

UNITED STATES GOVERNMENT

# Memorandum

**TO :** W.A. Beetem, Analytical Services Coordinator,  
Reston, Virginia M/S 412                   **DATE:** February 28, 1977

**FROM :** L.J. Schroder, WRD, Lakewood, Colorado  
M/S 407

**SUBJECT:** QUALITY CONTROL - July through December 1976 Summary

Enclosed is the summary for July through December 1976.

LeRoy J. Schroder

Enclosures

**cc:** D.K. Leifeste  
B.A. Malo  
R.L. McAvoy  
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5010-110

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Quality-control review for the Albany, Atlanta, and Denver Laboratories  
for the period from July through December 1976

1. A summary documentation of the blind and SRWS program for the laboratories is presented in the January through June 1976 summary. An addition to the blind program is a data system that gives the laboratories a rapid report of the blind results and requests written response when 1.5 s.d. is exceeded.

The SRWS data used for internal control by the laboratories is summarized on the attached tables. The data summary was performed by automated data processing utilizing the SRWS data file. This file includes some data which was not edited by the laboratories. Therefore, the ranges and standard deviations (s.d.) may be slightly misleading. If an analysis was known to be in error and not updated, the determination was used to compute the range and standard deviation. Data was not edited to be consistent with laboratory reporting.

The following summary is the number of blind sample determinations and the percentage of results which exceeded 1.5 s.d.

<u>Albany</u>			<u>Atlanta</u>		
<u>Analysis type</u>	<u>No. of det'n</u>	<u>% rejected (&gt;1.5 s.d.)</u>	<u>Analysis type</u>	<u>No. of det'n</u>	<u>% rejected (&gt;1.5 s.d.)</u>
Major constituent	156	9.0	Major constituent	78	11.5
Trace metal	106	6.6	Trace metal	56	5.4
Total	262	8.0	Total	134	9.0

<u>Denver</u>			<u>Central Laboratories</u>		
<u>Analysis type</u>	<u>No. of det'n</u>	<u>% rejected (&gt;1.5 s.d.)</u>	<u>Analysis type</u>	<u>No. of det'n</u>	<u>% rejected (&gt;1.5 s.d.)</u>
Major constituent	101	7.9	Major constituent	335	9.3
Trace metals	99	4.0	Trace metals	261	5.4
Total	200	6.0	Total	596	7.6

The rejection rate for the major constituents ranged from 7.9 to 11.5%, trace metals from 4.0 to 6.6%, and the total from 6.0 to 9.0%. Three summaries indicate a rejection range from 5.4 to 9.3% for the entire laboratory system during the record period.

The blind sample determinations which exceeded 1.5 s.d. are listed below.

Albany

Determination	HCO <sub>3</sub>	Cr	Li	SO <sub>4</sub>	Ca	Mg	Cl	Na	SiO <sub>2</sub>
No. of rejections	2	4	2	3	1	1	2	1	1

Atlanta

Determination	B	Cl	Ca	SiO <sub>2</sub>	Cu	HCO <sub>3</sub>	Mg	Mn	Co	ROE
No. of rejections	1	2	4	1	1	1	1	1	1	1

Denver

Determination	Cl	HCO <sub>3</sub>	SO <sub>4</sub>	Cu	Na	As
No. of rejections	1	3	1	1	1	2

A consistent positive bias (5 of 6) is shown for bicarbonate determination when the bicarbonate concentration is <70 mg/L. The problem may be the automated instrumentation.

The trace metal determinations rejection rate decreased from the January to June 1976 period of record. The major constituent determinations rejection rate increased in the Albany and Atlanta Laboratories.

A brief summary, by constituent, of the SRWS determinations indicate trends within a laboratory as compared to the weighted mean of all laboratories. It should be noted that these trends do not indicate poor analytical results, only possible systematic error in a laboratory.

<u>Constituent</u>	<u>Atlanta</u>	<u>Albany</u>	<u>Denver</u>
B			Slight negative bias
Cd		Slight positive bias	Slight negative bias
C1		Slight negative bias	
Cr	Slight negative bias		
DSRD 180	Slight positive bias		Slight negative bias
HCO <sub>3</sub>		Slight positive bias	Slight negative bias
Hg	Slight negative bias		
Li		Slight negative bias	Slight positive bias
Mg	Possible positive bias		
Mo		Slight positive bias	
Se	Possible positive bias		Slight negative bias
SiO <sub>2</sub>		Slight positive bias	Slight negative bias
Sp. Cond.	Positive bias to SRWS mean		

The SRWS 53 mean as determined by Atlanta for selenium is noted only because both the dissolved and total means are 10  $\mu\text{g/l}$  above SRWS reported mean.

The total iron determinations indicate either a contamination problem for all laboratories, dominate trend for the total mean to exceed the dissolved mean, or that 0.45 micron filtration does not remove all non-dissolved iron from the sample.

In conclusion, the summary of blind sample data indicates fewer rejections during the July to December 1976 period compared to the January to June 1976 period. The major constituent analysis rejection percentage was higher for Albany and Atlanta, lower for Denver. The trace metal rejection percentage decreased for all laboratories. The laboratories had an overall rejection percentage of 7.6 percent. Review of the "in-house" SRWS data indicates no serious calibration errors in any of the laboratories.

