.862 nm	0.01/.002 µg/mL	1	ion	W, Re, Al, Ta
ICP-MS	59 amu	2 ppt	n/a	M^+	$^{42}Ca^{16}O^1H$, $^{40}Ar^{18}O^1H$, $^{36}Ar^{23}Na$, $^{43}Ca^{16}O$, $^{24}Mg^{35}Cl$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

010428

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

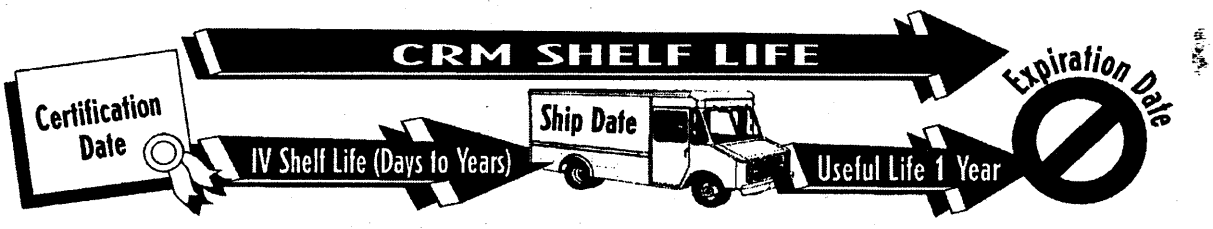
10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: September 05, 2002

Expiration Date: EXPIRES 1 MAR 2004

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 3/03/03
DATE EXPIRED: 3/01/2004
DATE OPENED: 3/04/03
INORG: 3973 PO: F52064

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Debbie Newman, QA Administrator

Certificate Approved By: Katalin Le, QC Supervisor

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Manganese in 2% HNO_3 (abs)

Catalog Number: CGMN1-1, CGMN1-2, and CGMN1-5

Lot Number: **T-MN02033**

Starting Material:	Manganese Metal
Starting Material Purity:	99.998%
Starting Material Lot No:	21563

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 01/16/03
DATE EXPIRED: 02/01/2004
DATE OPENED: 01/16/03
INORG: 3921 PO: F52073

CERTIFIED CONCENTRATION: 1004 ± 3 µg/mL

The Certified Value is the wet assay value. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1004 ± 3 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 1001 ± 3 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3132.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.** An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

M	Al	<0.00090	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	0.0040	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	s	Mn		M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	i	Ga		O	Hg	<0.030	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	0.00024	M	Sm	<0.00010	M	Sn	<0.00050
M	B	<0.0070	M	Au	<0.00030	M	Nd	<0.00020	M	Sc	<0.0010	M	Ti	<0.0050
M	Cd	<0.00030	M	Hf	<0.00020	O	Ni	<0.050	O	Se	<0.40	M	W	<0.0010
O	Ca	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.020	M	U	<0.00020
M	Ce	<0.00050	i	In		n	Os		M	Ag	<0.00020	i	V	
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.090	M	Yb	<0.00010
M	Cr	<0.00050	i	Fe		i	P		M	Sr	<0.000050	M	Y	<0.0040
O	Co	<0.050	M	La	<0.000050	M	Pt	<0.00020	n	S		M	Zn	<0.0020
M	Cu	<0.00060	M	Pb	<0.00030	n	K		M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.015 g/mL

(over)

QA:KL Rev.082202DN

Paul F. Haines

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Quality Assurance Manager

EXPIRES 1 FEB 2004

Certificate of Analysis

010430

CUSTOM-GRADE SOLUTION 1000 µg/mL Vanadium in 1.4% HNO_3 (abs)

Catalog Number: CGV1-1, CGV1-2 and CGV1-5

Lot Number: **S-QV01080**

Starting Material:	Vanadium Pentoxide	INORGANIC LABS/RADCHEM LABS
Starting Material Purity:	99.999%	DATE RECEIVED: 10/22/03
Starting Material Lot No:	46	DATE EXPIRED: 11/01/2003
		DATE OPENED: 10/23/03
		INORG: 3740 PO: FS2057

CERTIFIED VALUE: 995 µg/mL

The certified value is the average of the classical wet assay and instrument analysis unless otherwise specified. All standards are accurate to a relative precision of ± 0.5% at the 95% confidence level for a period of 1 year. (See expiration date below)

Classical Wet Assay: 999 µg/mL

Method: EDTA Titration vs NIST SRM 928 Lead Nitrate

Sufficient number of sample measurements were made to give a minimum relative precision of ± 0.3% at the 95% confidence level.

Instrument Analysis: 991 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3165

Sufficient number of sample measurements were made to give a minimum relative precision of ± 0.5% at the 95% confidence level.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room**.
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Al	0.0095	M	Dy	<0.0006	M	Li	<0.001	M	Pr	<0.00003	M	Te	<0.003
M	Sb	0.042	M	Er	<0.0005	M	Lu	<0.00004	M	Re	<0.0001	M	Tb	<0.00003
M	As	<0.001	M	Eu	<0.0003	M	Mg	0.0089	M	Rh	<0.0001	M	Tl	<0.0001
M	Ba	<0.001	M	Gd	<0.0001	O	Mn	i	M	Rb	<0.0001	M	Th	<0.0001
M	Be	<0.00005	M	Ga	<0.0001	O	Hg	i	M	Ru	<0.0002	M	Tm	<0.00004
M	Bi	<0.00004	M	Ge	<0.0006	M	Mo	0.016	M	Sm	<0.0001	M	Sn	<0.0005
M	B	<0.007	M	Au	<0.0003	M	Nd	<0.0002	M	Sc	<0.001	M	Ti	<0.005
M	Cd	<0.0003	M	Hf	<0.0002	O	Ni	<0.05	O	Se	<0.4	M	W	0.00055
O	Ca	<0.01	M	Ho	<0.00005	M	Nb	0.00024	O	Si	<0.03	M	U	0.0011
M	Ce	<0.0005	O	In	<0.07	n	Os		M	Ag	0.00044	s	V	
M	Cs	<0.00003	M	Ir	<0.0005	M	Pd	<0.0005	O	Na	<0.09	M	Yb	<0.0001
O	Cr	<0.02	O	Fe	<0.05	O	P	i	M	Sr	<0.00005	M	Y	<0.004
O	Co	<0.05	M	La	<0.00005	M	Pt	<0.0002	n	S		M	Zn	0.0041
M	Cu	<0.0006	M	Pb	<0.0003	n	K		M	Ta	<0.0007	M	Zr	<0.0005

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.013 g/mL

QA:KL Rev.011002DN

(over)

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Paul R. Haines
Quality Assurance Manager

EXPIRES
1 Y 2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Zinc in 1.4% HNO_3 (abs)

010431

Catalog Number: CGZN1-1, CGZN1-2, and CGZN1-5

Lot Number: **T-ZN02015**

Starting Material:	Zinc Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	J17L26

INORGANIC VENTURES, INC.
DATE LABELED: 7/12/02
DATE EXPIRES: 8/01/2003
DATE OPENED: 7/15/02
INITIAL: 3567 PO#: #51959

CERTIFIED CONCENTRATION: 1007 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1007 ± 2 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate

Instrument Analysis: 1006 ± 4 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3168a

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	<0.0020	M	Dy	<0.025	O	Li	0.0000050	M	Pr	<0.0013	M	Te	<0.13
M	Sb	<0.0021	M	Er	<0.021	M	Lu	<0.0017	M	Re	<0.0041	M	Tb	<0.0013
M	As	<0.041	M	Eu	<0.013	O	Mg	0.00011	M	Rh	<0.0041	M	Tl	<0.0041
M	Ba	<0.041	M	Gd	<0.0041	M	Mn	<0.017	M	Rb	<0.0041	M	Th	<0.0041
M	Be	<0.0021	M	Ga	<0.0041	O	Hg	<0.010	M	Ru	<0.0082	M	Tm	<0.0017
M	Bi	<0.0017	M	Ge	<0.025	M	Mo	<0.0082	M	Sm	<0.0041	M	Sn	<0.021
O	B	0.00015	M	Au	<0.013	M	Nd	<0.0082	M	Sc	<0.041	M	Ti	<0.21
M	Cd	<0.013	M	Hf	<0.0082	O	Ni	0.000085	M	Se	<0.033	M	W	<0.041
O	Ca	0.00022	M	Ho	<0.0021	M	Nb	<0.0021	O	Si	<0.0040	M	U	<0.0082
M	Ce	<0.021	M	In	<0.041	n	Os		M	Ag	<0.0082	M	V	<0.0082
M	Cs	<0.0013	M	Ir	<0.021	M	Pd	<0.021	O	Na	0.00055	M	Yb	<0.0041
O	Cr	<0.0010	O	Fe	0.000045	O	P	<0.0030	M	Sr	<0.0021	M	Y	<0.17
M	Co	<0.013	M	La	<0.0021	M	Pt	<0.0082	O	S	<0.020	s	Zn	
O	Cu	<0.00050	M	Pb	<0.013	O	K	0.00018	M	Ta	<0.029	M	Zr	<0.021

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 21°C): 1.011 g/mL

QA:KL Rev.051702DN

(over)

Inorganic Ventures, Inc.
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Paul R. Haines
Quality Assurance Manager

EXPIRES
1 2003

Certificate of Analysis

010432

CUSTOM-GRADE SOLUTION 1000 µg/mL Lanthanum in 1.4% HNO_3 (abs)

Catalog Number: CGLA1-1 and CGLA1-5

Lot Number: **S-QLA01054**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 08/23/02
DATE EXPIRED: 09/01/2003
DATE OPENED: 08/26/02
INORG: 3650 PO: F52042

Starting Material:	Lanthanum Oxide
Starting Material Purity:	99.999%
Starting Material Lot No:	LA-0-5-017

CERTIFIED VALUE: 1001 µg/mL

The certified value is the average of the classical wet assay and instrument analysis unless otherwise specified. All standards are accurate to a relative precision of ± 0.5% at the 95% confidence level for a period of 1 year. (See expiration date below)

Classical Wet Assay: 1002 µg/mL

Method: EDTA Titration vs NIST SRM 928 Lead Nitrate

Sufficient number of sample measurements were made to give a minimum relative precision of ± 0.3% at the 95% confidence level.

Instrument Analysis: 999 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3127a

Sufficient number of sample measurements were made to give a minimum relative precision of ± 0.5% at the 95% confidence level.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room**.
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.04	M	Dy	<0.0006	M	Li	<0.001	O	Pr	<0.02	M	Te	<0.003
M	Sb	<0.00005	M	Er	0.001	M	Lu	0.00004	M	Re	<0.0001	M	Tb	<0.00003
M	As	<0.001	M	Eu	<0.0003	M	Mg	<0.003	M	Rh	<0.0001	M	Tl	<0.0001
O	Ba	<0.02	M	Gd	0.039	M	Mn	<0.0004	M	Rb	<0.0001	M	Th	<0.0001
M	Be	<0.00005	M	Ga	<0.0001	O	Hg	<0.03	M	Ru	<0.0002	M	Tm	<0.00004
M	Bi	<0.00004	M	Ge	<0.0006	M	Mo	<0.0002	M	Sm	0.0004	M	Sn	<0.0005
O	B	<0.02	M	Au	<0.0003	M	Nd	0.0002	M	Sc	<0.001	M	Ti	<0.005
M	Cd	<0.0003	M	Hf	<0.0002	O	Ni	<0.05	O	Se	<0.4	M	W	<0.001
O	Ca	<0.01	M	Ho	0.0001	M	Nb	<0.00005	O	Si	<0.02	M	U	<0.0002
O	Ce	i	O	In	<0.03	n	Os		M	Ag	<0.0002	M	V	<0.0002
n	Cs		M	Ir	<0.0005	M	Pd	<0.0005	O	Na	<0.09	M	Yb	<0.0001
M	Cr	<0.0005	O	Fe	<0.05	O	P	<0.05	M	Sr	<0.00005	M	Y	<0.004
M	Co	<0.0003	s	La		M	Pt	<0.0002	n	S		M	Zn	<0.002
M	Cu	<0.0006	M	Pb	<0.0003	n	K		M	Ta	<0.0007	M	Zr	<0.0005

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.009 g/mL

QA:KSL Rev.110101DN

(over)

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Paul K. Haines
Quality Assurance Manager

EXPIRES
1 SEP 2003

Certificate of Analysis

010433

CUSTOM-GRADE SOLUTION 1000 µg/mL Palladium in 3.3% HCl (abs)

Catalog Number: CGPD1-1 and CGPD1-5

Lot Number: **T-PD02014**

Starting Material:	Palladium Nitrate
Starting Material Purity:	99.999%
Starting Material Lot No:	00614

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/03
DATE EXPIRED: 3/01/2004
DATE OPENED: 2/28/03
INORG: 3964 PO: F52C64

CERTIFIED CONCENTRATION: 1001 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 1002 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 1001 ± 3 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3138.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Al	<0.00090	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	0.0017	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.060	M	Eu	<0.00030	M	Mg	0.0090	O	Rh	<0.020	M	Tl	0.00010
M	Ba	<0.0010	M	Gd	<0.00010	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	0.00026	O	Hg	<0.030	O	Ru	<0.010	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	0.0058	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
M	B	<0.0070	M	Au	0.00090	M	Nd	0.00090	M	Sc	<0.0010	M	Ti	<0.0050
O	Cd	<0.010	M	Hf	<0.00020	O	Ni	<0.050	O	Se	<0.40	M	W	<0.0010
O	Ca	0.040	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.020	M	U	<0.00020
M	Ce	<0.00050	O	In	<0.030	n	Os		O	Ag	0.26	O	V	<0.010
i	Cs		M	Ir	<0.00050	s	Pd		O	Na	<0.090	M	Yb	<0.00010
O	Cr	<0.020	O	Fe	<0.050	O	P	<0.050	M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	0.016	n	S		M	Zn	0.0030
M	Cu	0.0023	M	Pb	0.0022	n	K		M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.022 g/mL

QA:KSL Rev.050202DN

(over)

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Paul R. Haines
Quality Assurance Manager

EXPIRES 1 MAR 2004

Certificate of Analysis

010434

CUSTOM-GRADE SOLUTION 1000 µg/mL Sulfur in H_2O

Catalog Number: CGS1-1, CGS1-2, and CGS1-5

Lot Number: **T-S01058**

Starting Material:	H_2SO_4
Starting Material Purity:	99.999%
Starting Material Lot No:	N38818

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/22/02
DATE EXPIRED: 11/01/2003
DATE OPENED: 10/23/02
INORG: 3739 PO: F52057

CERTIFIED CONCENTRATION: 1000 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1000 ± 2 µg/mL
Method: Acidimetric Titration vs NIST SRM KHP 84k.

Instrument Analysis: 1003 ± 4 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3154.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.0030	M	Dy	<0.012	O	Li	<0.00016	M	Pr	<0.00060	M	Te	<0.060
M	Sb	<0.0010	M	Er	<0.010	M	Lu	<0.00080	M	Re	<0.0020	M	Tb	<0.00060
M	As	<0.020	M	Eu	<0.0060	O	Mg	<0.000040	M	Rh	<0.0020	M	Tl	<0.0020
M	Ba	<0.020	M	Gd	<0.0020	M	Mn	<0.0080	M	Rb	<0.0020	M	Th	<0.0020
O	Be	<0.0020	M	Ga	<0.0020	O	Hg	<0.011	M	Ru	<0.0040	M	Tm	<0.00080
M	Bi	<0.00080	M	Ge	<0.012	M	Mo	<0.0040	M	Sm	<0.0020	M	Sn	<0.010
O	B	<0.010	M	Au	<0.0060	M	Nd	<0.0040	M	Sc	<0.020	M	Ti	<0.10
M	Cd	<0.0060	M	Hf	<0.0040	O	Ni	<0.0023	O	Se	<0.0062	M	W	<0.020
O	Ca	<0.0037	M	Ho	<0.0010	M	Nb	<0.0010	O	Si	<0.0041	M	U	<0.0040
M	Ce	<0.010	M	In	<0.020	n	Os		M	Ag	<0.0040	M	V	<0.0040
M	Cs	<0.00060	M	Ir	<0.010	M	Pd	<0.010	O	Na	<0.00010	M	Yb	<0.0020
M	Cr	<0.010	O	Fe	<0.0011	O	P	<0.0048	M	Sr	<0.0010	M	Y	<0.080
M	Co	<0.0060	M	La	<0.0010	M	Pt	<0.0040	s	S		O	Zn	0.0019
M	Cu	<0.012	M	Pb	<0.0060	O	K	<0.0017	M	Ta	<0.014	M	Zr	<0.010

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 0.999 g/mL **(over)**

QA/KL

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Paul R. Haines
Quality Assurance Manager

EXPIRES 1 NOV 2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Thorium in 3% HNO_3 (abs) 010435

Catalog Number: CGTH1-1 and CGTH1-5

Lot Number: **T-TH01059**

Starting Material:	Thorium Nitrate
Starting Material Purity:	99.999%
Starting Material Lot No:	C01L32

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 9/4/02
DATE EXPIRED: 10/1/2003 DR
DATE OPENED: 9/4/02
INORG: 3681 PO: F52048

CERTIFIED CONCENTRATION: 1001 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1001 ± 3 µg/mL
Method: EDTA Titration vs NIST SRM Lead Nitrate.

