

REPORT OF  
ANALYTICAL EVALUATION PROGRAM  
STANDARD REFERENCE WATER SAMPLES NUMBERS 22 AND 23

Chemical Analysis

U.S. GEOLOGICAL SURVEY  
WATER RESOURCES DIVISION  
Denver, Colorado  
1967

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## STANDARD REFERENCE WATER SAMPLES NUMBERS 22 AND 23

### PURPOSE AND PLAN

As a means of providing an independent and objective statistical evaluation of the water quality data published by Geological Survey and other cooperating laboratories, standard reference water samples are prepared and distributed at regular intervals. This report summarizes the analytical results submitted by 28 laboratories for Standard Reference Water Samples numbers 22 and 23 distributed on May 29, 1967.

The preparation and distribution of Standard Reference Water Samples numbers 22 and 23 represent another phase in a continuing effort to provide stable and reliable natural standards that will not change in chemical composition during storage. As natural waters, they are identical to many samples analyzed routinely by water quality laboratories.

### PREPARATION OF SAMPLES

Each sample was collected in bulk volume, filtered through a 0.45 $\mu$  membrane filter into a 55-gallon polyethylene drum and mixed with a motor-driven stirrer for approximately twelve hours. The sample was then pumped through an ultraviolet (2537A) sterilizer and packaged in sterile Teflon bottles under ultraviolet radiation.

### DETERMINATIONS

Detailed instructions for analysis and reporting of results were provided at the time the samples were shipped. The following determinations were requested for each sample: pH, alkalinity, specific conductance, silica, manganese, calcium, magnesium, sodium, potassium, zinc, sulfate, chloride, fluoride, and nitrate. Each laboratory was requested to perform the pH and alkalinity determinations immediately after opening the sample container. The order for performing the other determinations was not specified. Each determination was performed in duplicate and each laboratory was requested to indicate the analytical procedure used. As in the past, participating laboratories are identified by code number only.

PARTICIPATING LABORATORIES

U. S. Geological Survey

Alabama, Tuscaloosa	New York, Albany ✓
Alaska, Anchorage ✓	North Carolina, Raleigh ✓
Arizona, Tucson	Ohio, Columbus
Arkansas, Little Rock ✓	Oklahoma, Oklahoma City
California, Menlo Park ✓	Oregon, Portland ✓
California, Sacramento	Pennsylvania, Philadelphia
Colorado, Denver	Puerto Rico, San Juan
D. C., Washington	Texas, Austin ✓
Florida, Ocala	Utah, Salt Lake City
Louisiana, Baton Rouge ✓	Washington, Tacoma
Nebraska, Lincoln ✓	Wyoming, Worland
New Mexico, Albuquerque	

Other

Colorado, Denver, Board of Water Commissioners, Water Quality Lab  
Kansas, Topeka, State Department of Health, Sanitary Engineering Lab  
North Dakota, Bismarck, State Laboratories Department  
Ohio, Cincinnati, Federal Water Pollution Control Administration  
Wyoming, Laramie, State Department of Agriculture

## MATHEMATICAL TREATMENT OF DATA

Since these are natural waters rather than synthetic standards, the true value of each of the various constituents and properties measured is not known. However, a reliable estimate of the true value can be obtained by a statistical evaluation of the analytical data supplied by many laboratories, each analyzing the sample independently.

A computer was programmed to statistically analyze and evaluate the data. Mathematical calculations are the same as those used for samples numbers 18 and 19.

The mean, average deviation, percent deviation from the mean, standard deviation, and total range were calculated for each determination. Confidence limits about the mean were also calculated in order to define the concentration range within which the true value may be expected to fall with a confidence level of 90 percent. Outlying values were rejected on the basis of statistical tests. The validity of statistical quantities calculated for any determination with an abundance of zero values is questionable.

### REPORTED VALUES

The reported values for each determination by each participating laboratory are tabulated in Appendix B. No outlying values were included in the final calculations of the mean, standard deviation, average deviation, and most probable value for each determination. The number of laboratories reporting values for each determination and the percentage of rejected values are also shown in Appendix B. The percentage of laboratories reporting values falling within the 90% confidence interval, within one standard deviation ( $\bar{X} \pm s$ ), and within two standard deviations ( $\bar{X} \pm 2s$ ) is also shown. These calculations are based only on the acceptable or unrejected values. Thus, many of the statements concerning accuracy and precision in the following sections are based only on the performance of laboratories reporting acceptable values. The data of Appendix B are shown graphically in the attached Appendix A, wherein each reported value and the frequency of its occurrence is shown.

### CONCLUSIONS

#### Specific Conductance

Approximately 80 percent of all laboratories reported values within  $\pm s$  for both samples. The large standard deviation indicates a probable accuracy of about  $\pm 7$   $\mu\text{mhos}$  in this range (300 to 400  $\mu\text{mhos}$ ).

#### pH

The pH determination was performed within  $\pm s$  by a minimum of 68 percent of all laboratories. An accuracy of about  $\pm 0.3$  pH unit is attainable.

### Silica

The silica determination is accurate to within  $\pm 1$  ppm at the 12 ppm concentration level; the accuracy is probably no better than  $\pm 0.3$  ppm at concentrations of less than 10 ppm. The fact that more than 70 percent of the unrejected values fell within  $\pm s$  indicates that most laboratories performed the determination satisfactorily.

### Manganese

Manganese concentrations of less than 0.1 ppm can be determined within  $\pm 0.03$  ppm. At concentration levels of about 2 ppm, reporting results to  $\pm 0.1$  ppm appears justified.

### Calcium

The accuracy of the calcium determination approaches  $\pm 1$  ppm at the concentrations found in these samples (about 30 ppm). Most laboratories performed the determination satisfactorily.

### Magnesium

Magnesium can be determined within  $\pm 1$  ppm at the concentrations found in these samples (about 10 ppm). The reporting of concentrations of less than 10 ppm to  $\pm 0.1$  ppm cannot be justified by the data submitted for sample no. 23.

### Sodium

Sodium was determined within  $\pm s$  on both samples by 88 percent of all reporting laboratories. Accuracy is within  $\pm 1$  ppm at the concentrations encountered in the samples (17 to 21 ppm).

### Potassium

Potassium was determined within  $\pm s$  in both samples by more than 75 percent of all laboratories reporting results. Accuracy is about  $\pm 0.2$  ppm at a concentration of 2.3 ppm, but decreases to  $\pm 0.4$  ppm at 6.7 ppm.

### Bicarbonate

More than 60 percent of all laboratories reported bicarbonate values within  $\pm s$ . Accuracies of about  $\pm 1$  ppm and  $\pm 2$  ppm should be expected at concentrations of 4 ppm and 94 ppm, respectively.

### Sulfate

Most laboratories determined sulfate within  $\pm 2$  ppm of the most probable value at concentrations of about 50 ppm. At 141 ppm, the determination should be accurate to within  $\pm 5$  ppm, despite the fact that a few laboratories reported extreme values.

### Chloride

The wide range of reported values and the high standard deviation for sample no. 22 indicate an inability to determine chloride within  $\pm 0.1$  ppm at concentrations below 10 ppm. This poor performance has been borne out in past programs. Relative performance improves at higher concentrations and most laboratories reported values within  $\pm 2$  ppm of the mean at 27 ppm.

### Fluoride

Fluoride values within  $\pm 0.1$  ppm or  $\pm s$  were reported by 70 percent of all laboratories.

### Zinc

With two exceptions, all laboratories determined zinc within  $\pm 0.1$  ppm at the concentration found in sample no. 22 (1.10 ppm). The distribution of data for sample no. 23 does not justify reporting of zinc values to two decimals at concentrations below 1.0 ppm.

### Nitrate

Most laboratories determined nitrate to within about  $\pm 1$  ppm at the 17 ppm level. At concentrations of less than 1.0 ppm, an accuracy of no better than  $\pm 0.3$  ppm can be expected.

## LABORATORY PERFORMANCE

In addition to the tabulated summaries of the analytical data, the results of each Survey laboratory will be evaluated (1) on each determination, and (2) on overall performance (all determinations). This evaluation will be based on four levels of performance: (1) E (excellent), results within 90% confidence level; (2) A (acceptable), results within  $\pm s$  (one standard deviation); (3) Q (questionable), results within  $\pm 2s$  (two standard deviations); and (4) R (rejected), results in error by an amount exceeding two standard deviations.

The summary of these evaluations will be transmitted to Washington according to instructions issued by the Chief Hydrologist in a memorandum dated June 20, 1967.

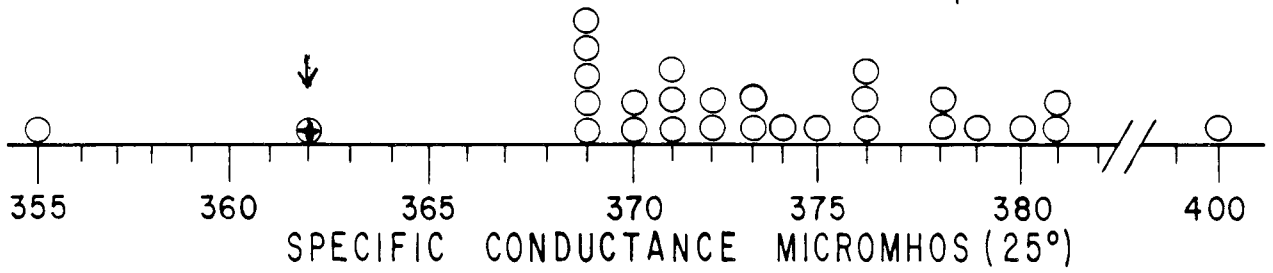
REPORT OF  
ANALYTICAL EVALUATION PROGRAM  
STANDARD REFERENCE WATER SAMPLES NUMBERS 22 AND 23