A comparison of Standard Reference Water Sample results from the Albany, Atlanta, and Denver Laboratories

July to December 1976

Constituent	SRWS No.	SRWS mean	Mean concentration <sup>1/</sup>			C.L. mean	Standard deviation			C.L. mean	No. of det'n	At1		Alb		Den	
			At1	Alb	Den		SRWS	At1	Alb			Range	No. of det'n	Range	No. of det'n	Range	
Al	48	597	578	580	540	576	147	46	46	2/	46	6	520-640	5	500-610	1	-----
	---3/	520	600	---	560	---	---	20	10	---	46						
	49	84	108	90	100	104	26	40	10	2/	35	12	80-230	3	80-100	1	-----
	---4/	95	95	---	95	---	2/	2/	2/	2/	2/						
	52	396	390	374	383	382	85	26	11	22	20	3	360-410	5	360-390	11	350-420
	---4/	340	405	446	406	---	---	17	2/	48	36						
	53	792	774	765	777	772	65	18	82	29	41	5	750-790	6	660-860	11	670-820
	---4/	710	785	728	736	---	---	2/	2/	2/	2/						
	56	190	192	185	199	193	27	11	17	6.9	12	5	180-210	4	170-200	7	190-210
	---4/	160	180	208	186	---	---	20	2/	5.0	26						
Ag	57	373	385	398	380	387	59	23	31	22	25	6	360-420	5	360-430	7	350-400
	---4/	363	400	433	399	---	35	2/	15	39							
	59	318	340	----	355	350	35	2/	2/	2/	1		-----	-	-----	2	310-400
	48	10.1	9.3	8.0	9.0	9.1	1.2	2.1	2/	2/	2/	6	6.0-12.0	1	-----	1	-----
	---4/	10.3	----	----	----	----	----	----	----	----	----						
	49	6.3	6.0	----	----	----	1.0	2/	----	----	2/	11	4.0- 9.0	-	-----	--	-----
As	52	4.2	3.7	4.5	3.8	3.9	1.9	.6	2/	.8	.8	3	3.0- 4.0	2	4.0-5.0	12	2.0- 5.0
	53	8.0	9.0	6.0	8.6	8.3	2.5	1.0	1.7	1.4	1.7	5	8.0-10	3	5.0-8.0	12	6.0-11
	56	15.3	13.4	15.0	13.0	13.3	4.9	2.2	2/	3.0	2.5	5	11 -15	1	-----	7	8.0-17
	57	5.0	4.7	7.0	5.0	5.0	1.3	.5	2/	1.0	1.0	6	4.0- 5.0	1	-----	7	4.0- 6.0
	59	2.2	5.0	----	8.5	7.3	.4	2/	2/	2/	1		-----	-	-----	2	2.0-15
	48	44.6	52.5	49.6	36.0	49.4	8.8	6.8	12.5	2/	10.4	4	45 -61	5	37 -70	1	-----
As	---4/	45.5	44.7	----	45	----	2/	5.7	----	----	----						
	49	18.1	16.1	18.3	22.0	17.1	2.6	5.8	1.5	2/	5.1	9	6.0-24	3	17 -20	1	-----
	---4/	22.0	20.5	----	21.2	----	----	----	----	----	----						
	52	9.1	10.0	9.6	10.0	9.9	3.7	1.0	2.1	4.2	3.3	3	9.0-11	5	7.0-12	9	3.0-13
	---4/	9.0	8.0	12.2	10.9	----	2/	2/	2.5	2/	2/						
	53	55.5	58.5	59.2	53.3	55.3	12.8	8.8	3.7	11.2	8.7	4	49 -69	6	54 -65	12	40 -65
As	---4/	----	54.0	61.0	55.7	56.6	2/	2/	22.0	2/	2/						