Instrument Analysis: 1002 ± 4 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3159.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	<0.00090	M	Dy	0.0062	O	Li	<0.000030	M	Pr	0.00037	O	Te	<0.031
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
O	As	<0.014	M	Eu	<0.00030	O	Mg	<0.000060	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	0.0050	M	Gd	0.0054	O	Mn	<0.0000030	M	Rb	<0.00010	s	Th	
O	Be	<0.00020	M	Ga	<0.00010	i	Hg		M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	0.0095	M	Sn	<0.00050
O	B	<0.00060	M	Au	<0.00030	M	Nd	0.0026	M	Sc	<0.0010	O	Ti	<0.00092
O	Cd	<0.0045	M	Hf	<0.00020	O	Ni	<0.0023	M	Se	<0.010	M	W	<0.0010
O	Ca	<0.030	M	Ho	0.00022	M	Nb	<0.000050	O	Si	<0.0034	M	U	0.074
M	Ce	<0.00050	O	In	<0.0020	n	Os		M	Ag	<0.00020	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.00010	M	Yb	<0.00010
O	Cr	<0.00080	O	Fe	<0.0011	i	P		M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	O	S	<0.072	O	Zn	<0.00058
M	Cu	<0.00060	M	Pb	<0.00030	O	K	<0.0017	M	Ta	<0.00070	M	Zr	0.0085

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.022 g/mL

QA:KL Rev.050802DN

(over)

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Paul R. Haines
Quality Assurance Manager

EXPIRES 1st 2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION

1000 µg/mL Uranium in 1% HNO_3 (abs)

Catalog Number: CGU1-1 and CGU1-5

010436

Lot Number: **T-U01056**

Starting Material:	Uranium Oxynitrate*
Starting Material Purity:	99.95%
Starting Material Lot No:	E14L40

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 3/03/03
DATE EXPIRED: 3/01/2004
DATE OPENED: 3/04/03
INORG: 3974 PO: E52064

CERTIFIED CONCENTRATION: 1001 ± 1 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Instrument Analysis: 1001 ± 1 µg/mL (Avg. 2 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3164.

Calculated Value: 1000 µg/mL
Method: Calculated, based on starting material.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.20	M	Dy	<0.0060	O	Li	<0.010	M	Pr	<0.00030	M	Te	<0.030
M	Sb	0.00020	M	Er	<0.0050	M	Lu	<0.00040	M	Re	<0.0010	M	Tb	<0.00030
i	As	<0.010	M	Eu	<0.0030	O	Mg	0.012	M	Rh	<0.0010	M	Tl	<0.0010
M	Ba	0.0022	M	Gd	<0.0010	M	Mn	<0.0040	M	Rb	<0.0010	M	Th	<0.0010
O	Be	<0.10	M	Ga	<0.0010	i	Hg		M	Ru	<0.0020	M	Tm	<0.00040
M	Bi	0.00030	M	Ge	<0.0060	M	Mo	<0.0020	M	Sm	<0.0010	M	Sn	0.043
O	B	0.0020	M	Au	<0.0030	M	Nd	<0.0020	M	Sc	0.00080	M	Ti	0.029
M	Cd	<0.0030	M	Hf	<0.0020	i	Ni		M	Se	<0.0080	M	W	<0.010
O	Ca	0.11	M	Ho	<0.00050	M	Nb	<0.00050	i	Si		s	U	
M	Ce	<0.0050	M	In	<0.010	n	Os		M	Ag	<0.0020	M	V	0.00040
M	Cs	<0.00030	M	Ir	<0.0050	M	Pd	<0.0050	O	Na	0.19	M	Yb	<0.0010
M	Cr	0.0047	i	Fe		i	P		M	Sr	0.0011	M	Y	0.56
M	Co	0.014	M	La	0.0014	M	Pt	<0.0020	i	S		M	Zn	0.020
M	Cu	0.022	M	Pb	0.0025	i	K		M	Ta	<0.0070	M	Zr	0.00060

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

****NOTICE TO ICP-MS USERS:** The ^{235}U in this standard is depleted. The certified abundances in Atom % are as follows:

	Isotope	Natural Abundance Atom %	IV's Certified Abundance Atom %
Uranium	^{238}U	99.3	99.8 ± 0.1
	^{235}U	0.70	0.195 ± 0.005

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.008 g/mL

(over) QA:KSL Rev.092502DN

Paul R. Haines

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Quality Assurance Manager

EXPIRES 1 MAR 2004

Certificate of Analysis

010437

CUSTOM-GRADE SOLUTION 1000 µg/mL Tungsten in 0.1% HNO_3 (abs)/1% HF (abs)

Catalog Number: CGW1-1, CGW1-2, and CGW1-5

This standard should **not** be prepared or stored in glass.

Lot Number: **T-W01078**

INORGANIC LABS/RADIOCHEM LABS
DATE RECEIVED: 7/12/02
DATE ENTERED: 8/01/2003
DATE CHECKED: 7/15/02
ENTERED: 3568 CK: F51959

Starting Material:	Tungsten Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	E03K06

CERTIFIED CONCENTRATION: 1003 ± 4 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 1000 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 1003 ± 4 µg/mL (Average of 2 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3163.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	0.030	M	Dy	<0.00060	O	Li	<0.000030	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.020	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	O	Mg	0.0010	M	Rh	<0.0010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	<0.00010	i	Hg		M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
M	B	<0.0070	M	Au	<0.00030	M	Nd	<0.00020	M	Sc	<0.0040	M	Ti	<0.0050
M	Cd	<0.00030	M	Hf	0.00037	O	Ni	<0.10	M	Se	<0.010	s	W	
O	Ca	0.00086	M	Ho	<0.000050	M	Nb	≤0.00080	n	Si		M	U	<0.00020
M	Ce	<0.00050	M	In	<0.0010	n	Os		M	Ag	<0.00020	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	0.047	M	Yb	<0.00010
M	Cr	<0.00050	i	Fe		i	P		M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	n	S		M	Zn	0.031
M	Cu	<0.00060	M	Pb	<0.00030	O	K	0.028	M	Ta	<0.010	M	Zr	0.0026

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.006 g/mL

(over)

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
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Technical Support: 800-569-6799

Paul R. Haines
Quality Assurance Manager

EXPIRES
1 Aug 2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Yttrium in 1.4% HNO_3 (abs)

010438

Catalog Number: CGY1-1 and CGY1-5

Lot Number: **T-Y01086**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 05/09/03
DATE EXPIRED: 06/01/2004
DATE OPENED: 05/12/03
INORG: 4063 PO: F52181

Starting Material:	Y_2O_3
Starting Material Purity:	99.999%
Starting Material Lot No:	Y-O-5-9503201

CERTIFIED CONCENTRATION: 1004 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1004 ± 3 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 1004 ± 4 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3167a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.** An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	0.00021	M	Dy	<0.0060	M	Li	<0.010	M	Pr	<0.00030	M	Te	<0.030
M	Sb	<0.00050	M	Er	<0.0050	M	Lu	<0.000020	M	Re	<0.0010	M	Tb	<0.00030
M	As	<0.010	M	Eu	<0.0030	O	Mg	<0.000030	M	Rh	<0.0010	M	Tl	<0.0010
M	Ba	<0.010	M	Gd	<0.0010	O	Mn	<0.000020	M	Rb	<0.0010	M	Th	<0.0010
M	Be	<0.00050	M	Ga	<0.0010	O	Hg	<0.020	M	Ru	<0.0020	M	Tm	<0.00040
M	Bi	<0.00040	M	Ge	<0.0060	M	Mo	<0.0020	M	Sm	<0.0010	M	Sn	<0.0050
O	B	<0.00014	M	Au	<0.0030	M	Nd	<0.0020	O	Sc	0.00024	M	Ti	<0.050
M	Cd	<0.0030	M	Hf	<0.0020	M	Ni	<0.080	M	Se	<0.0080	M	W	<0.010
O	Ca	0.00014	M	Ho	<0.00050	M	Nb	<0.00050	O	Si	0.000077	M	U	<0.0020
M	Ce	<0.0050	M	In	<0.010	n	Os		M	Ag	<0.0020	O	V	<0.00080
M	Cs	<0.00030	M	Ir	<0.0050	O	Pd	<0.10	O	Na	<0.050	M	Yb	<0.0010
M	Cr	<0.0050	O	Fe	0.0015	O	P	<0.070	M	Sr	<0.00050	s	Y	
M	Co	<0.0030	M	La	<0.00050	M	Pt	<0.0020	O	S	<0.043	M	Zn	<0.020
M	Cu	<0.0060	M	Pb	<0.0030	O	K	<0.10	M	Ta	<0.0070	O	Zr	<0.00070

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.010 g/mL

(over)

QA:KL Rev.061802DN

Paul R. Haines

Quality Assurance Manager

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Technical Support: 800-569-6799

EXPIRES
1 JUN 2004

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Zirconium in H_2O tr. HF tr. HNO_3

010439

Catalog Number: CGZR1-1 and CGZR1-5
This standard should **not** be prepared or stored in glass.

Lot Number: **T-QZR01062**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 02/13/03
DATE EXPIRED: 03/01/2004
DATE OPENED: 02/13/03
INORG: 3958 PO: F52060

Starting Material:	Zirconium Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	SP4811A

CERTIFIED CONCENTRATION: 1005 ± 6 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Instrument Analysis: 1005 ± 6 µg/mL (Average of 2 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3169

Calculated Value: 1000 µg/mL (For informational purposes)
Method: Calculated based on starting material.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room**.
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	0.055	M	Dy	<0.012	O	Li	<0.000030	M	Pr	<0.00059	M	Te	<0.059
M	Sb	0.00017	M	Er	<0.0098	M	Lu	<0.00079	M	Re	<0.0020	M	Tb	<0.00059
M	As	<0.020	M	Eu	<0.0059	O	Mg	<0.000030	M	Rh	<0.0020	M	Tl	<0.0020
M	Ba	0.013	M	Gd	<0.0020	O	Mn	0.0020	M	Rb	<0.0020	M	Th	<0.0020
O	Be	<0.10	M	Ga	<0.0020	O	Hg	<0.011	M	Ru	<0.0040	M	Tm	<0.00079
M	Bi	<0.00079	M	Ge	<0.012	O	Mo	<0.10	M	Sm	<0.0020	M	Sn	0.0011
i	B		M	Au	<0.0059	M	Nd	<0.0040	O	Sc	<0.00016	O	Ti	0.0031
O	Cd	<0.0053	M	Hf	0.087	O	Ni	0.014	M	Se	<0.016	M	W	0.0016
O	Ca	0.0020	M	Ho	<0.00098	i	Nb		i	Si		M	U	0.00040
M	Ce	<0.0098	M	In	<0.020	n	Os		i	Ag		M	V	0.0016
M	Cs	<0.00059	M	Ir	<0.0098	i	Pd		O	Na	0.041	M	Yb	<0.0020
O	Cr	0.034	O	Fe	0.45	O	P	<0.0048	M	Sr	<0.00098	O	Y	<0.0010
M	Co	<0.0059	M	La	<0.00098	M	Pt	<0.0040	i	S		O	Zn	0.0057
M	Cu	0.013	M	Pb	<0.0059	O	K	0.013	M	Ta	0.0011	s	Zr	

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.000 g/mL

QA:KL Rev.100302DN

(over)

Paul R. Haines

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Technical Support: 800-569-6799

Quality Assurance Manager

EXPIRES 1 MAR 2004

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Silver in 3.5% HNO_3 (abs)

010440

Catalog Number: CGAG1-1, CGAG1-2 and CGAG1-5

Lot Number: **T-AG02013**

Starting Material:	Silver Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	F15I02

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 08/23/02
DATE EXPIRED: 09/01/2003
DATE OPENED: 08/26/02
INORG: 3653 PO: F52042

CERTIFIED CONCENTRATION: 996 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 998 ± 3 µg/mL
Method: Volhard Titration vs NIST SRM 999a Potassium Chloride

Instrument Analysis: 996 ± 3 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3151.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room**. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Al	<0.0009	M	Dy	<0.0006	M	Li	<0.001	M	Pr	<0.00003	M	Te	<0.003
M	Sb	0.0006	M	Er	<0.0005	M	Lu	<0.00004	M	Re	<0.0001	M	Tb	0.00003
M	As	<0.001	M	Eu	<0.0003	M	Mg	<0.003	n	Rh		M	Tl	<0.0001
M	Ba	<0.001	M	Gd	<0.0001	M	Mn	<0.0004	M	Rb	<0.0001	M	Th	<0.0001
M	Be	<0.00005	M	Ga	<0.0001	O	Hg	<0.02	n	Ru		M	Tm	<0.00004
M	Bi	0.0007	M	Ge	0.001	M	Mo	<0.0002	M	Sm	<0.0001	M	Sn	<0.0005
M	B	<0.007	M	Au	<0.0003	M	Nd	<0.0002	M	Sc	<0.001	M	Ti	<0.005
O	Cd	<0.01	M	Hf	<0.0002	O	Ni	<0.05	O	Se	<0.4	M	W	<0.001
O	Ca	<0.01	M	Ho	<0.00005	M	Nb	<0.00005	O	Si	<0.02	M	U	<0.0002
M	Ce	<0.0005	O	In	<0.03	n	Os		s	Ag		M	V	<0.0002
M	Cs	<0.00003	M	Ir	<0.0005	n	Pd		O	Na	<0.09	M	Yb	<0.0001
M	Cr	<0.002	O	Fe	<0.05	O	P	<0.05	M	Sr	<0.00005	M	Y	<0.004
M	Co	<0.0003	M	La	<0.00005	M	Pt	<0.0002	n	S		M	Zn	0.006
M	Cu	<0.0006	M	Pb	<0.0003	n	K		M	Ta	<0.0007	M	Zr	<0.0005

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.025 g/mL (over)

QA-KL

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Paul R. Haines
Quality Assurance Manager

EXPIRES 1 Sep 2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Arsenic in 1.4% HNO_3 (abs) 010441

Catalog Number: CGAS1-1, CGAS1-2 and CGAS1-5

Lot Number: **T-AS02019**

Starting Material:	Arsenic Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	23014

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 01/09/03
DATE EXPIRED: 02/04/2004 DR
DATE OPENED: 01/10/03
INORG: 3899 PO: F52071

CERTIFIED CONCENTRATION: 1006 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 1003 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 1006 ± 3 µg/mL (Average of 3 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3103a.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room**.
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	0.00030	M	Dy	<0.012	O	Li	<0.000020	M	Pr	<0.00060	M	Te	<0.060
O	Sb	<0.010	M	Er	<0.010	M	Lu	<0.00080	O	Re	<0.010	M	Tb	<0.00060
s	As		M	Eu	<0.0060	O	Mg	<0.000030	M	Rh	<0.0020	M	Tl	<0.0020
M	Ba	<0.020	M	Gd	<0.0020	O	Mn	<0.000030	M	Rb	<0.0020	M	Th	<0.0020
M	Be	<0.0010	M	Ga	<0.0020	O	Hg	<0.012	M	Ru	<0.0040	M	Tm	<0.00080
M	Bi	<0.00080	M	Ge	<0.012	M	Mo	<0.0040	M	Sm	<0.0020	O	Sn	0.00053
O	B	<0.012	M	Au	<0.0060	M	Nd	<0.0040	M	Sc	<0.020	M	Ti	<0.10
M	Cd	<0.0060	M	Hf	<0.0040	M	Ni	<0.016	M	Se	<0.016	M	W	<0.020
O	Ca	<0.0015	M	Ho	<0.0010	O	Nb	<0.0020	O	Si	0.0077	M	U	<0.0040
M	Ce	<0.010	M	In	<0.020	n	Os		M	Ag	<0.0040	M	V	<0.0040
M	Cs	<0.00060	M	Ir	<0.010	M	Pd	<0.010	O	Na	0.00096	M	Yb	<0.0020
M	Cr	<0.010	O	Fe	<0.0011	O	P	<0.0026	M	Sr	<0.0010	M	Y	<0.080
M	Co	<0.0060	M	La	<0.0010	M	Pt	<0.0040	O	S	<0.025	O	Zn	0.00019
M	Cu	<0.012	M	Pb	<0.0060	O	K	0.00096	M	Ta	<0.014	M	Zr	<0.010

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.010 g/mL

QA:KSL Rev.061202DN

(over)

Paul R. Haines

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Quality Assurance Manager

EXPIRES 1 FEB 2004

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Lead in 0.35% HNO_3 (abs)

010442

Catalog Number: CGPB1-1, CGPB1-2 and CGPB1-5

Lot Number: **T-PB02110**

Starting Material:	Lead Nitrate
Starting Material Purity:	99.995%
Starting Material Lot No:	22150

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/22/02
DATE EXPIRED: 11/01/2003
DATE OPENED: 10/23/02
INORG: 3735 PO: F52057

CERTIFIED CONCENTRATION: 1004 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1004 ± 2 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 995 ± 8 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3128.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.040	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	<0.0030	M	Rh	<0.020	M	Tl	<0.0050
M	Ba	<0.0010	M	Gd	<0.00010	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	<0.00010	O	Hg	<0.090	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.0010	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
O	B	<0.020	M	Au	<0.00030	M	Nd	<0.00020	M	Sc	<0.0010	M	Ti	<0.0050
M	Cd	<0.00030	M	Hf	<0.00020	O	Ni	<0.050	O	Se	<0.40	M	W	<0.0010
O	Ca	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.020	M	U	<0.00020
M	Ce	<0.00050	O	In	<0.030	n	Os		i	Na		M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	M	Sr	0.00034	M	Yb	<0.00010
M	Cr	<0.00050	O	Fe	<0.050	O	P	<0.050	n	S		M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	M	Ta	<0.00070	M	Zn	<0.0020
M	Cu	<0.00060	s	Pb		n	K					M	Zr	0.00120