APPENDIX A

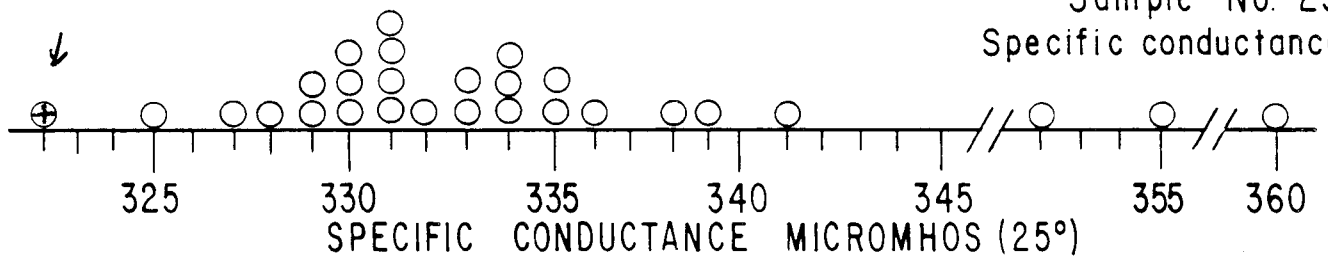
Graphical Presentation of Data



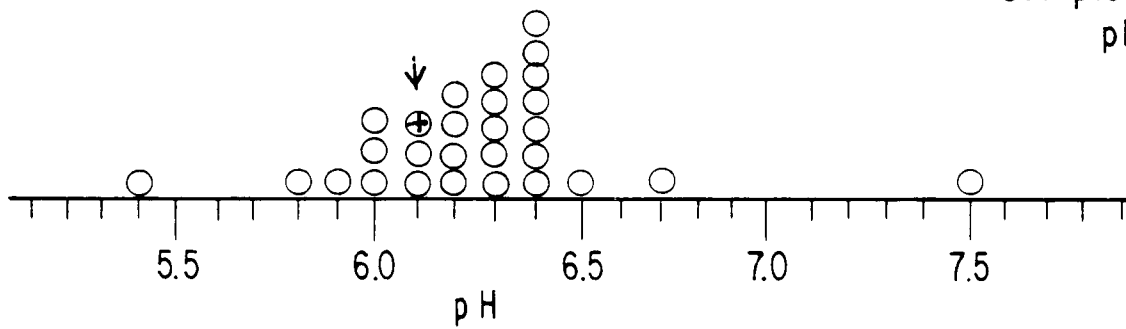
Sample No. 22  
Specific conductance



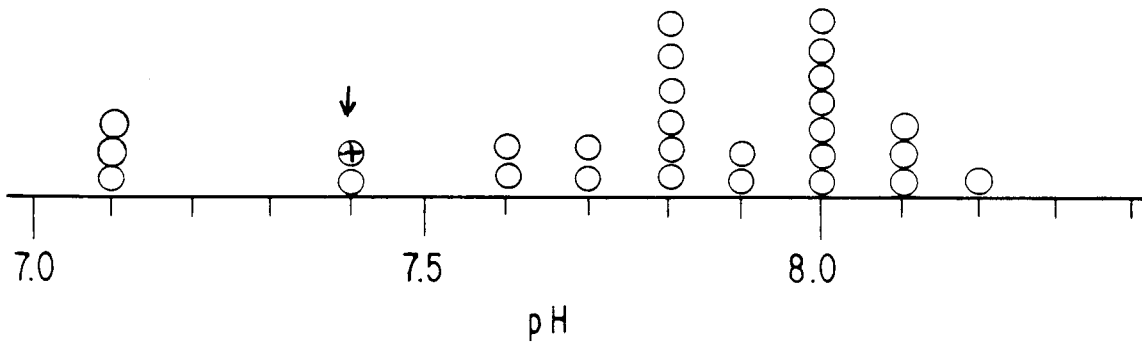
Sample No. 23  
Specific conductance



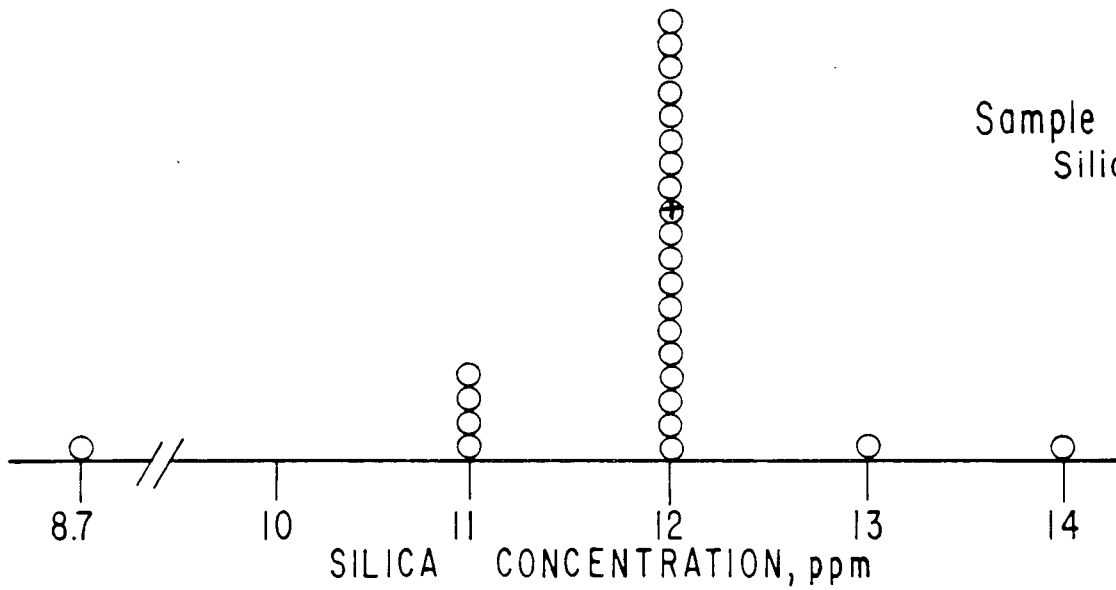
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pH



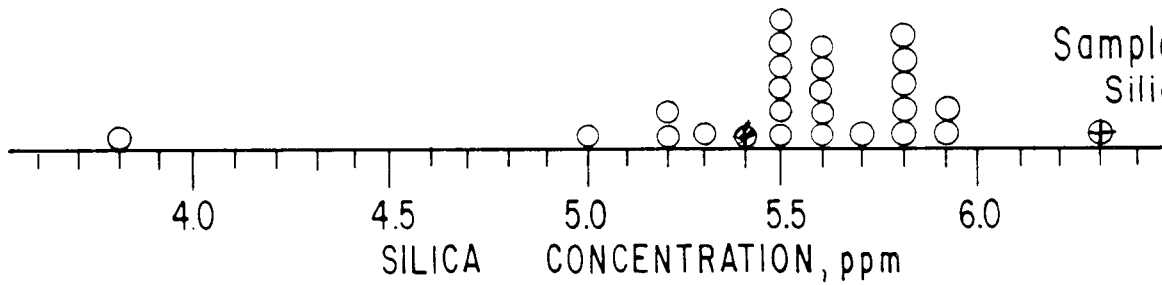
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pH



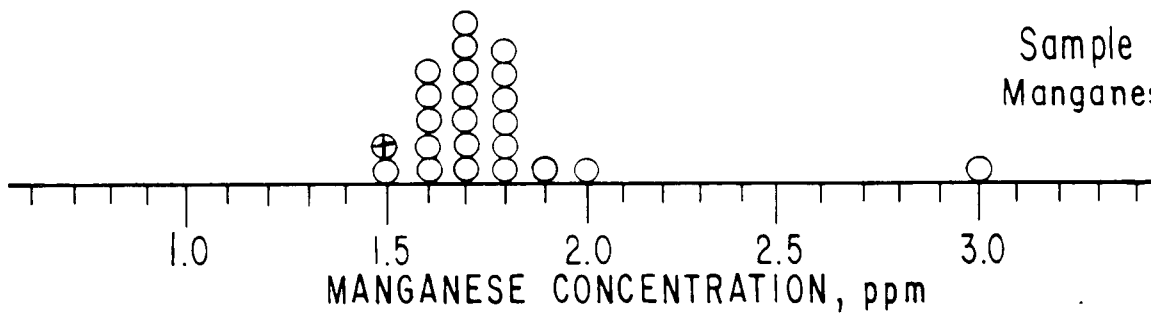
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Silica (SiO<sub>2</sub>)



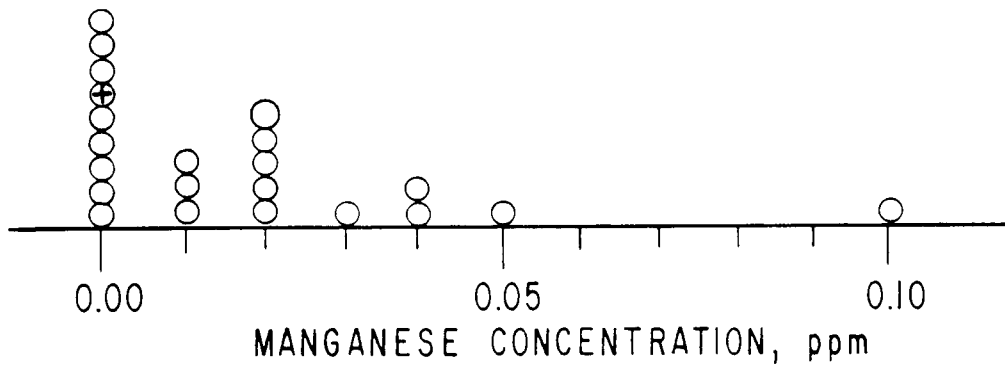
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Silica (SiO<sub>2</sub>)



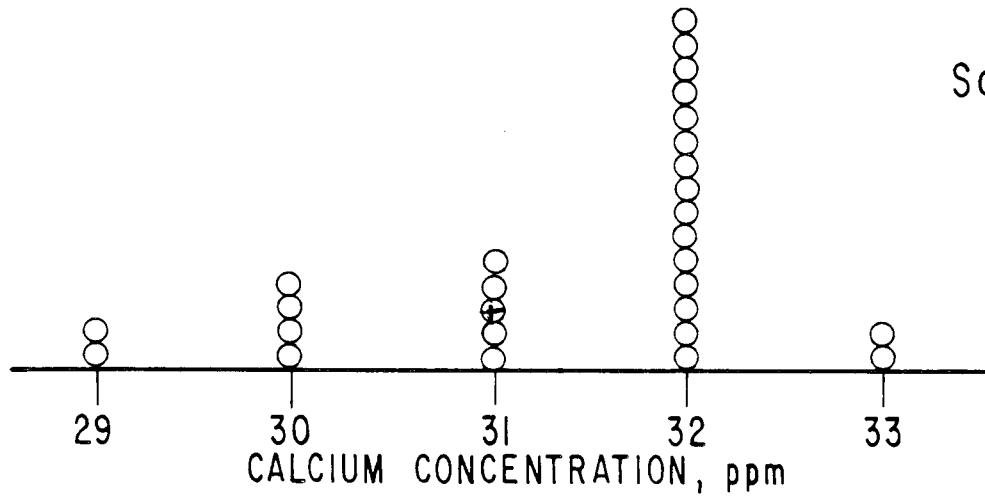
Sample No. 22  
Manganese (Mn)



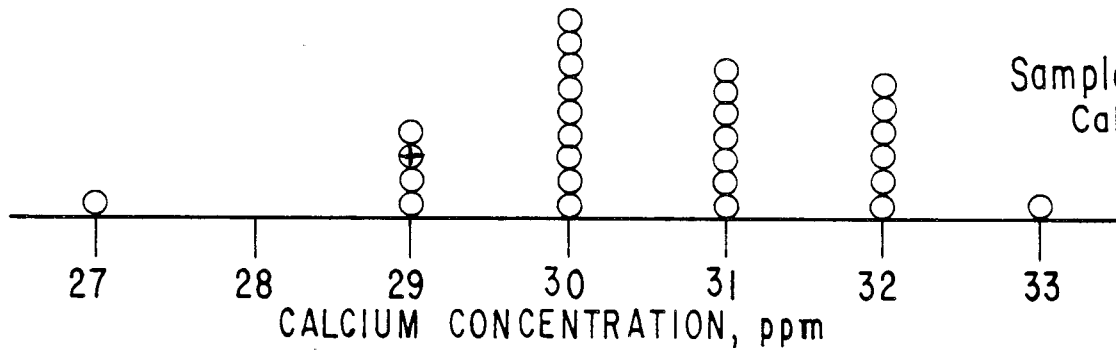
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Manganese (Mn)



