UNITED STATES GOVERNMENT

memorandum

DA… November 1, 1978

REPLY TO ATTN OF: Linda Friedman, WRD, MS-407, Lakewood, CO

SUBJECT: WATER QUALITY - Quality Assurance

TO: Analytical Services Coordinator, WRD, MS-412, Reston, VA

Enclosed is the inorganic quality assurance report for January through June, 1978. Tables and graphs were prepared under my direction by Greg Darlington who also carried out most of the statistical tests employed in writing this report.

The computer programs used in the preparation of this report are in the process of being revised. Hopefully, by the beginning of 1979, most of the tables will be fully prepared by the computer and, by the middle of 1979, a number of statistical tests will be automatic.

I expect to develop a means of utilizing the SAS programs in looking at this data and in looking at the quality assurance data from contractor laboratories. I also hope to apply the SAS multiple regression program to aquifer or basin data in WATSTORE in order to develop and program quality assurance "limits" for constituents.

Linda Friedman

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Hydrologist

cc w/encl:
- Chief, Denver Central Laboratory
- Chief, Atlanta Central Laboratory
- Regional Research Hydrologist, CR
- L. J. Schroder
- M. J. Fishman ✓
- V. J. Janzer
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INORGANIC QUALITY ASSURANCE REPORT FOR THE CENTRAL LABORATORIES

January 1 - June 30, 1978

INTRODUCTION

The inorganic quality assurance program is based heavily on "blind" reference samples (or samples submitted to the laboratory via the district offices) and on central laboratory unknowns (or reference samples submitted as unknowns to the laboratory by the laboratory management). In either case, the analyst does not know which samples are reference samples and in the case of the blind samples the laboratory management also does not know which samples are reference samples.

The blind sample results tabulated are "first time" results. They are likely to be worse than regular water analyses would be since they have not undergone the routine quality control checks which all analyses must undergo (e.g. anion/cation balance), checks which would have caught many of the errors. The central laboratory unknown results, on the hand, are "final" results; however, since the laboratory is informed immediately (via computer) about all errors in these analyses, it is possible that these analyses are slightly better than regular analyses.

Each inorganic laboratory section also uses reference materials to monitor its daily work. EPA reference material are relied on quite heavily on the sections in monitoring nutrient analyses. No effort was made to tabulate such data here (the data is available in the laboratory sections).

Radiochemical analyses are performed only by the Denver Central Laboratory. The radiochemical section participates regularly in the EPA quality assurance crosscheck programs.

RESULTS

Table 1 summarizes the blind sample results. Theoretically, 68.27% of the results should be within ± one standard deviation, 95.45% should be within ± two standard deviations, and 99.73% should be within ± three standard deviations.

Figures 1 through 31 graphically depict the blind sample results. If every result reported were the theoretical result, all results would be along the 0 line; the graphs not only show visually the scatter of results summarized in table 1, but also show trends, or bias, in results.

Table 2 is a summary of results from central laboratory unknowns (also called "in-house" samples). Results indicated to be "total" or "total recoverable" are actually those of dissolved reference samples which have undergone any additional treatment required for the analyses of a total or total recoverable constituent (e.g. acid digestion).

Table 3 shows data from a precipitation study, conducted by the U.S. Department of Energy (DOE), in which the Atlanta laboratory participated. Since only a preliminary report has been issued by DOE, data in this table is subject to change.

Table 4 lists analyses of uranium and alpha and beta radioactivity for subsamples of a natural water sample. These subsamples were submitted during a two month period as unknowns along with the inorganic central laboratory unknowns. The mean, standard deviation, and relative deviation (coefficient of variation) is shown.

Results from the EPA reference crosscheck program are included in tables 5 and 8. Gross alpha radioactivity, gross beta radioactivity, radium-226, strontium-89, strontium-90, and tritium results are summarized in table 5, while table 8 lists data from the analyses of a "mixed" sample.

The means and differences of duplicate analyses of radium-226 and uranium are tabulated in table 6 and table 7 respectively.

CONCLUSIONS

Alkalinity - Results from both the blind samples and central laboratory unknowns appear excellent.

The Atlanta laboratory results for samples A and B of the DOE precipitation study appear high. In fact, the sample B result was rejected by DOE prior to computing the interlaboratory mean (note that only four other labs reported data). It seems probable that no special precautions were taken in titrating these samples and that a simple titration to a pH 4.5 ws made.

Aluminum - One Atlanta blind sample result is -3.68 standard deviations, another is -3.01 standard deviations, and one Denver result is -3.80 standard deviations from the mean. The results from the Denver Central laboratory's unknowns appear to have a negative bias with a less than 5 percent chance that the bias is random; however, this apparent bias is based on the over-all means of only 5 reference samples. The Atlanta unknowns seem positively biased, but the bias is not statistically significant unless the single 180 ug/L result is considered to be a mean.

Antimony - Results are generally excellent.

Arsenic - Results are generally excellent; however a slight negative trend may be developing in Atlanta.

Barium - One Atlanta blind sample result is -7.00 standard deviations. The results from the Denver Central Laboratory unknowns appear to have greater single-laboratory standard deviations than would be expected when compared to the multilaboratory standard deviation data.

Beryllium - Results are generally excellent.

Boron - Results are generlly excellent. However, no blind samples were analyzed by either laboratory, and only thirteen central laboratory unknowns were analyzed in Denver.

Bromine - Results are limited, but generally excellent.

Cadmium - Results for blind and central laboratory unknown samples appear generally excellent, although the single laboratory standard deviations appear somewhat large. The Atlanta result for sample H of the DOE precipitation study is obviously in error.

Calcium - One Atlanta blind sample result was +4.21 standard deviations (29 mg/L was reported instead of 24 mg/L). Results for other blind samples and for Central laboratory unknowns appear generally excellent.

The Atlanta results for the DOE precipitation study show a positive bias (with a less than 5 percent chance that the bias is due to random causes) when compared to the interlaboratory results. Further investigation into analyses of low concentrations is probably necessary (Note: that the calcium concentrations are very low with the interlaboratory means ranging from about .04 to 2.07 mg/L).

Cesium-134 - Data from precipitation in the EPA crosscheck of May 1978 (table 8) looks very good.

Chloride - Results appear generally excellent.

Chromium - One Denver blind sample result was +12.18 standard eviations (55 µg/L was reported instead of 9 µg/L). The other blind samples appear to show a negative bias.

The Atlanta results from the central laboratory unknowns appear negatively biased with a less than 5 percent chance that this bias is random. Although this apparent bias is based on the means of only 4 reference samples, it is a continuation of the negative trend reported for the Atlanta quality assurance data for 1977.

All results reported by Atlanta for the DOE precipitation samples were 0 µg/L. Assuming that the method used was the atomic absorption, chelation extraction procedure, a 1 µg/L should have been reported instead. Use of an alternative procedure (such as graphite furnace - atomic absorption) should be considered for future work of this type.

Cobalt - One Atlanta result was -3.43 standard deviations from the mean. There appears to be a general negative bias on the blind sample results and the Denver results from the central laboratory unknowns are also negatively biased with a less than 5 percent chance that the bias is random (based on means of 5 reference samples). This bias is a continuation of the negative trend reported for the Denver quality assurance data for 1977.

Cobalt-60 - Data from participation in the EPA cross-check of May 1978 (table 8) indicates a positive bias.

Copper - Atlanta reported a blind sample result which was -8.09 standard deviations (5 µg/L was reported instead of 107 µg/L because of a mispunched value). Denver reported 0 mg/L instead of 191 mg/L for a blind sample result. (Since this is -10.23 standard deviations, the Denver response message "Std curve linear-absorbance normal-stds ok" seems somewhat inadequate). The Central laboratory unknown results reported by the Denver laboratory show greater single-laboratory standard deviations than would be expected from the multi-laboratory standard deviations.

Fluoride - Denver reported a blind sample result of -5.09 standard deviations due to a clogged electrode (after cleaning the electrode, all samples were rerun). All other results appear good, however, there is a continuation of the slight negative bias reported for the Atlanta quality assurance data for 1977.

Gross alpha radioactivity - The replicate samples submitted as weekly unknowns (Table 4) show a sudden shift in the mean: The originally established values were 3.5 ± 1.1 µg/L as U natural. Last summer's results were 3.32 ± .67 µg/L, but this summer's results are 2.24 ± 43 µg/L. The reason for this shift should be investigated.

The bias in the EPA cross-check program (tables 5 and 8) is due to EPA's distribution of americium rather than uranium. This discrepancy has been elaborated on by Vic Janzer (Janzer, Victor J., 1978, Discordant gross radioactivity measurements of natural and treated waters).

Gross beta radioactivity - The replicate samples submitted as weekly unknowns (table 4) show a sudden shift in the mean: The originally established values were 3.0 ± 0.5 pCi/L as Cs-137, last summer's results were 3.06 ± 0.27 pCi/L and this summer's results are 2.31 ± .21. The reason for this shift should be investigated.

Data from the EPA cross-check program are generally excellent, but appear to show a slight positive bias.

Iodine - Results from the Denver Central Laboratory unknowns appear excellent. No other results were reported.

Iron - One Atlanta blind sample was +16.53 standard deviations and one Denver sample was -7.23 standard deviations. There appears to be a positive bias in both the blind sample results (also reported in 1977) and in the central laboratory unknown results.

The results reported by Atlanta for the DOE precipitation study all appear very good except that < 10 µg/L should have been reported for samples B and C rather than 0 µg/L.

Lead - Although a wrong value was initially punched for one Atlanta blind sample resulting in +47.18 standard deviations, all other blind and unknown reference sample values appear generally excellent. It should be noted, however, that while neither dissolved nor total recoverable unknown sample values are "in error", the means of the total recoverable values for the Denver laboratory do show a statistically significant positive bias with respect to the means of the Denver dissolved results (or vice versa); the reason for this bias should probably be investigated.

The Atlanta results for the DOE precipitation study appear generally good, although the zero reported for sample H is questionable.

Lithium - Results appear generally excellent.

Magnesium - One Atlanta blind sample value was -11.60 standard deviations due to an accidental update of the analyses. All other blind sample results are under 2 standard deviations; however, the Denver results seem positively biased. The central laboratory unknown results appear generally excellent.

As in the case of calcium, the Atlanta magnesium results for the DOE precipitation study show a positive bias for these low Mg concentration samples (means are .009 to .464 mg/L).

Manganese - Results appear generally excellent.

Mercury - Blind sample results seem negatively biased, and one result reported by Denver was -3.45 standard deviations (1.6 μg/L was reported instead of 3.5 μg/L). It should be noted that the inadequacy of acid alone to preserve mercury has been the subject of a number of studies and may well be responsible for this apparent bias.

The central laboratory unknown means for reference sample 59 appear even lower than the means reported for 1977 and are significantly lower than the SRWS mean. Deterioration of the mercury concentration in this sample appears possible. (It should be noted, however, that in the original SRWS round-robin, Atlanta, reported 0.3 μg/L and Denver reported 0.5 μg/L.) The central laboratory means for reference sample 61 and the Denver mean for reference sample 63 are also lower than the SRWS means; however, the mean of 61 is not much different than in 1977 and 63 was not analyzed last year.

Molybdenum - Atlanta reported one blind sample result which was -6.12 standard deviations because of a mispunched value. Other results appear generally good.

Nitrogen, nitrite and nitrate - There were no blind samples and Denver did not analyze any SRWS as unknowns (EPA reference materials are used in both laboratories, with records maintained by the section chief). The Atlanta results appear quite good. Although the DOE mean for sample D of the precipitation study was 4600 ug/L (Atlanta reported 7400 ug/L), it should be noted that thirteen of the twenty laboratories reported values in excess of 5,500 ug/L while the other seven laboratories reported values less than 1,400.

pH - Atlanta appears to have a positive bias in the results reported for the DOE precipitation study. This bias is not evident in the results for the central laboratory unknowns which appear generally excellent for both laboratories. (It is interesting to note, however, that both labs did show a positive bias last year.)

Phosphorus - Except for the result reported by Atlanta for sample H of the DOE precipitation study, all results are quite good.

Potassium - Results are generally excellent.

Radium-226 - Combining the duplicate analyses data in table 6 with the duplicate data reported for 1977, it appears that there is an average difference of .0445 pCi/L between .01 and 1.0 pCi/L and an average difference of .30 pCi/L for duplicate means greater than or equal to 1.0 pCi/L, but less than 10 pCi/L. These values were used to develop tentative control charts, figures 32 and 33.

Data from EPA cross-check program appear generally excellent.

Selenium - Results are generally excellent.

Silica - Results are generally excellent. Atlanta did report one blind result which was -4.26 standard deviations from the mean (6.7 mg/L was reported instead of 11 mg/L), but all other blind results were less than one standard deviation. Blind sample results do, however, seem to indicate a slightly positive bias.

Silver - Denver reported one blind sample result which was -5.64 standard deviations (0 µg/L reported instead of 2 µg/L) and another which was -3.76 standard deviations (0 µg/L reported instead of 11 µg/L).

Reference sample 63 should be watched closely in the future to see if Ag is stable in it. Lack of stability seems possible in looking at the central laboratory unknown results; however, it should be noted that in the original SRWS round-robin in October 1977, Denver reported 4 µg/L and Atlanta reported 10 µg/L.

Sodium - Results are generally excellent.

Solids, dissolved - Results are generally excellent.

Specific conductance - Results are generally excellent. The positive bias in blind sample results which was evident in 1977 appears to be continuing and also seems apparent in Atlanta's DOE results.

Strontium - Results are generally excellent.

Strontium-89 - Results from the EPA cross-check program (tables 5 and 8) are generally excellent.

Strontium-90 - Results from the EPA cross-check program (tables 5 and 8) are generally excellent.

Tritium - Results from the EPA cross-check program (tables 5 and 8) are generally excellent.

Uranium - The replicate samples submitted as weekly unknowns (table 4) show a positive shift in the mean: the originally established values were 2.1 ± 0.4 µg/L, last summer's results were 2.24 ± .35 µg/L, and this summer's results are 2.96 ± .34. The reason for this change should be investigated.

Duplicate analyses (table 7) appear good, but are too few to reach any conclusions.

Vanadium - The Atlanta results for the DOE precipitation study are low compared with the interlaboratory means, but most are within one standard deviation. (It should be noted that both these DOE means and the SRWS means for 60 and 62 are based on results from a limited number of laboratories.)

Zinc - Results appear generally excellent.

Carbon, organic - Although not an inorganic constituent, analyses are reported here which were part of the DOE precipitation study. The results from sample E and H appear questionable and look like they may be dilution or calculation errors. (For sample E, Atlanta reported 6.5 mg/L with other labs reporting 2.1 mg/L, 1.8 mg/L, 2.4 mg/L, and 3.2 mg/L; for sample H, Atlanta reported 2.2 mg/L with other labs reporting 20 mg/L, 18.1 mg/L, and 19. mg/L).

SUMMARY

Specific conductance and chloride both showed significant improvement in precision of blind sample results with respect to last year. Copper results, however, continue to show larger single laboratory standard deviations than would be expected when compared to the interlaboratory values as do the Denver results for barium.

The biases evident in last years results for beryllium, cadmium, and molybdenum are no longer evident; however, nickel results still show a negative bias as do Atlanta's chromium and fluoride results and Denver's cobalt results. Furthermore, it appears that biases may be developing in data for aluminum and iron. It should also be noted that nickel and lead "total recoverable" means appear greater than "dissolved" means. (Although the difference is certainly not great, possible contamination from the acid digestion should be considered if the biases grow larger.)

It seems possible that mercury in reference sample 59 is not remaining stable. The silver in reference sample 63 may also not be stable or the original mean may be incorrect. More data is necessary to determine if these stability problems are real.

The sample used as an unknown reference material for uranium and alpha and beta radioactivity has rather suddenly shown a change in concentration. The reason for this change should be investigated.

The precipitation analyses reported by Atlanta for the DOE study indicated further work needs to be done in analyzing low concentrations of calcium and magnesium. Both pH and conductance also showed a positive bias. It is obvious that the pH 4.5 end-point which was probably used for alkalinity is inadequate. This study also points out the need to take care in reporting values which are less than the detection level: a "< detection level" should be used rather than "O".