Analytical range

<u>Constituent</u>	<u>Mean concentration</u>						<u>Standard deviation</u>						<u>At1</u>		<u>Alb</u>		<u>Den</u>	
	<u>SRWS No.</u>	<u>SRWS mean</u>	<u>At1</u>	<u>Alb</u>	<u>Den</u>	<u>C.L. mean</u>	<u>SRWS</u>	<u>At1</u>	<u>Alb</u>	<u>Den</u>	<u>C.L. mean</u>	<u>No. of det'n</u>	<u>Range</u>	<u>No. of det'n</u>	<u>Range</u>	<u>No. of det'n</u>	<u>Range</u>	
As (continued)	56	14.3	14.8	13.8	14.2	14.2	4.9	2.2	2.1	2.8	2.5	4	13 -18	4	12 -16	7	13 -15	
		---4/	12.5	18.0	15.0	14.7	---	2/	2/	1.0	2/							
	57	5.4	4.7	5.4	4.7	4.9	1.3	.8	1.1	2.1	1.5	6	4.0- 6.0	5	4.0- 7.0	7	2.0- 7.0	
		---4/	4.0	5.5	4.7	4.7	---	---	---	1.5	2/					2	21 -50	
	59	20.2	20.0	---	35.5	30.3	2.7	2/	---	2/	2/	1	---	-	---			
B	50	220	193	198	189	192	99	36	18	39	36	24	130-270	5	170-210	24	9.0-210	
	51	23	38	20	13	25	14	58	0	5.6	39	24	10-200	5	0	26	4.0- 20	
	54	340	329	327	313	322	41	43	46	25	36	27	270-430	-	300-380	--	190 -330	
	55	50	33	33	30	32	29	22	10	2.8	14	20	0- 90	-	20- 50	20	- 40	
Ba	48	570	500	550	800	544	110	63	2/	2/	2/	6	400-600	2	500-600	1	-----	
		---4/	533	---	---	---	---	58	2/	2/	2/							
	52	260	233	250	220	229	80	58	58	89	78	3	200-300	4	200-300	11	100-300	
		---4/	267	---	283	278	---	58	---	41	44							
	53	760	740	767	775	765	70	55	58	45	49	5	700-800	3	700-800	12	700-800	
		---4/	800	---	729	744	---	2/	---	49	2/							
	56	100	100	100	100	100	50	71	2/	58	58	5	0-200	1	-----	7	0-200	
Be		---4/	133	100	100	112	---	58	2/	50	53							
	57	790	783	800	800	793	60	41	2/	58	46	6	700-800	2	0	7	700-900	
		---4/	833	---	800	825	---	58	---	2/	2/							
	52	18	16.7	20	20	19.5	4	5.7	0	0	2.3	3	10- 20	5	0	11	0	
		---4/	20	---	20	20	---	0	---	0	0							
	53	42	42	40	39	40	11	8.4	0	9.4	7.7	5	30- 50	3	0	12	0-50	
		---4/	45	---	40	41.3	---	2/	---	0	2/							
Ca	56	30	34	30	30	31.5	1.8	5.5	2/	0	3.8	5	30- 40	1	-----	7	0	
		---4/	30	20	30	28.6	---	0	2/	0	0							
	57	62	60	60	61.4	60.7	12	6.3	2/	3.8	4.6	6	50- 70	2	0	7	60-70	
			11	10	---	10	10	3	2/	---	2/	2/	---					
	59	11	10	---	10	10	2/	---	2/	2/	2/							
	50	45.2	46.2	45.2	43.5	45.0	2.9	1.2	0.9	7.0	4.1	24	44- 48	29	43- 47	24	11- 48	
	51	25.2	27.8	24.8	24.3	25.6	1.5	6.6	.8	4.8	5.2	24	24- 47	20	24- 27	26	22- 25	
	54	113	115	111	106	110	6	5.1	5.0	20.6	12.6	27	110-120	37	92-120	29	23-120	
		36.0	36.1	35.0	34.7	35.2	1.8	1.7	.7	1.3	1.2	20	32- 40	26	34- 37	26	33- 38	
	58	11.6	11.0	---	11.0	11.0	.7	2/	---	2/	2/	1	---	--	---	1	---	

Analytical range

Constituent	Mean concentration						Standard deviation						At1		Alb		Den	
	SRWS No.	SRWS mean	At1	Alb	Den	C.L. mean	SRWS	At1	Alb	Den	C.L. mean	No. of det'n	Range	No. of det'n	Range	No. of det'n	Range	
			At1	Alb	Den	At1		At1	Alb	Den	At1	Alb	At1	Alb	Den	At1	Alb	
Cd	48	16.0	16.0	17.6	14	16.5	3.7	0.6	2.0	2/	1.7	6	15 - 17	5	15 - 20	1	-----	
	--4/	14.3	17.0	---	15.7	---	.6	2.0	---	2.0								
	49	4.6	4.4	4.3	4.0	4.1	2.6	.6	.6	2/	.6	12	0 - 5.0	3	4.0 - 5.0	1	-----	
	--4/	4.0	5.0	---	4.5	---	2/	2/	---	2/								
	52	2.7	3.0	2.6	2.6	2.6	1.2	0	.6	0.5	.5	3	0	5	2.0 - 3.0	11	2.0 - 3.0	
	--4/	3.0	3.0	10.0	6.8	---	0	0	0	3.7								
	53	12.4	11.6	13.5	11.6	12.1	3.6	.9	1.0	.7	1.2	5	10 - 12	6	12 - 15	12	11 - 13	
Cl	--4/	11.0	13.0	2/	12.0	---	---	---	---	---	---							
	56	9.9	10.0	9.2	8.6	9.2	1.8	.7	.5	.5	.8	5	9.0 - 11	4	9.0 - 10	7	8.0 - 9.0	
	--4/	9.0	2.0	10.0	8.6	---	0	2/	0	2.7								
	57	6.6	5.8	6.2	5.4	5.8	2.1	.4	.4	.5	.6	6	5.0 - 6.0	5	6.0 - 7.0	7	5.0 - 6.0	
Co	50	122	126	123	121	123	5	5.0	4.6	25.4	14.7	24	120 - 150	29	120 - 130	24	3.6 - 130	
	51	8.7	23.4	8.5	8.1	13.5	1.1	41.2	.5	1.7	25	24	7.9 - 130	20	7.7 - 9.6	24	7.9 - 9.3	
	54	186	190	184	188	187	7	0	28	15	20	27	0	38	33 - 200	29	120 - 210	
	55	48.9	47.0	48.8	50.4	48.9	1.9	3.6	1.1	2.1	2.2	20	45 - 55	.26	46 - 50	26	48 - 56	
	58	1.7	1.8	----	1.5	1.6	.70	2/	---	2/	2/	--	-----	-----	-----	-----	-----	
Cr	48	13.6	14.0	14.6	13.0	14.2	1.8	0.7	0.6	2/	0.7	5	13 - 15	5	14 - 15	1	-----	
	49	5.1	4.8	4.3	5.0	4.8	.6	.7	.6	2/	.7	12	3.0 - 6.0	3	4.0 - 5.0	1	-----	
	52	3.8	3.3	3.2	3.4	3.4	1.3	1.2	1.1	0.5	.8	3	2.0 - 4.0	5	2.0 - 4.0	11	3.0 - 4.0	
	--4/	3.3	----	50.0	34.4	---	.6	---	.0	23.3								
	53	9.1	9.0	10.2	10.4	10.0	3.2	.7	1.0	.9	1.0	5	8.0 - 10	6	9.0 - 12	12	9.0 - 12	
	--4/	9.0	----	----	----	----	----	----	----	----	----							
	56	11.7	11.2	13.2	11.1	11.7	1.4	1.3	1.0	1.1	1.4	5	10 - 13	4	12 - 14	7	10 - 13	
Mn	57	7.7	7.7	8.0	7.3	7.6	.8	1.3	1.0	1.1	.9	6	7.0 - 8.0	5	7.0 - 9.0	7	6.0 - 9.0	
	59	5.8	7.0	----	6.5	6.7	.7	2/	---	2/	2/	1	-----	-----	-----	2	6.0 - 7.0	
	--4/	13.3	10.0	10.0	11.0	---	5.6	0	0	3.2								