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.002 g/mL

(over)

QA:KSL Rev.061702JTS

Paul R. Haines
Quality Assurance Manager

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Technical Support: 800-569-6799

EXPIRES 1 NOV 2003

010443

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Antimony in 0.7% HNO_3 (abs) / 3% Tartaric Acid

Catalog Number: CGSB1-1, CGSB1-2 and CGSB1-5

Lot Number: **T-SB02074**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 02/13/03
DATE EXPIRED: 03/01/2004
DATE OPENED: 02/13/03
INORG: 3953 PO: F52060

Starting Material:	Antimony Metal
Starting Material Purity:	99.995%
Starting Material Lot No:	E14H25

CERTIFIED CONCENTRATION: 1003 ± 2 µg/mL

The Certified Value is the instrument analysis value. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 999 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 1003 ± 2 µg/mL (Average of 2 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3102a.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Al	<0.0050	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	n	Te	
s	Sb		M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	<0.0030	M	Rh	<0.00010	M	Tl	0.00030
O	Ba	<0.020	M	Gd	<0.00010	M	Mn	0.0080	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	<0.00010	O	Hg	<0.030	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	0.00070	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	n	Sn	
M	B	<0.0070	M	Au	<0.00030	M	Nd	<0.00020	M	Sc	<0.0010	M	Ti	<0.0050
M	Cd	<0.00030	M	Hf	<0.00020	O	Ni	<0.050	O	Se	<0.40	M	W	<0.0010
O	Ca	<0.020	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.020	M	U	<0.00020
M	Ce	0.0018	O	In	<0.030	n	Os		M	Ag	<0.00020	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.090	M	Yb	<0.00010
M	Cr	0.031	O	Fe	<0.050	O	P	<0.050	M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.040	M	Pt	<0.00020	n	S		M	Zn	<0.0020
M	Cu	0.0016	M	Pb	0.0011	n	K		M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.019 g/mL

(over)

QA:KL Rev.082202DN

Paul R. Haines

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Quality Assurance Manager

Expires:

EXPIRES 1 MAR 2004

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Selenium in 1.4% HNO_3 (abs)

010444

Catalog Number: CGSE1-1, CGSE1-2 and CGSE1-5

Lot Number: **T-SE01098**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 08/23/02
DATE EXPIRED: 09/01/2003
DATE OPENED: 08/26/02
INORG: 3652 PO: F52042

Starting Material:	Selenium Metal
Starting Material Purity:	99.998%
Starting Material Lot No:	A09C08

CERTIFIED CONCENTRATION: 996 ± 4 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 1005 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 996 ± 4 µg/mL (Average of 2 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3149.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.04	M	Dy	<0.0006	M	Li	<0.001	M	Pr	<0.00003	M	Te	<0.003
M	Sb	<0.00005	M	Er	<0.0005	M	Lu	<0.00004	M	Re	<0.0001	M	Tb	<0.00003
M	As	0.004	M	Eu	<0.0003	M	Mg	<0.003	M	Rh	<0.0001	M	Tl	<0.0001
M	Ba	<0.001	M	Gd	<0.0001	M	Mn	0.0008	M	Rb	0.0002	M	Th	<0.0001
M	Be	<0.00005	M	Ga	<0.0001	O	Hg	<0.02	M	Ru	<0.0002	M	Tm	<0.00004
M	Bi	<0.00004	M	Ge	<0.0006	M	Mo	0.0024	M	Sm	<0.0001	M	Sn	<0.0005
M	B	<0.007	M	Au	<0.0003	M	Nd	<0.0002	M	Sc	<0.001	M	Ti	<0.005
M	Cd	<0.0003	M	Hf	<0.0002	O	Ni	<0.05	s	Se		M	W	0.0042
O	Ca	<0.01	M	Ho	<0.00005	M	Nb	<0.03	O	Si	<0.02	M	U	<0.0002
M	Ce	<0.0005	M	In	<0.0001	n	Os		M	Ag	<0.0002	M	V	0.0012
M	Cs	<0.00003	M	Ir	<0.0005	M	Pd	<0.0005	O	Na	<0.09	M	Yb	<0.0001
M	Cr	<0.0005	O	Fe	<0.05	O	P	<0.05	M	Sr	<0.00005	M	Y	<0.004
M	Co	<0.0003	M	La	<0.00005	M	Pt	<0.0002	n	S		M	Zn	0.0032
M	Cu	0.0035	M	Pb	<0.0003	M	K	<0.02	M	Ta	<0.0007	M	Zr	<0.004

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.009 g/mL

QA:KSL Rev.032502DN

(over)

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Paul R. Haines
Quality Assurance Manager

EXPIRES
1 Sep 2003

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Thallium in 0.5% HNO_3 (abs) 010445

Catalog Number: CGTL1-1, CGTL1-2 and CGTL1-5

Lot Number: **T-TL01075**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 01/16/03
DATE EXPIRED: 02/01/2004
DATE OPENED: 01/16/03
INORG: 3922 PO: F52073

Starting Material:	Thallium Nitrate
Starting Material Purity:	99.999%
Starting Material Lot No:	59001

CERTIFIED CONCENTRATION: 997 ± 1 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 1000 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 997 ± 1 µg/mL (Average of 2 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3158.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.040	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	0.000080	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	<0.0030	M	Rh	<0.00010	s	Tl	
M	Ba	<0.0010	M	Gd	<0.00010	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	<0.00010	O	Hg	i	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	0.00060
O	B	<0.020	M	Au	<0.00030	M	Nd	<0.00020	M	Sc	<0.0010	M	Ti	<0.0050
M	Cd	0.00090	M	Hf	0.0010	O	Ni	<0.050	O	Se	<0.40	M	W	<0.0010
O	Ca	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.020	M	U	<0.00020
M	Ce	<0.00050	O	In	i	n	Os		M	Ag	<0.00020	M	V	<0.00020
M	Cs	0.00010	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.090	M	Yb	<0.00010
M	Cr	<0.00050	O	Fe	<0.050	O	P	i	M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	n	S		M	Zn	0.015
M	Cu	<0.00060	M	Pb	<0.00030	n	K		M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.002 g/mL

QA:KL Rev.031402DN

(over)

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Quality Assurance Manager

EXPIRES 1 DEC 2004

Certificate of Analysis

010446

CUSTOM GRADE SOLUTION 1000 µg/mL Boron in H_2O

Catalog Number: CGB1-1, CGB1-2 and CGB1-5

Lot Number: **T-B02038**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 02/13/03
DATE EXPIRED: 03/01/2004
DATE OPENED: 02/13/03
INORG: 3954 PO: F52060

Starting Material:	H_3BO_3
Starting Material Purity:	99.999%
Starting Material Lot No:	S-B02032

CERTIFIED CONCENTRATION: 1001 ± 3 µg/mL

The Certified Value is the instrument analysis value. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Instrument Analysis: 1001 ± 3 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3107.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.00090	M	Dy	<0.0060	O	Li	<0.000024	M	Pr	<0.00030	M	Te	<0.030
M	Sb	<0.00050	M	Er	<0.0050	M	Lu	<0.00040	M	Re	<0.0010	M	Tb	<0.00030
M	As	<0.010	M	Eu	<0.0030	O	Mg	<0.000060	M	Rh	<0.0010	M	Tl	<0.0010
O	Ba	<0.00010	M	Gd	<0.0010	O	Mn	<0.000023	M	Rb	<0.0010	M	Th	<0.0010
O	Be	<0.00017	O	Ga	<0.0016	O	Hg	<0.015	M	Ru	<0.0020	M	Tm	<0.00040
M	Bi	<0.00040	M	Ge	<0.0060	M	Mo	<0.0020	M	Sm	<0.0010	M	Sn	<0.0050
s	B		M	Au	<0.0030	M	Nd	<0.0020	O	Sc	<0.000023	M	Ti	<0.050
M	Cd	<0.0030	M	Hf	<0.0020	O	Ni	<0.0023	O	Se	<0.0062	M	W	<0.010
O	Ca	<0.000070	M	Ho	<0.00050	M	Nb	<0.00050	O	Si	0.00067	M	U	<0.0020
O	Ce	<0.0030	M	In	<0.010	n	Os		M	Ag	<0.0020	O	V	<0.00083
M	Cs	<0.00030	M	Ir	<0.0050	M	Pd	<0.0050	O	Na	<0.00010	M	Yb	<0.0010
M	Cr	<0.0050	O	Fe	<0.0011	O	P	<0.0025	M	Sr	<0.00050	M	Y	<0.040
O	Co	<0.0011	M	La	<0.00050	M	Pt	<0.0020	O	S	<0.10	O	Zn	<0.00019
M	Cu	<0.0060	M	Pb	<0.0030	O	K	<0.0030	M	Ta	<0.0070	M	Zr	<0.0050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 0.999 g/mL

QA:KL Rev.073102DN

(over)

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Quality Assurance Manager

EXPIRES 1 MAR 2004

Certificate of Analysis

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 02/13/03
DATE EXPIRED: 03/01/2004
DATE OPENED: 02/13/03
INORG: 3956 PO: F52060

CUSTOM-GRADE SOLUTION 1000 µg/mL Molybdenum in H_2O tr. NH_4OH

Catalog Number: CGMO1-1, CGMO1-2 and CGMO1-5

010447

Lot Number: **T-MO01130**

Starting Material:	Ammonium Molybdenum Oxide
Starting Material Purity:	99.9943%
Starting Material Lot No:	21410

CERTIFIED CONCENTRATION: 997 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 1000 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 997 ± 3 µg/mL (Average of 2 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3134.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room**.
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.050	M	Dy	<0.012	O	Li	<0.010	O	Pr	<0.10	i	Te		
M	Sb	0.0094	M	Er	<0.010	M	Lu	<0.00080	M	Re	<0.0020	M	Tb	<0.00060	
M	As	<0.020	M	Eu	<0.0060	O	Mg	<0.050	M	Rh	<0.0020	M	Tl	<0.0020	
M	Ba	<0.020	M	Gd	<0.0020	M	Mn	<0.0080	M	Rb	0.025	M	Th	<0.0020	
M	Be	<0.0010	M	Ga	<0.0020	i	Hg		M	Ru	<0.0040	M	Tm	<0.00080	
M	Bi	<0.00080	M	Ge	<0.012	s	Mo		M	Sm	<0.0020	M	Sn	<0.010	
O	B	<0.50	M	Au	<0.0060	O	Nd	<0.050	O	Sc	<0.050	O	Ti	<0.0050	
O	Cd	<0.50	M	Hf	<0.0040	M	Ni	<0.016	M	Se	<0.016	M	W	0.056*	
O	Ca	0.00026	M	Ho	<0.0010	O	Nb	<0.10	O	Si	<0.10	M	U	<0.0040	
O	Ce	<0.050	M	In	0.0024	n	Os		M	Ag	<0.0040	M	V	<0.0040	
M	Cs	<0.00060	M	Ir	<0.010	M	Pd	<0.010	O	Na	<0.10	M	Yb	<0.0020	
M	Cr	<0.010	O	Fe	<0.50	i	P		M	Sr	<0.0010	M	Y	<0.080	
M	Co	<0.0060	M	La	<0.0010	M	Pt	<0.0040	i	S		M	Zn	<0.040	
M	Cu	<0.012	M	Pb	< 0.0060	O	K	0.0098	M	Ta	<0.014	M	Zr	<0.010	

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

* W impurity may be due to Mo doubly charged ion and represents the maximum concentration possible.

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 0.999 g/mL **(over)**

QA:KL Rev.073102DN

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Paul R. Haines
Quality Assurance Manager

EXPIRES 1 MAR 2004

Certificate of Analysis

CUSTOM-GRADE SOLUTION — 1000 µg/mL Phosphorus in H_2O

010448

Catalog Number: CGP1-1, CGP1-2 and CGP1-5

Lot Number: **T-P01118**

Starting Material:	Phosphoric Acid
Starting Material Purity:	99.999%
Starting Material Lot No:	J18804

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 01/09/03
DATE EXPIRED: 02/01/2004 DR
DATE OPENED: 01/10/03
INORG: 3901 PO: F53171

CERTIFIED CONCENTRATION: 1004 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1004 ± 2 µg/mL
Method: Acidimetric Titration vs NIST SRM 84k KHP.

Instrument Analysis: 1000 ± 3 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3139a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.** An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.040	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	0.012	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	<0.0030	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	0.00070	O	Hg	<0.020	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
M	B	<0.0070	M	Au	<0.00030	M	Nd	<0.00020	n	Sc		n	Ti	
M	Cd	<0.00030	M	Hf	<0.00020	O	Ni	<0.050	O	Se	<0.40	M	W	<0.0010
O	Ca	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.020	M	U	<0.00020
M	Ce	<0.00050	M	In	<0.030	n	Os		M	Ag	<0.00020	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.090	M	Yb	<0.00010
M	Cr	<0.00050	O	Fe	<0.050	s	P		M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	n	S		M	Zn	0.0035
M	Cu	0.080	M	Pb	<0.00030	n	K		M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 0.999 g/mL

(over)

QA:KL Rev.122002DN

Paul R. Haines

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Quality Assurance Manager

EXPIRES 1 FEB 2004

inorganic ventures / iv labs

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e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

010449

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Silicon in H_2O tr. HNO_3 tr. HF**

Catalog Number:	CGSI1-1, CGSI1-2, and CGSI1-5
Lot Number:	**W-SI02082**
Starting Material:	SiO2
Starting Material Purity (%):	99.996367
Starting Material Lot No	C05310C
Matrix:	H_2O tr. HNO_3 tr. HF

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 06/20/03
DATE EXPIRED: 07/01/2004
DATE OPENED: 06/23/03
INORG: 4153 PO: F52370

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1000 ± 5 µg/mL

Certified Density: 1.002 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ($\bar{x}$) = $\frac{\sum x_i}{n}$

Uncertainty (±) = $\frac{2[(\sum S_i)^2]^{1/2}}{(n)^{1/2}}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
$\sum S_i$ = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

☐ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

☐ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **1000 ± 5 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3150 Lot Number: 991108

Assay Method #2 **1001 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O Al 0.02730	M Dy < 0.01358	O Li < 0.00009	M Pr < 0.00068	M Te < 0.06791
M Sb < 0.00113	M Er < 0.01132	M Lu < 0.00091	M Re < 0.00226	M Tb < 0.00068
M As < 0.02264	M Eu < 0.00679	O Mg < 0.04991	M Rh < 0.00226	M Tl < 0.00226
M Ba < 0.02264	M Gd < 0.00226	M Mn < 0.00906	M Rb < 0.00226	M Th < 0.00226
O Be < 0.00091	M Ga < 0.00226	O Hg < 0.04991	M Ru < 0.00453	M Tm < 0.00091
M Bi < 0.00091	M Ge < 0.01358	M Mo < 0.00453	M Sm < 0.00226	M Sn < 0.01132
O B 0.02409	M Au < 0.00679	M Nd < 0.00453	O Sc < 0.00091	O Ti 0.01325
M Cd < 0.00679	M Hf < 0.00453	O Ni < 0.01044	M Se < 0.01811	M W < 0.02264
O Ca 0.00135	M Ho < 0.00113	M Nb < 0.00113	s Si	M U < 0.00453
M Ce < 0.01132	M In < 0.02264	n Os	M Ag < 0.00453	O V < 0.00408
M Cs < 0.00068	M Ir < 0.01132	M Pd < 0.01132	O Na 0.02008	M Yb < 0.00226
O Cr < 0.00681	O Fe < 0.00499	O P < 0.02269	O Sr < 0.00032	M Y < 0.09055
M Co < 0.00679	M La < 0.00113	M Pt < 0.00453	O S < 0.11342	M Zn < 0.04528
O Cu < 0.00454	M Pb < 0.00679	O K < 0.00771	M Ta 0.00200	M Zr < 0.01132

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010450

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 28.0855; +4; 6; $Si(OH)_x(F)_y^{2-}$
Chemical Compatibility - Soluble in HCl, HF, H_3PO_4, H_2SO_4 and HNO_3 as the $Si(OH)_x(F)_y^{2-}$. Avoid neutral to basic media. Unstable at ppm levels with metals that would pull F^- away (i.e. Do not mix with Alkaline or Rare Earths, or high levels of transition elements unless they are fluorinated). Stable with most inorganic anions with a tendency to hydrolyze forming silicic acid (silicic acid is soluble up to ~100 ppm in water) in all dilute acids except HF.
Stability - 2-100 ppb levels - stability unknown - (alone or mixed with all other metals) as the $Si(OH)_x(F)_y^{2-}$. 1-10,000 ppm single element solutions as the $Si(OH)_x(F)_y^{2-}$ chemically stable for years in 2-5 % HNO_3 / trace HF in a LDPE container.
Si Containing Samples (Preparation and Solution) - Metal (Soluble in 1:1:1 H_2O / HF / HNO_3); Oxide - SiO_2, amorphic (Dissolve by heating in 1:1:1 H_2O / HF / HNO_3); Oxide - quartz (Fuse in Pt° with Na_2CO_3); Geological Samples (Fuse in Pt° with Na_2CO_3 followed by HCl solution of the fuseate); Organic Matrices containing silicates and non volatile silicon compounds (Dry ash at 450°C in Pt° and dissolve by gently warming with 1:1:1 H_2O / HF / H_2SO_4 or fuse / ash with Na_2CO_3 and dissolve fuseate with HCl / H_2O); Silicone Oils - dimethyl silicones depolymerize to form volatile monomer units when heated (Measure directly in alcoholic KOH / xylene mixture where sample is treated first with the KOH at 60-100 °C to "unzip" the Si-O-Si polymeric structure or digest with concentrated H_2SO_4/H_2O_2 followed by cooling and dissolution of the dehydrated silica with HF.) Note that the direct analysis of silicone oils in an organic solvent will result in false high results due to high vapor pressure of volatile monomer units like hexamethylcyclotrisiloxane. The KOH forms the $K_2{}^+Si(CH_3)_2O^-$ salt which is not volatile at room temperature.
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe interfs.)
ICP-OES	251.611 nm	0.012 / 0.003 µg/mL	1	ion	Ta, U, Zn, Th
ICP-OES	212.412 nm	0.02 / 0.01 µg/mL	1	ion	Hf, Os, Mo, Ta
ICP-OES	288.158 nm	0.03 / 0.004 µg/mL	1	ion	Ta, Ce, Cr, Cd, Th
ICP-MS	28 amu	4000 - 8000 ppt	n/a	M+	$^{14}N_2$, $^{12}C^{16}O$

HF Note: This standard should not be prepared or stored in glass.