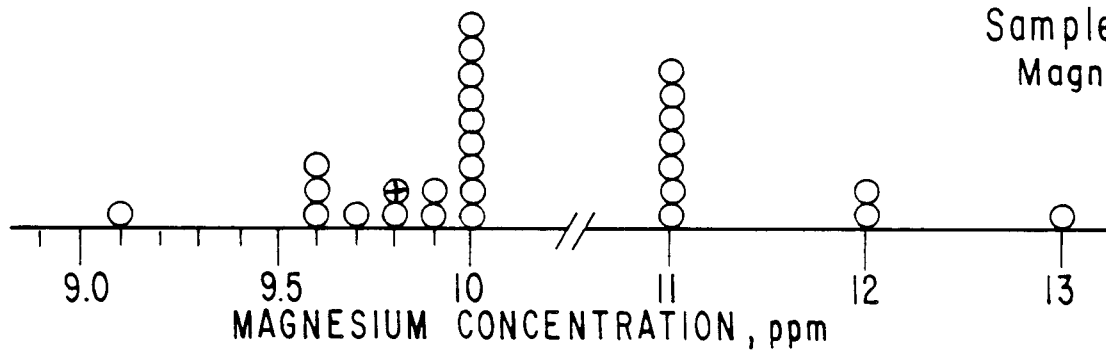
Sample No. 22  
Calcium (Ca)



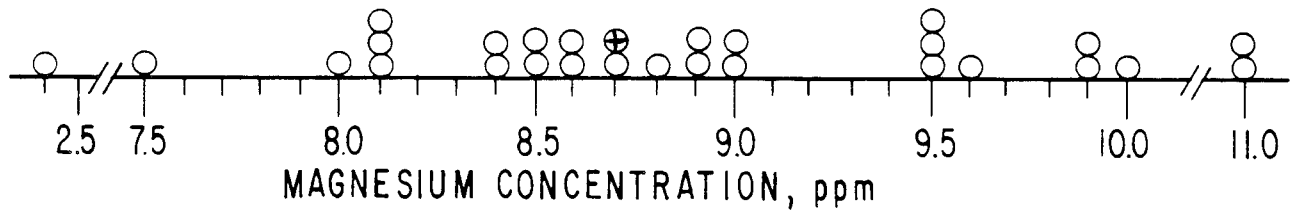
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Calcium (Ca)



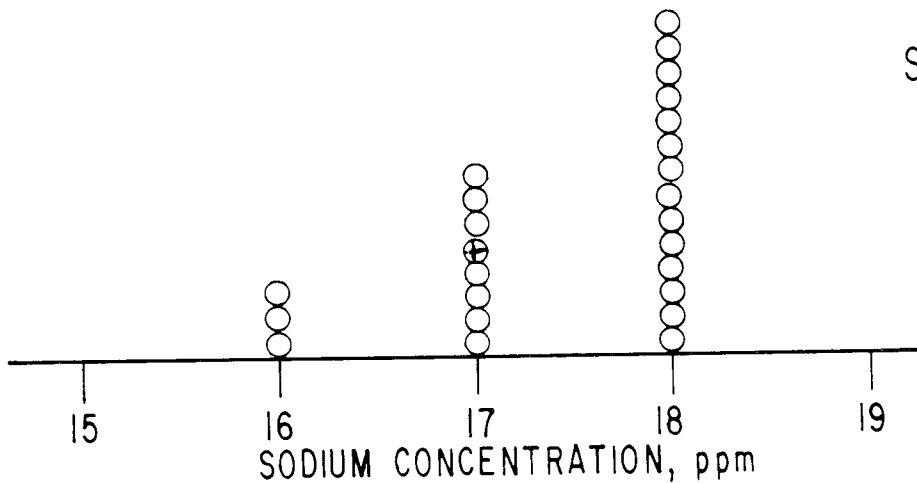
Sample No. 22  
Magnesium (Mg)



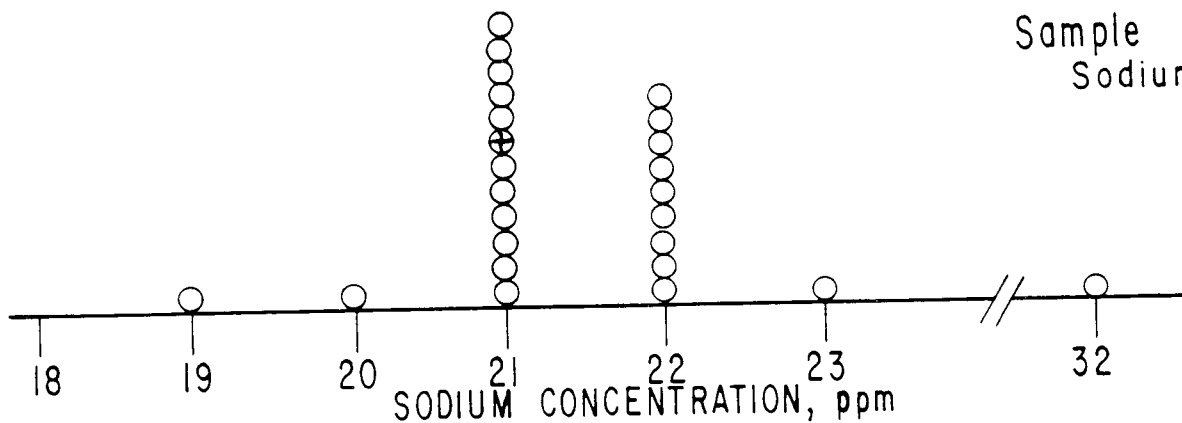
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Magnesium (Mg)



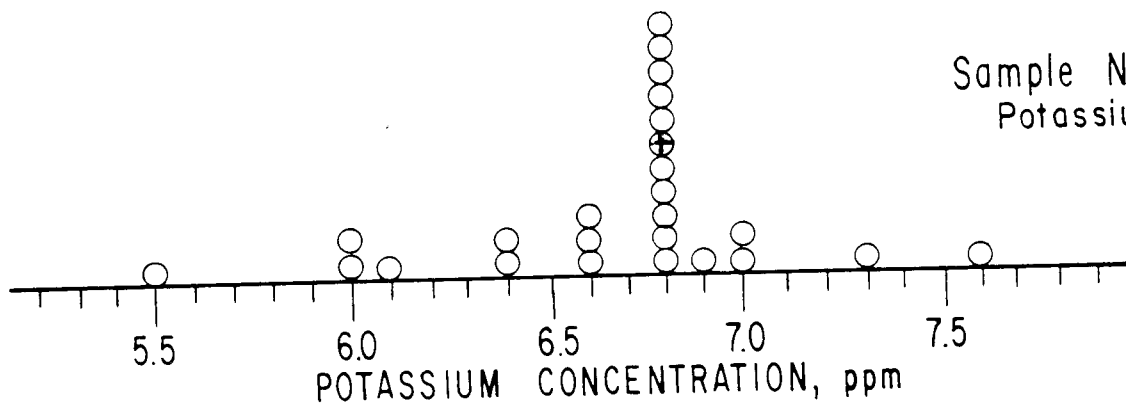
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Sodium (Na)



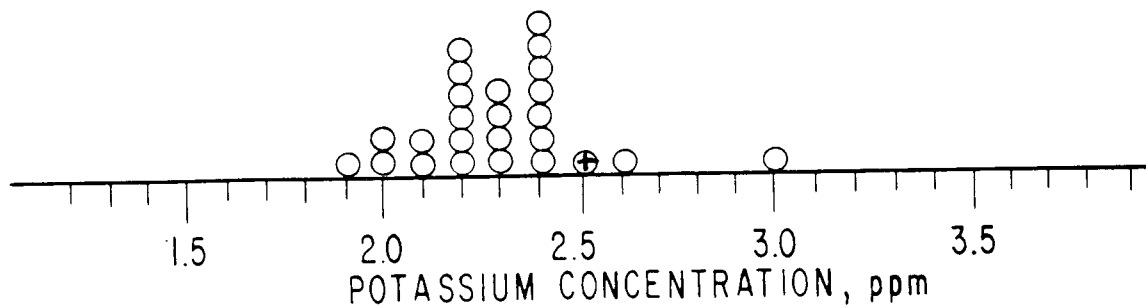
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Sodium (Na)



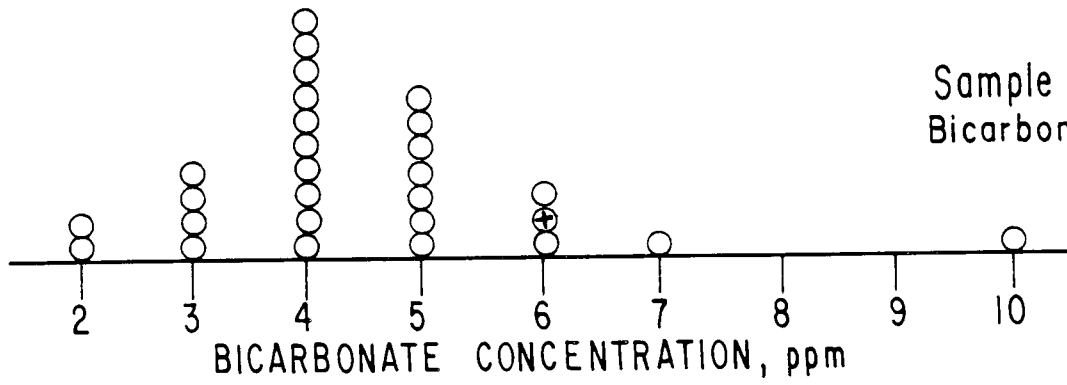
Sample No. 22  
Potassium (K)



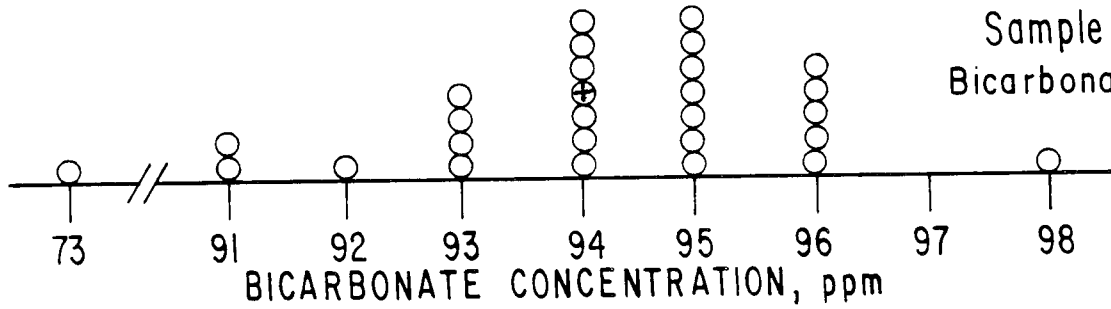
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Potassium (K)