TABLE 1.--BLIND SAMPLE SUMMARY

January 1 - June 30, 1978

Determination	Percent of "blind" results which are ≤1 standard deviation	≤2 standard deviations	≤3 standard deviations
Alkalinity	100	100	100
Aluminum	56	67	67
Antimony	50	100	100
Arsenic	78	89	100
Barium	67	78	89
Beryllium	43	71	100
Cadmium	56	78	100
Calcium	82	91	91
Chloride	73	82	100
Chromium	44	56	89
Cobalt	67	89	89
Copper	56	67	78
Fluoride	82	82	91
Iron	33	67	78
Lead	89	89	89
Lithium	56	100	100
Magnesium	82	91	91
Manganese	78	100	100
Mercury	29	43	86
Molybdenum	71	86	86
Nickel	44	89	100
Potassium	100	100	100
Selenium	89	100	100
Silica	90	90	90
Silver	44	67	78
Sodium	73	91	100
Solids residue on evaporation at 180°C	75	75	100
Specific conductance	38	75	100
Strontium	50	75	100
Sulfate	55	82	100
Zinc	89	100	100

TABLE 2.--1/78-6/78

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* No.
Alkalinity (mg/L)	26.7 ± 3.1	21	25.72 ± 2.29	72	25.63 ± 3.14	37	25.81 ± 1.00	37	58 d
	70.1 ± 5.7	22	70.03 ± 3.19	70	68.30 ± 2.28	30	71.32 ± 3.18	40	62 d
	100.1 ± 2.9	19	------	--	96.00 ± 4.00	4	-----	--	55 d
	158.6 ± 10.9	29	159.72 ± 1.68	72	159.31 ± 2.59	29	160.00 ± 0	43	60 d
Aluminum (μg/L)	74 ± 19	16	77.1 ± 24.4	22	89.2 ± 15.6	12	62.5 ± 25.7	10	61 d
			72.1 ± 33.3	9	75.0	2	71.3 ± 35.6	7	t
	138 ± 38	17	137.8 ± 36.0	9	180.0	1	132.5 ± 34.5	8	63 d
			112.9 ± 55.3	7	100.0	1	115.0 ± 60.3	6	t
	190 ± 27	13	180.0 ± 21.8	9	186.7 ± 15.3	3	176.7 ± 25.0	6	56 d
			------	-	-----	-	203.3 ± 15.3	3	t
	318 ± 35	14	342.1 ± 38.1	19	366.7 ± 22.4	9	320.0 ± 36.2	10	59 d
			338.0 ± 19.3	10	353.3 ± 23.1	3	331.4 ± 14.6	7	t
	373 ± 59	13	370.7 ± 38.9	14	410.0 ± 60.8	3	360.0 ± 25.3	11	57 d
							398.6 ± 33.9	7	t
Antimony (μg/L)	1.8 ± 1.0	4	-----	--	-----		2.13 ± 1.25	8	63 d
	4.5 ± 1.3	4	5.21 ± .80	14	5.75 ± .50	4	5.00 ± .82	10	61 d
	20.3 ± .6	3	20.36 ± 1.43	11	21.00	1	20.30 ± 1.49	10	59 d
			-----	--	-----	-	19.86 ± .69	7	t

[a] = number of laboratories.

[b] = number results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Arsenic (μg/L)	2.5 ± .9	15	2.14 ± 1.04	22	1.83 ± .94	12	2.50 ± 1.08 2.43 ± .98	10 7	61 d t
	5.4 ± 1.3	11	4.64 ± 1.74 5.00 ± 1.69	14 8	2.67 ± 1.15 2.00	3 1	5.18 ± 1.47 5.43 ± 1.27	11 7	57 d t
	14.3 ± 4.9	12	12.00 ± 4.12	9	8.00 ± 4.35	3	14.0 ± 2.28 14.50 ± 1.91	6 4	56 d t
	20.2 ± 2.7	9	19.42 ± 4.06	19	18.44 ± 4.67	9	20.30 ± 3.43 20.00 ± 1.53	10 7	59 d t
	36.9 ± 14.8	18	38.56 ± 9.54	9	23.00	1	40.50 ± 8.07 37.17 ± 5.67	8 6	63 d t
Barium (μg/L)	100 ± 50	10	122.2 ±83.3 ----------	9 --	133.3 ±57.7 ------------	3 -	116.7 ±98.3 75.0 ±50.0	6 4	56 d t
	200 ± 30	18	227.7 ±68.5 233.3 ±86.6	22	200.0 ± 0 200.0	12 2	250.1 ±97.2 242.9 ±97.6	10 7	61 d t
	299 ± 42	18	311.1 ±60.1 271.4 ±48.8	9 7	300.0 300.0	1 1	312.5 ±64.1 266.7 ±51.6	8 6	63 d t
	560 ± 50	14	500.0 ±137.4 518.2 ± 60.3	19 11	533.3 ±50.0 500.0 ± 0	9 4	470.0 ±182.9 528.6 ± 75.6	10 7	59 d t
	790 ± 60	10	814.3 ± 66.3 ----------	14 --	800.0 ± 0 ------------	3 --	818.2 ± 75.1 742.9 ± 78.7	11 7	57 d t

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Beryllium (μg/L)	10 ± 5	11	9.1 ± 2.9	22	10.0 ± 0	12	8.0 ± 4.2	10	61 d
			6.7 ± 7.1	9	10.0	2	5.7 ± 7.9	7	t
	11 ± 3	10	9.5 ± 2.3	19	10.0 ± 0	9	9.0 ± 3.2	10	59 d
			9.1 ± 5.4	11	10.0 ± 0	4	8.6 ± 6.9	7	t
	18.6 ± 2.0	11	20.0 ± 0	9	20.0	1	20.0 ± 0	8	63 d
			-------------	--	---------	--	20.0 ± 0	6	t
	30 ± 6	6	28.9 ± 3.3	9	30.0 ± 0	3	28.3 ± 4.1	6	56 d
							30.0 ± 10.0	3	t
	62 ± 12	6	62.1 ± 5.8	14	70.0 ± 0	3	60.0 ± 4.5	11	57 d
			62.5 ± 4.6	8	70.0	1	61.4 ± 3.8	7	t
Boron (μg/L)	35 ± 30	10	19.7 ± 17.2	24	20.1 ± 17.41	23	10.0	1	62 d
	50 ± 29	8	-------------	--	35.0 ± 5.8	4	-----------	--	55 d
	324 ± 40	12	321.6 ± 23.0	37	314.0 ± 24.3	25	337.5 ± 6.2	12	60 d
Bromine (μg/L)	.362 ± .079	4	.407 ± .080	15	.400 ± .082	4	.409 ± .083	11	60 d
	.550 ± .312	4	.400 ± .100	3	.45	2	.30	1	62 d

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Cadmium (µg/L)	2.4 ± .6	24	2.62 ± 1.20	21	2.45 ± .69	11	2.80 ± 1.62	10	61 d
			3.00 ± 2.12	9	1.0	2	3.57 ± 2.07	7	t
	4.4 ± .9	21	4.26 ± 1.15	19	4.33 ± 1.58	9	4.20 ± .63	10	59 d
			3.73 ± 1.74	11	2.25 ± 1.50	4	4.57 ± 1.27	7	t
	6.6 ± 2.1	19	5.43 ± .85	14	5.33 ± .58	3	5.45 ± .93	11	57 d
			5.13 ± 2.23	8	1.0	1	5.71 ± 1.60	7	t
	9.9 ± 1.8	19	8.22 ± 2.39	9	8.33 ± .58	3	8.17 ± 2.99	6	56 d
							8.00 ± 2.31	4	t
	14.9 ± 2.1	24	12.78 ± 1.48	9	14.0	1	12.63 ± 1.51	8	63 d
			12.43 ± 1.99		15.0	1	12.00 ± 1.79	6	t
Calcium (µg/L)	11.6 ± .7	21	11.78 ± .54	72	11.91 ± .56	35	11.65 ± .48	37	58 d
	26.7 ± 1.4	26	26.43 ± .99	70	26.67 ± 1.09	30	26.25 ± .87	40	62 d
	36.0 ± 1.8	22	------------	--	37.25 ± .50	4	------------	--	55 d
	72.4 ± 3.0	35	73.00 ± 3.25	73	72.80 ± 1.73	30	73.14 ± 4.00	43	60 d
Chloride (mg/L)	1.71 ± .70	21	1.78 ± .23	73	1.76 ± .29	36	1.79 ± .14	37	58 d
	8.76 ± 2.22	25	8.14 ± .35	70	8.11 ± .34	30	8.16 ± .36	40	62 d
	48.9 ± 1.9	24	----------	--	48.75 ± .50	4	-----------	--	55 d
	58.0 ± 1.7	30	57.42 ± 1.36	73	57.17 ± 1.02	30	57.60 ± 1.55	43	60 d

[a] = number of laboratories.
b = number of results.
* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Chromium, hexavalent (µg/L)			1.00 ± 2.24	5	0.0 ±	2	1.67 ± 2.89	3	61 d
			--------------	-	------------	--	2.40 ± 2.19	5	57 d
			2.75 ± 3.20	4	5.0	1	2.0 ± 3.46	3	59 d
			3.67 ± 3.51	3	0.0	1	5.5	2	63 d
Chromium (µg/L)	10.0 ± 1.2	14	4.71 ± 4.55	14	7.00 ± 2.00	3	4.09 ± 4.91	11	57 d
			11.88 ± 9.23	8	30.0	1	9.29 ± 6.07	7	t
	7.2 ± 2.2	16	8.44 ± 6.06	9	6.0	1	8.75 ± 6.41	8	63 d
			-------------	--	-----------	--	10.00 ± 6.32	6	t
	14.9 ± 3.0	23	15.24 ± 4.12	21	12.27 ± 1.85	11	18.50 ± 3.37	10	61 d
			18.33 ± 7.91	9	25.0	2	16.43 ± 7.48	7	t
	30.3 ± 5.2	20	25.95 ± 4.34	19	24.78 ± 3.63	9	27.00 ± 4.83	10	59 d
			29.00 ± 5.68	10	23.33 ± 5.77	3	31.43 ± 3.78	7	t
	39.2 ± 9.9	19	36.89 ± 5.64	9	37.33 ± 7.77	3	36.67 ± 5.16	6	56 d
			--------------	--	-------------	--	40.0 ± 0	4	t
Cobalt (µg/L)	4.8 ± 1.3	15	4.67 ± 1.53	21	5.45 ± .93	11	3.80 ± 1.62	10	61 d
			3.78 ± 1.79	9	5.0	2	3.43 ± 1.90	7	t
	5.8 ± .7	9	5.53 ± .84	19	5.56 ± 1.13	9	5.50 ± .53	10	59 d
			5.09 ± 2.17	11	5.50 ± 3.32	4	4.86 ± 1.46	7	t
	7.7 ± .8	7	6.50 ± 2.59	14	8.67 ± 1.15	3	5.91 ± 2.59	11	57 d
			-------------	--	------------	--	7.29 ± .76	7	t
	11.7 ± 1.4	7	10.33 ± 1.80	9	12.00 ± 1.73	3	9.50 ± 1.22	6	56 d
			-------------	--	------------	--	11.25 ± .96	4	t
	14.8 ± 3.0	12	13.11 ± 1.76	9	15.0	1	12.88 ± 1.73	8	63 d
			11.86 ± 3.08	7	16.0	1	11.17 ± 2.71	6	t

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Copper (µg/L)	62. ± 8	28	60.8 ± 19.0	9	56.0 ±	1	61.4 ± 20.2	8	63 d
			57.3 ± 6.2	7	57.0	1	57.3 ± 6.7	6	t
	110 ± 5	25	106.4 ± 7.7	22	106.3 ± 5.7	12	106.6 ± 9.9	10	61 d
			98.9 ± 28.5	9	115.0	2	94.3 ± 31.0	7	t
	196 ± 8	19	190.0 ± 10.0	9	193.3 ± 11.6	3	188.3 ± 9.8	6	56 d
			-------------	--	-------------	--	190.0 ± 5.8	4	t
	239 ± 17	19	229.5 ± 41.8	19	240.0 ± 15.8	9	220.0 ± 55.4	10	59 d
			236.4 ± 10.3	11	232.5 ± 5.0	4	238.6 ± 12.2	7	t
	320 ± 14	21	323.6 ± 19.9	14	330.0 ± 10.0	3	321.8 ± 21.8	11	57 d
			330.0 ± 10.7	8	350.0	1	327.1 ± 7.6	7	t
Fluoride (µg/L)	.78 ± .08	19	-------------	--	.70 ± 0.00	4	-------------	--	55 d
	.80 ± .06	25	.78 ± .08	70	.72 ± .05	30	.83 ± .05	40	62 d
	.84 ± .10	27	.81 ± .12	73	.74 ± .06	30	.86 ± .13	43	60 d
	.92 ± .07	17	.92 ± .08	72	.86 ± .05	35	.98 ± .06	37	58 d
Iodine (µg/L)	.0540 ± .0043	4					.0544 ± .0005	12	60 d
	estimated mean (.20)						.24	1	62 d

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION $\pm$ STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Iron (µg/L)	40 $\pm$ 13	22	46.8 $\pm$ 11.1	19	43.3 $\pm$ 8.7	9	50.0 $\pm$ 12.5	10	59 d
			86.0 $\pm$ 31.3	10	100.0 $\pm$ 36.1	3	80.0 $\pm$ 30.0	7	t
	93 $\pm$ 17	23	97.6 $\pm$ 23.2	21	97.3 $\pm$ 19.0	11	98.0 $\pm$ 28.2	10	61 d
			97.8 $\pm$ 10.9	9	100.0	2	97.1 $\pm$ 11.1	7	t
	117 $\pm$ 14	27	125.6 $\pm$ 12.4	9	110.0	1	127.5 $\pm$ 11.7	8	63 d
							111.7 $\pm$ 11.7	6	t
			352.1 $\pm$ 14.2	14	360.0 $\pm$ 10.0	3	350.0 $\pm$ 14.8	11	57 d
	343 $\pm$ 25	23	388.8 $\pm$ 55.2	8	380.0	1	390.0 $\pm$ 59.4	7	t
	844 $\pm$ 66	23	868.9 $\pm$ 29.4	9	900.0 $\pm$ 30.0	3	853.3 $\pm$ 12.2	6	56 d
			-------------	--	-------------	--	860.0 $\pm$ 26.5	3	t
Lead (µg/L)	4.9 $\pm$ 3.5	18	3.22 $\pm$ 1.79		7.0	1	2.75 $\pm$ 1.16	8	63 d
			------------	--	---	--	5.33 $\pm$ 2.42	6	t
	10.6 $\pm$ 3.9	20	10.62 $\pm$ 2.48	21	11.18 $\pm$ 2.79	11	10.00 $\pm$ 2.05	10	61 d
			11.22 $\pm$ 4.44	9	9.5	2	11.71 $\pm$ 4.99	7	t
	19.6 $\pm$ 14.4	19	12.78 $\pm$ 3.77	9	11.33 $\pm$ 1.53	3	13.50 $\pm$ 4.46	6	56 d
			-------------	--	-------------	--	14.25 $\pm$ .96	4	t
	20.0 $\pm$ 7.3	18	16.43 $\pm$ 4.38	14	17.33 $\pm$ 3.06	3	16.18 $\pm$ 4.77	11	57 d
			17.13 $\pm$ 1.64	8	15.0	1	17.43 $\pm$ 1.51	7	t
	16.8 $\pm$ 4.8	18	20.11 $\pm$ 3.14	19	21.89 $\pm$ 3.44	9	18.50 $\pm$ 1.78	10	59 d
			18.73 $\pm$ 3.69	11	18.75 $\pm$ 6.50	4	18.71 $\pm$ 1.25	7	t