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 06/20/03
DATE EXPIRED: 07/01/2004
DATE OPENED: 06/23/03
INORG: 4153 PO: F52370

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: February 24, 2003

Expiration Date: EXPIRES 01 FEB 2004

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	JoAnn Struthers, QA Administrative Assistant	JoAnn Struthers
Certificate Approved By:	Katalin Le, QC Supervisor	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

Certificate of Analysis

010451

CUSTOM-GRADE SOLUTION 1000 µg/mL Titanium in 1.4% HNO_3 (abs) tr. HF

Catalog Number: CGTI1-1, CGTI1-2 and CGTI1-5

This standard should **not** be prepared or stored in glass.

Lot Number: **T-TI02039**

Starting Material:	Titanium Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	F29I14

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/12/02
DATE EXPIRED: 12/1/2003 JR
DATE OPENED: 11/13/02
INORG: 3762 PO: F52061

CERTIFIED CONCENTRATION: 1010 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 1002 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 1010 ± 3 µg/mL (Average of 3 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3162a.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.010	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	O	Mg	< 0.020	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	M	Mn	0.0020	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	<0.00010	O	Hg	<0.050	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
O	B	<0.050	M	Au	<0.00030	M	Nd	<0.00020	O	Sc	<0.0020	s	Ti	
M	Cd	<0.00030	M	Hf	<0.00020	O	Ni	<0.050	O	Se	<0.40	M	W	<0.0010
O	Ca	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.010	M	U	<0.00020
M	Ce	<0.00050	O	In	<0.020	n	Os		M	Ag	<0.00020	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	0.12	M	Yb	<0.00010
M	Cr	<0.00050	O	Fe	<0.010	i	P		M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	i	S		M	Zn	0.19
O	Cu	<0.040	M	Pb	<0.00030	n	K	0.23	M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.011 g/mL

QA:KL Rev.060502DN

(over)

Paul R. Haines

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
Orders: 800-669-6799 • FAX (732) 901-1903
Technical Support: 800-569-6799

Quality Assurance Manager

EXPIRES 1 Dec 2003

inorganic ventures / iv labs

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e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

010452

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Strontium in 0.1% (abs) HNO_3**

Catalog Number:	CGSR1-1, CGSR1-2, and CGSR1-5
Lot Number:	**T-SR01123**
Starting Material:	$SrCO_3$
Starting Material Purity (%):	99.9951
Starting Material Lot No	22593
Matrix:	0.1% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 06/20/03
DATE EXPIRED: 07/01/2004
DATE OPENED: 06/23/03
INORG: 4154 PO: F52370

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 998 ± 2 µg/mL

Certified Density: 1.000 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value $(\bar{x}) = \frac{\sum x_i}{n}$

Uncertainty $(\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
$\sum S_i$ = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **998 ± 2 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

Assay Method #2 **1002 ± 8 µg/mL**
ICP Assay NIST SRM 3153a Lot Number: 990906

4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O Al < 0.00090	M Dy < 0.00600	O Li < 0.00003	M Pr < 0.00030	O Te < 0.10000
M Sb < 0.00050	M Er < 0.00500	M Lu < 0.00040	M Re < 0.00100	M Tb < 0.00030
O As < 0.00500	M Eu < 0.00300	O Mg 0.00037	O Rh < 0.00600	M Tl < 0.00100
M Ba 0.04001	M Gd < 0.00100	O Mn 0.00018	i Rb	M Th < 0.00100
O Be < 0.00009	M Ga < 0.00100	O Hg < 0.01500	O Ru < 0.00300	M Tm < 0.00040
M Bi < 0.00040	M Ge < 0.00600	M Mo < 0.00200	M Sm < 0.00100	M Sn < 0.00500
O B < 0.00060	M Au < 0.00300	M Nd < 0.00200	M Sc < 0.01000	M Ti < 0.05001
M Cd < 0.00300	M Hf < 0.00200	O Ni < 0.00300	O Se < 0.05000	M W < 0.01000
O Ca 0.03600	M Ho < 0.00050	M Nb < 0.00050	O Si 0.00056	M U < 0.00200
M Ce < 0.00500	O In < 0.00200	n Os	M Ag < 0.00200	M V < 0.00200
M Cs < 0.00030	M Ir < 0.00500	O Pd < 0.00400	O Na 0.00520	M Yb < 0.00100
O Cr < 0.00080	O Fe 0.00080	O P < 0.00480	s Sr	O Y < 0.00004
M Co < 0.00300	M La < 0.00050	M Pt < 0.00200	n S	M Zn < 0.02000
O Cu < 0.00140	M Pb < 0.00300	O K < 0.00170	M Ta < 0.00700	M Zr < 0.00500

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4° C. Do not pipet from container. Do not return portions removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 87.62; +2; 6; $Sr(H_2O)_6^{+2}$
Chemical Compatibility - Soluble in HCl, and HNO_3. Avoid H_2SO_4, HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, suffate, oxalate, chromate, arsenate and tungstate in neutral aqueous media.
Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1 - 3.5% HNO_3 / LDPE container.
Sr Containing Samples (Preparation and Solution) - Metal (Best dissolved in diluted HNO_3); Ores (Carbonate fusion in Pt^0 followed by HCl dissolution); Organic Matrices (Dry ash and dissolution in dilute HCl).
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≈ concs.)
ICP-OES	407.771 nm	0.0004 / 0.00006 µg/mL	1	ion	U, Ce
ICP-OES	421.552 nm	0.0008 / 0.00004 µg/mL	1	ion	Rb
ICP-OES	460.733 nm	0.07 / 0.003 µg/mL	1	atom	Ce
ICP-MS	88 amu	1200 ppt	n/a	M+	$^{72}Ge^{16}O$, $^{176}Yb^{+2}$, $^{176}Lu^{+2}$, $^{176}Hf^{+2}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

010453

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

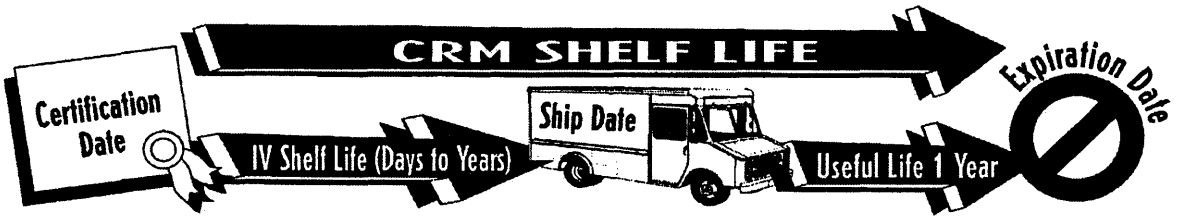
10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: October 31, 2002

Expiration Date: EXPIRES 01/2004

INORGANIC LABS/RADCHEM LABS pg. 2 of 2
DATE RECEIVED: 06/20/03
DATE EXPIRED: 07/01/2004
DATE OPENED: 06/23/03
INORG: 4154 PO: F52370

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Debbie Newman, QA Administrator

Certificate Approved By: Katalin Le, QC Supervisor

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

inorganic ventures / iv labs

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e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

010454

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Tin in H_2O tr HNO_3 tr HF**

Catalog Number:	CGSN1-1, CGSN1-2, and CGSN1-5
Lot Number:	**T-SN01110**
Starting Material:	#1, #2 SN SHOT
Starting Material Purity (%):	99.9969
Starting Material Lot No	AAJM H12H17, A23F09
Matrix:	H_2O tr HNO_3 tr HF

INORGANIC LABS/RADCHEM LABS Pg 1 of 2
DATE RECEIVED: 3/26/03
DATE EXPIRED: 4/01/2004
DATE OPENED: 3/28/03
INORG: 4026 PO: F52167

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1003 ± 5 µg/mL

Certified Density: 1.000 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ($\bar{x}$) = $\frac{\Sigma x_i}{n}$

Uncertainty (±) = $\frac{2[(\Sigma s_i)^2]^{1/2}}{(n)^{1/2}}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
Σs = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **1003 ± 5 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3161a Lot Number: 993107

Assay Method #2 **1000 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

4.2 BALANCE CALIBRATION - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O Al 0.00100	M Dy < 0.01217	O Li < 0.00002	M Pr < 0.00061	M Te < 0.06087
O Sb < 0.01000	M Er < 0.01014	M Lu < 0.00081	M Re < 0.00203	M Tb < 0.00061
M As < 0.02029	M Eu < 0.00609	O Mg < 0.00003	M Rh < 0.00203	M Tl < 0.00203
O Ba < 0.00070	M Gd < 0.00203	M Mn < 0.00812	M Rb < 0.00203	M Th < 0.00203
M Be < 0.00101	M Ga < 0.00203	O Hg < 0.01500	M Ru < 0.00406	M Tm < 0.00081
M Bi < 0.00081	M Ge < 0.01217	M Mo < 0.00406	M Sm < 0.00203	S Sn
O B < 0.01200	M Au < 0.00609	M Nd < 0.00406	M Sc < 0.02029	M Ti < 0.10144
O Cd < 0.00500	M Hf < 0.00406	O Ni < 0.01000	M Se < 0.01623	M W < 0.02029
O Ca < 0.00150	M Ho < 0.00101	M Nb < 0.00101	O Si 0.02700	M U < 0.00406
M Ce < 0.01014	M In < 0.02029	n Os	M Ag < 0.00406	M V < 0.00406
M Cs < 0.00061	M Ir < 0.01014	M Pd < 0.01014	O Na 0.00325	M Yb < 0.00203
M Cr < 0.01014	O Fe < 0.00110	O P < 0.00500	M Sr < 0.00101	M Y < 0.08115
O Co < 0.00200	M La < 0.00101	M Pt < 0.00406	N S	M Zn < 0.04058
M Cu < 0.01217	M Pb < 0.00609	O K < 0.00200	M Ta < 0.01420	M Zr < 0.01014

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

010455

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 118.710; +4; 4,5, 6,7,8 $Sn(OH)_4F_2^{2-}$

Chemical Compatibility - Soluble in HCl and dilute HF / HNO_3. Avoid neutral to basic media. Unstable at ppm levels with metals that would pull F^- away. (i.e. Do not mix with Alkaline or Rare Earths or high levels of transition elements unless they are fluorinated.) Stable with most inorganic anions provided it is in the chemical form shown above.

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the $Sn(OH)_4F_2^{2-}$ for 1 year in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $Sn(OH)_4F_2^{2-}$ chemically stable for years in 2-5% HNO_3 / trace HF in a LDPE container.

Sn Containing Samples (Preparation and Solution) - Metal (Soluble in HF /HNO_3 or HCl); Oxides - SnO (soluble in HCl), SnO_2 -very resistant to all acids including HF(Fusion with equal parts of Na_2CO_3 and S. It is then soluble in water or dilute acids as the thiostannate.); Alloys (Treat first 0.1 g with 10 mL conc. H_2SO_4 to boiling until the alloy disintegrates and nearly all of the sulfuric acid is expelled. Then add 100 mL O_2 free water and 50 mL of conc HCl or transfer to a plastic container and add 1 mL HF in either case warming gently to bring about solution.); Organic Matrices (Volatility and precipitation of the insoluble stannic oxide are problems. Consultation of the literature should be made for individual matrices / Sn compounds.)

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≤ 1000 ppm concs.)
ICP-OES 189.989 nm	0.03 / 0.003 µg/mL	1	ion	
ICP-OES 242.949 nm	0.1 / 0.01 µg/mL	1	atom	W, Mo, Rh, Ta, Co
ICP-MS 120 amu	5 ppt	n/a	M^+	^{240}Te, $^{104}Ru^{16}O$, $^{104}Pd^{16}O$

HF Note: This standard should not be prepared or stored in glass.

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

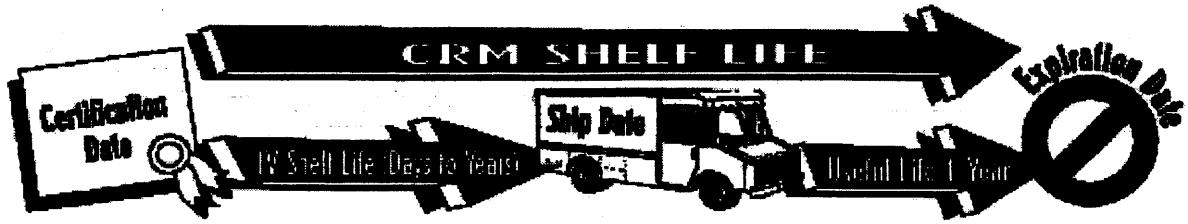
10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 3/26/03
DATE EXPIRED: 4/01/2004
DATE OPENED: 3/28/03
INORG: 4026 PO: F52167

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: December 17, 2002

Expiration Date: EXPIRES 1 APR 2004

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Debbie Newman, QA Administrator	Debbie Newman
Certificate Approved By:	Katalin Le, QC Supervisor	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

Certificate of Analysis

010456

CUSTOM-GRADE SOLUTION

1000 µg/mL Bismuth in 3.5% HNO_3 (abs)

Catalog Number: CGBI1-1 and CGBI1-5

Lot Number: **T-BI01087**

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 8/1/02
DATE EXPIRED: 8/1/2003
DATE OPENED: 8/1/02
INORG: 3606 PO: F52013

Starting Material:	Bismuth Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	L13D09

CERTIFIED CONCENTRATION: 996 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Calculated Value: 1001 µg/mL
Method: Calculated, based on starting material.

Instrument Analysis: 996 ± 3 µg/mL (Average of 2 runs)
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3106.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.020	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	<0.0030	M	Rh	<0.00010	M	Tl	<0.00010
M	Ba	<0.0010	M	Gd	<0.00010	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	<0.00010	O	Hg	<0.15	M	Ru	<0.00020	M	Tm	<0.000040
s	Bi		M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
O	B	<0.020	M	Au	<0.00030	M	Nd	<0.00020	M	Sc	<0.0010	M	Ti	<0.0050
M	Cd	<0.00030	M	Hf	<0.00020	O	Ni	<0.010	O	Se	<0.20	M	W	<0.0010
O	Ca	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	<0.020	M	U	<0.00020
M	Ce	<0.00050	O	In	<0.030	n	Os		M	Ag	<0.00020	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	0.0020	O	Na	<0.050	M	Yb	<0.00010
M	Cr	<0.00050	O	Fe	<0.020	O	P	<0.050	M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	n	S		M	Zn	<0.0020
M	Cu	<0.00060	M	Pb	0.020	n	K		M	Ta	<0.00070	M	Zr	<0.00050

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.027 g/mL

QA:KL Rev.031402DN

(over)

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
Orders: 800-669-6799 • FAX (732) 901-1903
Technical Support: 800-569-6799

Paul R. Haines
Quality Assurance Manager

EXPIRES 1 Aug 2003

inorganic ventures / iv labs

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certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

010457

2.0 DESCRIPTION OF CRM Custom-Grade **10000 µg/mL Magnesium in 1.4% (abs) HNO_3**

Catalog Number:	CGMG10-1 and CGMG10-5
Lot Number:	**T-MG03006**
Starting Material:	Mg metal
Starting Material Purity (%):	99.9968
Starting Material Lot No	RML91191
Matrix:	1.4% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 07/31/03
DATE EXPIRED: 08/01/2004
DATE OPENED: 08/01/03
INORG: 4204 PO: F52391

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 9921 ± 20 µg/mL

Certified Density: 1.050 g/mL (measured at 22° C)

The Certified Value is the instrument analysis value. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value $(\bar{x}) = \frac{\sum x_i}{n}$

Uncertainty $(\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
$\sum s$ = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **9998 ± 20 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

Assay Method #2 **9921 ± 20 µg/mL**
ICP Assay NIST SRM 3131a Lot Number: 991107

4.2 BALANCE CALIBRATION - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	0.02454	M	Dy	< 0.02455	O	Li	0.00797	M	Pr	< 0.00123	M	Te	< 0.12275
M	Sb	0.00306	M	Er	< 0.02046	M	Lu	< 0.00164	M	Re	< 0.00409	M	Tb	< 0.00123
M	As	< 0.04092	M	Eu	< 0.01228	S	Mg		M	Rh	< 0.00409	M	Tl	< 0.00409
M	Ba	< 0.04092	M	Gd	< 0.00409	M	Mn	< 0.01637	M	Rb	< 0.00409	M	Th	< 0.00409
O	Be	< 0.00017	M	Ga	< 0.00409	O	Hg	< 0.00900	M	Ru	< 0.00818	M	Tm	< 0.00164
M	Bi	< 0.00164	M	Ge	< 0.02455	M	Mo	< 0.00818	M	Sm	< 0.00409	M	Sn	< 0.02046
O	B	0.00871	M	Au	< 0.01228	M	Nd	< 0.00818	M	Sc	< 0.04092	O	Ti	0.10206
M	Cd	< 0.01228	M	Hf	< 0.00818	O	Ni	0.01404	M	Se	< 0.03273	M	W	< 0.04092
O	Ca	0.01070	M	Ho	< 0.00205	M	Nb	< 0.00205	O	Si	0.03186	M	U	< 0.00818
M	Ce	< 0.02046	M	In	< 0.04092	n	Os		M	Ag	< 0.00818	M	V	< 0.00818
M	Cs	< 0.00123	M	Ir	< 0.02046	M	Pd	< 0.02046	O	Na	0.01817	M	Yb	< 0.00409
O	Cr	0.02315	O	Fe	0.02467	O	P	< 0.01600	M	Sr	< 0.00205	M	Y	< 0.16367
M	Co	< 0.01228	M	La	< 0.00205	M	Pt	< 0.00818	n	S		O	Zn	0.01892
O	Cu	0.00672	O	Pb	0.03236	O	K	< 0.05000	M	Ta	< 0.02864	M	Zr	< 0.02046

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010458

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 24.305; +2; 6; $Mg(H_2O)_6^{+2}$

Chemical Compatibility - Soluble in HCl, HNO_3, and H_2SO_4 avoid HF, H_3PO_4 and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicates, carbonates, hydroxides, oxides, and tungstates in neutral and slightly acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-10% HNO_3 / LDPE container.