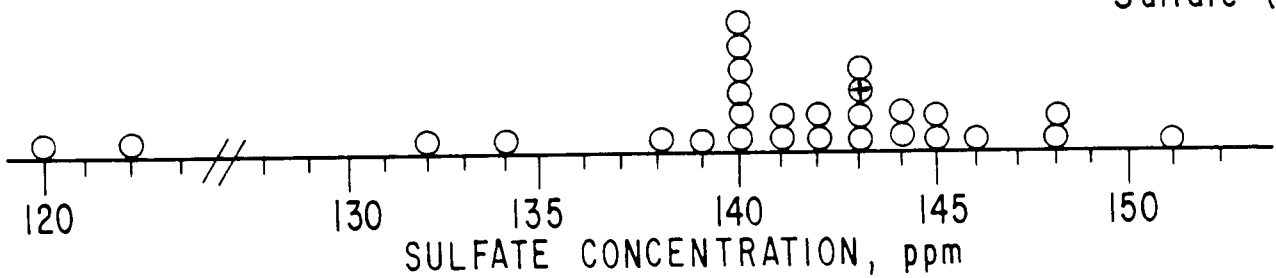
Sample No. 22  
Bicarbonate ( $\text{HCO}_3$ )



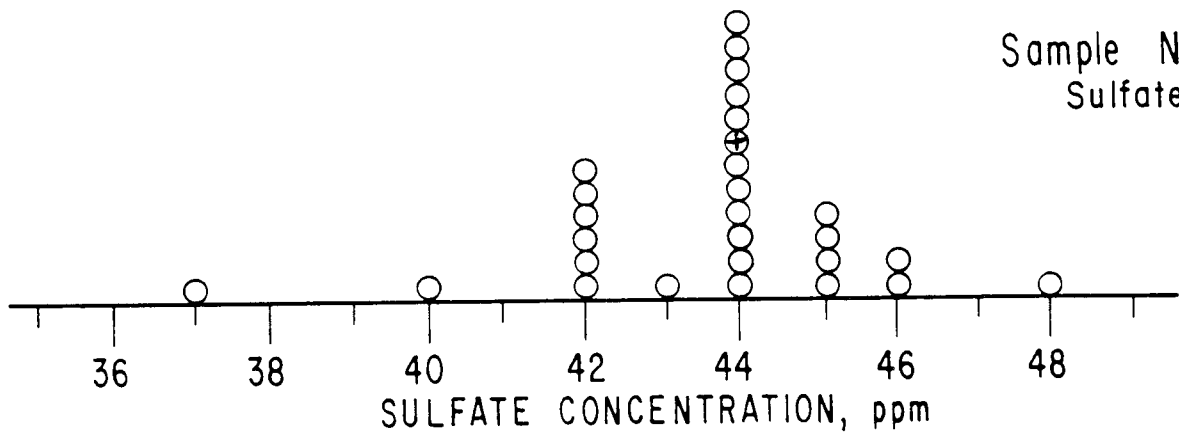
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Bicarbonate ( $\text{HCO}_3$ )



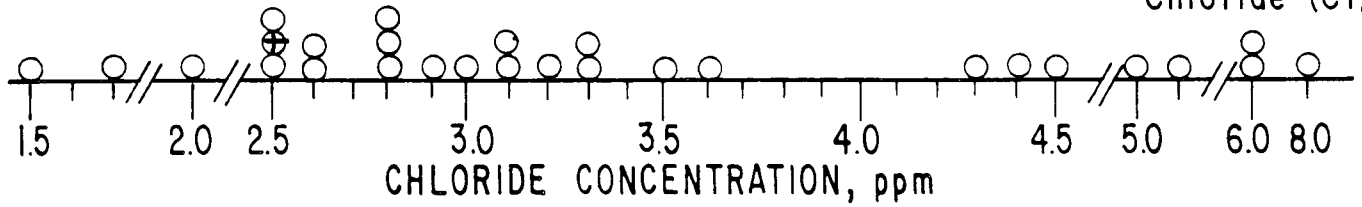
Sample No. 22  
Sulfate ( $\text{SO}_4$ )



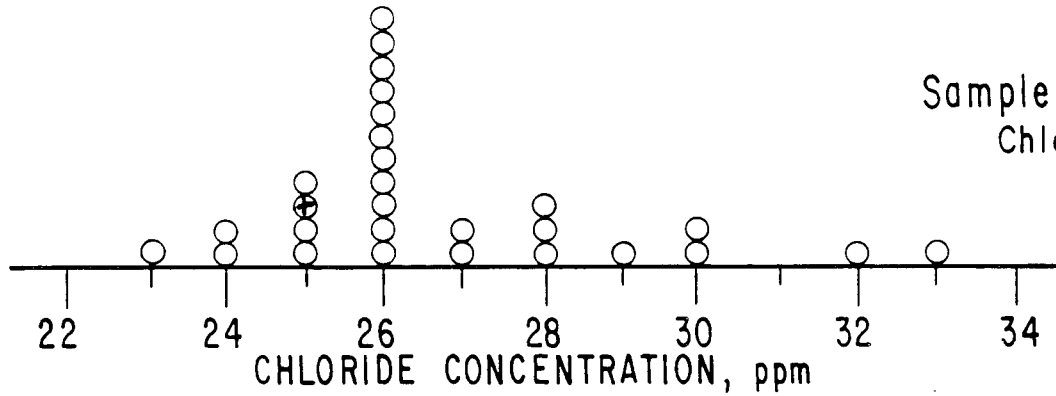
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Sulfate ( $\text{SO}_4$ )



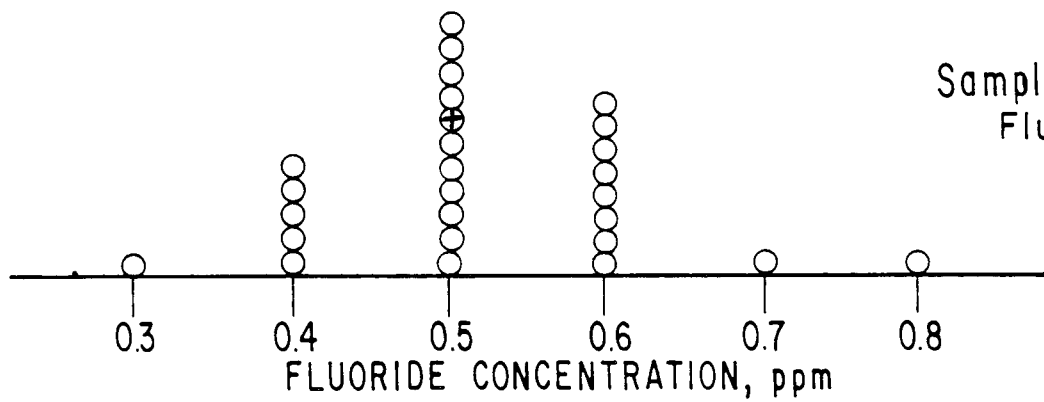
Sample No. 22  
Chloride (Cl)



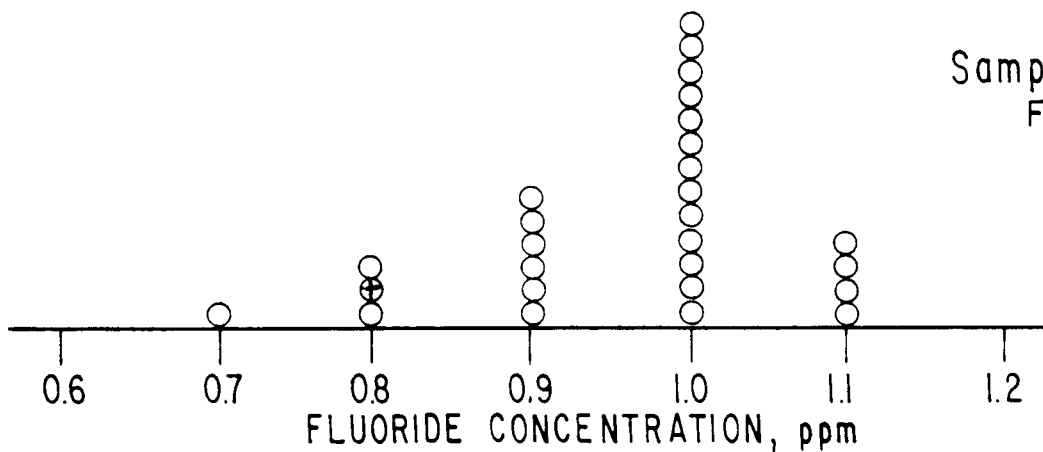
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Chloride (Cl)



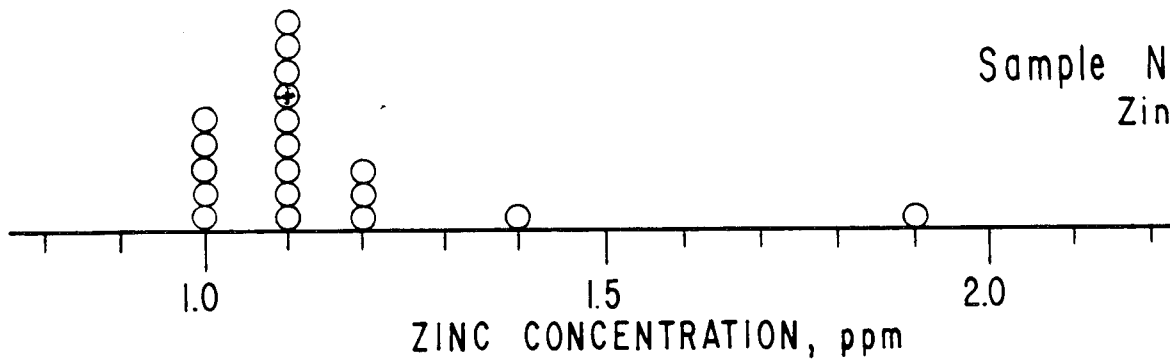
Sample No. 22  
Fluoride (F)



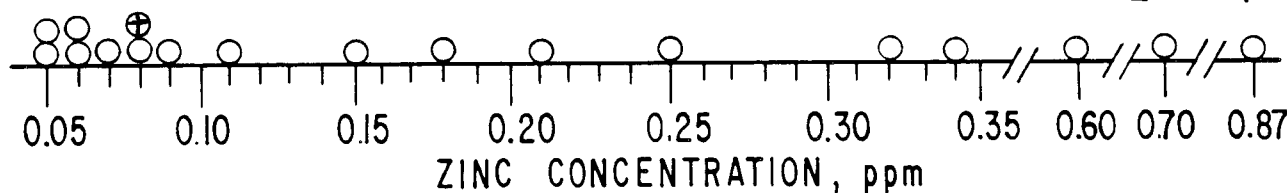
Sample No. 23  
Fluoride (F)