### Analytical range

Constituent	Mean concentration						Standard deviation						At1		Alb		Den	
	SRWS No.	SRWS mean	At1	Alb	Den	C.L. mean	SRWS	At1	Alb	Den	C.L. mean	No. of det'n	Range	No. of det'n	Range	No. of det'n	Range	
Cr (continued)	53	19.3	14.6	21.7	20.0	19.3	4.5	2.4	7.5	6.0	6.2	5	12 - 18	6	10 - 30	12	10 - 30	
		--4/	20.0	20.0	20.0	20.0	---	2/	2/	5.8	2/							
	56	39.2	39.6	37.5	40.0	39.2	9.9	6.7	5.0	0	4.2	5	28 - 44	4	30 - 40	7	0	
	57	10.0	11.3	10.0	11.4	11.0	1.2	4.3	0	3.8	3.3	6	6.0- 16	5	0	7	10 - 20	
		--4/	26.7	10.0	10.0	17.1	---	2/	2/	2/	2/							
Cu	48	227	226	218	230	223	13	5.5	4.5	2/	6.5	5	220 - 230	5	210 - 220	1	-----	
		--4/	217	220	218	218	---	2/	2/	2/	2/							
	49	385	363	380	380	367	19	80	10	2/	68.9	12	110 - 390	3	370 - 390	1	-----	
		--4/	390	375	382	382	---	2/	2/	2/	2/							
	52	79	82	80	73	76	.8	2.1	0	21.7	16.6	3	80 - 84	5	0	11	8 - 80	
		--4/	76	75	83	80	---	8.4	2/	5.2	7.0							
	53	443	440	428	438	435	20	8.2	7.5	12.2	11.0	4	430 - 450	6	420 - 440	12	420 - 460	
		--4/	445	425	325	362	---	2/	2/	2/	2/							
DSRD 180	56	196	194	192	199	196	.8	5.5	5.0	3.8	5.1	5	190 - 200	4	190 - 200	7	190 - 200	
		--4/	197	190	195	195	---	5.8	2/	5.8	5.8							
	57	320	317	318	321	319	14	8.2	8.4	6.9	7.6	6	300 - 320	5	310 - 330	7	310 - 330	
		--4/	323	310	320	319	---	5.8	2/	2/	2/							
F	50	427.4	417	422	386	409	39.7	17.0	14.6	68.8	43.0	24	389 - 455	29	397 - 449	24	72 - 428	
	51	201.2	222	190	189	201	9.5	71	3.7	10.3	28	24	187 - 414	22	181 - 198	26	174 - 206	
	54	1161	1152	1156	1116	1142	48	24	19	58	32	27	1090 - 1200	38	1130 - 1200	29	399 - 1170	
	55	266.6	269	267	268	268	5.0	8.2	4.9	7.1	6.7	20	248 - 286	26	254 - 277	26	258 - 291	
	58	61.0	66.0	----	74.0	2/	5.2	2/	----	2/	2/	1	-----	--	-----	1	-----	
F	50	2.11	2.0	2.0	1.9	2.0	0.10	0.1	0.1	0.4	0.3	24	1.9-	2.2	29	1.8 -	2.2	24
	51	.92	1.1	.9	.9	.9	.13	.4	<.1	.2	.3	24	.8-	2.0	20	.8 -	.9	26
	54	1.03	1.1	1.0	1.0	1.0	.14	.1	<.1	.2	.1	27	.9-	1.3	37	.8 -	1.1	29
	55	.78	.8	.8	.8	.8	.08	.2	<.1	.2	.1	20	0 -	.9	26	.7 -	.8	26