Mg Containing Samples (Preparation and Solution) - Metal (Best dissolved in diluted HNO_3); Oxide (Readily soluble in above compatible aqueous acidic solutions); Ores (Carbonate fusion in Pt⁰ followed by HCl dissolution); Organic Matrices (Sulfuric / peroxide digestion or nitric / sulfuric / perchloric acid decomposition, or dry ash and dissolution in dilute HCl).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≈ concs.)
ICP-OES	279.553 nm	0.0002 / 0.00003 µg/mL	1	ion	Th
ICP-OES	280.270 nm	0.0003 / 0.00005 µg/mL	1	ion	U, V
ICP-OES	285.213 nm	0.002 / 0.00003 µg/mL	1	atom	U, Hf, Cr, Zr
ICP-MS	24 amu	42 ppt	n/a	M⁺	$^{7}Li^{16}O$, $^{48}Ti^{+2}$, $^{48}Ca^{+2}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

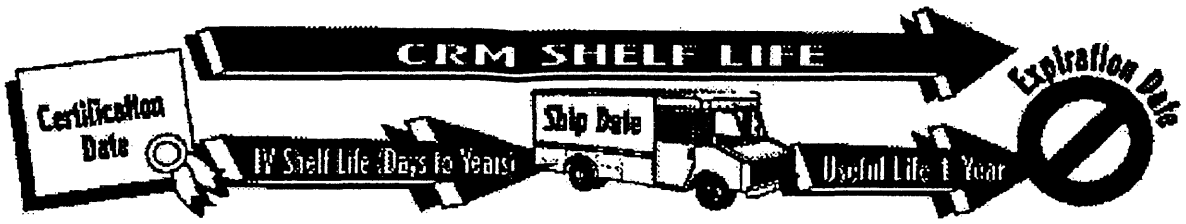
10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 07/31/03
DATE EXPIRED: 08/01/2004
DATE OPENED: 08/01/03
INORG: 4204 PO: E52391

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: August 28, 2002

Expiration Date: EXPIRES 01 02 04

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Debbie Newman, QA Administrator
Certificate Approved By:	Katalin Le, QC Supervisor
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director

inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa
phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."*

010459

2.0 **DESCRIPTION OF CRM** Custom-Grade **10000 µg/mL Sodium in 1.4% (abs) HNO_3**

Catalog Number:	CGNA10-1, CGNA10-2, and CGNA10-5
Lot Number:	**T-NA03006**
Starting Material:	Na_2CO_3
Starting Material Purity (%):	99.999936
Starting Material Lot No	42095
Matrix:	1.4% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS Pg 1 of 2
DATE RECEIVED: 07/31/03
DATE EXPIRED: 08/01/2004
DATE OPENED: 08/01/03
INORG: 4205 PO: F52391

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 10,005 ± 7 µg/mL

Certified Density: 1.032 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ($\bar{x}$) = $\frac{\Sigma x_i}{n}$

Uncertainty (±) = $\frac{2[(\Sigma s_i)^2]^{1/2}}{(n)^{1/2}}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
Σs_i = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

☐ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

☐ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **10,067 ± 75 µg/mL**
ICP Assay NIST SRM 3152a Lot Number: 990907

Assay Method #2 **10,005 ± 7 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al < 0.00090	M	Dy < 0.02499	O	Li < 0.00003	M	Pr < 0.00125	M	Te < 0.12494
M	Sb < 0.00208	M	Er < 0.02082	M	Lu < 0.00167	M	Re < 0.00417	M	Tb < 0.00125
M	As < 0.04165	M	Eu < 0.01249	O	Mg 0.00015	M	Rh < 0.00417	M	Tl < 0.00417
M	Ba < 0.04165	M	Gd < 0.00417	O	Mn < 0.00003	M	Rb < 0.00417	M	Th < 0.00417
O	Be < 0.00020	M	Ga < 0.00417	O	Hg < 0.01500	M	Ru < 0.00833	M	Tm < 0.00167
M	Bi < 0.00167	O	Ge < 0.00150	M	Mo < 0.00833	M	Sm < 0.00417	M	Sn < 0.02082
O	B < 0.00060	O	Au < 0.00300	M	Nd < 0.00833	O	Sc < 0.00002	O	Ti < 0.00070
M	Cd < 0.01249	M	Hf < 0.00833	O	Ni < 0.00230	O	Se < 0.05000	M	W < 0.04165
O	Ca 0.00160	M	Ho < 0.00208	M	Nb < 0.00208	O	Si < 0.00340	M	U < 0.00833
M	Ce < 0.02082	M	In < 0.04165	n	Os	M	Ag < 0.00833	O	V < 0.00090
M	Cs 0.00104	M	Ir < 0.02082	M	Pd < 0.02082	S	Na	M	Yb < 0.00417
M	Cr < 0.02082	O	Fe < 0.00110	O	P < 0.04000	M	Sr < 0.00208	M	Y < 0.16658
M	Co < 0.01249	M	La < 0.00208	M	Pt < 0.00833	O	S < 0.07200	O	Zn 0.00130
O	Cu < 0.00140	M	Pb < 0.01249	O	K 0.00873	M	Ta < 0.02915	M	Zr < 0.02082

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 22.98977; +1; (6); $Na^{+}(aq)$ largely ionic in nature (Coordination Number in parentheses is assumed, not certain.)

Chemical Compatibility - Soluble in HCl, HNO_3, H_2SO_4 and HF aqueous matrices. Stable with all metals and inorganic anions.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.

Na Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Lithium carbonate fusion in graphite crucible followed by HCl dissolution - blank levels of Na in lithium carbonate critical); Organic Matrices (Sulfuric / peroxide digestion or nitric/sulfuric/perchloric acid decomposition).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≤ppms.)
ICP-OES	589.595 nm	0.07 / 0.00009 µg/mL	1	atom	2nd order radiation from R.E.s on some optical designs
ICP-OES	588.995 nm	0.03 / 0.006 µg/mL	1	atom	2nd order radiation from R.E.s on some optical designs
ICP-OES	330.237 nm	2.0 / 0.09 µg/mL	1	atom	Pd, Zn
ICP-MS	23 amu	310 ppt	n/a	M+	$^{46}Ti^{2+}$, $^{46}Ca^{2+}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

010460

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: January 24, 2003

Expiration Date: EXPIRES 01/2004

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 07/31/03
DATE EXPIRED: 08/01/2004
DATE OPENED: 08/01/03
INORG: 4205 PO: F52391

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Debbie Newman, LIMS Administrator
Certificate Approved By:	Katalin Le, QC Supervisor
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director

Certificate of Analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Lithium in 0.1% HNO_3 (abs)

Catalog Number: CGLI1-1, CGLI1-2 and CGLI1-5

010461

Lot Number: **W-LI02066**

Starting Material:	Li_2CO_3	
Starting Material Purity:	99.999%	
Starting Material Lot No:	1053	

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 06/20/03
DATE EXPIRED: 07/01/2004
DATE OPENED: 06/23/03
INORG: 4149 PO: F52379

CERTIFIED CONCENTRATION: 998 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 998 ± 2 µg/mL
Method: Gravimetric as the Sulfate vs NIST weights #822/254143-94.

Instrument Analysis: 1000 ± 4 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3129a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.**
An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	<0.010	M	Dy	<0.00060	s	Li		M	Pr	<0.000030	O	Te	<0.0090	
M	Sb	<0.000050	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030	
O	As	<0.044	M	Eu	<0.00030	O	Mg	<0.00010	M	Rh	<0.00010	M	Tl	<0.00010	
M	Ba	<0.0010	M	Gd	<0.00010	O	Mn	<0.00020	M	Rb	<0.00010	M	Th	<0.00010	
O	Be	<0.000050	M	Ga	<0.00010	O	Hg	<0.0070	M	Ru	<0.00020	M	Tm	<0.000040	
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050	
O	B	<0.0060	O	Au	<0.010	M	Nd	<0.00020	M	Sc	<0.0010	O	Ti	<0.00030	
O	Cd	<0.0018	M	Hf	<0.00020	O	Ni	<0.0040	O	Se	<0.020	M	W	<0.0010	
O	Ca	0.051	M	Ho	<0.000050	M	Nb	<0.000050	O	Si	0.023	M	U	<0.00020	
M	Ce	<0.00050	O	In	<0.030	n	Os		O	Ag	<0.0040	O	V	<0.0010	
M	Cs	0.0018	M	Ir	<0.00050	M	Pd	<0.00050	O	Na	<0.10	M	Yb	<0.00010	
O	Cr	<0.0020	O	Fe	<0.0020	O	P	<0.030	O	Sr	<0.0010	M	Y	<0.0040	
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	O	S	<0.050	O	Zn	<0.030	
M	Cu	<0.00060	M	Pb	<0.00030	O	K	0.0070	M	Ta	<0.00070	M	Zr	<0.00050	

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.004 g/mL

(over)

QA:KL Rev.022403DN

Paul R. Haines

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
Orders: 800-669-6799 • FAX (732) 901-1903
Technical Support: 800-569-6799

Quality Assurance Manager

EXPIRES 01 02 2004

Certificate of Analysis

010462

CUSTOM-GRADE SOLUTION 1000 µg/mL Zinc in 1.4% HNO_3 (abs)

Catalog Number: CGZN1-1, CGZN1-2, and CGZN1-5

Lot Number: **T-ZN02015**

Starting Material:	Zinc Metal
Starting Material Purity:	99.999%
Starting Material Lot No:	J17L26

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/22/02
DATE EXPIRED: 11/01/2003
DATE OPENED: 10/22/02
INORG: 3741 PO: F52057

CERTIFIED CONCENTRATION: 1007 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1007 ± 2 µg/mL
Method: EDTA Titration vs NIST SRM 928 Lead Nitrate

Instrument Analysis: 1006 ± 4 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3168a

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities by **ICP-MS** were analyzed in an **ULPA-Filtered Clean Room.** An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm .

O	Al	<0.0020	M	Dy	<0.025	O	Li	0.0000050	M	Pr	<0.0013	M	Te	<0.13
M	Sb	<0.0021	M	Er	<0.021	M	Lu	<0.0017	M	Re	<0.0041	M	Tb	<0.0013
M	As	<0.041	M	Eu	<0.013	O	Mg	0.00011	M	Rh	<0.0041	M	Tl	<0.0041
M	Ba	<0.041	M	Gd	<0.0041	M	Mn	<0.017	M	Rb	<0.0041	M	Th	<0.0041
M	Be	<0.0021	M	Ga	<0.0041	O	Hg	<0.010	M	Ru	<0.0082	M	Tm	<0.0017
M	Bi	<0.0017	M	Ge	<0.025	M	Mo	<0.0082	M	Sm	<0.0041	M	Sn	<0.021
O	B	0.00015	M	Au	<0.013	M	Nd	<0.0082	M	Sc	<0.041	M	Ti	<0.21
M	Cd	<0.013	M	Hf	<0.0082	O	Ni	0.000085	M	Se	<0.033	M	W	<0.041
O	Ca	0.00022	M	Ho	<0.0021	M	Nb	<0.0021	O	Si	<0.0040	M	U	<0.0082
M	Ce	<0.021	M	In	<0.041	n	Os		M	Ag	<0.0082	M	V	<0.0082
M	Cs	<0.0013	M	Ir	<0.021	M	Pd	<0.021	O	Na	0.00055	M	Yb	<0.0041
O	Cr	<0.0010	O	Fe	0.000045	O	P	<0.0030	M	Sr	<0.0021	M	Y	<0.17
M	Co	<0.013	M	La	<0.0021	M	Pt	<0.0082	O	S	<0.020	s	Zn	
O	Cu	<0.00050	M	Pb	<0.013	O	K	0.00018	M	Ta	<0.029	M	Zr	<0.021

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 21°C): 1.011 g/mL

QA:KL Rev.051702DN

(over)

Inorganic Ventures, Inc.
195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701
Orders: 800-669-6799 • FAX (732) 901-1903
Technical Support: 800-569-6799

Paul R. Haines
Quality Assurance Manager

EXPIRES
10/2003

inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa
phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."

010463

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Bismuth in 3.5% (abs) HNO_3**

Catalog Number:	CGBI1-1 and CGBI1-5
Lot Number:	**W-BI01089**
Starting Material:	Bi needles
Starting Material Purity (%):	99.999090
Starting Material Lot No	G25L16
Matrix:	3.5% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 07/31/03
DATE EXPIRED: 08/01/2004
DATE OPENED: 08/01/03
INORG: 4200 PO: F52383

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1002 ± 4 µg/mL

Certified Density: 1.026 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ($\bar{x}$) = $\frac{\Sigma x_i}{n}$

Uncertainty (±) = $\frac{2[(\Sigma s_i)^2]^{1/2}}{(n)^{1/2}}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
Σs_i = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

☐ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

☐ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **1002 ± 4 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3106 Lot Number: 991212

Assay Method #2 **1002 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

4.2 BALANCE CALIBRATION - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Al	0.00012	M	Dy	< 0.01202	O	Li	< 0.00002	M	Pr	< 0.00060	M	Te	< 0.06008
M	Sb	< 0.00100	M	Er	< 0.01001	M	Lu	< 0.00080	M	Re	< 0.00200	M	Tb	< 0.00060
M	As	< 0.02003	M	Eu	< 0.00601	O	Mg	0.00070	M	Rh	< 0.00200	M	Tl	< 0.00200
M	Ba	< 0.02003	M	Gd	< 0.00200	O	Mn	< 0.00020	M	Rb	< 0.00200	M	Th	< 0.00200
M	Be	< 0.00100	M	Ga	< 0.00200	O	Hg	< 0.01500	M	Ru	< 0.00401	M	Tm	< 0.00080
s	Bi		M	Ge	< 0.01202	M	Mo	< 0.00401	M	Sm	< 0.00200	M	Sn	< 0.01001
M	B	< 0.14018	M	Au	< 0.00601	M	Nd	< 0.00401	M	Sc	< 0.02003	M	Ti	< 0.10013
O	Cd	0.00017	M	Hf	< 0.00401	M	Ni	< 0.01602	M	Se	< 0.01602	M	W	< 0.02003
O	Ca	0.00245	M	Ho	< 0.00100	M	Nb	< 0.00100	O	Si	0.00105	M	U	< 0.00401
M	Ce	< 0.01001	O	In	0.00105	n	Os		M	Ag	< 0.00401	M	V	< 0.00401
M	Cs	< 0.00060	M	Ir	< 0.01001	O	Pd	< 0.00400	O	Na	0.00240	M	Yb	< 0.00200
O	Cr	0.00020	O	Fe	0.00014	O	P	< 0.01000	M	Sr	< 0.00100	M	Y	< 0.08011
M	Co	< 0.00601	M	La	< 0.00100	M	Pt	< 0.00401	O	S	< 0.03000	O	Zn	0.00008
O	Cu	0.00014	O	Pb	0.00135	O	K	0.00039	M	Ta	< 0.01402	M	Zr	< 0.01001

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 208.9804; +3; 6 ;$Bi(O)(H_2O)_5^{3+}$

Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4 and HF. **Avoid** basic media forming insoluble hydroxide. Stable with most metals and inorganic anions in acidic media. Many salts that are insoluble in water are soluble in HCl, HNO_3 and HF. The major problem with Bi^{3+} is its tendency to hydrolyze at higher concentrations or in dilute acid. Nitric acid solutions should be 5% to hold the Bi in solution in the 100 to 10000 µg/mL concentration range

Stability - 2-100 ppb levels stable for months in 1 % HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 5 - 7% HNO_3 / LDPE container.