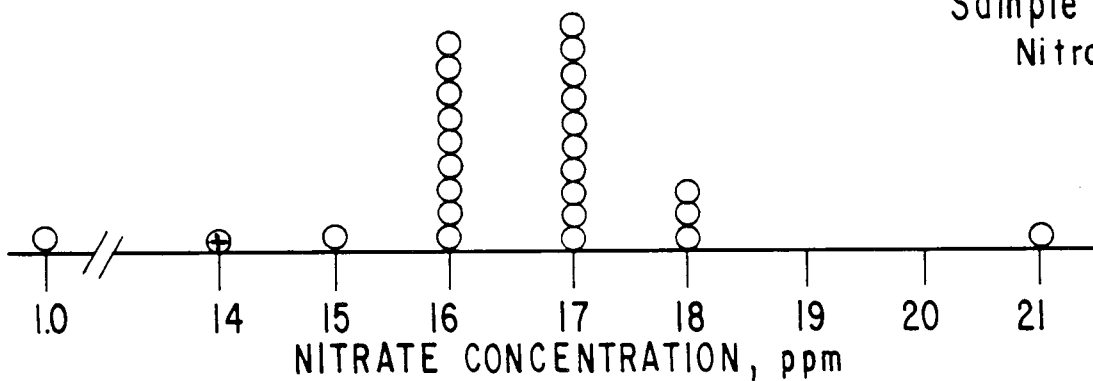
Sample No. 22  
Zinc (Zn)



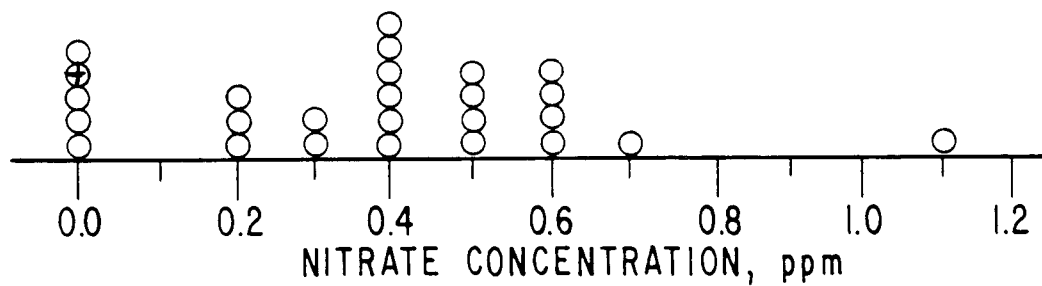
Sample No. 23  
Zinc (Zn)



Sample No. 22  
Nitrate (NO<sub>3</sub>)



Sample No. 23  
Nitrate (NO<sub>3</sub>)



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APPENDIX B

Reported Results  
Calculated Means and Measures of Dispersion  
Laboratories Reporting  
Percentage of Rejected Values  
Percentage Distribution About the Mean



DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN		METHOD
06-67	1	376	0.9	0.1	WHEATSTONE BRIDGE
06-67	2	371	0.4	0.1	DO
06-67	3	379	1.7	0.1	DIRECT READING INSTRUMENTS
06-67	4	371	0.4	0.1	WHEATSTONE BRIDGE
06-67	5	369	1.0	0.4	DO
06-67	6	374	0.4	0.4	DO
07-67	7	373	0.1	0.4	DO
06-67	8	370	0.7	0.4	DIRECT READING INSTRUMENTS
06-67	9	369	1.0	0.7	WHEATSTONE BRIDGE
06-67	10	376	0.9	0.7	DO
06-67	11	369	1.0	0.7	DO
06-67	12	378	1.5	0.7	OTHER
06-67	13	378	1.5	1.2	WHEATSTONE BRIDGE
06-67	14	370	0.7	0.8	DO
06-67	15	372	0.1	1.0	DO
06-67	16	376	0.9	1.0	DIRECT READING INSTRUMENTS
06-67	17	381	2.3	1.0	WHEATSTONE BRIDGE
→ 06-67	18	362	2.8	1.3	DO
06-67	19	372	0.1	1.5	DO
06-67	20	375	0.7	1.5	DO
06-67	21	381	2.3	1.7	DO
06-67	22	373	0.1	2.0	DO
06-67	23	369	1.0	2.3	DO
06-67	24	371	0.4	2.3	DO
06-67	25	400	7.4	REJECT	DO
06-67	26	355	4.7	4.7	DO
06-67	28	369	1.0	7.4	DO
06-67	29	380	2.0		DO

TOTAL RANGE 355- 400  
 MEAN 372.6  
 STANDARD DEVIATION 5.71

AVERAGE DEVIATION 4.21  
 90 PCT.CONF.INTVLOF MEAN 372.6 ± 1.87

SAMPLE 22

CIND

DATE MO-YR	CODE	REPORTED VALUE	PCT. DEV. FROM MEAN	METHOD
06-67	1	6.0	3.4	INSTRUMENT METHOD, (POTENTIOMETRIC)
06-67	2	6.3	1.4	DO
06-67	3	6.1	1.8	DO
06-67	4	6.4	3.0	DO
06-67	5	6.2	0.2	DO
06-67	6	6.7	7.9	DO
07-67	7	6.0	3.4	DO
06-67	8	6.2	0.2	DO
06-67	9	6.5	4.7	DO
06-67	10	6.3	1.4	DO
06-67	11	5.4	13.1	DO
06-67	12	5.8	6.6	OTHER
06-67	13	6.2	0.2	INSTRUMENT METHOD, (POTENTIOMETRIC)
06-67	14	5.9	5.0	DO
06-67	15	6.4	3.0	DO
06-67	16	6.4	3.0	DO
06-67	17	6.2	0.2	DO
06-67	18	6.1	1.8	DO
06-67	19	6.3	1.4	DO
06-67	20	6.0	3.4	DO
06-67	21	6.4	3.0	DO
06-67	22	6.4	3.0	DO
06-67	23	6.1	1.8	DO
06-67	24	6.3	1.4	DO
06-67	25	6.4	3.0	DO
06-67	26	7.5	20.8	REJECT
06-67	28	6.3	1.4	DO
06-67	29	6.4	3.0	DO

"9"

TOTAL RANGE	5.4 - 7.5	AVERAGE DEVIATION	0.188
MEAN	6.21	90 PCT. CONF. INTVLOF MEAN	6.21 ± 0.084
STANDARD DEVIATION	0.256		

SAMPLE 22

PH

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN		METHOD
06-67	1	14	17.1		MOLYBDATE BLUE, USGS WSP 1454, D:34A-1
06-67	2	12	0.3		DD
06-67	3	12	0.3		DD
06-67	4				NOT DETERMINED
06-67	5	12	0.3		MOLYBDATE BLUE, USGS WSP 1454, D:34A-1
06-67	6	12	0.3		DD
07-67	7	12	0.3		DD
06-67	8	8.7	27.3	REJECT	COLORIMETRIC MOLYBDOOSILICATE, APHA STD. METH., 1965
06-67	9	12	0.3		MOLYBDATE BLUE, USGS WSP 1454, D:34A-1
06-67	10	13	8.7		DD
06-67	11	12	0.3		OTHER
06-67	12	11	8.0		DD
06-67	13	12	0.3		MOLYBDATE BLUE, USGS WSP 1454, D:34A-1
06-67	14	12	0.3		DD
06-67	15	12	0.3		DD
06-67	16	12	0.3		DD
06-67	17	11	8.0		DD
06-67	18	12	0.3		DD
06-67	19	12	0.3		DD
06-67	20	12	0.3		DD
06-67	21	12	0.3		DD
06-67	22	12	0.3		DD
06-67	23	11	8.0		DD
06-67	24	12	0.3		DD
06-67	25				NOT DETERMINED
06-67	26	11	8.0		OTHER
06-67	28	12	0.3		MOLYBDATE BLUE, USGS WSP 1454, D:34A-1
06-67	29	12	0.3		DD

TOTAL RANGE 8.7- 14  
MEAN 12.0  
STANDARD DEVIATION 0.611

AVERAGE DEVIATION 0.307  
90 PCT.CONF.INTVLOF MEAN 12.0 ± 0.209

SAMPLE 22

SI02

DATE	CODE	REPORTED VALUE	PCT. DEV. FROM MEAN	METHOD
06-67	1	1.7	0.5	
06-67	2	1.7	0.5	DO
06-67	3	1.7	0.5	DO
06-67	4			NOT DETERMINED
06-67	5			NOT DETERMINED
06-67	6	2.0	17.0	PERSULFATE, USGS WSP 1454, D124A-1
06-67	7	1.5	12.2	
06-67	8	1.6	6.4	PERSULFATE, APHA STD. METH., 1965
06-67	9	1.7	0.5	
06-67	10			NOT DETERMINED
06-67	11	1.8	5.3	
06-67	12			NOT DETERMINED
06-67	13	1.8	5.3	
06-67	14	1.9	11.2	DO
06-67	15			NOT DETERMINED
06-67	16	1.6	6.4	
06-67	17	1.8	5.3	DO
06-67	18	1.5	12.2	DO
06-67	19	1.8	5.3	DO
06-67	20	1.6	6.4	DO
06-67	21	1.7	0.5	DO
06-67	22	1.8	5.3	DO
06-67	23	1.6	6.4	DO
06-67	24	1.8	5.3	DO
06-67	25	1.6	6.4	OTHER
06-67	26	3.0	75.5	REJECT
06-67	28	1.7	0.5	DO
06-67	29	1.7	0.5	DO

TOTAL RANGE 1.5-3.0

MEAN 1.71  
STANDARD DEVIATION 0.123

AVERAGE DEVIATION 0.093  
90 PCT. CONF. INTVL OF MEAN 1.71 ± 0.045

SAMPLE 22

MN

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN S	METHOD
06-67	1	30	4.4	ATOMIC ABSORPTION
06-67	2	32	1.9	DO
06-67	3	33	5.1	DO
06-67	4	32	1.9	COMPLEXOMETRIC, USGS WSP 1454, D:8A-1
06-67	5	32	1.9	DO
06-67	6	30	4.4	DO
07-67	7	32	1.9	ATOMIC ABSORPTION
06-67	8	32	1.9	EDTA TITRIMETRIC, APHA STD, METH. 1965
06-67	9	30	4.4	ATOMIC ABSORPTION
06-67	10	32	1.9	COMPLEXOMETRIC, USGS WSP 1454, D:8A-1
06-67	11	31	1.3	ATOMIC ABSORPTION
06-67	12	33	5.1	OTHER
06-67	13	31	1.3	ATOMIC ABSORPTION
06-67	14	32	1.9	COMPLEXOMETRIC, USGS WSP 1454, D:8A-1
06-67	15	29	7.6	OTHER
06-67	16	31	1.3	ATOMIC ABSORPTION
06-67	17	32	1.9	COMPLEXOMETRIC, USGS WSP 1454, D:8A-1
06-67	18	31	1.3	ATOMIC ABSORPTION
06-67	19	32	1.9	COMPLEXOMETRIC, USGS WSP 1454, D:8A-1
06-67	20	31	1.3	ATOMIC ABSORPTION
06-67	21	32	1.9	DO
06-67	22	32	1.9	COMPLEXOMETRIC, USGS WSP 1454, D:8A-1
06-67	23	32	1.9	ATOMIC ABSORPTION
06-67	24	30	4.4	DO
06-67	25	29	7.6	EDTA TITRIMETRIC, APHA STD, METH. 1965
06-67	26	32	1.9	DO
06-67	28	32	1.9	COMPLEXOMETRIC, USGS WSP 1454, D:8A-1
06-67	29	32	1.9	ATOMIC ABSORPTION