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Lithium (µg/L)	32 ± 4	14	32.7 ± 4.6	22	30.0 ± 0.0	12	36.0 ± 5.2	10	61 d
			31.1 ± 3.3		30.0	2	31.4 ± 3.8	7	t
	56 ± 5	12	57.9 ± 5.4	19	55.6 ± 5.3	9	60.0 ± 4.7	10	59 d
			57.3 ± 4.7	11	55.0 ± 5.8	4	58.6 ± 3.8	7	t
	163 ± 8	6	159.0 ± 46.2	13	163.3 ± 5.8	3	157.7 ± 53.2	10	57 d
			----------	--	----------	--	165.7 ± 5.4	7	t
	220 ± 11	15	228.9 ± 6.0	9	220.0	1	230.0 ± 5.4	8	63 d
			----------	--	----------	--	223.3 ± 10.3	6	t
	338 ± 13	6	344.4 ± 7.3	9	343.3 ± 5.8	3	345.0 ± 8.4	6	56 d
			----------	--	----------	--	345.0 ± 5.8	4	t
Magnesium (mg/L)	2.02 ± .18	18	1.96 ± .11	72	1.90 ± .08	35	2.01 ± .10	37	58 d
	6.74 ± .25	26	6.81 ± .25	70	6.62 ± .13	30	6.95 ± .21	40	62 d
	13.7 ± .7	23	----------	--	14.0 ± 0.0	4	----------	--	55 d
	15.4 ± 1.0	31	15.79 ± .50	73	15.53 ± .51	30	15.98 ± .41	43	60 d
Manganese (µg/L)	40 ± 6	23	45.0 ± 26.1	22	40.8 ± 5.2	12	50.0 ± 38.9	10	61 d
			40.0 ± 0	8	40.0	2	40.0 ± 0	6	t
	60 ± 7	22	58.9 ± 3.3	9	56.7 ± 5.8	3	60.0 ± 0.0	6	56 d
			----------	--	----------	--	60.0 ± 0.0	4	t
	104 ± 7	21	100.7 ± 4.8	14	100.0 ± 0.0	3	100.0 ± 5.4	11	57 d
			101.3 ± 9.9	8	110.0	1	100.0 ± 10.0	7	t
	158 ± 10	22	157.4 ± 8.1	19	153.3 ±10.0	9	161.0 ± 3.2	10	59 d
			157.3 ± 9.1	11	157.5 ± 9.6	4	157.1 ± 9.5	7	t
	253 ± 22	26	251.1 ± 16.2	9	240.0	1	252.5 ± 16.7	8	63 d
			248.6 ± 9.0	7	240.0	1	250.0 ± 9.0	6	t

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Mercury	.62 ± .23	14	.23 ± .25	12	.55	2	.17 ± .23	10	59 d
µg/L)			-----------	--	-----------	--	.09 ± .15	7	t
	1.97 ± .37	15	1.60 ± .26	22	1.71 ± .14	12	1.46 ± .31	10	61 d
			-----------	--	-----------	--	1.41 ± .21	7	t
	1.67 ± .35	11	1.61 ± .38	8	1.55 ± .40	2	1.63 ± .44	6	56 d
			-----------	--	-----------	--	1.48 ± .05	4	t
	2.25 ± .38	10	2.21 ± .32	14	2.33 ± .06	3	2.17 ± .36	11	57 d
			-----------	--	-----------	--	2.23 ± .29	7	t
	4.68 ± 1.07	17	3.00 ± .67	9	4.0	1	2.88 ± .59	8	63 d
			-----------	--	-----------	--	2.83 ± .54	6	t
Molybdenum	2.0 ± .7	5	1.68 ± .58	19	1.56 ± .53	9	1.80 ± .63	10	59 d
(µg/L)			2.18 ± 1.08	11	1.75 ± .50	4	2.43 ± 1.27	7	t
	25.8 ± 4.5	10	23.22 ± 3.56	9	21.00	1	23.50 ± 3.70	8	63 d
			23.00 ± 3.10	6	21.00	1	23.40 ± 3.29	5	t
	31.0 ± 3.9	6	30.33 ± 3.28	9	29.33 ± 1.53	3	30.83 ± 3.92	6	56 d
			-----------	--	-----------	--	32.00 ± 3.00	3	t
	39.2 ± 3.3	6	37.07 ± 2.73	14	36.33 ± 4.73	3	37.27 ± 2.24	11	57 d
			-----------	--	-----------	--	37.71 ± 8.48	7	t
	43.4 ± 9.5	10	44.05 ± 4.54	21	45.00 ± 4.00	11	43.00 ± 5.08	10	61 d
			45.33 ± 5.17	9	46.50	2	45.00 ± 5.92	7	t
Nickel	5.1 ± 2.5	12	4.05 ± 1.91	22	4.17 ± 1.59	12	3.90 ± 2.33	10	61 d
(µg/L)			5.13 ± 1.81	8	5.00	1	5.14 ± 1.95	7	t
	7.4 ± 3.4	12	5.78 ± 1.39	9	6.00	1	5.75 ± 1.49	8	63 d
			6.43 ± 2.76	7	11.00	1	5.67 ± 2.07	6	t

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Nickel (cont.) (µg/L)	13.5 ± 9.6	14	8.78 ± 4.94 ----------	9 --	8.00 ± 1.00 ----------	3 -	9.17 ± 6.18 10.00 ± 2.16	6 4	56 d t
	11.3 ± 5.8	12	9.43 ± 2.79 10.25 ± 2.76	14 8	10.33 ± 2.08 12.00	3 1	9.18 ± 2.99 10.00 ± 2.89	11 7	57 d t
	10.2 ± 2.9	14	9.68 ± 2.19 11.80 ± 3.58	19 10	10.67 ± 2.69 13.33 ± 1.53	9 3	8.80 ± 1.14 11.14 ± 4.10	10 7	59 d t
Nitrite and nitrate as N (mg/L)**	.021 ± .021**	17			.01 ± .01	30			62 d
	unknown				.15 ± .01	35			58 d
	.13 ± .06**	21			.23 ± .02	4			55 d
	4.86 ± .52**	30			5.18 ± .34				60 d
pH	7.57 ± .19	23	7.55 ± .17	72	7.52 ± .15	35	7.59 ± .19	37	58 d
	7.99 ± .23	27	7.89 ± .16	70	7.59 ± .14	30	7.84 ± .17	40	62 d
	8.30 ± .11	34	8.29 ± .14	73	8.38 ± .10	30	8.22 ± .12	43	60 d
	8.33 ± .10	24	----------	--	8.33 ± .05	4	----------	43	55 d
Phosphorus (mg/L)	.344 ± .032	22			.31 ± .02	29			62 d
	1.48 ± .09	30			1.51 ± .34	28			60 d
Potassium (mg/L)	.92 ± .15	23	.92 ± .09	72	.99 ± .08	35	.87 ± .05	37	58 d
	2.39 ± .30	22			2.25 ± .06	4			55 d
	4.37 ± .41	23	4.42 ± .18	70	4.28 ± .10	30	4.52 ± .14	40	62 d
	5.23 ± .58	35	5.24 ± .32	73	5.02 ± .31	30	5.40 ± .23	43	60 d

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

** = SRWS values given are for nitrate only.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Selenium (µg/L)	2.5 ± 1.7	12	1.89 ± 1.17	9	3.00	1	1.75 ± 1.16	8	63 d
			------------	--	----	-	1.67 ± 1.03	6	g
	3.5 ± .9	11	3.11 ± 1.28	18	3.33 ± 1.50	9	2.89 ± 1.05	9	59 d
			------------	--	-------------	-	2.57 ± .79	7	g
	5.4 ± 2.4	10	6.86 ± 1.56	14	7.33 ± .58	3	6.73 ± 1.74	11	57 d
			6.25 ± 1.28	8	8.0	1	6.00 ± 1.15	7	t
	7.3 ± 1.3	9	9.44 ± 1.81	9	10.33 ± 1.15	3	9.00 ± 2.00	6	56 d
			------------	--	-------------	-	8.25 ± 1.89	4	t
	8.4 ± 2.8	16	11.14 ± 2.29	22	11.42 ± 1.78	12	10.80 ± 2.86	10	61 d
			------------	--	-------------	--	8.00 ± 2.58	7	t
Silica (mg/L)	6.48 ± .49	19	6.84 ± .26	73	6.76 ± .15	36	6.92 ± .32	37	58 d
	6.99 ± .80	14	------------	--	7.25 ± .06	4	-----------	--	55 d
	10.3 ± 1.3	18	10.39 ± .55	70	10.20 ± .41	30	10.54 ± .60	40	62 d
	11.2 ± 1.2	21	11.30 ± .57	73	11.13 ± .35	30	11.42 ± .66	43	60 d
Silver (µg/L)	2.2 ± .4	13	2.21 ± .79	19	2.00 ± .71	9	2.40 ± .84	10	59 d
			2.44 ± .88	9	3.0	2	2.29 ± .95	7	t
	5.0 ± 1.3	11	4.64 ± 1.22	14	5.00 ± 1.73	3	4.55 ± 1.13	11	57 d
			-----------	--	-------------	-	4.71 ± .95	7	t
	6.6 ± 1.2	18	5.27 ± 1.75	22	5.83 ± .83	12	4.60 ± 2.32	10	61 d
			4.11 ± 1.45	9	3.00	2	4.43 ± 1.40	7	t
	9.2 ± 1.1	14	6.00 ± 1.58	9	7.00	1	5.88 ± 1.64	8	63 d
			6.43 ± 3.60	7	9.00	1	6.00 ± 3.74	6	t
	15.3 ± 4.9	14	14.13 ± 3.44	8	13.0	2	14.50 ± 3.99	6	56 d
			------------	-	-------------		9.50 ± 5.45	4	t

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Sodium (µg/L)	3.22 ± .24	21	3.21 ± .18	72	3.34 ± .10	35	3.09 ± .14	37	58 d
	22.0 ± .9	25	21.59 ± .65	70	21.60 ± .62	30	21.58 ± .67	40	62 d
	36.8 ± 1.4	23	------------	--	35.25 ± .96	4	-----------	--	55 d
	74.3 ± 2.5	35	75.23 ± 1.81	73	74.40 ± 1.73	30	75.81 ± 1.64	43	60 d
Solids, residue on evaporation at 180°C (mg/L)	61.0 ± 5.2	20	57.88 ± 6.58	72	60.57 ± 5.38	35	55.32 ± 6.67	37	58 d
	189.3 ± 7.9	19	182.67 ± 5.91	70	186.53 ± 5.78	30	179.78 ± 4.12	40	62 d
	266.6 ± 5.0	17	-----------	--	271.50 ± 5.00	4	-------------	--	55 d
	518.2 ± 15.9	27	507.24 ± 13.52	72	512.76 ±18.42	29	503.51 ± 6.90	43	60 d
Solids, residue, total filterable at 105° C (mg/L)							60.50 ± 1.85	8	58 d
Specific conductance µmhos/cm at at 25°C	96.50 ± 3.9	22	97.92 ± 3.56	72	99.31 ± 3.44	35	96.59 ± 3.18	37	58 d
	300.6 ± 8.3	27	303.59 ± 4.49	70	305.77 ± 2.33	30	301.95 ± 5.01	40	62 d
	467.7 ± 15.7	23	-------------	--	475.50 ± 2.89	4	-------------	--	55 d
	800.3 ± 18.8	30	806.75 ± 8.37	73	812.06 ± 5.20	30	803.04 ± 8.23	43	60 d

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Strontium (µg/L)	69 ± 3	11	74.3 ± 19.4	58	75.7 ± 21.3	35	72.2 ± 16.2	23	58 d
	----------	--	----------	--	80.0	1	----------	--	59 d
	223 ± 19	13	----------	--	210.0	1	----------	--	63 d
			----------	--	200.0	1	----------	--	t
	258 ± 28	11	255.2 ± 29.7	62	250.7 ± 39.7	30	259.4 ± 15.0	32	62 d
	269 ± 46	11	----------	--	258.3 ± 28.2	12	----------	--	61 d
			----------	--	260.0	2	----------	--	t
	355 ± 25	10			337.5 ± 17.1	4			55 d
	523 ± 38	10	528.0 ± 35.2	56	524.3 ± 37.3	30	532.3 ± 32.8	26	60 d
Sulfate (mg/L)	13.5 ± 2.2	18	14.37 ± 1.17	73	14.3 ± .79	36	14.43 ± 1.46	37	58 d
	56.9 ± 9.5	21			54.25 ± .96	4			55 d
	59.7 ± 4.2	22	62.76 ± 1.85	70	63.07 ± 2.32	30	62.52 ± 1.40	40	62 d
	144 ± 8	27	146.85 ± 10.66	73	155.00 ± 6.30	30	141.16 ± 9.31	43	60 d
Vanadium (µg/L)	3.4 ± 1.8	5	2.38 ± .56	6	2.26 ± .53	5	3.00	1	62 d
	10.3 ± 4.5	3	5.37 ± .87	15	6.83 ± .58	3	5.01 ± .43	12	60 d

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

TABLE 2.--1/78-6/78 (Cont.)

MEAN CONCENTRATION ± STANDARD DEVIATION

Constituent	SRWS	#[a]	Both central laboratories	#[b]	Atlanta	#[b]	Denver	#[b]	SRWS* no.
Zinc (µg/L)	36 ± 7	18	36.4 ± 6.3	14	36.7 ± 5.8	3	36.4 ± 6.7	11	57 d
			43.8 ± 7.4	8	40.0	1	44.3 ± 7.9	7	t
	44 ± 9	24	41.8 ± 8.5	22	39.2 ± 6.7	12	45.0 ± 9.7	10	61 d
			42.5 ± 4.6	8	45.0	2	41.7 ± 4.1	6	t
	187 ± 20	21	194.4 ± 29.2	9	180.0 ± 10.0	3	201.7 ± 33.7	6	56 d
							190.0 ± 8.2	4	t
	212 ± 14	27	214.4 ± 11.3	9	200.0	1	216.3 ± 10.6	8	63 d
			207.1 ± 9.5	7	200.0	1	208.3 ± 9.8	6	t
	336 ± 16	22	322.1 ± 12.7	19	320.0 ± 10.0	9	324.0 ± 15.1	10	59 d
			328.9 ± 12.7	9	330.0 ± 0.0	3	328.3 ± 16.0	6	t

[a] = number of laboratories.

[b] = number of results.

* = d = dissolved, t = total or total recoverable.

Table 3.--Department of Energy precipitation study.

		Atlanta Lab	Interlaboratory values		
Constituent	Sample	Value	Mean	± Std. Dev.	#[a]
Bicarbonate (µg/L)	A	8000	3242	4186	3
	B	12000	3398	296	4
	C	3000	5176	3031	6
	D	0	11.0	19.1	3
	E	0	25.0	------	2
	F	0	1.0	1.7	3
	G	0	0	------	2
	H	0	0	------	2
Cadmium (µg/L)	A	1	.5	.3	6
	B	0	.2	.1	6
	C	1	.7	.3	7
	D	0	.3	.2	5
	E	1	1.0	.0	5
	F	1	.8	.2	7
	G	77	75.0	13.7	9
	H	0	107.9	15.0	7
Calcium (µg/L)	A	730	742.2	60.7	20
	B	600	448.6	31.3	18
	C	590	446.6	25.7	17
	D	1300	1051	69	17
	E	2400	2067	270	20
	F	2000	1739	131	16
	G	120	60.2	48.9	17
	H	110	36.4	23.3	13
Carbon, total organic	A	1800	1838	149	4
	B	2000	1963	229	4
	C	2000	1880	217	5
	D	2200	2175	287	4
	E	5400	2375	602	4
	F	2800	1900	718	5
	G	1900	1540	451	5
	H	2200	14850	8470	4

[a]Number of labs reporting accepted values for this sample.