Bi Containing Samples (Preparation and Solution) - Metal (soluble in HNO_3); Oxides (Soluble in HNO_3); Alloys (Dissolve in conc. 4:1 HCl /HNO_3. Heating may be required.); Organic based (dry ash at 450°C and dissolve ash in HNO_3 or acid digestion with conc. hot sulfuric acid adding hydrogen peroxide dropwise and carefully until clear.)

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≤5ppcs.)
ICP-OES	223.061 nm	0.04 / 0.005 µg/mL	1	atom	Th, Ir, Ti Cu
ICP-OES	306.772 nm	0.08 / 0.01 µg/mL	1	atom	Th, U, Zr, Hf, Fe
ICP-OES	222.825 nm	0.1 / 0.02 µg/mL	1	atom	Cr, Hf, Ce, Os
ICP-MS	209 amu	2 ppt	n/a	M+	$^{193}Ir^{16}O$

010464

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 07/31/03
DATE EXPIRED: 08/01/2004
DATE OPENED: 08/01/03
INORG: 4200 PO: F52383

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: March 28, 2003

Expiration Date: EXPIRES 1&2004

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	JoAnn Struthers, QA Administrative Assistant	JoAnn Struthers
Certificate Approved By:	Katalin Le, QC Supervisor	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa
phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

1.0 **Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02.** *The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."* **010465**

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Tungsten in 1% (abs) HNO_3/1% (abs) HF**

Catalog Number:	CGW1-1 and CGW1-5
Lot Number:	**W-W01080**
Starting Material:	W Powder
Starting Material Purity (%):	99.990703
Starting Material Lot No	21418,C31H46,D02J21,E03K06,D11F29
Matrix:	1% (abs) HNO_3/1% (abs) HF

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 07/31/03
DATE EXPIRED: 08/01/2004
DATE OPENED: 08/01/03
INORG: 4203 PO: E52383

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1001 ± 2 µg/mL

Certified Density: 1.006 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ($\bar{x}$) = $\frac{\sum x_i}{n}$

Uncertainty (±) = $\frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
$\sum s_i$ = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

☐ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

☐ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 **Assay Method #1** **1001 ± 2 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3163 Lot Number: 990209

Assay Method #2 **1000 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

4.2 BALANCE CALIBRATION - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O Al 0.01792	M Dy < 0.00595	O Li < 0.00008	M Pr < 0.00030	M Te < 0.02974
M Sb < 0.00050	M Er < 0.00496	M Lu < 0.00040	i Re	M Tb < 0.00030
M As < 0.00991	M Eu < 0.00297	O Mg 0.00120	M Rh < 0.00099	M Tl < 0.00099
M Ba < 0.00991	M Gd < 0.00099	M Mn < 0.00397	M Rb < 0.00099	M Th < 0.00099
M Be < 0.00050	M Ga < 0.00099	O Hg < 0.04778	M Ru < 0.00198	M Tm < 0.00040
M Bi < 0.00040	M Ge < 0.00595	M Mo 0.00050	M Sm < 0.00099	M Sn < 0.00496
O B < 1.19460	M Au < 0.00297	M Nd < 0.00198	O Sc < 0.00036	M Ti 0.00198
M Cd < 0.00297	M Hf < 0.00198	M Ni < 0.00793	M Se < 0.00793	S W
O Ca 0.00080	M Ho < 0.00050	O Nb < 0.06371	O Si < 0.01354	M U < 0.00198
M Ce < 0.00496	M In < 0.00991	n Os	M Ag < 0.00198	M V < 0.00198
M Cs < 0.00030	M Ir < 0.00496	M Pd < 0.00496	O Na 0.04778	M Yb < 0.00099
M Cr < 0.00496	O Fe < 0.03982	n P	M Sr < 0.00050	M Y < 0.03965
M Co < 0.00297	M La < 0.00050	M Pt < 0.00198	n S	M Zn < 0.01983
M Cu < 0.00595	M Pb 0.00060	O K 0.03146	O Ta < 0.39820	M Zr 0.00079

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010466

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 183.85; +6; 6,7,8,9; WOF_5^- (chemical form as received)

Chemical Compatibility - W is very readily hydrolyzed requiring 0.1 to 1% HF solutions for stable acidic solutions. The WOF_5^- is soluble in % levels of HCl and HNO_3 provided it is in the WOF_5^- form. Stable at ppm levels with some metals provided it is fluorinated. Do not mix with Alkaline or Rare Earths. Is best to be mixed only with other fluorinated metals (Ti, Zr, Hf, Nb, Ta, Mo, Si, Sn, Ge). Look for yellow WO_3 precipitate if mixed with other transition elements at higher levels indicating instability. The yellow WO_3 will form over a period of weeks even in trace HF, therefore, HF levels of W multi- element blends should be ~ 1 %.

Stability - 2-100 ppb levels stable (Alone or mixed with all other metals that are at comparable levels) as the WOF_5^- for months in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the WOF_5^- chemically stable for years in 1% HF in an LDPE container.

W Containing Samples (Preparation and Solution) - Metal (Soluble in HF / HNO_3); Oxide (Soluble in HF or NH_4OH) ; Organic Matrices (Dry ash at 450 °C in Pt* and dissolve oxide with HF).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at ≤5ppcs.)
ICP-OES	207.911 nm	0.03 / 0.001 µg/mL	1	ion	Ru, In
ICP-OES	224.875 nm	0.05 / 0.005 µg/mL	1	ion	Co, Rh, Ag
ICP-OES	209.475 nm	0.05 / 0.005 µg/mL	1	ion	Mo
ICP-MS	182 amu	5 ppt	n/a	M+	$^{166}Er^{16}O$

HF Note: This standard should not be prepared or stored in glass.

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

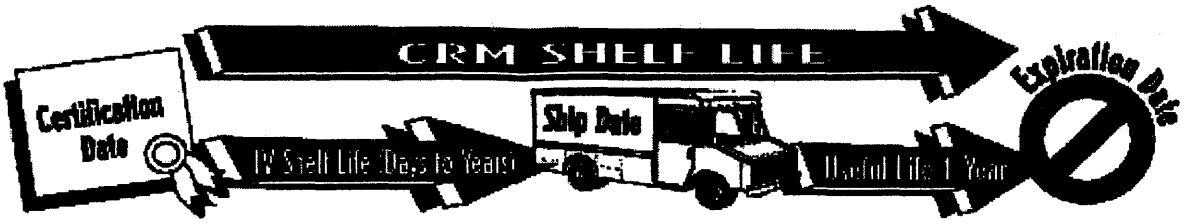
10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 07/31/03
DATE EXPIRED: 08/01/2004
DATE OPENED: 08/01/03
INORG: 4203 PO: F52383

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life.
Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: February 10, 2003

Expiration Date: EXPIRES 1 2 2004

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	JoAnn Struthers, QA Administrative Assistant	JoAnn Struthers
Certificate Approved By:	Katalin Le, QC Supervisor	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 030714-8
SRR: 24618
SDG: 230259
CASE: CNWRA
VTSR: July 14, 2003
PROJECT#: 06002.01.141

Pipette Calibrations

Book/Page: 03 011

010467

SwRI – Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

(Space provide for Inorganic Laboratories' Fixed Volume Pipette Verification Spreadsheet)

6-25-03

SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Spreadsheet

Eppendorf #	True Value (uL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
Lab30	1000	1.0151	1.0076	1.0131	1.01	101.19
TMA1	1000	1.0117	1.0064	1.0062	1.01	100.81
TMA2	1000	1.0118	1.0116	1.0064	1.01	100.99
TMA3	1000	1.0027	1.0069	1.0043	1.00	100.46
TMA6	1000	1.0176	1.0141	1.0151	1.02	101.56
TMB1	900	0.9071	0.9012	0.9038	0.90	100.45
TMC1	800	0.8032	0.7975	0.7989	0.80	99.98
TMDD1	750	0.7542	0.7558	0.7513	0.75	100.50
TMD1	700	0.7028	0.7011	0.7019	0.70	100.28
TMD2	700	0.7056	0.7069	0.7075	0.71	100.95
TME1	600	0.6064	0.6006	0.5994	0.60	100.36
TMF2	500	0.5003	0.5011	0.5021	0.50	100.23
TMF5	500	0.5129	0.5082	0.5075	0.51	101.91
ICF1	500	0.5024	0.4976	0.5027	0.50	100.18
L30-500	500	0.5057	0.5034	0.5015	0.50	100.71
TMG3	400	0.4018	0.4001	0.3983	0.40	100.02
TMH1	300	0.2994	0.3003	0.3003	0.30	100.00
TMH2	300	0.3011	0.2985	0.2988	0.30	99.82
TMJ1	250	0.2524	0.2505	0.2516	0.25	100.60
TMJ2	250	0.2507	0.2517	0.2511	0.25	100.47
TMJ3	250	0.2509	0.2528	0.2508	0.25	100.60
TMK2	200	0.2003	0.2021	0.2026	0.20	100.83
TML1	150	0.1528	0.1515	0.1508	0.15	101.13
TMM1	120	0.1208	0.1211	0.1201	0.12	100.56
TMN3	100	0.1008	0.1004	0.0996	0.10	100.27
ICN1	100	0.1015	0.1008	0.1001	0.10	100.80
TMQ1	80	0.0808	0.0806	0.0804	0.08	100.75
TMR1	70	OUT	OF	SERVICE		
TMS1	60	OUT	OF	SERVICE		
LAB-30A	50	0.0495	0.0497	0.0503	0.05	99.67
TMU1	40	0.0399	0.0401	0.0399	0.04	99.92
TMU2	40	0.0401	0.0402	0.0403	0.04	100.50
TMV1	30	0.0306	0.0301	0.0304	0.03	101.22
L30-20	20	0.0202	0.0201 ~~0.02~~	0.0201	0.02	100.50
TMW1	25	0.0248	0.0249	0.0254	0.03	100.13
TMY1	15	OUT	OF	SERVICE		

Book/Page 03 012

SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

Balance #: 16 Thermometer #: G-058 diH20 Temperature (°C): 010468

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
Lab30	1000	1.0151	1.0076	1.0131
TMA1	1000	1.0117	1.0064	1.0062
TMA2	1000	1.0118	1.0116	1.0064
TMA3	1000	1.0027	1.0069	1.0043
TMA6	1000	1.0176	1.0141	1.0151
TMB1	900	.9071	.9012	.9038
TMC1	800	.8032	.7975	.7989
TMDD1	750	.7542	.7558	.7513
TMD1	700	.7028	.7011	.7019
TMD2	700	.7056	.7069	.7075
TME1	600	.6064	.6006	.5994
TMF2	500	.5003	.5011	.5021
TMF5	500	.5129	.5082	.5075
ICF1	500	.5024	.4976	.5027
L30-500	500	.5057	.5034	.5015
TMG3	400	.4018	.4001	.3983
TMH1	300	.2994	.3003	.3003
TMH2	300	.3011	.2985	.2988
TMJ1	250	.2524	.2505	.2516
TMJ2	250	.2507	.2517	.2511
TMJ3	250	.2509	.2528	.2508
TMK2	200	.2003	.2021	.2026
TML1	150	.1528	.1515	.1508
TMM1	120	.1208	.1211	.1201
TMN3	100	.1008	.1004	.0996
ICN1	100	.1015	.1008	.1001
TMQ1	80	.0808	.0806	.0804
TMR1	70	OUT	OF	SERVICE
TMS1	60	OUT	OF	SERVICE
LAB-30A	50	.0495	.0497	.0503
TMU1	40	.0399	.0401	.0399
TMU2	40	.0401	.0402	.0403
TMV1	30	.0306	.0301	.0304
L30-20	20	.0202	.0201	.0201
TMW1	25	.0248	.0249	.0254
TMY1	15	OUT	OF	SERVICE

Analyst: John Wills Date: 6-25-03

Reviewed by: Valerie Alfaro Date: 07-11-03

Book/Page: 03 013

010469

SwRI – Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

(Space provide for Inorganic Laboratories' Fixed Volume Pipette Verification Spreadsheet)

8/3/03

SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Spreadsheet

Eppendorf #	True Value (uL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
Lab30	1000	1.0158	1.0092	1.0126	1.01	101.25
TMA1	1000	1.0034	1.0076	1.0201	1.01	101.04
TMA2	1000	1.0112	1.0209	1.0177	1.02	101.66
TMA3	1000	1.0091	1.0152	1.0041	1.01	100.95
TMA6	1000	1.0007	1.0036	1.0004	1.00	100.16
TMB1	900	0.9022	0.9003	0.9038	0.90	100.23
TMC1	800	0.7947	0.8009	0.7956	0.80	99.63
TMDD1	750	0.7534	0.7569	0.7581	0.76	100.82
TMD1	700	0.7063	0.7016	0.7059	0.70	100.66
TMD2	700	0.7030	0.7074	0.7027	0.70	100.62
TME1	600	0.6104	0.5907	0.6003	0.60	100.08
TMF2	500	NOT	FOUND			
TMF5	500	0.5109	0.5036	0.5014	0.51	101.06
ICF1	500	0.5011	0.4982	0.5011	0.50	100.03
L30-500	500	0.5072	0.5072	0.5050	0.51	101.29
TMG3	400	0.3997	0.4014	0.4036	0.40	100.39
TMH1	300	0.2987	0.2986	0.2991	0.30	99.60
TMH2	300	0.2976	0.3010	0.3014	0.30	100.00
TMJ1	250	0.2507	0.2536	0.2527	0.25	100.93
TMJ2	250	0.2522	0.2530	0.2541	0.25	101.24
TMJ3	250	0.2515	0.2541	0.2504	0.25	100.80
TMK2	200	0.2001	0.2000	0.2019	0.20	100.33
TML1	150	0.1503	0.1516	0.1519	0.15	100.84
TMM1	120	0.1191	0.1209	0.1198	0.12	99.94
TMN3	100	0.0991	0.1007	0.1015	0.10	100.43
ICN1	100	0.1010	0.0999	0.1004	0.10	100.43
TMQ1	80	0.0807	0.0800	0.0803	0.08	100.42
TMR1	70	OUT	OF	SERVICE		
TMS1	60	OUT	OF	SERVICE		
LAB-30A	50	0.0491	0.0490	0.0497	0.05	98.53
TMU1	40	0.0400	0.0403	0.0404	0.04	100.58
TMU2	40	0.0399	0.0402	0.0403	0.04	100.33
TMV1	30	0.0305	0.0305	0.0303	0.03	101.44
L30-20	20	0.0197	0.0201	0.0201	0.02	99.83
TMW1	25	0.0248	0.0249	0.0249	0.02	99.47
TMY1	15	OUT	OF	SERVICE		

FRM-246 (Rev 1/Mar 03)

Book/Page 03 014

SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

010470

Balance #: 34 Thermometer #: G011 diH20 Temperature (°C): 21

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
Lab30	1000	1.0158	1.0092	1.0126
TMA1	1000	1.0034	1.0076	1.0201
TMA2	1000	1.0112	1.0209	1.0177
TMA3	1000	1.0091	1.0152	1.0041
TMA6	1000	1.0007	1.0036	1.0004
TMB1	900	0.9022	0.9003	0.9038
TMC1	800	0.7947	0.8009	0.7956
TMDD1	750	0.7534	0.7569	0.7581
TMD1	700	0.7063	0.7016	0.7059
TMD2	700	0.7030	0.7074	0.7027
TME1	600	0.6104	0.5907	0.6003
TMF2	500	NOT FOUND		
TMF5	500	0.5109	0.5036	0.5014
ICF1	500	0.5011	0.4982	0.5011
L30-500	500	0.5072	0.5072	0.5050
TMG3	400	0.3997	0.4014	0.4036
TMH1	300	0.2987	0.2986	0.2991
TMH2	300	0.2976	0.3010	0.3014
TMJ1	250	0.2507	0.2536	0.2527
TMJ2	250	0.2522	0.2530	0.2541
TMJ3	250	0.2515	0.2541	0.2504
TMK2	200	0.2001	0.2000	0.2019
TML1	150	0.1503	0.1516	0.1519
TMM1	120	0.1191	0.1209	0.1198
TMN3	100	0.0991	0.1007	0.1015
ICN1	100	0.1010	0.0999	0.1004
TMQ1	80	0.0807	0.0800	0.0803
TMR1	70	OUT	OF	SERVICE
TMS1	60	OUT	OF	SERVICE
LAB-30A	50	0.0491	0.0490	0.0497
TMU1	40	0.0400	0.0403	0.0404
TMU2	40	0.0399	0.0402	0.0403
TMV1	30	0.0305	0.0305	0.0303
L30-20	20	0.0197	0.0201	0.0201
TMW1	25	0.0248	0.0249	0.0249
TMY1	15	OUT	OF	SERVICE