TOTAL RANGE	29- 33	AVERAGE DEVIATION	0.880
MEAN	31.4	90 PCT.CONF.INTVLOF MEAN	31.4 ± 0.343
STANDARD DEVIATION	1.07		

SAMPLE 22

CA

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	11	6.8	ATOMIC ABSORPTION
06-67	2	9.1	11.5	DO
06-67	3	10	2.9	DO
06-67	4	11	6.8	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	5	9.9	3.4	DO
06-67	6	12	16.5	DO
07-67	7	9.9	3.8	ATOMIC ABSORPTION
06-67	8	11	6.8	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	9	9.7	5.8	ATOMIC ABSORPTION
06-67	10	11	6.8	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	11	10	2.9	ATOMIC ABSORPTION
06-67	12	10	2.9	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	13	9.8	4.8	ATOMIC ABSORPTION
06-67	14	9.6	6.8	DO
06-67	15	10	2.9	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	16	10	2.9	ATOMIC ABSORPTION
06-67	17	11	6.8	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	18	9.8	4.8	ATOMIC ABSORPTION
06-67	19	11	6.8	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	20	13	26.3	REJECT DO
06-67	21	10	2.9	ATOMIC ABSORPTION
06-67	22	10	2.9	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	23	10	2.9	ATOMIC ABSORPTION
06-67	24	9.6	6.8	DO
06-67	25	12	16.5	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	26	10	2.9	DO
06-67	28	11	6.8	DO
06-67	29	9.6	6.8	ATOMIC ABSORPTION

TOTAL RANGE 9.1 - 13  
 MEAN 10.3  
 STANDARD DEVIATION 0.737  
 AVERAGE DEVIATION 0.617  
 90 PCT.CONF.INTVL OF MEAN 10.3 ± 0.242  
 SAMPLE 22  
 MG

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	16	8.3	ATOMIC ABSORPTION
06-67	2	18	3.2	DO
06-67	3	17	2.5	FLAME PHOTOMETRY
06-67	4			NOT DETERMINED
06-67	5	18	3.2	FLAME PHOTOMETRY
06-67	6			NOT DETERMINED
07-67	7	17	2.5	ATOMIC ABSORPTION
06-67	8	16	8.3	FLAME PHOTOMETRY
06-67	9	18	3.2	ATOMIC ABSORPTION
06-67	10			NOT DETERMINED
06-67	11	17	2.5	FLAME PHOTOMETRY
06-67	12	16	8.3	OTHER
06-67	13	18	3.2	FLAME PHOTOMETRY
06-67	14	18	3.2	ATOMIC ABSORPTION
06-67	15	18	3.2	FLAME PHOTOMETRY
06-67	16	17	2.5	ATOMIC ABSORPTION
06-67	17	18	3.2	FLAME PHOTOMETRY
06-67	18	17	2.5	ATOMIC ABSORPTION
06-67	19	17	2.5	FLAME PHOTOMETRY
06-67	20	17	2.5	ATOMIC ABSORPTION
06-67	21	17	2.5	DO
06-67	22	18	3.2	FLAME PHOTOMETRY
06-67	23	18	3.2	ATOMIC ABSORPTION
06-67	24	18	3.2	DO
06-67	25	18	3.2	FLAME PHOTOMETRY
06-67	26	18	3.2	DO
06-67	28	18	3.2	DO
06-67	29	18	3.2	ATOMIC ABSORPTION

TOTAL RANGE	16- 18				SAMPLE 22
MEAN	17.4	AVERAGE DEVIATION	0.627		
STANDARD DEVIATION	0.712	90 PCT.CONF.INTVLOF MEAN	17.4 ± 0.244		NA

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	6.8 ✓	1.9	ATOMIC ABSORPTION
06-67	2	→ 7.3 ✓	9.4	DO
06-67	3	6.4	4.1	OTHER
06-67	4			NOT DETERMINED
06-67	5	6.8	1.9	OTHER
06-67	6			NOT DETERMINED
07-67	7	6.4 ✓	4.1	ATOMIC ABSORPTION
06-67	8	7.0	4.9	OTHER
06-67	9	6.6 ✓	1.1	ATOMIC ABSORPTION
06-67	10			NOT DETERMINED
06-67	11	6.8	1.9	OTHER
06-67	12	6.8	1.9	
06-67	13	6.8	1.9	OTHER
06-67	14	6.6 ✓	1.1	ATOMIC ABSORPTION
06-67	15	6.0	10.1	OTHER
06-67	16	6.8 ✓	1.9	ATOMIC ABSORPTION
06-67	17	6.1	8.6	OTHER
06-67	18	6.8 ✓	1.9	ATOMIC ABSORPTION
06-67	19	6.9	3.4	OTHER
06-67	20	6.8 ✓	1.9	ATOMIC ABSORPTION
06-67	21	→ 5.5 ✓	17.6	DO
06-67	22	6.8	1.9	OTHER
06-67	23	6.8 ✓	1.9	ATOMIC ABSORPTION
06-67	24	→ 7.0 ✓	4.9	DO
06-67	25	7.6	13.9	OTHER
06-67	26	6.0	10.1	DO
05-67	28	6.6	1.1	DO
06-67	29	6.8 ✓	1.9	ATOMIC ABSORPTION

TOTAL RANGE 5.5-7.6

MEAN 6.67

STANDARD DEVIATION 0.432

AVERAGE DEVIATION

0.308

90 PCT.CONF.INTVLOF MEAN

6.67 ± 0.148

SAMPLE 22

K



DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	3 ✓	30.2	POTENTIOMETRIC, USGS WSP 1454, D:2A-1
06-67	2	5 ✓	16.4	DO
06-67	3	3 ✓	30.2	DO
06-67	4	5 ✓	16.4	DO
06-67	5	5 ✓	16.4	DO
06-67	6	4 ✓	6.9	DO
07-67	7	5 ✓	16.4	DO
06-67	8	7 ✓	62.9	DO
06-67	9	5 ✓	16.4	DO
06-67	10	4 ✓	6.9	DO
06-67	11	4 ✓	6.9	DO
06-67	12	3 ✓	30.2	OTHER
06-67	13	4 ✓	6.9	POTENTIOMETRIC, USGS WSP 1454, D:2A-1
06-67	14	3 ✓	30.2	DO
06-67	15	5 ✓	16.4	DO
06-67	16	4 ✓	6.9	DO
06-67	17	6 ✓	39.7	DO
06-67	18	6 ✓	39.7	DO
06-67	19	4 ✓	6.9	DO
06-67	20	6 ✓	39.7	DO
06-67	21	4 ✓	6.9	POTENTIOMETRIC, APHA STD. METH., 1965
06-67	22	4 ✓	6.9	POTENTIOMETRIC, USGS WSP 1454, D:2A-1
06-67	23	5 ✓	16.4	DO
06-67	24	4 ✓	6.9	DO
06-67	25	2 ✓	53.4	INDICATOR METHOD, APHA STD. METH., 1965
06-67	26	10 ✓	132.8	DO REJECT
06-67	28	4 ✓	6.9	POTENTIOMETRIC, USGS WSP 1454, D:2A-1
06-67	29	2 ✓	53.4	DO

TOTAL RANGE 2- 10  
 MEAN 4.30  
 STANDARD DEVIATION 1.20

AVERAGE DEVIATION 0.944  
 90 PCT.CONF.INTVLOF MEAN 4.30 ± 0.395

SAMPLE 22

HC03

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	141	0.2	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D:38A-2
06-67	2	148	4.8	VISUAL THORIN, USGS WSP 1454, D:38A-1
06-67	3	144	1.9	DO
06-67	4	143	1.2	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D:38A-2
06-67	5	145	2.6	DO
06-67	6	139	1.6	DO
07-67	7	134	5.1	DO
06-67	8	132	6.6	GRAVIMETRIC WITH IGNITION, APHA STD. METH., 1965
06-67	9	142	0.5	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D:38A-2
06-67	10	148	4.8	VISUAL THORIN, USGS WSP 1454, D:38A-1
06-67	11	141	0.2	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D:38A-2
06-67	12	151	6.9	OTHER
06-67	13	143	1.2	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D:38A-2
06-67	14	143	1.2	DO
06-67	15	142	0.5	GRAVIMETRIC WITH IGNITION, APHA STD. METH., 1965
06-67	16	140	0.9	OTHER
06-67	17	145	2.6	VISUAL THORIN, USGS WSP 1454, D:38A-1
06-67	18	143	1.2	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D:38A-2
06-67	19	140	0.9	DO
06-67	20	146	3.4	DO
06-67	21	140	0.9	DO
06-67	22	144	1.9	DO
06-67	23	138	2.3	DO
06-67	24	140	0.9	DO
06-67	25	122	13.6	HACH-SULFA VER
06-67	26	120	15.0	GRAVIMETRIC WITH IGNITION, APHA STD. METH., 1965
06-67	28	140	0.9	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D:38A-2
06-67	29	140	0.9	DO

REJECT

18 141.2 ± 2.80

22 142.1 ± 3.30

gross 3 131.3 ± 11.0

TOTAL RANGE 120-151  
 MEAN 141.3 AVERAGE DEVIATION 3.66  
 STANDARD DEVIATION 5.54 90 PCT.CONF.INTVLOF MEAN 141.3 ± 1.82

SAMPLE 22

S04

DATE MO-YR	CODE	REPORTED VALUE	PCT. DEV. FROM MEAN	METHOD
06-67	1	3.3	1.7	MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
06-67	2	2.6	22.5	DO
06-67	3	4.3	28.1	DO
06-67	4	3.6	7.3	DO
06-67	5	1.7	49.3	✓ PROPOSED VISUAL MERCURIMETRIC (JUNE 1963)
06-67	6	5.1	52.0	MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
07-67	7	3.1	7.6	PROPOSED SPECTROPHOTOMETRIC MERCURIMETRIC (JUNE 1963)
06-67	8	6.0	78.8	ARGENTOMETRIC, APHA STD. METH., 1965
06-67	9	3.3	1.7	MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
06-67	10	4.4	31.1	DO
05-67	11	2.9	13.6	MERCURIC THIOCYANATE, BULL. CHEM. SOC. JAPAN, V. 25
06-67	12	3.1	7.6	OTHER
06-67	13	2.0	40.4	MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
06-67	14	2.6	22.5	✓ PROPOSED VISUAL MERCURIMETRIC (JUNE 1963)
06-67	15	2.8	16.6	MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
06-67	16	4.5	34.1	✓ PROPOSED VISUAL MERCURIMETRIC (JUNE 1963)
06-67	17	8.0	138.4	REJECT MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
06-67	18	2.5	25.5	DO
06-67	19	2.5	25.5	✓ PROPOSED VISUAL MERCURIMETRIC (JUNE 1963)
06-67	20	2.8	16.6	MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
06-67	21	3.2	4.6	PROPOSED SPECTROPHOTOMETRIC MERCURIMETRIC (JUNE 1963)
06-67	22	3.5	4.3	MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
06-67	23	3.0	10.6	DO
06-67	24	2.5	25.5	PROPOSED SPECTROPHOTOMETRIC MERCURIMETRIC (JUNE 1963)
06-67	25	1.5	55.3	OTHER
06-67	26	5.0	49.0	MOHR VOLUMETRIC, USGS WSP 1454, D:10A-1
06-67	28	6.0	78.8	DO
06-67	29	2.8	16.6	DO