Table 3.--Department of Energy precipitation study.--Continued

Constituent	Sample	Atlanta Lab Value	Interlaboratory values Mean	± Std. Dev.	#[a]
Chloride (μg/L)	A	460	434.4	42.6	13
	B	650	701.2	161.5	19
	C	610	623.9	117.2	19
	D	640	659.7	107.6	18
	E	2500	2134	1145	21
	F	1200	1070	328	19
	G	23000	19990	800	14
	H	20000	18960	890	19
Chromium (μg/L)	A	0	.2	.2	4
	B	0	.2	.2	4
	C	0	.2	.3	4
	D	0	.2	.3	4
	E	0	.8	.8	5
	F	0	1.0	.8	5
	G	0	.2	.3	4
	H	-----	398.5	54.5	6
Iron (μg/L)	A	20	38.8	24.8	9
	B	0	4.9	3.1	6
	C	0	3.6	.5	4
	D	10	18.5	1.8	6
	E	110	113.7	9.7	9
	F	110	110.4	8.5	7
	G	150	155.2	17.4	9
	H	130	145.9	13.8	9
Lead (μg/L)	A	15	11.9	5.5	6
	B	1	1.6	1.3	6
	C	3	2.5	1.8	5
	D	25	18.5	11.3	8
	E	140	113.1	28.6	8
	F	150	138.7	22.4	7
	G	200	200.0	0.0	4
	H	0	3.0	1.8	6

[a]Number of labs reporting accepted values for this sample.

Table 3.--Department of Energy precipitation study.--Continued

Constituent	Sample	Atlanta Lab Value	Interlaboratory values Mean	± Std. Dev.	#[a]
Magnesium (μg/L)	A	200	170.5	16.4	16
	B	170	148.6	13.1	16
	C	170	145.1	13.9	16
	D	320	284.5	27.7	19
	E	520	464.1	28.9	17
	F	460	413.9	42.6	19
	G	30	19.3	6.7	15
	H	20	9.4	6.1	13
Manganese (μg/L)	A	20	16.0	2.3	10
	B	160	147.6	11.7	7
	C	20	14.3	4.1	9
	D	40	25.5	4.9	9
	E	40	32.5	5.8	10
	F	30	29.5	2.7	9
	G	100	91.6	6.1	9
	H	60	53.7	4.7	9
Nickel (μg/L)	A	5	2.5	1.7	4
	B	4	3.8	3.1	4
	C	3	1.6	1.1	4
	D	5	2.4	2.0	4
	E	6	4.5	1.9	4
	F	5	33.0	57.3	4
	G	230	211.1	13.2	8
	H	5	167.2	10.5	6
Nitrogen, Ammonium (μg/L) as NH_4	A	2640	2749	323	18
	B	3350	2809	1262	21
	C	2840	2879	222	16
	D	361	349.8	91.5	14
	E	673	688.3	70.9	16
	F	506	640.4	66.6	15
	G	13	23.2	13.2	15
	H	0	19.9	16.1	13

[a]Number of labs reporting accepted values for this sample.

Table 3.--Department of Energy precipitation study.--Continued

Constituent	Sample	Atlanta Lab Value	Interlaboratory values Mean	± Std. Dev.	#[a]
Nitrogen, Nitrate ($\mu g/L$) as NO_3	A	257	229.4	29.0	16
	B	66	89.2	58.4	16
	C	102	67.3	39.1	17
	D	7400	4600	3332	21
	E	2830	3104	432	19
	F	3650	3316	337	19
	G	57600	54590	2970	16
	H	13300	13200	400	15
pH (mil equivalence per liter)	A	25.12	15.86	6.95	20
	B	1.58	.94	.62	17
	C	.79	.35	.26	20
	D	50.12	30.40	19.98	22
	E	39.81	27.12	7.51	19
	F	50.12	38.89	6.21	18
	G	1259	1374	143	19
	H	794.3	708.0	92.6	20
Phosphorus, Orthophosphate ($\mu g/L$) as PO_4	A	411	402.0	114.0	18
	B	392	381.2	98.8	18
	C	454	468.8	83.1	16
	D	497	445.1	103.1	17
	E	454	462.3	51.1	15
	F	101	117.4	51.5	17
	G	18	14.38	12.09	9
	H	3	28.50	19.26	9
Potassium ($\mu g/L$)	A	750	808.7	33.9	13
	B	500	593.1	56.1	17
	C	500	579.4	55.9	17
	D	560	619.5	33.2	14
	E	110	149.7	70.5	20
	F	80	107.6	48.0	20
	G	10	33.2	27.6	15
	H	200	249.4	108.5	19

[a] Number of labs reporting accepted values for this sample.

Table 3.--Department of Energy precipitation study.--Continued

Constituent	Sample	Atlanta Lab Value	Interlaboratory values Mean	± Std. Dev.	#[a]
Sodium (µg/L)	A	270	234.4	41.6	16
	B	770	728.2	60.3	16
	C	3300	3223	377	18
	D	3900	3828	332	17
	E	630	592.4	51.5	16
	F	450	367.8	44.1	15
	G	50	87.2	41.3	18
	H	10	19.4	10.8	10
Specific conductance (micromhos per cm at 25°C)	A	41	38.7	2.2	18
	B	37	35.2	1.7	17
	C	42	40.9	2.2	18
	D	54	44.8	4.7	17
	E	42	39.5	2.7	18
	F	46	41.7	2.0	17
	G	584	560.4	30.7	16
	H	291	284.9	12.4	15
Sulfate (µg/L)	A	11000	11410	1060	21
	B	7200	7639	519	20
	C	7100	7444	508	19
	D	8700	9033	681	20
	E	5900	6297	368	18
	F	7200	7997	780	21
	G	100	34.6	41.6	6
	H	100	227.8	201.4	12
Vanadium (µg/L)	A	0	6.7	7.9	5
	B	0	11.3	13.7	4
	C	0	4.4	4.7	5
	D	0	2.0	1.4	4
	E	9	7.8	1.5	4
	F	9	9.8	3.1	6
	G	140	167.9	23.0	7
	H	160	202.7	27.0	7

[a]Number of labs reporting accepted values for this sample.

Table 3.--Department of Energy precipitation study.--Continued

Constituent	Sample	Atlanta Lab Value	Interlaboratory values Mean	± Std. Dev.	#[a]
Zinc (µg/L)	A	40	40.9	12.6	9
	B	30	23.7	7.7	9
	C	20	22.1	5.5	8
	D	40	38.4	6.5	7
	E	100	85.6	20.1	10
	F	110	103.1	25.6	10
	G	110	116.6	19.2	10
	H	80	75.8	11.9	10

[a]Number of labs reporting accepted values for this sample.

TABLE 4.--Replicates of Unknown Sample: Gross Alpha and Beta Radioactivity and Uranium

Determination	Date submitted to laboratory									Mean ± Standard Deviation	Relative Deviation
	4/20	4/26	5/1	5/10	5/17	5/22	5/30	6/6	6/22		
Gross alpha radioactivity, dissolved (μg/L as U natural)	1.9	1.8	2.5	2.9	2.1	2.1	2.2	1.8	2.9	2.24 ± .43	19%
Gross beta radioactivity, dissolved (pCi/L as Cs-137)	2.6	2.2	2.2	2.3	2.7	2.2	2.4	2.1	2.1	2.31 ± .21	9%
Uranium, dissolved (μg/L as U)	3.7	3.1	0.0[a]	2.9	2.9	2.7	3.0	2.8	2.6	2.96 ± .34	12%

[a]Outlier, not used in the computation of standard deviation.

TABLE 5.--Radiochemical Determinations

Determination	Theoretical value	Multi-laboratory Mean	Multi-laboratory Standard deviation	Multi-laboratory No. of labs	Denver Central Laboratory Mean	Denver Central Laboratory Standard deviation	Denver Central Laboratory No. of analyses	Denver Central Laboratory Percent relative deviation	Denver Central Laboratory Percent bias (based on theoretical value)	Denver Central Laboratory Percent bias (based on multi-lab value)
Gross alpha radioactivity, dissolved (pCi/L as U natural)	7*	7*	±3*	63	14.07	± 1.26	3	9	+101	+101
	20*	17*	±6*	72	38.10	± 5.90	3	15	+ 91	124
	13*	--	--	--	24.33	± 2.52	3	10	+ 87	---
Gross beta radioactivity dissolved (pCi/L as Sr-90	39	37	±6	61	40.27	± 1.14	3	3	+ 3	+ 9
	29	30	±4	59	32.93	± .76	3	2	+14	+ 10
	18	--	--	--	18.67	± .58	3	3	+ 4	---
Radium-226 (pCi/L)	5.5	4.8	±1.6	23	5.40	± .10	3	2	-2	+12
	3.7	--	--	--	3.50	± .10	3	3	-6	---
Sr-89 (pCi/L)	25	24	±4	26	25.5(24 and 27)		2	--	+ 2	+ 6
	16	19	±9	35	17.25	± 2.50	4	15	+ 8	− 9
Sr-90	31	30	±5	36	30.5(30 and 31)		2	--	-2	+ 2
	27	24	±5	36	26.00	± .82	4	3	- 4	+ 8
Tritium	1680	1742	±203	54	1750	±36	3	2	+ 4	+ .5
	2220	2198	±267	65	2257	±83	3	4	+ 2	+ 3
	970	1008	±197	52	1123	±46	3	4	+16	+ 11
	2270	----	---	--	2353	±25	3	1	+ 4	---

*Based on the americium EPA standard rather than uranium.

TABLE 6.--Duplicate Analyses of Radium 226

Mean (pCi/L)	Difference (pCi/L)
.07	.02
.435	.13
.555	.17
.92	.14
.94	.12
1.14	.02
1.165	.01
1.775	1.09
2.085	.11
2.435	.13
2.805	.35
2.89	.16
3.26	.08
4.01	.72
4.075	.59
4.68	.04
4.735	.07
4.79	.04
4.885	.07
5.67	.48
6.74	.58
7.59	.38
7.745	.07
8.03	1.44
9.765	.01
11.00	.60
16.40	1.40
25.65	1.20
211.00	16.00
350.25	5.10
402.75	19.90

TABLE 7.--Duplicate Analyses of Uranium (μg/L as U)

Mean	Difference
.55	.10
.85	.10
1.15	.10
1.87	.07
2.80	.20
3.40	.20
5.30	.40
6.30	1.00
351.40	11.10

Table 8.--Radioactivity replicates[a]

Determination	Theoretical value	Control limits[b]	Multilaboratory: Mean	Multilaboratory: Standard deviation	Multilaboratory: No. of labs	Denver Central Laboratory: Mean	Denver Central Laboratory: Standard deviation	Denver Central Laboratory: No. of analyses	Denver Central Laboratory: % Relative deviation	Denver Central Laboratory: % Bias (based on theoretical value)	Denver Central Laboratory: % Bias (based on multilab value)
Gross alpha radioactivity (pCi/L as U natural)	20 [c]	15	20[c]	± 7	53	41.3	± 3.8	3	9	+ 107	+ 107
Gross beta radioactivity (pCi/L as Sr-90)	59	15	57	± 10	54	63.7	± 1.2	3	2	+ 8	+ 12
Strontium-89 (pCi/L)	21	15	21	± 3	29	21.7	± .6	3	3	+ 3	+ 3
Strontium-90 (pCi/L)	10	4.5	9	± 1	34	9.0	± 1.0	3	11	- 10	0
Radium-226 (pCi/L)	6.5	3.0	6.0	± 1.7	33	6.47	± .25	3	4	0	+ 8
Tritium (pCi/L)	----	----	106	± 26	31	97.3	± 6.4	3	7	-----	- 8
Cobalt-60 (pCi/L)	20	15	21	± 3	40	25.3	± 1.2	3	5	+ 27	+ 20
Cesium-134 (pCi/L)	15	15	19	± 5	36	18.7	± .6	3	3	+ 25	- 2
Cesium-137 (pCi/L)	0	----	----[d]	------[d]	41	<3	-------[d]	3	--[d]	-----[d]	----[d]

[a]Reported results are corrected for decay as of collection date April 21, 1978.

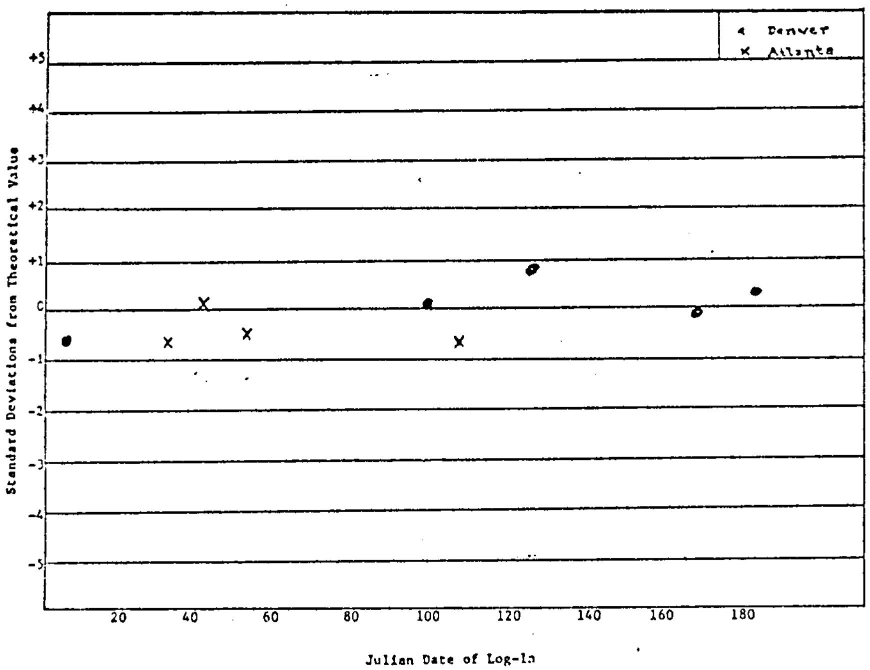
[b]Control Limits are EPA estimations of three standard deviations from the theoretical value.

[c]Value may have been based on Americium Standard rather than U Natural.

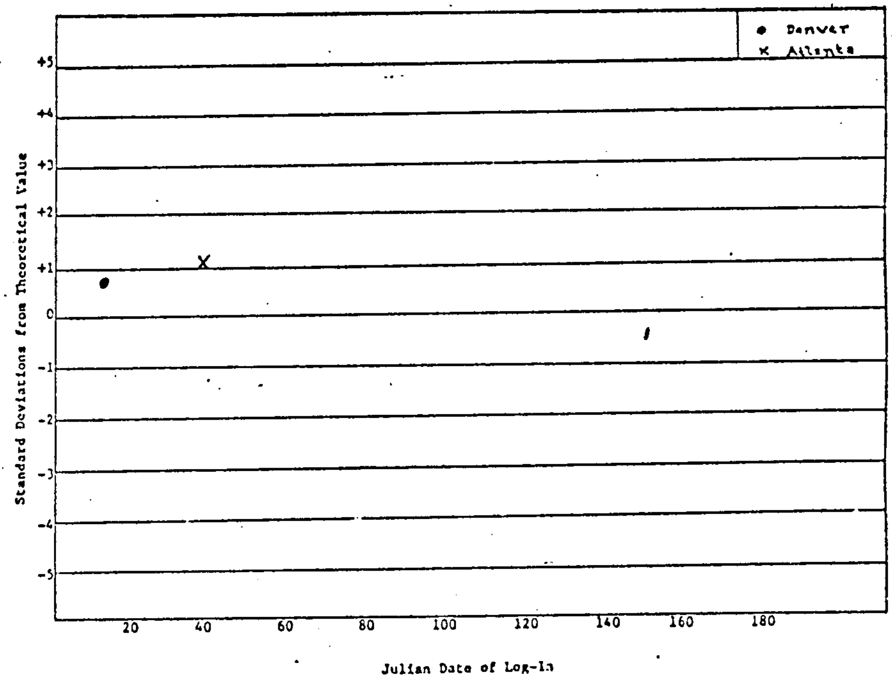
[d]Values not computed because nearly all data reported as zeroes and less than values.