Analyst: [signature] Date: 8/3/03

Reviewed by: [signature] Date: 08/15/03

Book/page: 03 029

010471

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

7/22/03

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	20	0.0201	0.0200	0.0201	0.020	100.33
ADJ200-A	100	0.0992	0.0995	0.0991	0.099	99.27
	200	0.1985	0.1990	0.1987	0.199	99.37
	20	0.0198	0.0196	0.0196	0.020	98.33
ADJ200-C	100	0.0982	0.0985	0.0981	0.098	98.27
	200	0.1973	0.1968	0.1978	0.197	98.65
	20	0.0199	0.0202	0.0200	0.020	100.17
ADJ200-D	100	0.1003	0.1004	0.0998	0.100	100.17
	200	0.2005	0.2001	0.1985	0.200	99.85
	20	0.0199	0.0203	0.0201	0.020	100.50
ADJ200-E	100	0.0986	0.0980	0.0978	0.098	98.13
	200	0.1966	0.1968	0.1976	0.197	98.50
	20	0.0200	0.0199	0.0203	0.020	100.33
ADJ200-G	100	0.0998	0.0997	0.0993	0.100	99.60
	200	0.1988	0.1968	0.1984	0.198	99.00
	20					
ADJ200	100					
	200					
	20					
ADJ200	100					
	200					
	20					
ADJ200	100					
	200					
	20					
ADJ200	100					
	200					

FRM-247a (Rev 2/Mar 03)

Book/page: 03 030

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010472

Balance #: 34 Thermometer #: G-011 diH20 Temperature (° C) 22.5

20 µL – 200 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	20	0.0201	0.0200	0.0201
ADJ200-A	100	0.0992	0.0995	0.0991
Lab 34	200	0.1985	0.1990	0.1987
	20	0.0198	0.0196	0.0196
ADJ200-C	100	0.0982	0.0985	0.0981
Lab 28	200	0.1973	0.1968	0.1978
	20	0.0199	0.0202	0.0200
ADJ200-D	100	0.1003	0.1004	0.0998
Lab 30	200	0.2005	0.2001	0.1985
mixing ejector jacket	20	0.0199	0.0203	0.0201
ADJ200-E	100	0.0986	0.0980	0.0978
Lab 39	200	0.1966	0.1968	0.1976
	20	0.0200	0.0199	0.0203
ADJ200-G	100	0.0998	0.0997	0.0993
Lab 21	200	0.1988	0.1968	0.1984
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			

WJ 7/11/03

Analyst: Laura Wright Date: 7/11/03

Reviewed by: Valerie Wilson Date: 07/22/03

Book/page: 03 035

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010473

8/1/03

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	20	0.0199	0.0201	0.0203	0.020	100.50
ADJ200-A	100	0.0992	0.0994	0.0998	0.099	99.47
	200	0.1984	0.1997	0.1980	0.199	99.35
	20	0.0205	0.0201	0.0201	0.020	101.17
ADJ200-C	100	0.0988	0.0991	0.0987	0.099	98.87
	200	0.1974	0.1983	0.1979	0.198	98.93
	20	0.0200	0.0199	0.0199	0.020	99.67
ADJ200-D	100	0.0997	0.0990	0.0993	0.099	99.33
	200	0.1975	0.1980	0.1983	0.198	98.97
	20	0.0201	0.0200	0.0201	0.020	100.33
ADJ200-E	100	0.0980	0.0985	0.0989	0.098	98.47
	200	0.1969	0.1987	0.1991	0.198	99.12
	20	0.0200	0.0197	0.0201	0.020	99.67
ADJ200-G	100	0.0989	0.0998	0.0990	0.099	99.23
	200	0.1985	0.1989	0.2008	0.199	99.70
	20				0.000	0.00
ADJ200	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200	100				0.000	0.00
	200				0.000	0.00

Book/page: 03 036

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

010474

Balance #: 34 Thermometer #: G011 diH20 Temperature (° C) 21

20 µL – 200 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	20	0.0199	0.0201	0.0203
ADJ200-A	100	0.0992	0.0994	0.0998
	200	0.1984	0.1997	0.1980
	20	0.0205	0.0201	0.0201
ADJ200-C	100	0.0988	0.0991	0.0987
	200	0.1974	0.1983	0.1979
	20	0.0200	0.0199	0.0199
ADJ200-D	100	0.0997	0.0990	0.0993
	200	0.1975	0.1980	0.1983
	20	0.0201	0.0200	0.0201
ADJ200-E	100	0.0980	0.0985	0.0989
	200	0.1969	0.1987	0.1991
	20	0.0200	0.0197	0.0201
ADJ200-G	100	0.0989	0.0998	0.0990
	200	0.1985	0.1989	0.2008
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			

8/1/03

Analyst: Richard Handy Date: 8/1/03

Reviewed by: Valerie Glenn Date: 08/15/03

Book/page: 03 037

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010475

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	20	0.0203	0.0203	0.0201	0.020	101.17
ADJ200-A	100	0.0999	0.0993	0.0990	0.099	99.40
	200	0.1997	0.1996	0.1994	0.200	99.78
	20	0.0204	0.0202	0.0203	0.020	101.50
ADJ200-C	100	0.0985	0.0985	0.0993	0.099	98.77
	200	0.1990	0.1993	0.1985	0.199	99.47
	20	0.0204	0.0203	0.0204	0.020	101.83
ADJ200-D	100	0.0996	0.0999	0.0991	0.100	99.53
	200	0.1986	0.1988	0.1986	0.199	99.33
	20	0.0203	0.0204	0.0202	0.020	101.50
ADJ200-E	100	0.0987	0.0986	0.0986	0.099	98.63
	200	0.1975	0.1969	0.1993	0.198	98.95
	20	0.0203	0.0199	0.0201	0.020	100.50
ADJ200-G	100	0.0999	0.0995	0.0990	0.099	99.47
	200	0.1991	0.1989	0.1987	0.199	99.45
	20					
ADJ200	100					
	200					
	20					
ADJ200	100					
	200					
	20					
ADJ200	100					
	200					
	20					
ADJ200	100					
	200					

8-9-05

Book/page: 03 038

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

010476

Balance #: 34 Thermometer #: G-011 diH20 Temperature (° C) 21

20 µL – 200 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	20	.0203	.0203	.0201
ADJ200-A	100	.0999	.0993	.0990
	200	.1997	.1996	.1994
	20	.0204	.0202	.0203
ADJ200-C	100	.0985	.0985	.0993
	200	.1990	.1993	.1985
	20	.0204	.0203	.0204
ADJ200-D	100	.0996	.0999	.0991
	200	.1986	.1988	.1986
	20	.0203	.0204	.0202
ADJ200-E	100	.0987	.0986	.0986
	200	.1975	.1969	.1993
	20	.0203	.0199	.0201
ADJ200-G	100	.0999	.0995	.0990
	200	.1991	.1989	.1987
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			
	20			
ADJ200	100			
	200			

8-9-03

Analyst: John Wilks Date: 8-9-03

Reviewed by: Nadia Wilson Date: 08/15/03

Book/page: 03 081

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log 10477

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

V. Wright 7/18/03

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	100	0.0996	0.0999	0.0993	0.100	99.60
ADJ1000-C	500	0.4980	0.4973	0.4919	0.496	99.15
	1000	0.9840	0.9903	0.9898	0.988	98.80
	100	0.0992	0.0994	0.0994	0.099	99.33
ADJ1000-D	500	0.4981	0.4967	0.4900	0.495	98.99
	1000	1.0023	0.9960	0.9938	0.997	99.74
	100	0.0980	0.0982	0.0980	0.098	98.07
ADJ1000-E	500	0.4950	0.4938	0.4920	0.494	98.72
	1000	0.9951	0.9990	0.9966	0.997	99.69
	100	0.1023	0.1013	0.1021	0.102	101.90
ADJ1000-F	500	0.4983	0.4983	0.4972	0.498	99.59
	1000	0.9948	0.9936	0.9920	0.993	99.35
	100	~~0.099~~ 0.0997	0.0984	0.0981	~~0.099~~ 0.098	~~98.73~~ 98.07
ADJ1000-G	500	0.4903	0.4916	0.4899	0.491	98.12
	1000	0.9982	0.9912	0.9895	0.993	99.30
	100	0.0993	0.0988	0.0990	0.099	99.03
ADJ1000-H	500	0.4900	0.4902	0.4901	0.490	98.02
	1000	0.9937	0.9957	0.9931	0.994	99.42
	100					
ADJ1000	500					
	1000					
	100					
ADJ1000	500					
	1000					
	100					
ADJ1000	500					
	1000					

7/18/03

7/22/03

FRM-247b (Rev 1/Sept 02)

Book/page: 03 082

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010478

Balance #: 34 Thermometer #: G-011 diH20 Temperature (° C) 22.5

100 µL – 1000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	100	0.0996	0.0999	0.0993
ADJ1000-C	500	0.4980	0.4973	0.4919
Lab 30	1000	0.9840	0.9903	0.9898
	100	0.0992	0.0994	0.0994
ADJ1000-D	500	0.4981	0.4967	0.4900
	1000	1.0023	0.9960	0.9938
	100	0.0980	0.0982	0.0980
ADJ1000-E	500	0.4950	0.4938	0.4920
Lab 34	1000	0.9951	0.9990 MW	0.9966
	100	0.1023	0.1023 MW 7/11/03	0.1021
ADJ1000-F	500	0.4983	0.4983	0.4972
Lab 39	1000	0.9948	0.9936	0.9920
	100	0.0977	0.0984	0.0981
ADJ1000-G	500	0.4903	0.4916	0.4899
Lab 29	1000	0.9982	0.9912	0.9895
	100	0.0993	0.0988	0.0990
ADJ1000-H	500	0.4900	0.4902	0.4901
Lab 28	1000	0.9937	0.9957	0.9931
	100			
ADJ1000	500			
	1000			
	100			
ADJ1000	500		MW 7/11/03	
	1000			
	100			
ADJ1000	500			
	1000			

Analyst: Laura Wright Date: 7/11/03

Reviewed by: Nalini Date: 07/22/03

Book/page: 03 087

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

Michael Hardy 8/1/03

010479

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	100	0.1014	0.1010	0.1003	0.101	100.90
ADJ1000-C	500	0.4883	0.4937	0.4923	0.491	98.29
	1000	0.9819	0.9840	0.9866	0.984	98.42
	100	0.1000	0.1009	0.1006	0.101	100.50
ADJ1000-D	500	0.4999	0.5009	0.5005	0.500	100.09
	1000	1.0077	1.0053	1.0069	1.007	100.66
	100	0.0984	0.0984	0.0991	0.099	98.63
ADJ1000-E	500	0.4982	0.4993	0.5013	0.500	99.92
	1000	0.9936	0.9991	0.9962	0.996	99.63
	100	0.1020	0.1016	0.1010	0.102	101.53
ADJ1000-F	500	0.5016	0.5019	0.5017	0.502	100.35
	1000	0.9972	0.9972	0.9969	0.997	99.71
	100	0.0993	0.0987	0.1001	0.099	99.37
ADJ1000-G	500	0.4971	0.4913	0.5006	0.496	99.27
	1000	0.9793	0.9929	0.9817	0.985	98.46
	100	0.0992	0.0989	0.0998	0.099	99.30
ADJ1000-H	500	0.4889	0.4904	0.4911	0.490	98.03
	1000	0.9903	0.9857	0.9807	0.986	98.56
	100				0.000	0.00
ADJ1000	500				0.000	0.00
	1000				0.000	0.00
	100				0.000	0.00
ADJ1000	500				0.000	0.00
	1000				0.000	0.00
	100				0.000	0.00
ADJ1000	500				0.000	0.00
	1000				0.000	0.00

FRM-247b (Rev 1/Sept 02)

8/1/03 Michael Hardy

Book/page: 03 088

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010480

Balance #: 34 Thermometer #: G011 diH20 Temperature (° C) 21

100 µL – 1000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	100	0.1014	0.1010	0.1003
ADJ1000-C	500	0.4883	0.4937	0.4923
	1000	0.9819	0.9840	0.9866
	100	0.1000	0.1009	0.1006
ADJ1000-D	500	0.4999	0.5009	0.5005
	1000	1.0077	1.0053	1.0069
	100	0.0984	0.0984	0.0991
ADJ1000-E	500	0.4982	0.4993	0.5013
	1000	0.9936	0.9991	0.9962
	100	0.1020	0.1016	0.1010
ADJ1000-F	500	0.5016	0.5019	0.5017
	1000	0.9972	0.9972	0.9969
	100	0.0993	0.0987	0.1001
ADJ1000-G	500	0.4971	0.4913	0.5006
	1000	0.9793	0.9929	0.9817
	100	0.0992	0.0989	0.0998
ADJ1000-H	500	0.4889	0.4904	0.4911
	1000	0.9903	0.9857	0.9807
	100			
ADJ1000	500			
	1000			
	100			
ADJ1000	500			
	1000			
	100			
ADJ1000	500			
	1000			

8/1/03

Analyst: [signature] Date: 8/1/03

Reviewed by: [signature] Date: 08/15/03

Book/page: 03 089

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

8-9-03

010481

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	100	0.1003	0.1009	0.1006	0.101	100.60
ADJ1000-C	500	0.4917	0.4920	0.4946	0.493	98.55
	1000	0.9924	0.9930	0.9928	0.993	99.27
	100	0.0997	0.1007	0.1004	0.100	100.27
ADJ1000-D	500	0.4917	0.4918	0.4950	0.493	98.57
	1000	1.0050	0.9981	0.9923	0.998	99.85
	100	0.0990	0.0990	0.0991	0.099	99.03
ADJ1000-E	500	0.4985	0.4952	0.4945	0.496	99.21
	1000	0.9966	0.9969	0.9937	0.996	99.57
	100	0.0987	0.0990	0.1000	0.099	99.23
ADJ1000-F	500	0.4956	0.4972	0.5015	0.498	99.62
	1000	0.9983	1.0007	0.9948	0.998	99.79
	100	0.0997	0.0996	0.0997	0.100	99.67
ADJ1000-G	500	0.4930	0.4948	0.4941	0.494	98.79
	1000	1.0029	1.0027	0.9987	1.001	100.14
	100	0.1008	0.1010	0.0991	0.100	100.30
ADJ1000-H	500	0.4953	0.4944	0.4942	0.495	98.93
	1000	0.9899	0.9920	0.9876	0.990	98.98
	100					
ADJ1000	500					
	1000					
	100					
ADJ1000	500					
	1000					
	100					
ADJ1000	500					
	1000					

8-9-03

FRM-247b (Rev 1/Sept 02)

Book/page: 03 090

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010482

Balance #: 34 Thermometer #: G011 diH20 Temperature (° C) 21

100 µL – 1000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	100	.1003	.1009	.1006
ADJ1000-C	500	.4917	.4920	.4946
	1000	.9924	.9930	.9928
	100	.0997	.1007	.1004
ADJ1000-D	500	.4917	.4918	.4950
	1000	1.0050	.9981	.9923
	100	.0990	.0990	.0991
ADJ1000-E	500	.4985	.4952	.4945
	1000	.9966	.9969	.9937
	100	.0987	.0990	.1000
ADJ1000-F	500	.4956	.4972	.5015
	1000	.9983	1.0007	.9948
	100	.0997	.0996	.0997
ADJ1000-G	500	.4930	.4948	.4941
	1000	1.0029	1.0027	.9987
	100	.1008	.1010	.0991
ADJ1000-H	500	.4953	.4944	.4942
	1000	.9899	.9920	.9876
	100			
ADJ1000	500			
	1000			
	100			
ADJ1000	500			
	1000			
	100			
ADJ1000	500			
	1000			

8-9-03

Analyst: John Wilker Date: 8-9-03

Reviewed by: Date: 08/15/03

Book/page: 03 133

010483

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

L. Wright 7/18/03

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	500	0.5014	0.5013	0.5054	0.503	100.54
ADJ5000-C	2500	2.5025	2.4958	2.4986	2.499	99.96
	5000	5.0578	5.0412	5.0247	5.041	100.82
	500	0.4981	0.4972	0.4971	0.497	99.49
ADJ5000-G	2500	2.4889	2.4898	2.4824	2.487	99.48
	5000	5.0675	4.9995	5.0051	5.024	100.48
	500	0.4930	0.4923	0.4991	0.495	98.96
ADJ5000-H	2500	2.4711	2.4638	2.4647	2.467	98.66
	5000	5.0137	5.0142	4.9890	5.006	100.11
	500	0.4938	0.4990	0.4980	0.497	99.39
ADJ5000-I	2500	2.5046	2.4986	2.4961	2.500	99.99
	5000	5.0129	5.0133	5.0010	5.009	100.18
	500	0.5002	0.5010	0.5001	0.500	100.09
ADJ5000-J	2500	2.5049	2.5009	2.5066	2.504	100.17
	5000	5.0132	5.0029	5.0329	5.016	100.33
	500	0.5098	0.5044	0.5041	0.506	101.22
ADJ5000-K	2500	2.4922	2.4920	2.4912	2.492	99.67
	5000	5.0497	5.0548	5.0190	5.041	100.82
	500	0.5023	0.5025	0.5009	0.502	100.38
ADJ5000-L	2500	2.5001	2.5003	2.5011	2.501	100.02
	5000	4.9985	4.9922	4.9646	4.985	99.70
	500					
ADJ5000	2500					
	5000					
	500					
ADJ5000	2500					
	5000					
	500					
ADJ5000	2500					
	5000					
	500					
ADJ5000	2500					
	5000					

LW 7/18/03

FRM-247c (Rev 2/Mar 03)