Analytical range

Constituent	Mean concentration						Standard deviation						At1			Alb		
	SRWS No.	SRWS mean	At1	Alb	Den	C.L. mean	SRWS	At1	Alb	Den	C.L. mean	No. of det'n	Range	No. of det'n	Range	No. of det'n	Range	
Fe	48	79	75	75	80	75	21	10.5	8.9	2/	9.9	6	60 - 90	5	70 - 80	1	-----	
	49	---4/	88	87	---	88	--	75	11.6	---	63							
	49	87	122	97	110	116	16	116	21	2/	99	11	80 - 470	3	80 - 120	1	-----	
	52	---4/	80	95	---	88	--	2/	2/	---	2/							
	52	270	192	258	272	257	20	122	19.2	13.0	52.6	4	10 - 260	5	230 - 280	17	250 - 300	
	53	---4/	240	270	300	278	--	10.0	2/	80.2	63.2							
	53	630	610	617	519	554	42	14.1	24.2	225	184	5	590 - 630	6	580 - 650	19	10 - 630	
	56	---4/	640	630	641	639	--	2/	2/	31.3	2/							
HCO <sub>3</sub>	56	844	840	815	710	761	66	15.7	50	330	253	5	820 - 860	4	740 - 840	12	10 - 900	
	56	---4/	820	820	872	846	--	20.0	2/	58	48.4							
	57	343	342	344	369	358	25	17.2	18.2	27.6	26.7	6	320 - 370	5	320 - 360	14	340 - 440	
	57	---4/	377	360	387	376	--	25.2	2/	80.8	46.9							
Hg	50	23.7	23.8	24.7	21.5	23.4	2.5	2.3	3.8	5.5	4.2	24	20 - 27	29	20 - 35	24	1.0 - 28	
	51	72.7	68.5	74.3	69.7	70.6	5.7	14.0	1.6	15.1	12.3	24	20 - 79	21	71 - 77	26	60 - 78	
	54	24.5	26.9	28.6	23.5	26.5	2.5	3.1	5.1	5.7	5.2	27	20 - 33	37	23 - 40	29	17 - 28	
	55	122	120	122	122	122	3.5	4.8	2.3	4.7	3.8	20	114 - 126	26	120 - 131	26	114 - 127	
K	48	7.3	5.0	4.6	6.7	5.0	0.77	0.39	3.4	2/	2.4	4	4.5 - 5.4	5	0.6 - 7.5	1	-----	
	49	.68	.55	.97	.70	.65	.19	.13	.57	2/	.29	11	.4 - .8	3	.5 - 1.6	1	-----	
	52	.62	.63	.52	.65	.61	.10	.15	.04	0.23	.18	3	.5 - .8	5	.5 - .6	10	.4 - 1.2	
	52	---4/	.50	-----	2.1	1.9	----	2/	-----	3.8	2/							
	53	2.08	1.80	2.20	2.08	2.06	.26	.34	.24	.73	.57	4	1.6 - 2.3	6	1.9 - 2.6	12	1.1 - 4.1	
	53	---4/	1.60	-----	1.53	1.54	----	2/	-----	.96	2/							
	56	1.67	1.35	1.55	1.56	1.50	.35	.17	.21	.33	.26	4	1.2 - 1.5	4	1.3 - 1.8	7	1.1 - 2.0	
K	56	---4/	1.50	-----	1.50	1.50	----	2/	-----	.20	2/							
	57	2.25	1.40	2.24	2.10	1.97	.38	.22	.25	.29	.42	4	1.2 - 1.7	5	2.0 - 2.6	7	1.6 - 2.4	
	50	11.8	12.1	12.1	11.6	11.9	0.5	0.34	0.86	2.2	1.4	24	12 - 13	29	11 - 15	24	1.1 - 12	
	51	3.84	4.7	3.8	4.0	4.2	.38	2.6	.11	.23	1.6	24	3.8 - 13	20	3.7 - 4.0	26	3.9 - 4.1	
	54	7.69	7.8	7.7	8.0	7.8	.53	.49	.27	.81	.56	27	7.4 - 10	37	7.1 - 8.5	29	7.5 - 12	
K	55	2.39	2.3	2.3	2.3	2.3	.30	.53	.10	.06	.39	20	0 - 2.4	26	2.2 - 2.7	26	2.2 - 2.5	
	58	.92	.90	-----	.80	.85	.15	2/	-----	2/	2/	1	-----	-----	-----	1	-----	

Constituent	SRWS No.	SRWS mean	Mean concentration			Standard deviation			Atl			Alb			Den			
			Atl	Alb	Den	C.L. mean	SRWS	Atl	Alb	Den	C.L. mean	No. of det'n	Range	No. of det'n	Range	No. of det'n	Range	
Li	48	52	57	.57	60	57	5	5.2	5.8	2/	4.8	6	50 - 60	3	50 - 60	1	-----	
	---4/	53	---	---	53	---	5.8	---	---	2/	2/	12	110 - 120	1	-----	1	-----	
	49	110	113	110	120	113	5	5.8	2/	2/	2/	2/	12	110 - 120	1	-----	1	-----
	---4/	110	100	---	100	---	2/	2/	2/	2/	2/	2/	2/	2/	2/	2/	2/	
	52	86	83	75	84	83	7	5.8	2/	5.2	5.9	3	.80 - .90	2	.70 - .80	10	.80 - .90	
	---4/	77	---	72	73	---	5.8	---	7.2	6.7	5.9	5.1	5	200 - 220	3	200 - 210	12	210 - 240
	53	218	210	207	219	215	15	7.1	5.8	7.9	8.9	5	200 - 220	3	200 - 210	12	210 - 240	
	---4/	200	---	---	2/	---	2/	---	---	2/	2/	2/	2/	2/	2/	2/	2/	
Mg	56	338	336	335	336	336	13	5.5	2/	5.3	5.1	5	330 - 340	2	330 - 340	7	330 - 340	
	---4/	303	---	347	329	---	11.5	---	5.0	7.8	5.0	5.0	5	330 - 340	2	330 - 340	7	330 - 340
	57	163	165	160	175	168	8	5.5	.2	14	11	6	160 - 170	4	0	6	160 - 200	
	---4/	153	---	167	160	---	11.6	---	5.8	11.0	5.8	11.0	6	160 - 170	4	0	6	160 - 200
	50	27.2	28.0	27.3	26.4	27.2	1.6	0.6	1.0	5.4	3.1	24	.27 - .29	29	.25 - .29	24	1.4 - 29	
	51	6.57	8.90	6.51	6.53	7.24	.61	6.5	.31	.33	4.0	24	6.2 - 28	20	6.0 - 7.1	26	6.3 - 6.9	
	54	59.5	61.2	59.8	58.2	59.7	2.0	1.8	4.2	6.4	4.6	27	55 - 64	37	52 - 78	29	27 - 64	
	55	13.7	13.9	13.6	13.9	13.8	.7	.63	.49	.63	.74	20	13 - 15	26	13 - 14	26	13 - 15	
Mn	58	2.02	1.80	-----	1.90	1.8	.18	2/	---	2/	2/	1	-----	--	-----	1	-----	
	48	261	250	248	280	252	13	8.9	13	2/	13.4	6	240 - 260	5	240 - 270	1	-----	
	---4/	260	247	---	253	-----	10	12	---	12	12	12	12	12	12	12	12	
	49	162	151	157	170	153	12	18	5.8	2/	16	11	100 - 160	3	150 - 160	1	-----	
	---4/	155	155	---	155	---	2/	2/	2/	2/	2/	2/	2/	2/	2/	2/	2/	
	52	36	32.5	32.0	38.0	35.3	7	9.6	4.5	4.2	6.1	4	20 - 40	5	30 - 40	10	30 - 40	
	---4/	36.7	30.0	32	33	-----	5.8	2/	7.3	5.4	5.4	5	190 - 210	6	0	12	200 - 230	
	53	204	198	200	211	205	12	8.4	.3	10	9.9	5	190 - 210	6	0	12	200 - 230	
Mn	---4/	200	195	177	184	-----	2/	2/	86	2/	2/	86	2/	2/	2/	2/	2/	
	56	60	56	60	63	60	7	8.9	0	4.9	6.3	5	40 - 60	4	0	7	60 - 70	
	---4/	67	60	62	64	-----	5.8	2/	5.0	5.2	5.2	5	40 - 60	4	0	7	60 - 70	
	57	104	98	102	104	102	7	4.1	4.8	5.4	5.2	6	90 - 100	5	100 - 110	7	100 - 110	
	---4/	103	105	117	109	-----	5.8	2/	5.8	8.4	8.4	6	90 - 100	5	100 - 110	7	100 - 110	