BLIND SAMPLES

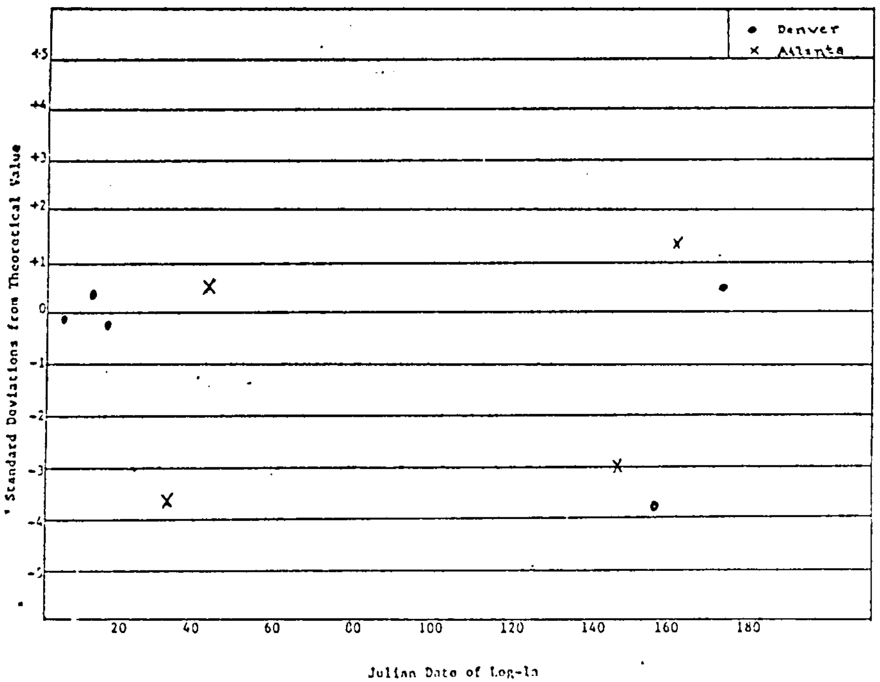
1. ALKALINITY



3. ANTIMONY



2. ALUMINUM



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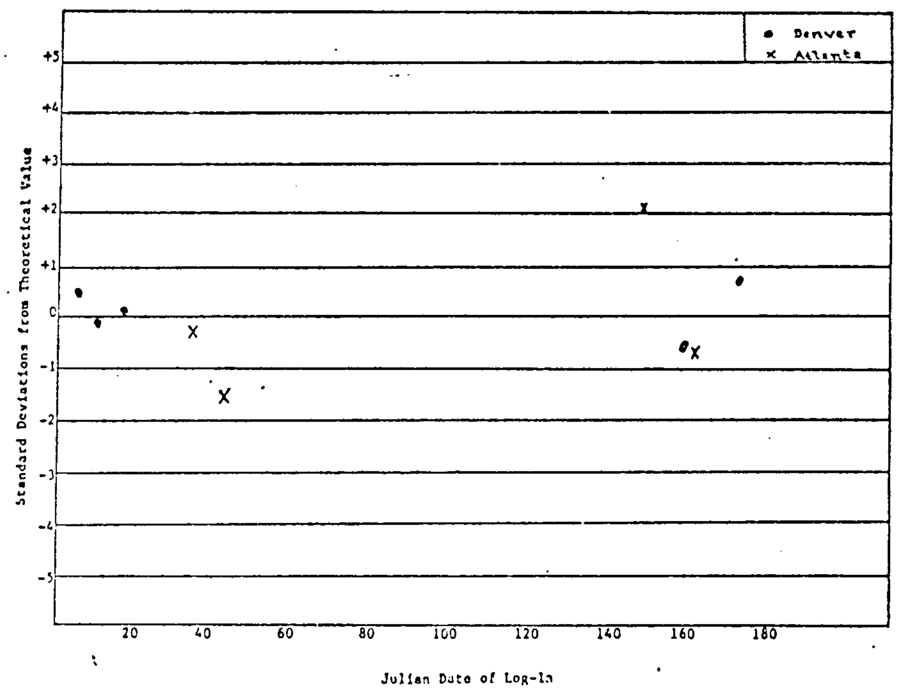

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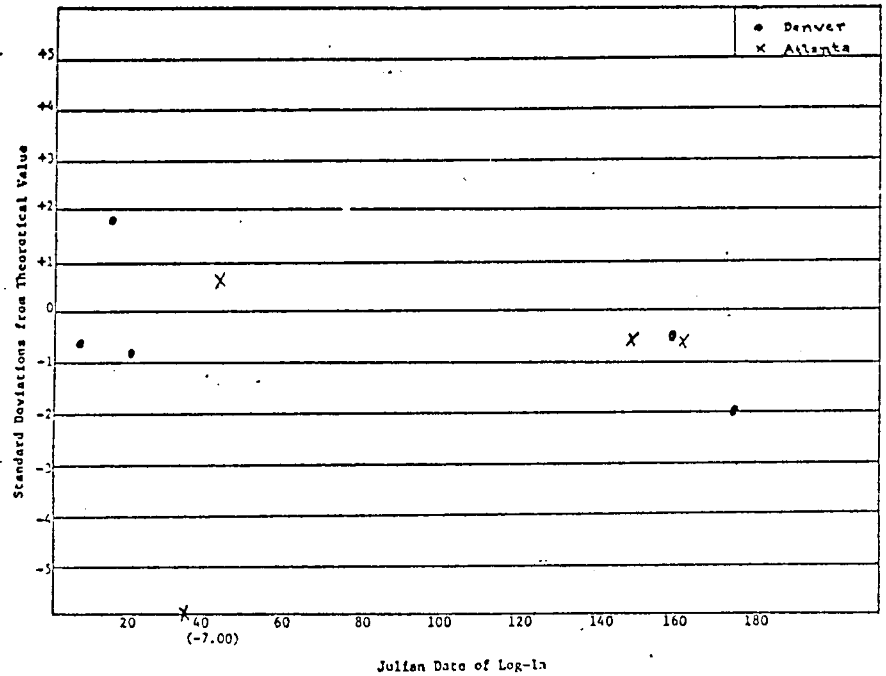
5. BARIUM



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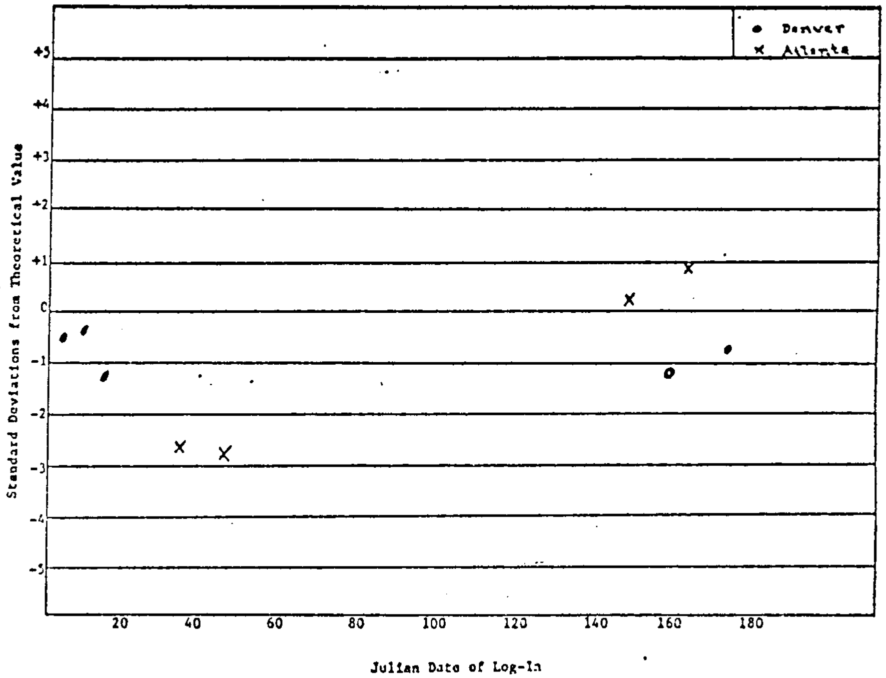

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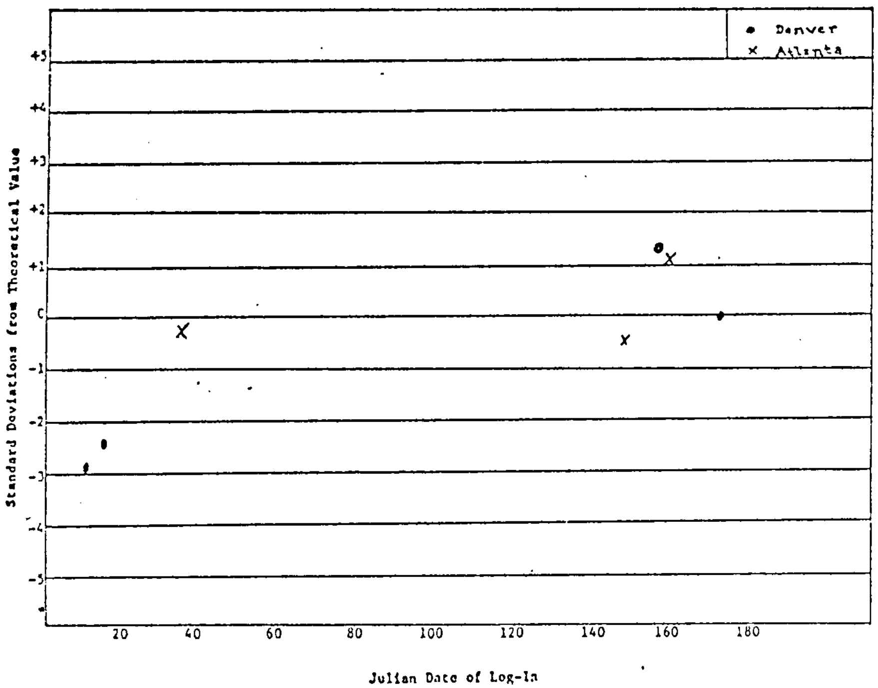

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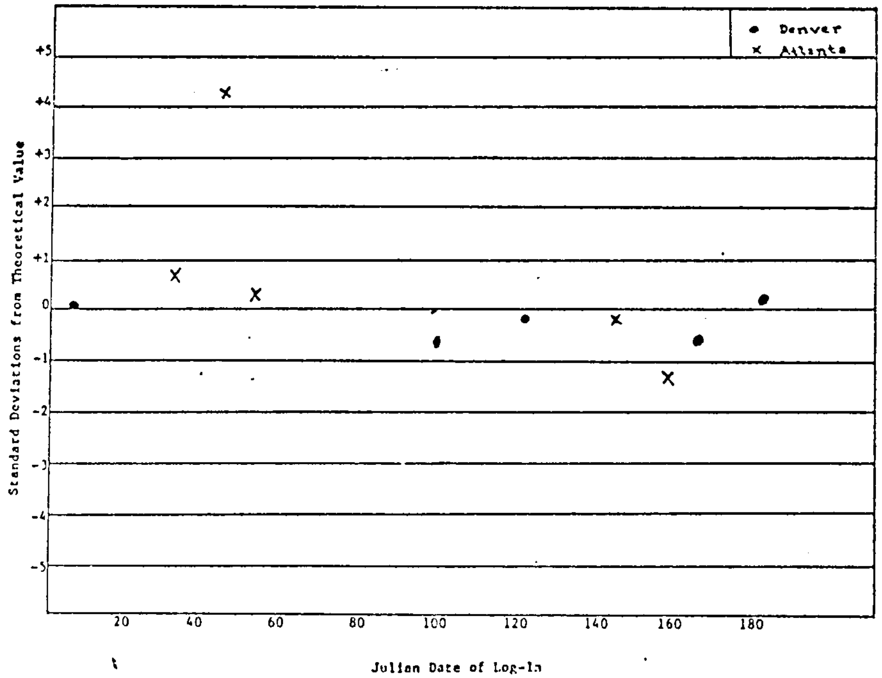

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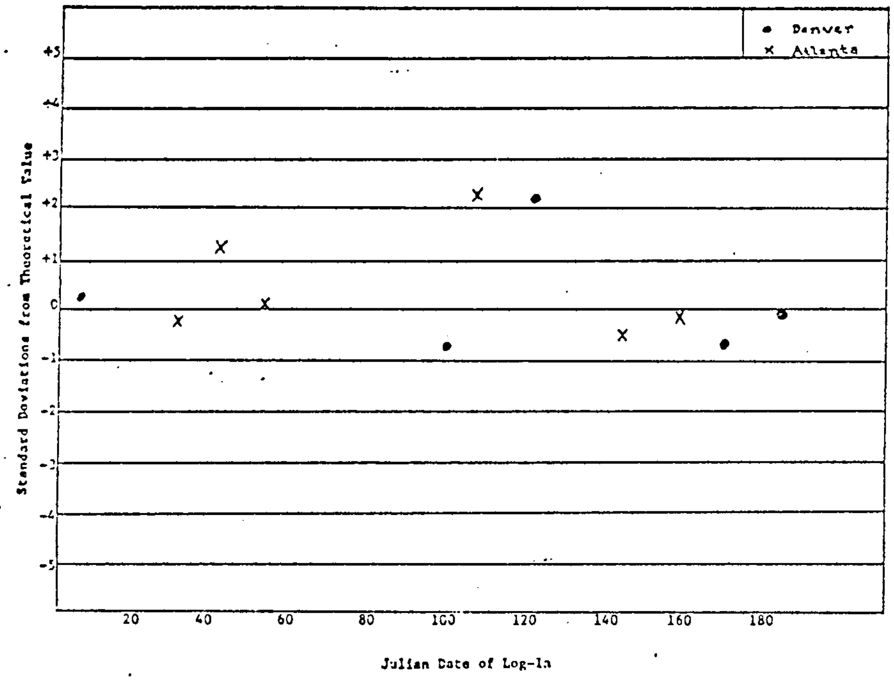

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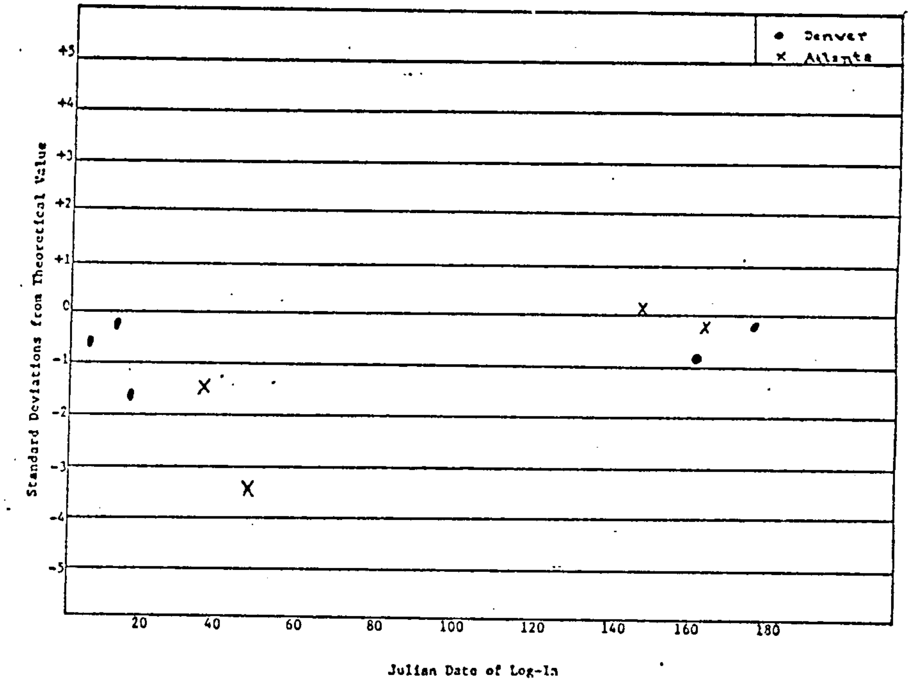