Book/page: 03 134

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010484

Balance #: 34 Thermometer #: G-011 diH20 Temperature (° C) 22.5

500 µL – 5000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	500	0.5014	0.5013	0.5054
ADJ5000-C	2500	2.5025	2.4958	2.4986
Lab 28	5000	5.0578	5.0412	5.0247
	500	0.4981	0.4972	0.4971
ADJ5000-G	2500	2.4889	2.4898	2.4824
Lab 28	5000	5.0675	4.9995	5.0051
	500	0.4930	0.4923	0.4991
ADJ5000-H	2500	2.4711	2.4638	2.4647
Lab 34	5000	5.0137	5.0142	4.9890
	500	0.4938	0.4990	0.4980
ADJ5000-I	2500	2.5046	2.4986	2.4961
Lab 21	5000	5.0129	5.0133	5.0010
	500	0.5002	0.5010	0.5001
ADJ5000-J	2500	2.5049	2.5009	2.5066
Lab 29	5000	5.0132	5.0029	5.0329
	500	0.5098	0.5044	0.5041
ADJ5000-K	2500	2.4922	2.4920	2.4912
Lab 30	5000	5.0497	5.0548	5.0190
	500	0.5023	0.5025	0.5009
ADJ5000-L	2500	2.5001	2.5003	2.5011
Lab 39	5000	4.9985	4.9922	4.9646
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			

7/11/03

Analyst: Donna Wright Date: 7/11/03

Reviewed by: John Wilks Date: 7-18-03

Book/page: 03 139

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

8/1/03

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	500	0.4906	0.4919	0.4921	0.492	98.31
ADJ5000-C	2500	2.4877	2.4832	2.4881	2.486	99.45
	5000	5.0236	5.0211	5.0213	5.022	100.44
	500	0.4961	0.4966	0.4982	0.497	99.39
ADJ5000-G	2500	2.4871	2.4803	2.4766	2.481	99.25
	5000	5.0147	5.0011	5.0366	5.017	100.35
	500	0.5040	0.5016	0.5033	0.503	100.59
ADJ5000-H	2500	2.5111	2.5207	2.5019	2.511	100.45
	5000	5.0236	5.0197	5.0217	5.022	100.43
	500	0.5070	0.5067	0.5060	0.507	101.31
ADJ5000-I	2500	2.5190	2.5117	2.5026	2.511	100.44
	5000	5.0184	5.0181	5.0142	5.017	100.34
	500	0.5052	0.5054	0.5046	0.505	101.01
ADJ5000-J	2500	2.5312	2.5337	2.5297	2.532	101.26
	5000	5.0900	5.0716	5.0734	5.078	101.57
	500	0.5040	0.5074	0.5160	0.509	101.83
ADJ5000-K	2500	2.5260	2.5299	2.5289	2.528	101.13
	5000	5.0808	5.0562	5.0478	5.062	101.23
	500	0.4979	0.4983	0.4992	0.498	99.69
ADJ5000-L	2500	2.4999	2.4985	2.4974	2.499	99.94
	5000	5.0589	5.0311	5.0437	5.045	100.89
	500				0.000	0.00
ADJ5000	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000	2500				0.000	0.00
	5000				0.000	0.00

FRM-247c (Rev 2/Mar 03)

Book/page: 03 140

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010486

Balance #: 34 Thermometer #: G011 diH20 Temperature (° C) 21

500 µL – 5000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	500	0.4906	0.4919	0.4921
ADJ5000-C	2500	2.4877	2.4832	2.4881
	5000	5.0236	5.0211	5.0213
	500	0.4961	0.4966	0.4982
ADJ5000-G	2500	2.4871	2.4803	2.4766
	5000	5.0147	5.0011	5.0366
	500	0.5040	0.5016	0.5033
ADJ5000-H	2500	2.5111	2.5207	2.5019
	5000	5.0236	5.0197	5.0217
	500	0.5070	0.5067	0.5060
ADJ5000-I	2500	2.5190	2.5117	2.5026
	5000	5.0184	5.0181	5.0142
	500	0.5052	0.5054	0.5046
ADJ5000-J	2500	2.5312	2.5337	2.5297
	5000	5.0900	5.0716	5.0734
	500	0.5040	0.5074	0.5160
ADJ5000-K	2500	2.5260	2.5299	2.5289
	5000	5.0808	5.0562	5.0478
	500	0.4979	0.4983	0.4992
ADJ5000-L	2500	2.4999	2.4985	2.4974
	5000	5.0589	5.0311	5.0437
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			

8/1/03

Analyst: Date: 8/1/03

Reviewed by: Date: 08/15/03

Book/page: 03 141

010487

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

8-4-03

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	500	0.4982	0.5075	0.5027	0.503	100.56
ADJ5000-C	2500	2.4979	2.5029	2.5033	2.501	100.05
	5000	5.0034	4.9939	4.9944	4.997	99.94
	500	0.4993	0.4991	0.4984	0.499	99.79
ADJ5000-G	2500	2.4984	2.5037	2.4882	2.497	99.87
	5000	5.0338	5.0165	5.0136	5.021	100.43
	500	0.5017	0.4958	0.4963	0.498	99.59
ADJ5000-H	2500	2.4914	2.4900	2.4987	2.493	99.73
	5000	5.0044	4.9930	4.9874	4.995	99.90
	500	0.4982	0.4978	0.4944	0.497	99.36
ADJ5000-I	2500	2.4985	2.5063	2.4972	2.501	100.03
	5000	5.0052	5.0128	4.9991	5.006	100.11
	500	0.4945	0.4987	0.4952	0.496	99.23
ADJ5000-J	2500	2.5072	2.4926	2.4976	2.499	99.97
	5000	5.0353	5.0047	5.0156	5.019	100.37
	500	0.5028	0.5014	0.5040	0.503	100.55
ADJ5000-K	2500	2.4961	2.5122	2.5034	2.504	100.16
	5000	5.0227	5.0277	5.0163	5.022	100.44
	500	0.4939	0.4938	0.4961	0.495	98.92
ADJ5000-L	2500	2.4994	2.5008	2.5024	2.501	100.03
	5000	5.0115	5.0102	5.0098	5.011	100.21
	500					
ADJ5000	2500					
	5000					
	500					
ADJ5000	2500					
	5000					
	500					
ADJ5000	2500					
	5000					
	500					
ADJ5000	2500					
	5000					

8.9.03

FRM-247c (Rev 2/Mar 03)

FRM-244 (Rev 2/Sept 02)

Book/page: 03 142

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010488

Balance #: 34 Thermometer #: G011 diH20 Temperature (° C) 21

500 µL – 5000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	500	8-03 .4982	.5075	.5027
ADJ5000-C	2500	2.4979	2.5029	2.5033
	5000	5.0034	4.9939	4.9944
	500	.4993	.4991	.4984
ADJ5000-G	2500	2.4984	2.5037	2.4882
	5000	5.0338	5.0165	5.0136
	500	.5017	.4958	.4963
ADJ5000-H	2500	2.4914	2.4900	2.4987
	5000	5.0044	4.9930	4.9874
	500	.4982	.4978	.4944
ADJ5000-I	2500	2.4985	2.5063	2.4972
	5000	5.0052	5.0128	4.9991
	500	.4945	.4987	.4952
ADJ5000-J	2500	2.5072	2.4926	2.4976
	5000	5.0353	5.0047	5.0156
	500	.5028	.5014	.5040
ADJ5000-K	2500	2.4961	2.5122	2.5034
	5000	5.0227	5.0277	5.0163
	500	.4939	.4938	.4961
ADJ5000-L	2500	2.4941	2.5008	2.5024
	5000	5.0115	5.0102	5.0098
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			

8-9-03

Analyst: John Wills Date: 8-9-03

Reviewed by: [signature] Date: 08/15/03

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 030714-8
SRR: 24618
SDG: 230259
CASE: CNWRA
VTSR: July 14, 2003
PROJECT#: 06002.01.141

Balance Calibrations

Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
16	28	P37987	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
7/21/03	2.0000	2.0003	MW	Sn: 5537
7-22-03	2.0000	2.0003	JW	"
7-23-03	2.0000	2.0003	JW	"
7-24-03	2.0000	2.0003	JW	"
7-25-03	2.0000	2.0003	JW	"
7/28/03	2.0000	2.0003	MW	"
7/29/03	2.0000	2.0003	MW	"
7-30-03	2.0000	2.0003	JW	"
7-31-03	2.0000	2.0003	JW	"
8/1/03	2.0000	2.0003	MW	"

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (x5896) for service.

Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
16	28	P37987	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
8/4/03	2.0000	2.0003	LW	SN: 5537
8/5/03	2.0000	2.0004	LW	"
8-6-03	2.0000	2.0003	JW	"
8-7-03	2.0000	2.0003	JW	"
8-8-03	2.0000	2.0003	JW	"
8/9/03	2.0000	2.0002	LW	"
8/10/03	2.0000	2.0003	LW	"
8/11/03	2.0000	2.0003	LW	"
8-12-03	2.0000	2.0003	JW	"
8/13/03	2.0000	2.0003	LW	"

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (x5896) for service.

FRM-112 (Rev 1/Dec 99)

Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
16	28	P37987	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
7-9-03	2.0000	2.0000	JW	S.N: 99-350526-15
7-10-03	2.0000	2.0000	JR	"
7-11-03	2.0000	2.0000	JW	"
7-14-03	2.0000	2.0000	JW	"
7/15/03	2.0000	2.0003	LW	SN: 5537
7/15/03	1.0000	1.0000	LW	"
7/16/03	2.0000	2.0002	MG	"
7-17-03	2.0000	2.0003	JW	"
7/18/03	2.0000	2.0003	LW	"
				ams 7/18/03

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (x5896) for service.

✓ ams 7/18/03

Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
19	28	0068597	±0.05	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
7-10-03	10.00	10.00	JC	SN: 99-JS0624-6
7-11-03	10.00	10.00	JW	"
7-14-03	10.00	10.00	JW	"
7/15/03	10.00	10.00	MW	SN: 5537
7/16/03	10.00	10.01	MW	"
7-17-03	10.00	10.01	JW	"
7/18/03	10.00	10.00	MW	"
				ans 7/18/03

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (x5896) for service.

✓ ans
7/18/03

Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
19	28	0068597	±0.05	
Date	Std Wt (g)	Recorded Wt (g)	Operator	SN: 5537
7/21/03	10.00	10.00	MW	"
7-22-03	10.00	10.00	JW	"
7-23-03	10.00	10.00	JW	"
7-24-03	10.00	10.00	JW	"
7-25-03	10.00	10.00	JW	"
7/28/03	10.00	10.00	MW	"
7/29/03	10.00	10.00	MW	"
7-30-03	10.00	10.00	JW	"
7-31-03	10.00	10.00	JW	"
8/01/03	10.00	10.00	MW	"

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (x5896) for service.

Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
19	28	0068597	±0.05	
Date	Std Wt (g)	Recorded Wt (g)	Operator	Sn:
8/4/03	10.00	10.00	MW	5537
8/5/03	10.00	10.00	MW	"
8-6-03	10.00	10.00	[illegible]	"
8-7-03	10.00	10.00	[illegible]	"
8-8-03	10.00	10.00	[illegible]	"
8-9-03	10.00	10.00	[illegible]	"
8/10/03	10.00	10.00	MW	"
8/11/03	10.00	10.00	MW	"
8-12-03	10.00	10.00	[illegible]	"
8/13/03	10.00	10.00	MW	"

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Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
34	28	1116031935	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	SN:99550526-15
7-7-03	2.0000	2.0000	JW	"
7-8-03	2.0000	2.0000	JW	"
7-9-03	2.0000	2.0001	JW	"
7-10-03	2.0000	2.0000	JP	"
7-11-03	2.0000	2.0000	JW	"
7-14-03	2.0000	2.0000	JW	"
7/15/03	2.0000	2.0003	MW	SN: 5537
7/15/03	1.0000	1.0001	MW	"
7/16/03	2.0000	2.0003	MW	"
7-17-03	2.0000	2.0003	JW	"

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
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FRM-112 (Rev 1/Dec 99)

7/17/03

010495

Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
34	28	1116031935	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
7/18/03	2.0000	2.0001	MW	SN:5537
7/19/03	2.0000	2.0002	MW	"
7/21/03	2.0000	2.0002	MW	"
7-22-03	2.0000	2.0003	JW	"
7-23-03	2.0000	2.0003	JW	"
7-24-03	2.0000	2.0003	JW	"
7-25-03	2.0000	2.0003	JW	"
7/28/03	2.0000	2.0003	MW	"
7/29/03	2.0000	2.0002	MW	"
7-30-03	2.0000	2.0003	JW	"

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
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Southwest Research Institute
Division 01

BALANCE VERIFICATION LOG

BALANCE #	LAB #:	SERIAL #:	TOLERANCE:	COMMENTS:
34	28	1116031935	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
7-31-03	2.0000	2.0004	JW	SN: 5537
8/01/03	2.0000	2.0003	MW	"
8/04/03	2.0000	2.0004	MW	"
8/05/03	2.0000	2.0004	MW	"
8-6-03	2.0000	2.0003	JW	"
8-7-03	2.0000	2.0004	JW	"
8-8-03	2.0000	2.0002	JW	"
8-9-03	2.0000	2.0003	JW	"
8/10/03	2.0000	2.0003	MW	"
8/11/03	2.0000	2.0004	MW	"

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (x5896) for service.

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 030714-8
SRR: 24618
SDG: 230259
CASE: CNWRA
VTSR: July 14, 2003
PROJECT#: 06002.01.141

DI Water Verification

D.I. WATER SYSTEM NOTEBOOK
METALS LAB
SOUTHWEST RESEARCH INSTITUTE

01 026

010498

DATE	INITIALS	READING (M OHMS)	SET PT./ QC LT. Green=OK	CALL FOR Service LT. Green=OK	USAGE (GALS)	COMMENTS
6/19/03	DR	18.0	✓	✓	50302.9	8:06 p.m.
6/20/03	DR	18.0	✓	✓	50316.2	7:52 p.m.
6/23/03	DR	18.0	✓	✓	50339.0	6:32 pm
6/24/03	DR	18.0	✓	✓	50355.5	8:36 pm
6/25/03	DR	18.0	✓	✓	50365.0	6:48 pm
6/26/03	DR	18.0	✓	✓	50374.7	6:18 pm
6/27/03	DR	18.0	✓	✓	50385.1	6:37 pm
6/30/03	DR	18.0	✓	✓	50404.7	6:45 pm
7/1/03	DR	18.0	✓	✓	50417.1	6:20 pm
7/2/03	DR	18.0	✓	✓	50427.2	9:20 pm
7/3/03	DR	18.0	✓	✓	5043 7.8	7:40 pm
7/7/03	DR	18.0	✓	✓	50447.4	5:20 pm
7/8/03	DR	18.0	✓	✓	50453.2	5:40 pm
7/9/03	DR	18.0	✓	✓	50462.8	4:40 pm
7/10/03	DR	18.0	✓	✓	50473.8	9:29 pm
			Expires	7/11/03		
7/11/03	DR	18.0	✓	✓	50482.2	7:30 pm
7/17/03	VDS	18.0	✓	✓	50557.5	5:00 pm
7/18/03			DR 7/19/03			
7/19/03	DR	18.0	✓	✓	50573.1	10:18 pm
7/20/03	DR	18.0	✓	✓	50574.5	9:31 p.m.
7/21/03	DR	18.0	✓	✓	50586.1	5:07 pm
7/22/03	DR	18.0	✓	✓	50602.5	5:16 p.m.
7/23/03	DR	18.0	✓	yellow	50614.8	5:36 pm. Red Pd. Italia U.S.
7/24/03	DR	18.0	✓	yellow	50681.4	3:40 p.m. U.S. Filter called.
7/25/03	DR	18.0	✓	✓	50692.6	Frank exchange. back online. 7:05 AM
7/28/03	DR	18.0	✓	✓	50717.2	5:48 pm
7/29/03	DR	18.0	✓	✓	50727.5	7:05 pm
7/30/03	DR	18.0	✓	✓	50740.8	6:16 p.m.
8/1/03	DR	18.0	✓	✓	50755.6	1:30 A.M (yes. A.M.)
			Ams 8/1/03			
8/3/03	DR	18.0	✓	✓	50767.8	12:07 AM (yes AM again A.M.
8/4/03	DR	18.0	✓	✓	50784.7	7:40 p.m.
8/5/03	DR	18.0	✓	✓	5081 8.2	6:20 pm
8/6/03	DR	18.0	✓	✓	50837.6	5:28 pm

T. Ahrens 8/14/03

D.I. WATER SYSTEM NOTEBOOK
METALS LAB
SOUTHWEST RESEARCH INSTITUTE

01 027

GL0499

DATE	INITIALS	READING (M OHMS)	SET PT./ QC LT. Green=OK	CALL FOR Service LT. Green=OK	USAGE (GALS)	COMMENTS
8/7/03	DR	18.0	✓	✓	50855.0	7:27 pm
8/8/03	DR	18.0	✓	✓	~~5085~~ DI 50875.2	5:40 pm. 8/6/03
8/11/03	DR	18.0	✓	✓	50904.9	6:36 pm
8/12/03	DR	18.0	✓	✓	50924.1	5:01 pm
8/13/03	DR	18.0	✓	✓	50941.6	8 pm
		T.S.B	8/14/03			