Analytical range

Analytical range

Constituent	Mean concentration						Standard deviation						At1			Alb			Den	
	SRWS No.	SRWS mean	At1			C.L. mean	SRWS	At1			C.L. mean	No. of det'n	Range		No. of det'n	Range		No. of det'n	Range	
			At1	Alb	Den	C.L. mean		At1	Alb	Den	C.L. mean	No. of det'n	Range	Range		Range	Range		Range	
Mo	48	14.6	16.0	18.2	14.0	17.2	3.2	1.4	1.0	2/	1.7	6	14	- 18	10	17	- 20	1	-----	
	---	4/	15.0	21.0	---	16.5	---	2.6	2/	---	2/	11	50	- 65	7	56	- 74	1	-----	
	49	56.5	56.4	68.0	60.0	60.9	4.6	6.1	5.8	2/	8.0	11	50	- 65	7	56	- 74	1	-----	
	---	4/	50.5	70.0	---	57.0	---	2/	2/	---	2/	11	9.0	- 12	9	9.0	- 11	11	8.0- 10	
	52	10.2	10.3	9.9	9.2	9.6	2.6	1.5	.8	0.8	.9	3	9.0	- 12	9	9.0	- 11	11	8.0- 10	
	---	4/	9.7	---	9.0	9.2	---	1.2	---	.9	1.0	11	28	- 39	11	30	- 40	11	30- 40	
	53	38.4	31.6	33.5	32.2	32.8	9.3	1.7	4.0	2.9	3.4	5	30	- 34	17	28	- 39	11	30- 40	
	---	4/	38.0	38.5	30.4	32.6	---	2/	2/	.9	2/	11	27	- 33	7	29	- 40	7	26- 34	
	56	31.0	30.6	35.3	30.3	32.2	3.9	2.9	3.6	2.9	3.8	5	27	- 33	7	29	- 40	7	26- 34	
	---	4/	31.0	---	26.8	28.6	---	2.6	---	2.8	3.4	11	34	- 48	9	38	- 50	7	38- 42	
	57	39.2	39.8	44.2	39.9	41.7	3.3	6.2	5.3	1.5	4.2	5	34	- 48	9	38	- 50	7	38- 42	
	---	4/	36.3	39.0	37.0	37.0	---	3.2	2/	1.0	2.2	11	34	- 48	9	38	- 50	7	38- 42	
Na	50	29.0	28.8	28.8	27.4	28.4	1.9	0.53	0.60	5.6	3.1	24	27	- 29	29	28	- 30	23	2.4- 29	
	51	23.3	23.6	23.5	23.1	23.4	1.6	1.4	.51	.51	.83	24	23	- 28	20	23	- 24	24	23- 24	
	54	144	142	144	142	143	5	4.0	5.4	22.3	12.9	27	140	- 150	26	140	- 160	29	29- 150	
	55	36.8	35.9	36.2	36.7	36.3	1.4	.44	.43	.47	.45	19	34	- 36	26	36	- 37	26	36- 37	
	58	3.22	3.3	---	3.1	3.2	.24	2/	---	2/	2/	1	-----	-----	---	-----	-----	1	-----	
Ni	48	13.0	13.3	13.0	12.0	13.1	4.7	1.6	1.9	2/	1.6	6	11	- 15	5	11	- 15	1	-----	
	---	4/	15.0	13.0	---	13.8	---	2/	2/	---	2/	11	3.0	- 9.0	3	8.0- 10	1	-----		
	49	7.8	7.3	9.0	7.0	7.6	4.2	1.7	1.0	2/	1.6	12	3.0	- 9.0	3	8.0- 10	1	-----		
	---	4/	7.5	9.0	---	8.2	---	2/	2/	---	2/	11	3.0	- 9.0	3	8.0- 10	1	-----		
	52	5.5	5.7	5.8	5.0	5.3	2.3	.58	1.3	1.1	1.1	3	5.0	- 6.0	5	4.0	- 7.0	11	4.0- 7.0	
	---	4/	5.7	6.0	<50	5.8	---	2/	2/	---	2/	11	3.0	- 9.0	3	8.0- 10	1	-----		
	53	21.7	21.0	24.0	19.8	21.2	7.6	1.7	1.6	2.0	2.5	5	18	- 22	6	22	- 26	12	17- 24	
	---	4/	20.5	23.0	<50	21.8	---	2/	2/	---	2/	11	3.0	- 9.0	3	8.0- 10	1	-----		
	56	13.5	9.0	11.5	7.3	8.9	9.6	.71	4.1	.76	2.6	5	8.0	- 10	4	7.0	- 17	7	7.0- 9.0	
	---	4/	12.3	9.0	<50	11.5	---	2/	2/	---	2/	11	3.0	- 9.0	3	8.0- 10	1	-----		
	57	11.3	12.0	14.6	10.9	12.3	9.6	2.2	2.5	1.2	2.4	6	10	- 16	5	12	- 17	7	10- 13	
	---	4/	11.7	16.5	<50	13.6	---	2/	2/	---	2/	11	3.0	- 9.0	3	8.0- 10	1	-----		