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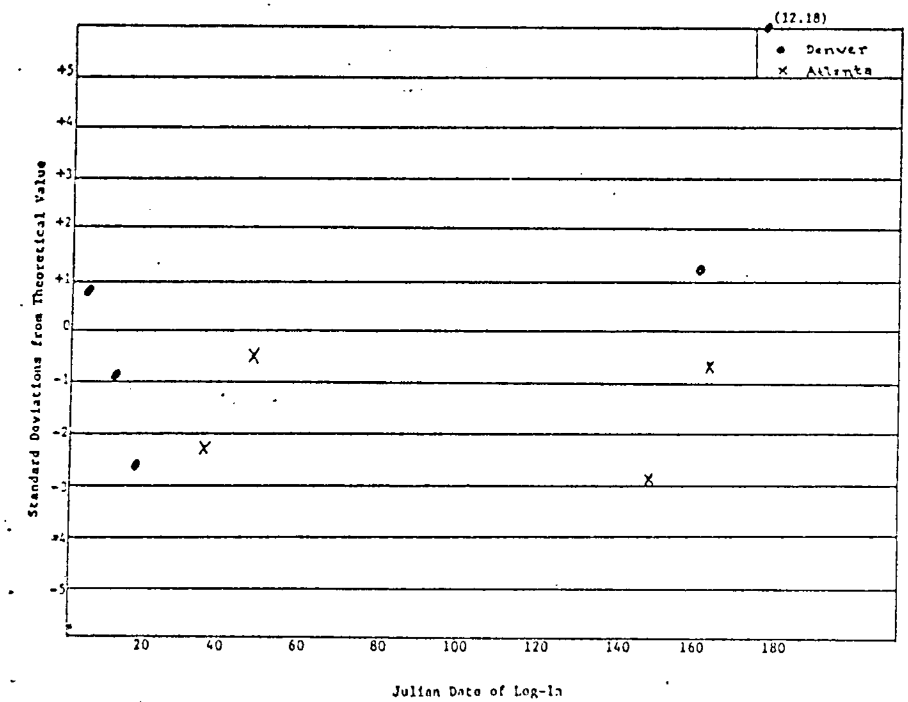

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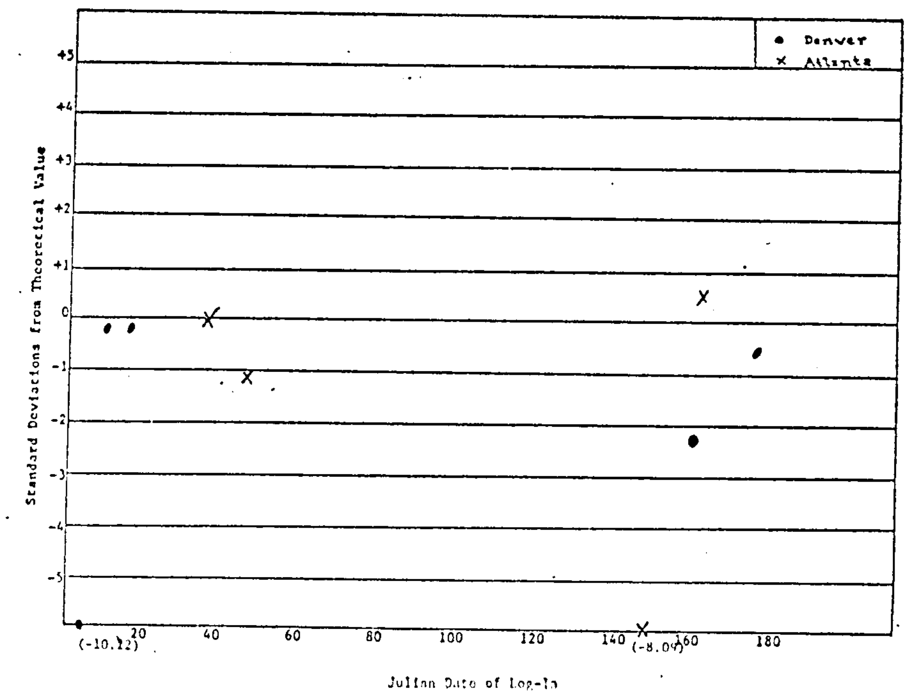

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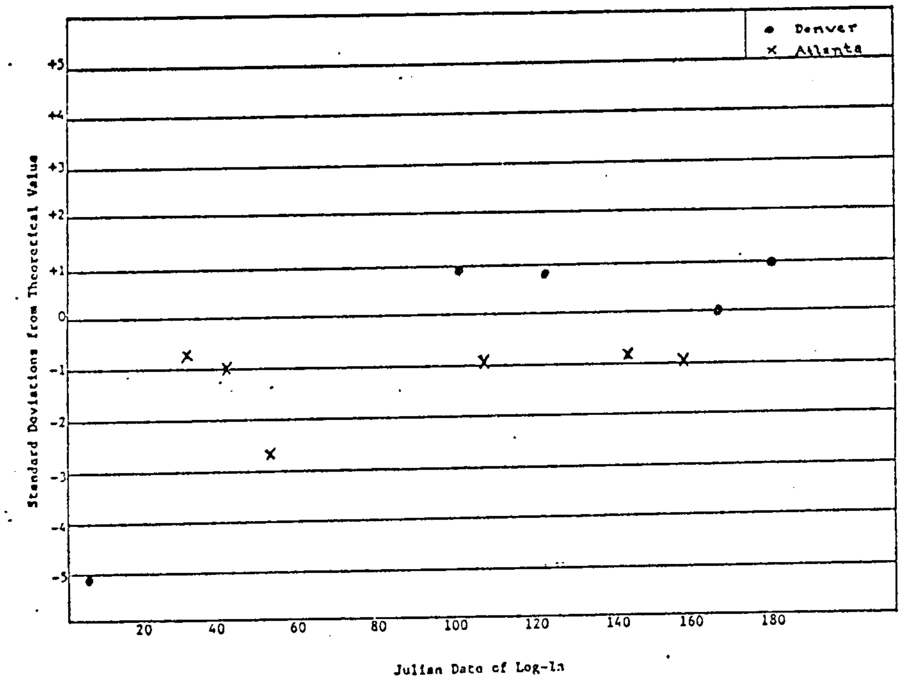
13. FLUORIDE



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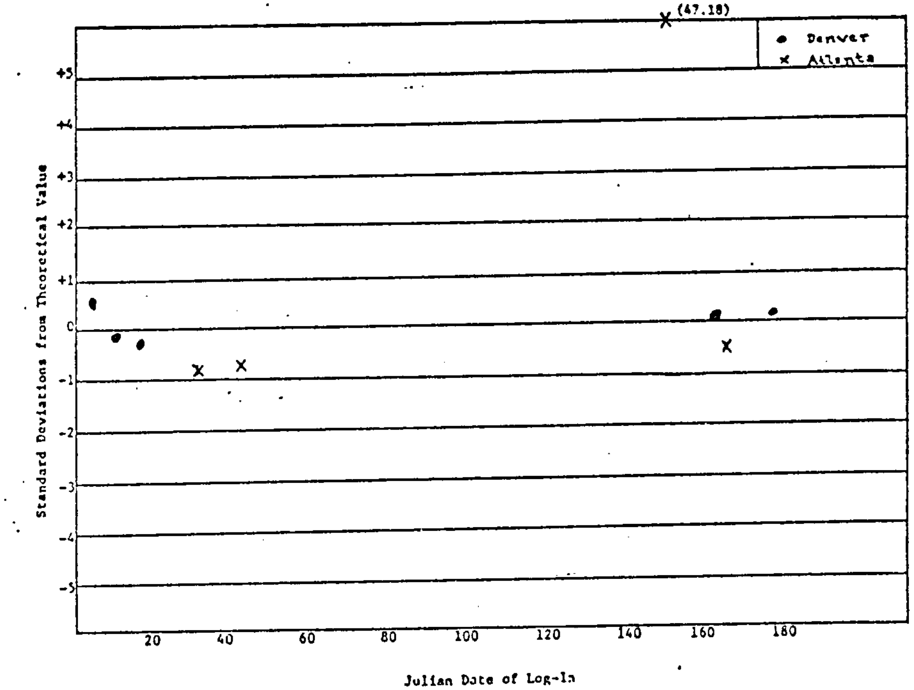

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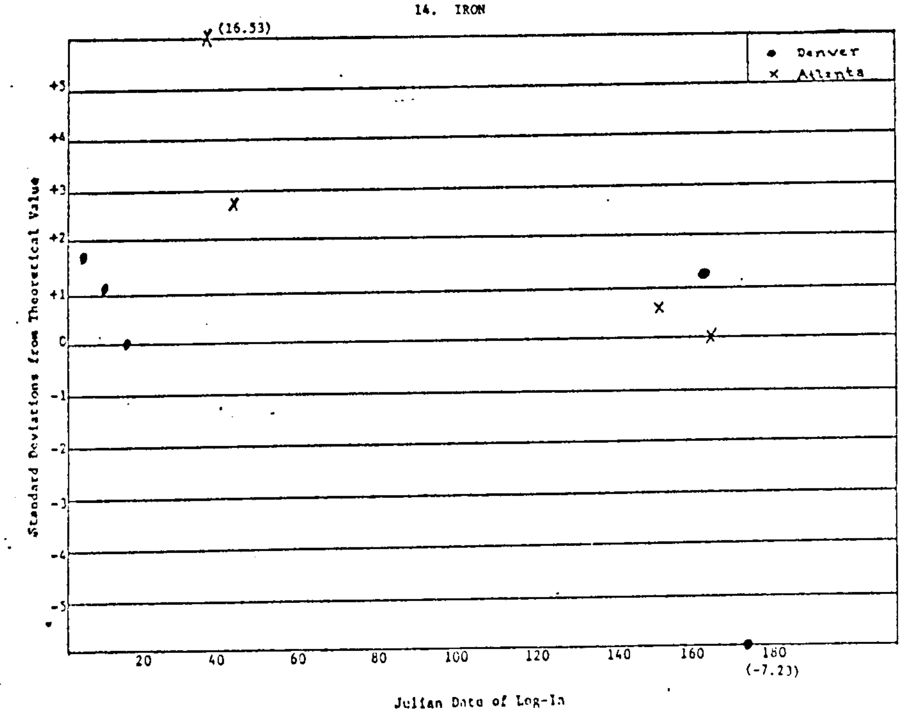

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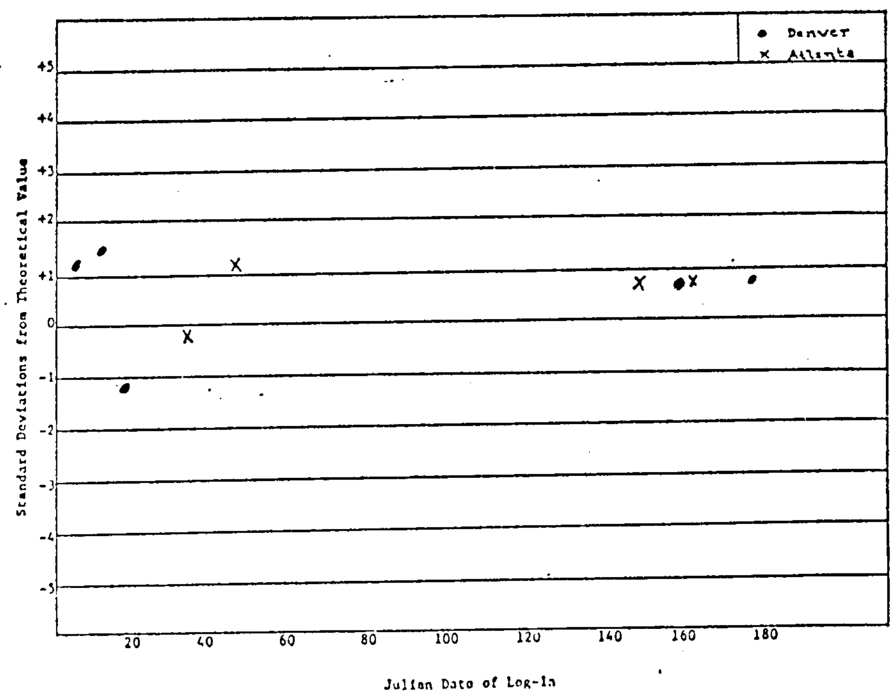

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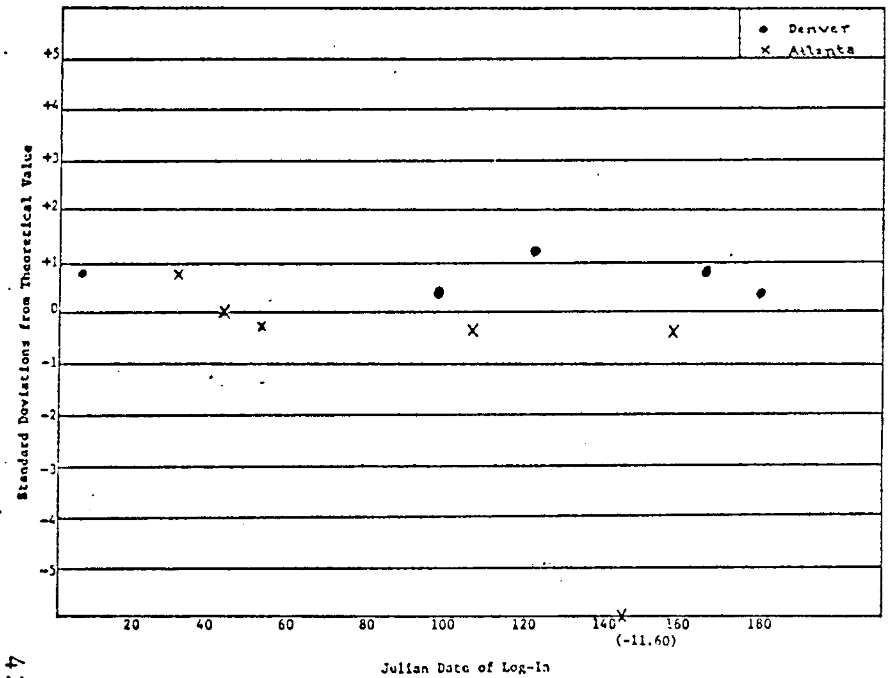

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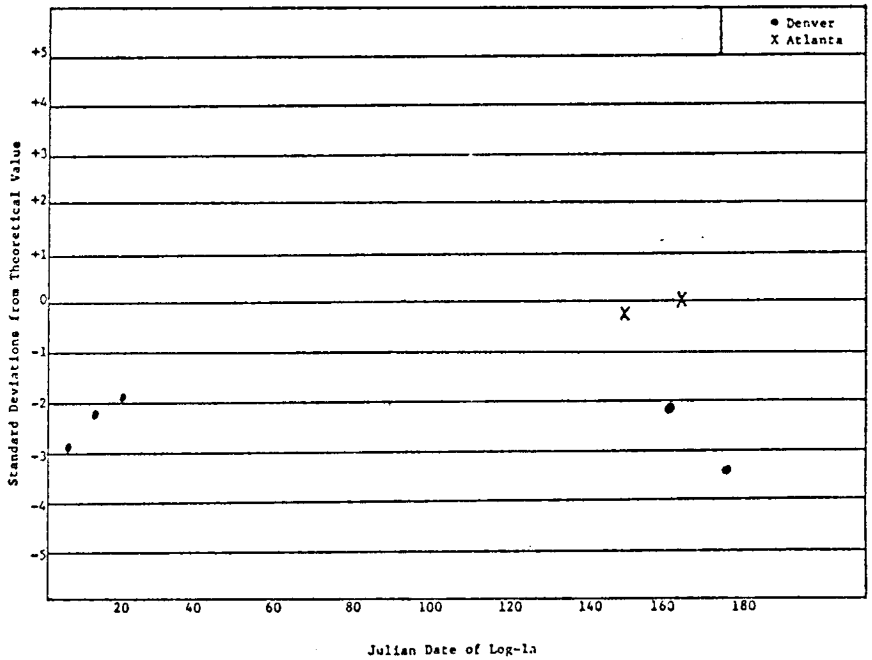