Vis 4  $2.82 \pm 1.18$   
 Spec 3  $2.93 \pm 0.38$   
 Comb 7  $2.87 \pm 0.86$

TOTAL RANGE 1.5- 8.0  
 MEAN 3.36 AVERAGE DEVIATION 0.904  
 STANDARD DEVIATION 1.17 90 PCT.CONF.INTVLOF MEAN  $3.36 \pm 0.386$

SAMPLE 22

CL

115"

DATE DD-MR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
05-67	1	0.5	4.3	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
05-67	2	0.6	14.9	DO
05-67	3	0.5	4.3	DO
05-67	4	0.4	23.4	DO
05-67	5	0.5	4.3	DO
06-67	6	0.4	23.4	DO
07-67	7	0.7	34.0	DO
08-67	8	0.6	14.9	VISUAL ALIZARIN, APHA STD, MET&CT 1965
08-67	9	0.5	4.3	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
08-67	10	0.5	14.9	DO
08-67	11	0.6	14.9	SPADNS METHOD, APHA STD, METH., 1965
08-67	12	0.5	4.3	DO
08-67	13	0.6	14.9	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	14	0.5	4.3	DO
08-67	15	0.5	4.3	SPADNS METHOD, APHA STD, METH., 1965
06-67	16	0.6	14.9	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	17	0.5	4.3	DO
06-67	18	0.5	4.3	ZIRCONIUM-ALIZARIN, USGS WSP 1454, D:16A-2
06-67	19	0.6	14.9	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	20	0.3	42.6	DO
06-67	21	0.4	23.4	DO
06-67	22	0.4	23.4	DO
06-67	23	0.8	53.2	DO
06-67	24	0.4	23.4	DO
06-67	25			NOT DETERMINED
06-67	26	0.5	4.3	SPADNS METHOD, APHA STD, METH., 1965
06-67	28	0.5	4.3	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	29	0.6	14.9	DO

TOTAL RANGE	0.3-0.8	AVERAGE DEVIATION	0.080
MEAN	0.522	90 PCT.CONF.INTVLOF MEAN	0.522 ± 0.034
STANDARD DEVIATION	0.105		

SAMPLE 22

F

1.90  
1.16  
-0.74

1.40  
1.11  
-0.29

DATE M-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN		METHOD
05-67	1	1.1	0.3		ATOMIC ABSORPTION
05-67	2				NOT DETERMINED
05-67	3	1.1	0.3		ATOMIC ABSORPTION
06-67	4				NOT DETERMINED
06-67	5				NOT DETERMINED
06-67	6				NOT DETERMINED
07-67	7	1.9	72.3	REJECT	ATOMIC ABSORPTION
05-67	8				NOT DETERMINED
05-67	9	1.1	0.3		ATOMIC ABSORPTION
06-67	10				NOT DETERMINED
06-67	11	1.2	8.8		ATOMIC ABSORPTION
06-67	12				NOT DETERMINED
06-67	13	1.1	0.3		ATOMIC ABSORPTION
06-67	14	1.1	0.3		DO
06-67	15	1.0	9.3		DO
06-67	16	1.0	9.3		DO
06-67	17	1.1	0.3		DO
06-67	18	1.1	0.3		DO
06-67	19	1.0	9.3		DO
06-67	20				NOT DETERMINED
06-67	21	1.2	8.8		ATOMIC ABSORPTION
06-67	22	1.4	27.0		DO
06-67	23	1.2	8.8		DO
06-67	24	1.0	9.3		DO
06-67	25	0.95	13.9		OTHER
05-67	26				NOT DETERMINED
05-67	28	1.1	0.3		ATOMIC ABSORPTION
06-67	29	1.1	0.3		DO

TOTAL RANGE 0.95- 1.9

MEAN 1.10

STANDARD DEVIATION 0.104

AVERAGE DEVIATION 0.065

90 PCT.CONF.INTVLOF MEAN 1.10 ± 0.042

SAMPLE 22

ZN

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	21	25.6	PHENOLDISULFONIC ACID, USGS WSP 1454, D1256-1
06-67	2	16	4.3	DO
06-67	3	17	1.7	DO
06-67	4	17	1.7	DO
06-67	5	17	1.7	DO
06-67	6	17	1.7	DO
07-67	7	17	1.7	DIAZOTIZATION, JAWWA, 56, 633-638, (1964)
06-67	8	17	1.7	PHENOLDISULFONIC ACID, APHA STD. METH., 1965
06-67	9	16	4.3	PHENOLDISULFONIC ACID, USGS WSP 1454, D1256-1
06-67	10			NOT DETERMINED
06-67	11	16	4.3	PHENOLDISULFONIC ACID, USGS WSP 1454, D1256-1
06-67	12	18	7.7	PHENOLDISULFONIC ACID, APHA STD. METH., 1965
06-67	13	17	1.7	PHENOLDISULFONIC ACID, USGS WSP 1454, D1256-1
06-67	14	18	7.7	DO
06-67	15	15	10.3	PHENOLDISULFONIC ACID, APHA STD. METH., 1965
06-67	16	17	1.7	PHENOLDISULFONIC ACID, USGS WSP 1454, D1256-1
06-67	17	17	1.7	DO
06-67	18	14	16.3	DO
06-67	19	16	4.3	DO
06-67	20	17	1.7	DO
06-67	21	18	7.7	DO
06-67	22	16	4.3	DO
06-67	23	16	4.3	DO
06-67	24	16	4.3	DO
06-67	25			NOT DETERMINED
06-67	26	1.0	94.0	REJECT BRUCINE, ANAL. CHEM., 36, 610 (1964)
06-67	28	16	4.3	PHENOLDISULFONIC ACID, USGS WSP 1454, D1256-1
06-67	29	16	4.3	DO

TOTAL RANGE	1.0	21			SAMPLE 22
MEAN		16.7	AVERAGE DEVIATION	0.874	
STANDARD DEVIATION		1.28	90 PCT.CONF.INTVLOF MEAN	16.7 ± 0.436	NO3

DETERMINATION	NO. LABS REPORTING	PCT. OF VALUES REJECTED	PCT. OF UNREJECTED VALUES WITHIN		
			90 PCT. CI	X + STD	X + 2STD
COND	28	4	30	78	96
PH	28	4	15	81	96
SiO2	26	4	76	76	96
MN	23	4	32	82	95
CA	28	0	0	71	93
HG	28	4	0	89	93
NA	25	0	0	88	88
K	25	0	56	76	92
HCU3	28	4	37	63	96
SO4	28	4	52	78	96
CL	28	4	30	74	93
F	27	0	41	70	93
NO3	26	4	40	76	92
ZN	19	5	50	89	94

DATE MO-YR	CODE	REPORTED VALUE	PCT. DEV. FROM MEAN	METHOD
06-67	1	334	0.1	WHEATSTONE BRIDGE
06-67	2	330	1.1	DO
06-67	3	355	6.4	DIRECT READING INSTRUMENTS
06-67	4	328	1.7	WHEATSTONE BRIDGE
06-67	5	331	0.8	DO
06-67	6	329	1.4	DO
07-67	7	333	0.2	DO
06-67	8	330	1.1	DIRECT READING INSTRUMENTS
06-67	9	331	0.8	WHEATSTONE BRIDGE
06-67	10	331	0.8	DO
06-67	11	339	1.6	DO
06-67	12	336	0.7	UTHER
06-67	13	341	2.2	WHEATSTONE BRIDGE
06-67	14	333	0.2	DO
06-67	15	331	0.8	DO
06-67	16	334	0.1	DIRECT READING INSTRUMENTS
06-67	17	338	1.3	WHEATSTONE BRIDGE
06-67	18	322	3.5	DO
06-67	19	334	0.1	DO
06-67	20	329	1.4	DO
06-67	21	327	2.0	DO
06-67	22	335	0.4	DO
06-67	23	335	0.4	DO
06-67	24	332	0.5	DO
06-67	25	360	7.9	REJECT DO
06-67	26	325	2.6	DO
06-67	28	330	1.1	DO
06-67	29	352	5.5	DO

TOTAL RANGE 322- 360  
MEAN 333.5  
STANDARD DEVIATION 7.08

AVERAGE DEVIATION 4.76  
90 PCT. CONF. INTVLOF MEAN 333.5 ± 2.33

SAMPLE 23  
COND



DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	7.8	0.3	INSTRUMENT METHOD (POTENTIOMETRIC)
06-67	2	7.8	0.3	
06-67	3	7.8	0.3	
06-67	4	8.2	5.4	
06-67	5	7.4	4.9	
06-67	6	7.8	0.3	
07-67	7	8.0	2.8	
06-67	8	7.1	8.7	
06-67	9	7.9	1.6	
06-67	10	8.0	2.8	
06-67	11	8.0	2.8	
06-67	12	8.1	4.1	OTHER
06-67	13	7.8	0.3	INSTRUMENT METHOD (POTENTIOMETRIC)
06-67	14	7.1	8.7	
06-67	15	8.1	4.1	
06-67	16	8.0	2.8	
06-67	17	7.1	8.7	
06-67	18	7.4	4.9	
06-67	19	7.9	1.6	
06-67	20	7.8	0.3	
06-67	21	8.1	4.1	
06-67	22	8.0	2.8	
06-67	23	7.7	1.0	
06-67	24	7.6	2.3	
06-67	25	8.0	2.8	
06-67	26	8.0	2.8	
06-67	28	7.6	2.3	
06-67	29	7.7	1.0	

TOTAL RANGE 7.1-8.2  
 MEAN 7.78  
 STANDARD DEVIATION 0.311  
 AVERAGE DEVIATION 0.236  
 90 PCT.CONF.INTVLOF MEAN 7.78 ± 0.100