Analytical range

Constituent	Mean concentration						Standard deviation						At1			Alb		
	SRWS No.	SRWS mean	At1	Alb	Den	C.L. mean	SRWS	At1	Alb	Den	C.L. mean	No. of det'n	Range	No. of det'n	Range	No. of det'n	Range	
$\text{NO}_2 + \text{NO}_3 - \text{N}$	50	1.08	1.15	1.12	1.25	1.17	0.10	0.08	0.04	0.09	0.09	24	1.1 - 1.4	28	1.1 - 1.2	23	1.1 - 1.5	
	51	.46	.53	.48	.53	.52	.11	.18	.01	.16	.14	24	.4 - 1.1	18	.46 - .50	26	.1 - .93	
	54	1.64	1.82	1.80	1.97	1.86	.16	.04	.04	.13	.11	27	1.8 - 1.9	36	1.7 - 1.9	29	1.8 - 2.3	
	55	.13	.19	.22	.27	.23	.06	.05	.02	.27	.07	20	.17 - .23	25	.20 - .27	26	.20 - .62	
	58	---	.13	---	.18	.16	---	2/	---	2/	2/	1	---	---	---	1	---	
Pb	48	47.5	47.2	46.6	46.0	46.8	6.8	1.0	3.4	2/	2.2	6	46 - 49	5	43 - 52	1	-----	
	---4/	46.3	47.7	-----	47.0	-----	2.1	.58	-----	1.55	-----	-----	-----	-----	-----	-----	-----	
	49	24.1	23.0	26.0	22.0	23.5	5.8	5.6	3.6	2/	5.1	12	7.0 - 28	3	23 - 30	1	-----	
	---4/	24.0	27.5	-----	25.8	-----	2/	2/	-----	2/	-----	-----	-----	-----	-----	-----	-----	
	52	11.1	7.7	7.4	8.0	7.8	7.1	.58	.55	1.34	1.1	3	7.0 - 8.0	5	7.0 - 8.0	11	6.0 - 11	
	---4/	8.0	11.0 <100	9.8	-----	-----	2/	2/	-----	2/	-----	-----	-----	-----	-----	-----	-----	
	53	41.3	40.6	40.2	37.0	38.6	9.7	2.0	4.5	1.9	3.2	5	39 - 44	6	34 - 45	12	34 - 40	
	---4/	40.0	37.0 <100	38.5	-----	-----	2/	2/	-----	2/	-----	-----	-----	-----	-----	-----	-----	
	56	19.6	15.8	12.0	12.0	13.2	14.4	1.8	1.8	1.2	2.3	5	14 - 18	4	10 - 14	7	11 - 14	
	---4/	17.0	13.0 <100	16.0	-----	-----	2/	2/	-----	2/	-----	-----	-----	-----	-----	-----	-----	
	57	20.0	18.2	18.4	16.7	17.7	7.3	2.2	1.1	4.4	3.0	6	14 - 20	5	17 - 20	7	7.0 - 20	
	---4/	19.0	19.0 <100	19.0	-----	-----	2/	2/	-----	2/	-----	-----	-----	-----	-----	-----	-----	
	59	16.8	22.0	---	19.0	20.0	4.8	2/	---	2/	2/	1	-----	-----	-----	2	0	
Se	48	34.8	42.8	31.4	35.0	36.9	25.3	5.4	5.2	2/	7.5	5	34 - 47	5	23 - 36	1	-----	
	---4/	35.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
	49	15.5	15.4	18.7	15.0	16.3	10.9*	4.5	6.4	2/	4.8	7	6.0 - 19	3	14 - 26	1	-----	
	---4/	18.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
	52	3.9	4.7	5.0	3.8	4.3	1.5	0.58	.71	0.87	0.93	3	4.0 - 5.0	5	4.0 - 6.0	11	2.0 - 5.0	
	---4/	4.0	-----	4.3	4.3	-----	2/	-----	-----	.82	2/	-----	-----	-----	-----	-----	-----	
	53	36.6	47.8	38.5	40.6	41.3	14.2	1.7	5.2	3.1	4.7	4	46 - 50	6	33 - 48	12	35 - 47	
	---4/	47.0	-----	41.8	42.3	-----	2/	-----	-----	2.7	2/	-----	-----	-----	-----	-----	-----	
	56	7.3	10.0	8.0	7.9	8.5	1.3	.01	2.0	1.1	1.5	4	0	4	7 - 11	7	6.0 - 9.0	
	---4/	8.5	-----	7.2	7.7	-----	2/	-----	-----	2.7	2/	-----	-----	-----	-----	-----	-----	
	57	5.4	6.8	6.6	6.0	6.4	2.4	2.2	1.1	.58	1.4	6	3.0 - 9.0	5	5.0 - 8.0	7	5.0 - 7.0	
	---4/	4.5	-----	6.7	5.8	-----	2/	-----	-----	1.2	2/	-----	-----	-----	-----	-----	2	2.0 - 3.0
	59	3.5	5.0	---	2.5	3.3	.9	2/	---	2/	2/	1	-----	-----	-----	-----	-----	