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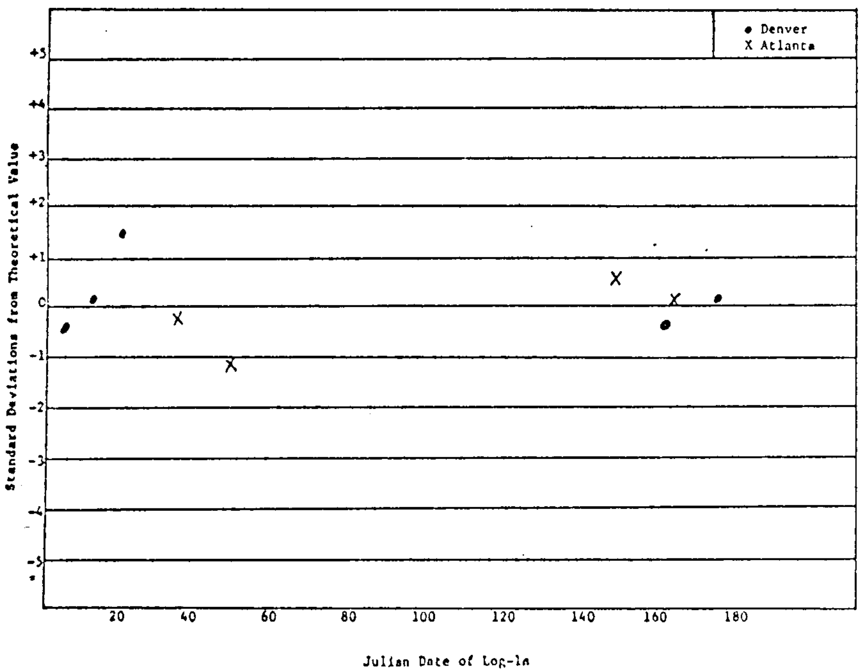

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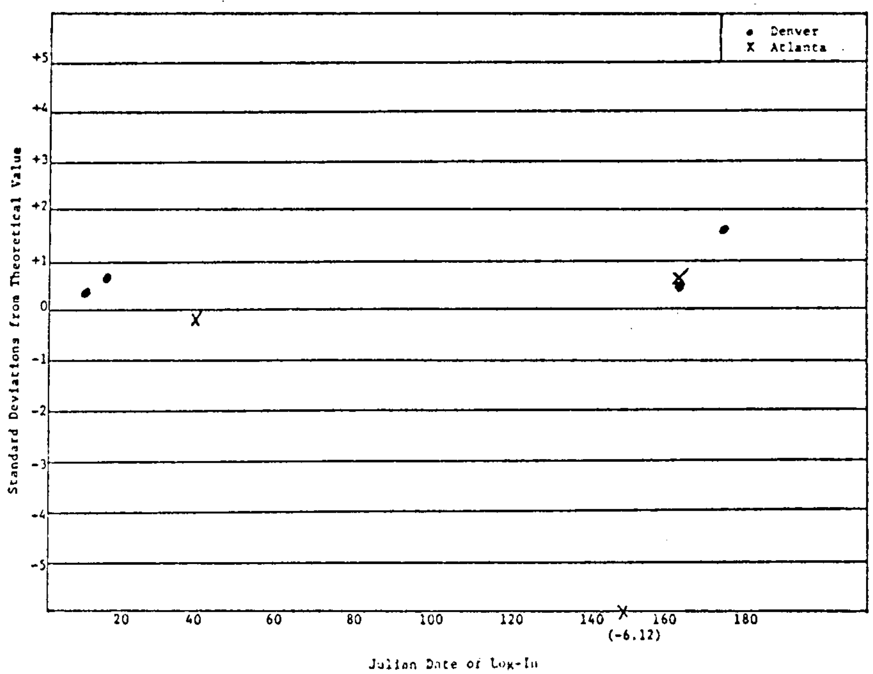

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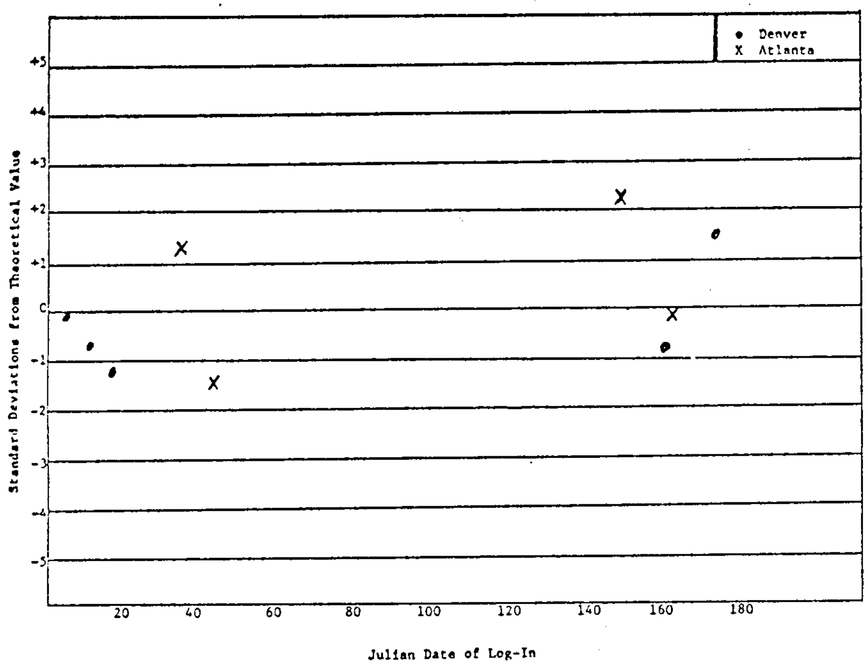

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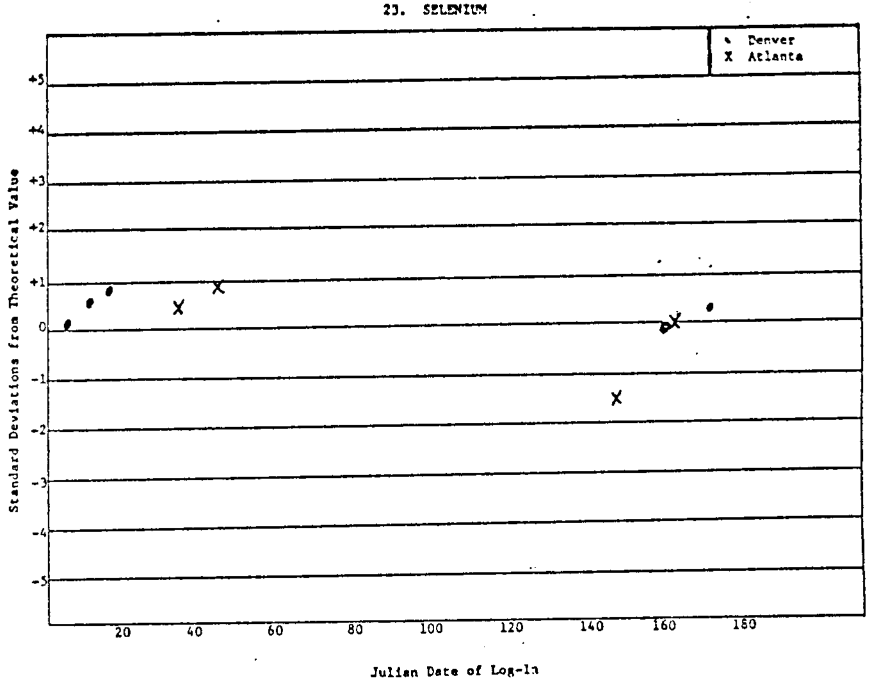

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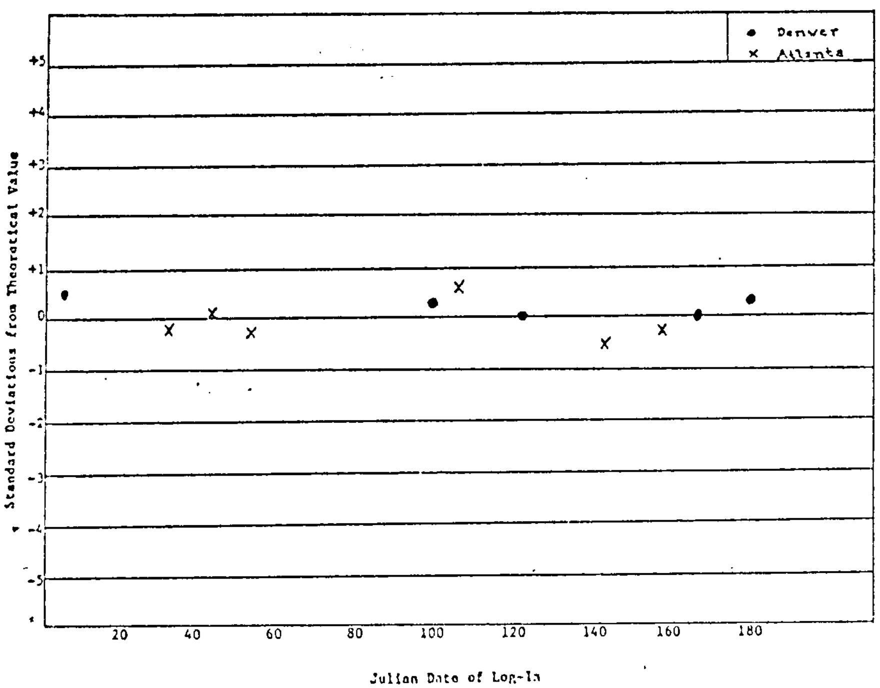

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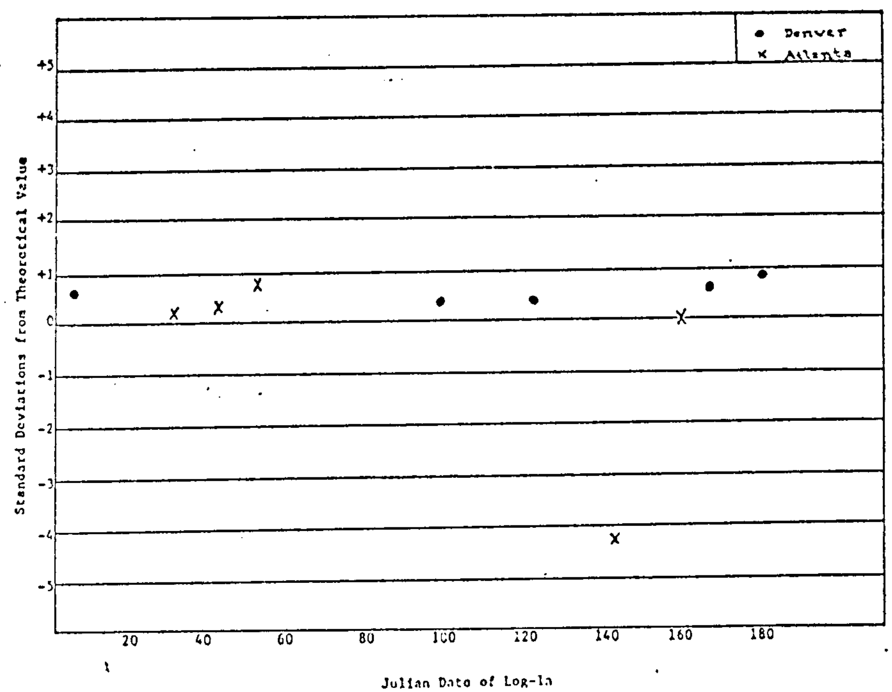

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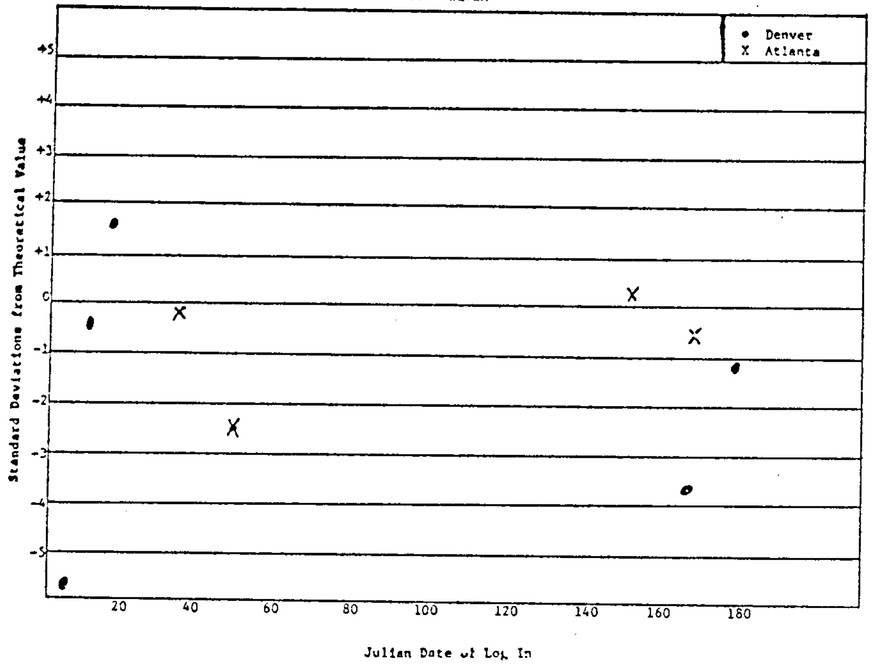

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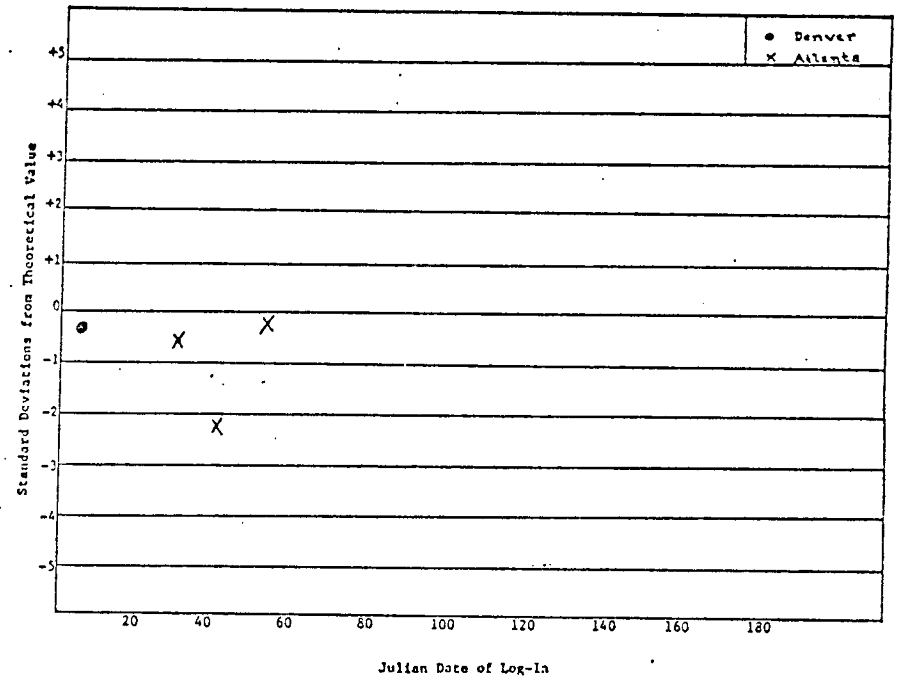