Analytical range

Constituent	Mean concentration						Standard deviation						At1		Alb		Den	
	SRWS No.	SRWS mean	At1	Alb	Den	C.L. mean	SRWS	At1	Alb	Den	C.L. mean	No. of det'n	Range	Np. of det'n	Range	Np. of det'n	Range	
			At1	Alb	Den	At1		At1	Alb	Den	Range	Range		Range	Range	Range		
SiO <sub>2</sub>	50	7.88	8.2	8.3	7.6	8.1	0.81	0.17	0.18	0.48	0.45	24	7.8-	8.5	29	7.6-	8.7	
	51	10.7	10.7	11.1	9.8	10.5	1.0	1.0	.44	2.1	1.5	24	7.8-	12	21	10 -	12	
	54	11.2	11.5	12.0	10.9	11.5	.7	.51	.17	.94	.76	27	11 -	12	37	11 -	12	
	55	6.99	6.9	7.4	6.9	7.1	.80	1.6	.14	.35	.90	20	0 -	7.5	26	7.0-	7.6	
	58	6.48	---	---	6.2	2/	.49	---	---	2/	2/	2/	-----	-----	-----	-----	1	
SO <sub>4</sub>	50	99.9	96.0	99.0	98.3	97.8	4.0	1.8	2.3	17.3	9.8	24	92 -	99	29	97 -	110	
	51	68.9	70.2	69.8	68.9	69.6	2.6	10.8	1.3	9.3	7.5	24	63 -	100	20	66 -	71	
	54	537	539	544	519	535	20	14	13	84	49	27	520 -	570	37	500 -	560	
	55	56.9	53.8	55.3	57.5	55.7	9.5	2.3	1.7	10.0	4.9	19	52 -	56	26	49 -	58	
	58	13.5	12.0	----	12.0	12.0	2.2	2/	----	2/	2/	1	-----	-----	-----	-----	1	
Sp. Cond.	50	669	684	683	1124	821	31.1	5.2	15.9	2189	2/	24	676 -	695	29	650 -	734	
	51	305	341	307	307	319	9.7	107	4.4	4.8	2/	24	306 -	691	21	300 -	316	
	54	1631	1656	1615	1616	1627	42	9.8	246	188	2/	27	1630 -	1670	37	170 -	1720	
	55	468	472	471	453	459	15.7	8.9	11	93	186	20	442 -	480	27	442 -	486	
	58	61	99	----	97	----	5.2	2/	----	2/	2/	1	-----	-----	-----	-----	1	
Sr	50	653	667	637	631	648	94	39.3	25.0	124.	89	23	600 -	750	4	600 -	650	
	51	236	294	250	247	272	33	128	2/	13	96	24	230 -	700	1	-----	20	
	54	1430	1456	1567	1376	1424	130	70	208	148	129	27	1400 -	1600	3	1400 -	1800	
	55	355	355	367	417	388	25	93	23	210	160	17	340 -	420	6	320 -	380	
	58	69	70.0	----	70.0	70.0	3	2/	----	2/	2/	-----	-----	-----	-----	-----	-----	
Zn	48	432	437	438	430	437	26	21	8.4	2/	15	6	400 -	460	5	430 -	450	
	49	447	335	----	337	----	2/	2/	----	2/	2/	12	40 -	350	3	330 -	340	
	49	345	315	337	340	321	18	88	5.8	2/	76	1	-----	-----	1	-----	-----	
	52	330	335	----	332	----	2/	2/	----	2/	2/	3	170 -	180	5	160 -	170	
	52	173	173	166	164	166	10	5.8	5.5	9.7	8.5	5	700 -	780	6	700 -	730	
	53	167	165	140	152	----	23	2/	69	52	2/	5	160 -	190	4	0	7	
	53	738	738	712	726	725	74	29	12	16	20	5	700 -	780	6	700 -	730	
	56	715	700	720	710	----	2/	2/	0	3.8	8.1	5	160 -	190	4	0	7	
57	187	180	190	189	186	20	12	0	2/	2/	2/	5	30 -	40	5	30 -	40	
	36	197	190	200	198	----	7	5.5	4.5	0	4.3	6	30 -	40	7	0	0	
	40	40	40	40	40	----	2/	2/	2/	2/	2/	-----	-----	-----	-----	-----	-----	

3/ No mean for SRWS determined.

4/ Total determinations.

1/ Concentration units are not consistent with USGS policy. 2/ Not calculated because of insufficient data.