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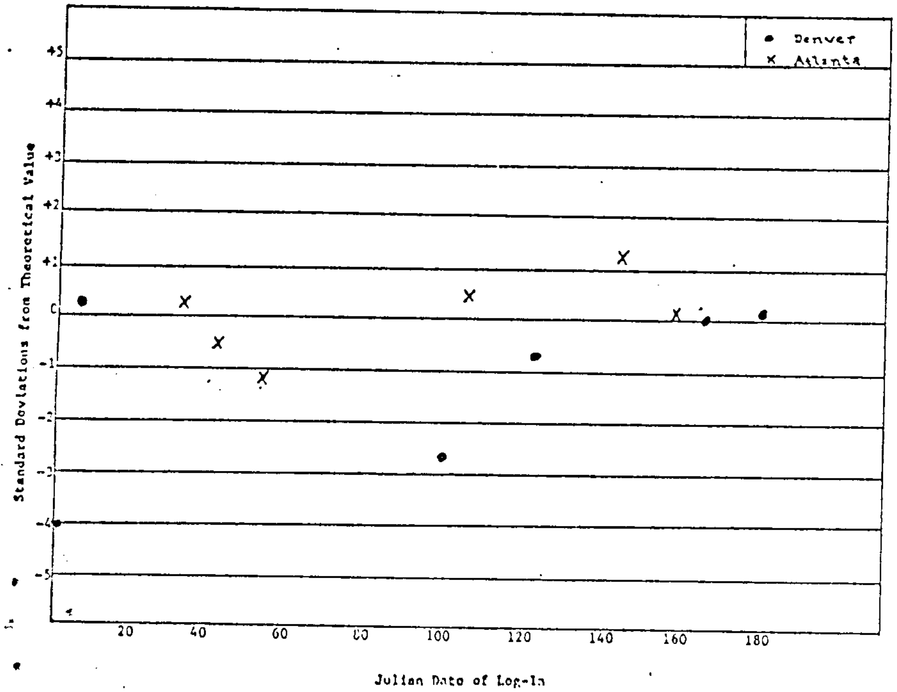
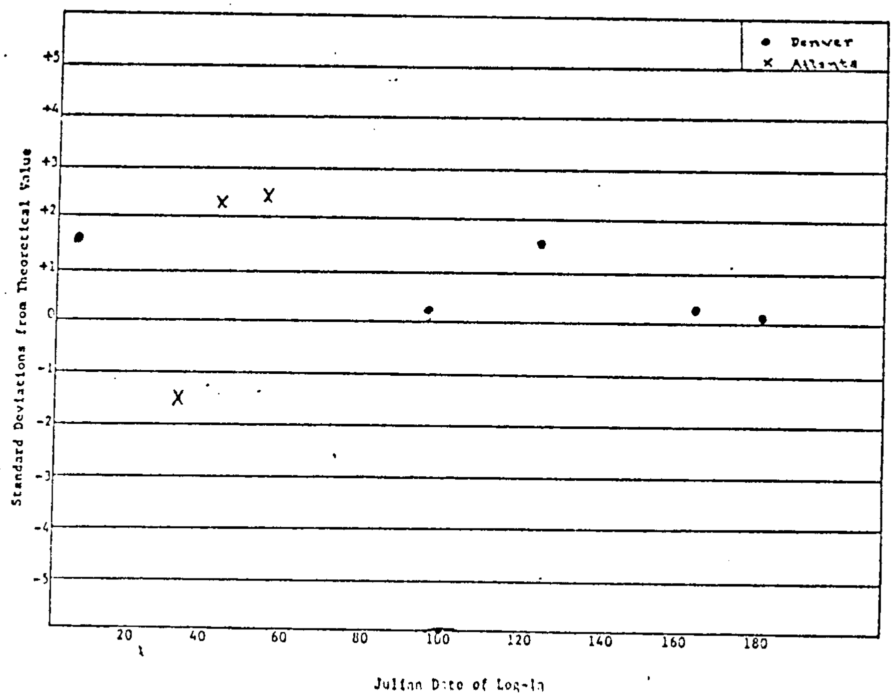


28. SPECIFIC CONDUCTANCE



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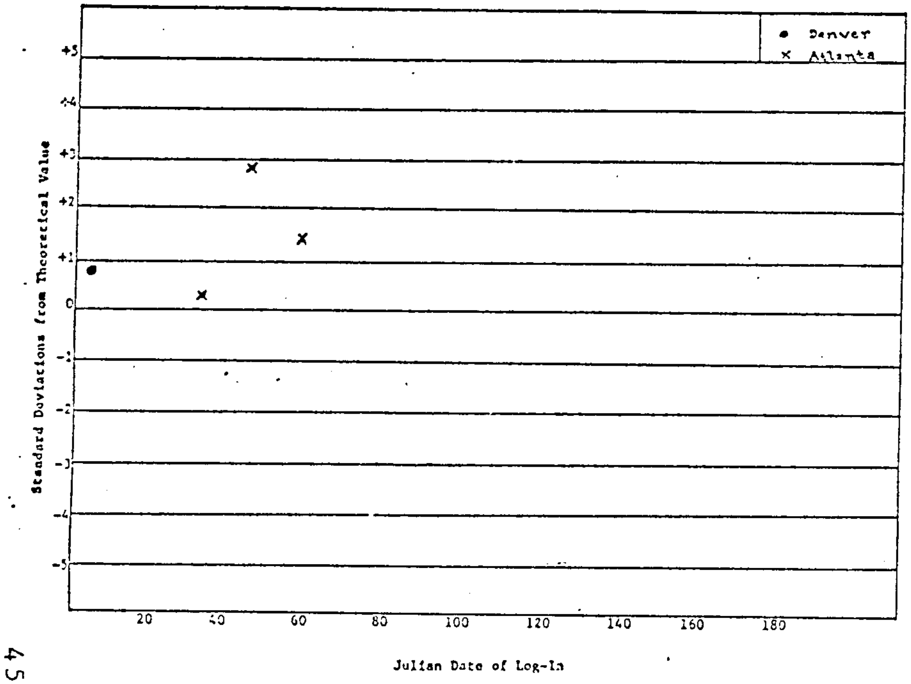
29. STRONTIUM



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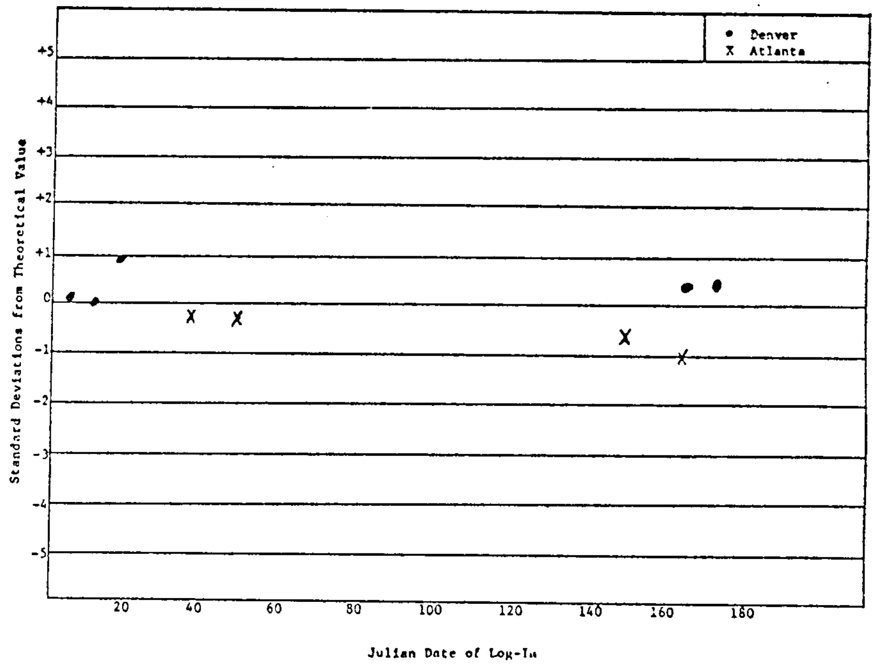

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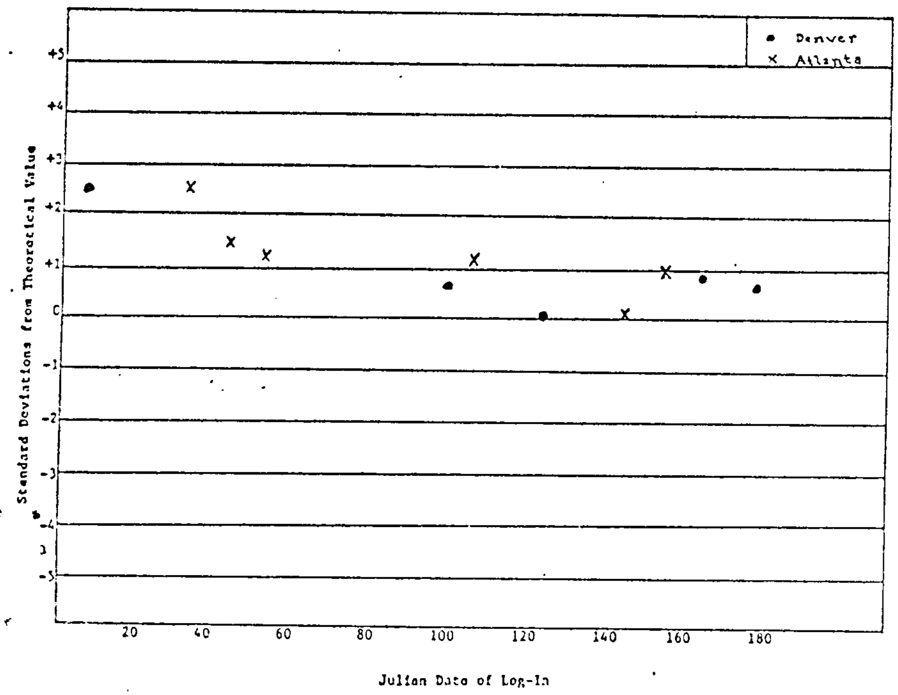

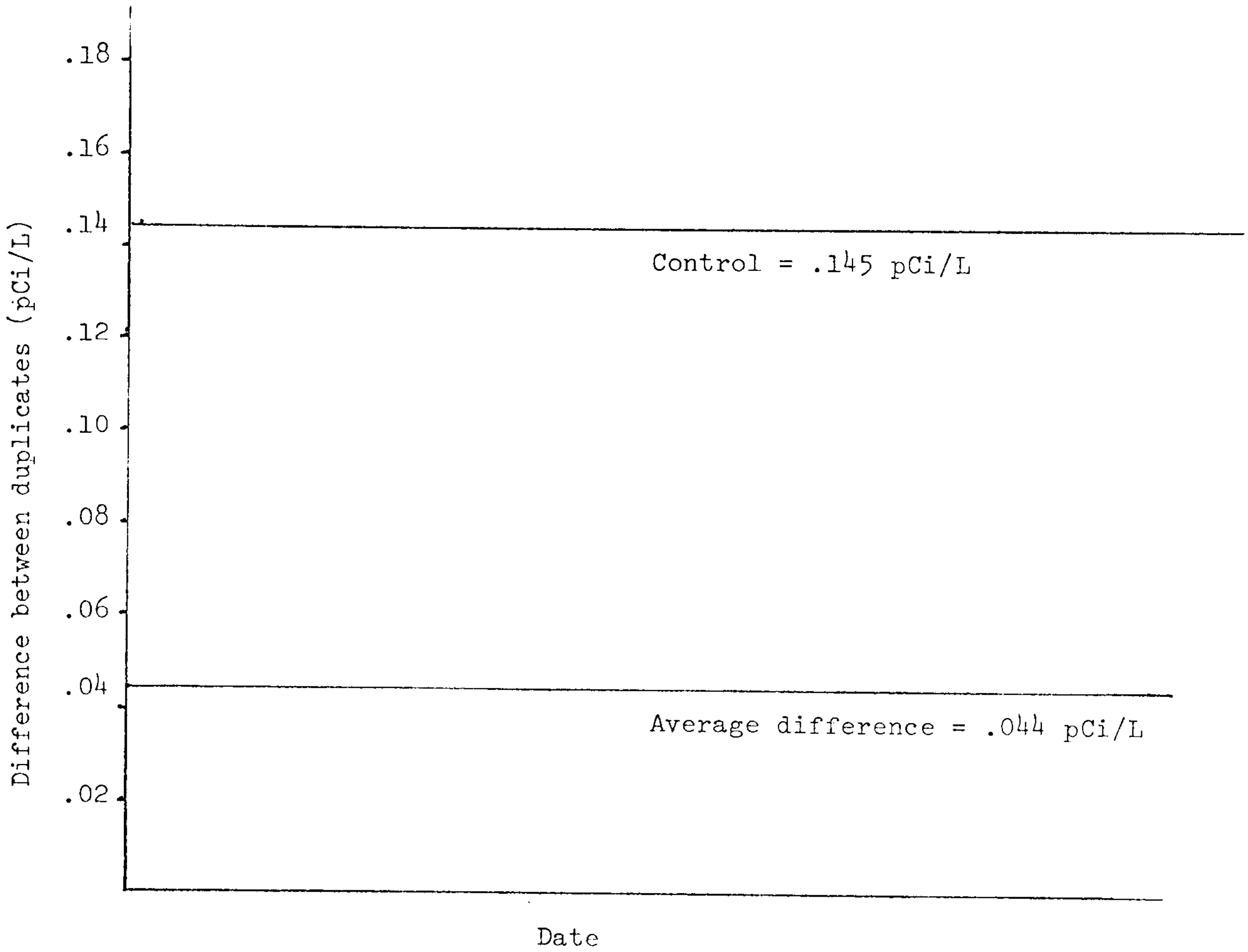

Figure 32.--Ra-226 Duplicate Control Chart: .01 pCi/L ≤ mean < 1.0 pCi/L.

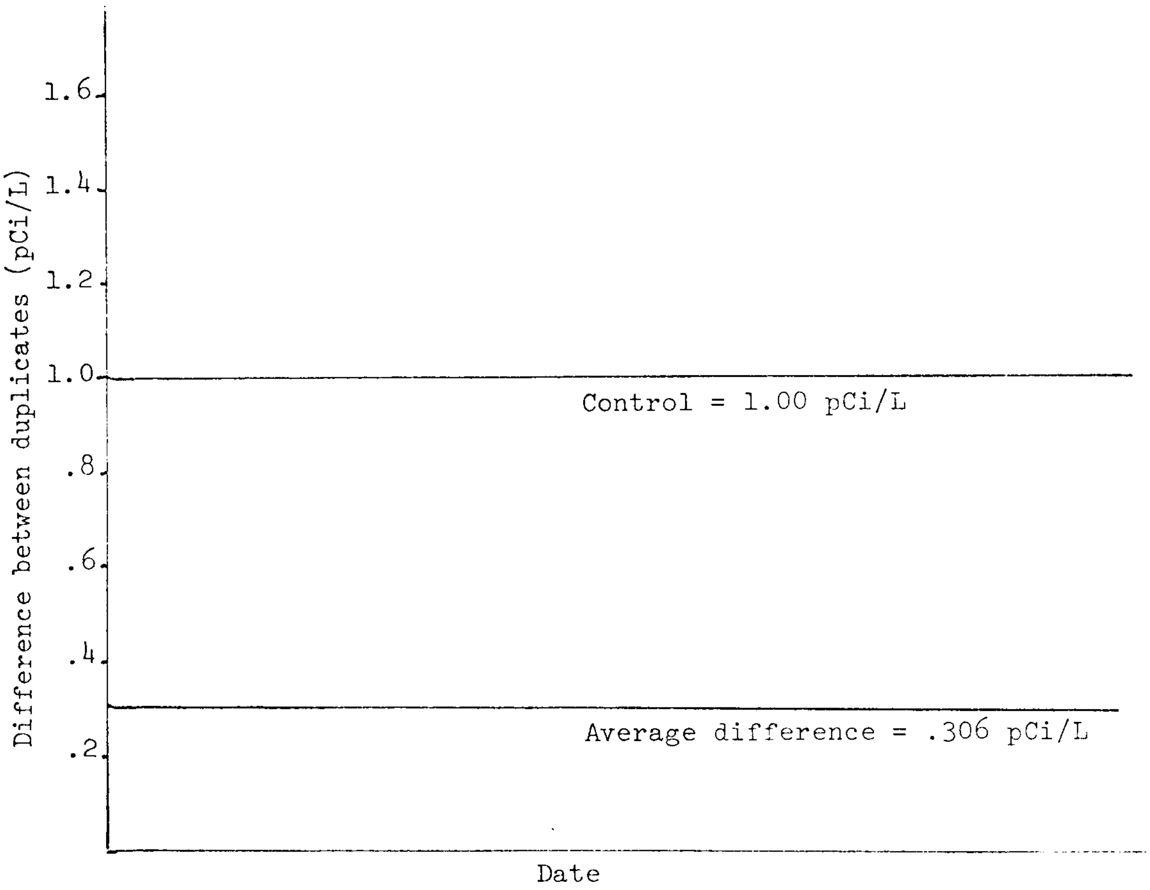

Figure 33.--Ra-226 Duplicate Control chart: 1.0 pCi/L ≤ mean < 10.