SAMPLE 23

PH

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN		METHOD
06-67	1	5.8	3.6		MOLYBDATE BLUE, USGS WSP 1454, D134A-1
06-67	2	5.6	0.1		DD
06-67	3	5.6	0.1		DD
06-67	4				NOT DETERMINED
06-67	5	5.9	5.4		MOLYBDATE BLUE, USGS WSP 1454, D134A-1
06-67	6	5.8	3.6		DD
07-67	7	5.6	0.1		DD
06-67	8	3.8	32.1	REJECT	COLORIMETRIC MOLYBDOSTYLICATE, ALPHA STD. METH., 1961
06-67	9	5.5	1.7		MOLYBDATE BLUE, USGS WSP 1454, D134A-1
06-67	10	5.8	3.6		DD
06-67	11	5.8	3.6		OTHER
06-67	12	5.2	7.1		DD
06-67	13	5.4	3.5		MOLYBDATE BLUE, USGS WSP 1454, D134A-1
06-67	14	5.8	3.6		DD
06-67	15	5.9	5.4		DD
06-67	16	5.6	0.1		DD
06-67	17	5.3	5.3		DD
06-67	18	6.3	12.6		DD
06-67	19	5.5	1.7		DD
06-67	20	5.7	1.9		DD
06-67	21	5.5	1.7		DD
06-67	22	5.5	1.7		DD
06-67	23	5.2	7.1		DD
06-67	24	5.5	1.7		DD
06-67	25				NOT DETERMINED
06-67	26	5.0	10.7		OTHER
06-67	28	5.5	1.7		MOLYBDATE BLUE, USGS WSP 1454, D134A-1
06-67	29	5.6	0.1		DD

22 5.63 ± 0.24  
25 5.60 ± 0.27

TOTAL RANGE 3.8 - 6.3  
MEAN 5.60  
STANDARD DEVIATION 0.270

AVERAGE DEVIATION 0.196  
90 PCT.CONF.INTVLOF MEAN 5.60 ± 0.092

SAMPLE 23  
S102

DATE MO-YR	CODE	REPORTED VALUE	PCI-023 FRG. MEAN	REMARKS
06-67	1	0.01	100.0	
06-67	2	0.00	100.0	
06-67	3	0.03	100.0	
06-67	4	0.02	100.0	
06-67	5	0.02	100.0	
06-67	6	0.02	100.0	
06-67	7	0.04	100.0	
06-67	8	0.03	100.0	
06-67	9	0.03	100.0	
06-67	10	0.01	100.0	
06-67	11	0.02	100.0	
06-67	12	0.10	100.0	
06-67	13	0.02	100.0	
06-67	14	0.02	100.0	
06-67	15	0.00	100.0	
06-67	16	0.01	100.0	
06-67	17	0.00	100.0	
06-67	18	0.00	100.0	
06-67	19	0.00	100.0	
06-67	20	0.00	100.0	
06-67	21	0.00	100.0	
06-67	22	0.04	100.0	
06-67	23	0.00	100.0	
06-67	24	0.02	100.0	
06-67	25	0.00	100.0	
06-67	26	0.00	100.0	
06-67	28	0.00	100.0	
06-67	29	0.02	100.0	

TOTAL RANGE 0.00-0.10  
 MEAN 0.014  
 STANDARD DEVIATION 0.016  
 AVERAGE DEVIATION 0.015  
 26 PCI-CORE-LIPIVLOF BEAR 0.014 ± 0.015  
 SAMPLE 23

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	29	5.0	ATOMIC ABSORPTION
06-67	2	31	1.5	DO
06-67	3	32	4.8	DO
06-67	4	32	4.8	COMPLEXOMETRIC, USGS WSP 1454, D18A-1
06-67	5	31	1.5	DO
06-67	6	29	5.0	DO
07-67	7	31	1.5	ATOMIC ABSORPTION
06-67	8	32	4.8	EDTA TITRIMETRIC, APHA STD. METH. 1965
06-67	9	30	1.8	ATOMIC ABSORPTION
06-67	10	31	1.5	COMPLEXOMETRIC, USGS WSP 1454, D18A-1
06-67	11	31	1.5	ATOMIC ABSORPTION
06-67	12	32	4.8	OTHER
06-67	13	30	1.8	ATOMIC ABSORPTION
06-67	14	31	1.5	COMPLEXOMETRIC, USGS WSP 1454, D18A-1
06-67	15	30	1.8	OTHER
06-67	16	29	5.0	ATOMIC ABSORPTION
06-67	17	30	1.8	COMPLEXOMETRIC, USGS WSP 1454, D18A-1
06-67	18	29	5.0	ATOMIC ABSORPTION
06-67	19	30	1.8	COMPLEXOMETRIC, USGS WSP 1454, D18A-1
06-67	20	30	1.8	ATOMIC ABSORPTION
06-67	21	31	1.5	DO
06-67	22	32	4.8	COMPLEXOMETRIC, USGS WSP 1454, D18A-1
06-67	23	30	1.8	ATOMIC ABSORPTION
06-67	24	30	1.8	DO
06-67	25	27	11.6	EDTA TITRIMETRIC, APHA STD. METH. 1965
06-67	26	33	8.1	DO
06-67	28	30	1.8	COMPLEXOMETRIC, USGS WSP 1454, D18A-1
06-67	29	32	4.8	ATOMIC ABSORPTION

TOTAL RANGE 27- 33  
 MEAN 30.5  
 STANDARD DEVIATION 1.29

AVERAGE DEVIATION 1.04  
 90 PCT. CONF. INTVL OF MEAN 30.5 ± 0.415

SAMPLE 23

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	9.9	10.1	ATOMIC ABSORPTION
06-67	2	8.1	9.9	DO
06-67	3	10	11.2	DO
06-67	4	8.9	1.0	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	5	8.1	9.9	DO
06-67	6	11	22.4	DO
07-67	7	8.9	1.0	ATOMIC ABSORPTION
06-67	8	8.8	2.1	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	9	8.6	4.3	ATOMIC ABSORPTION
06-67	10	8.6	4.3	NOT SPECIFIED
06-67	11	9.9	10.1	ATOMIC ABSORPTION
06-67	12	7.5	16.6	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	13	8.7	3.2	ATOMIC ABSORPTION
06-67	14	8.4	6.6	DO
06-67	15	2.4	73.3	REJECT CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	16	8.4	6.6	ATOMIC ABSORPTION
06-67	17	9.0	0.1	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	18	8.7	3.2	ATOMIC ABSORPTION
06-67	19	9.5	5.7	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	20	9.0	0.1	ATOMIC ABSORPTION
06-67	21	8.5	5.4	DO
06-67	22	8.1	9.9	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	23	9.5	5.7	ATOMIC ABSORPTION
06-67	24	8.5	5.4	DO
06-67	25	11	22.4	CALC. BY DIFFERENCE, USGS WSP 1454, D:17A-1, D:23A-1
06-67	26	8.0	11.0	DO
06-67	28	9.5	5.7	DO
06-67	29	9.6	6.8	ATOMIC ABSORPTION

TOTAL RANGE 2.4 11  
 MEAN 8.99  
 STANDARD DEVIATION 0.859

AVERAGE DEVIATION 0.668  
 90 PCT.CONF.INTVLOF MEAN 8.99 ± 0.282

SAMPLE 23

MG

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	20	6.3	ATOMIC ABSORPTION
06-67	2	21	1.6	DO
06-67	3	21	1.6	FLAME PHOTOMETRY
06-67	4			NOT DETERMINED
06-67	5	22	3.1	FLAME PHOTOMETRY
06-67	6			NOT DETERMINED
07-67	7	21	1.6	ATOMIC ABSORPTION
06-67	8	21	1.6	FLAME PHOTOMETRY
06-67	9	22	3.1	ATOMIC ABSORPTION
06-67	10			NOT DETERMINED
06-67	11	19	10.9	FLAME PHOTOMETRY
06-67	12	21	1.6	OTHER
06-67	13	22	3.1	FLAME PHOTOMETRY
06-67	14	21	1.6	ATOMIC ABSORPTION
06-67	15	32	50.0	REJECT
06-67	16	21	1.6	FLAME PHOTOMETRY
06-67	17	22	3.1	ATOMIC ABSORPTION
06-67	18	21	1.6	FLAME PHOTOMETRY
06-67	19	21	1.6	ATOMIC ABSORPTION
06-67	20	22	3.1	FLAME PHOTOMETRY
06-67	21	21	1.6	DO
06-67	22	21	1.6	FLAME PHOTOMETRY
06-67	23	22	3.1	ATOMIC ABSORPTION
06-67	24	22	3.1	DO
06-67	25	23	7.8	FLAME PHOTOMETRY
06-67	26	21	1.6	DO
06-67	28	22	3.1	DO
06-67	29	22	3.1	ATOMIC ABSORPTION

TOTAL RANGE 19- 32  
 MEAN 21.3  
 STANDARD DEVIATION 0.816

AVERAGE DEVIATION 0.639  
 90 PCT.CONF.INTVLOF MEAN 21.3 ± 0.286

SAMPLE 23

NA

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	2.0	11.8	ATOMIC ABSORPTION
06-67	2	2.4	5.9	DI
06-67	3	2.2	2.9	DI
06-67	4			NOT DETERMINED
06-67	5	2.4	5.9	OTHER
06-67	6			NOT DETERMINED
07-67	7	2.1	7.4	ATOMIC ABSORPTION
06-67	8	2.3	1.5	OTHER
06-67	9	2.3	1.5	ATOMIC ABSORPTION
06-67	10			NOT DETERMINED
06-67	11	2.4	5.9	OTHER
06-67	12	2.4	5.9	
06-67	13	2.4	5.9	OTHER
06-67	14	2.2	2.9	ATOMIC ABSORPTION
06-67	15	1.9	16.2	OTHER
06-67	16	2.2	2.9	ATOMIC ABSORPTION
06-67	17	2.0	11.8	OTHER
06-67	18	2.5	10.3	ATOMIC ABSORPTION
06-67	19	2.2	2.9	OTHER
06-67	20	2.4	5.9	ATOMIC ABSORPTION
06-67	21	2.1	7.4	DO
06-67	22	2.3	1.5	OTHER
06-67	23	2.4	5.9	ATOMIC ABSORPTION
06-67	24	2.3	1.5	DO
06-67	25	2.6	14.7	OTHER
06-67	26	3.0	32.4	DO
06-67	28	2.2	2.9	DO
06-67	29	2.2	2.9	ATOMIC ABSORPTION

REJECT

TOTAL RANGE 1.9- 3.0

MEAN 2.27

STANDARD DEVIATION 0.169

AVERAGE DEVIATION

0.136

90 PCT.CONF.INTVL OF MEAN

2.27 ± 0.059

SAMPLE 23

K

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	93 ✓	1.4	POTENTIOMETRIC; USGS WSP 1454, 012A-1
06-67	2	94 ✓	0.4	DO
06-67	3	93 ✓	1.4	DO
06-67	4	94 ✓	0.4	DO
06-67	5	95 ✓	0.7	DO
06-67	6	94 ✓	0.4	DO
07-67	7	95 ✓	0.7	DO
06-67	8	95 ✓	0.7	DO
06-67	9	94 ✓	0.4	DO
06-67	10	95 ✓	0.7	DO
06-67	11	95 ✓	0.7	DO
06-67	12	93 ✓	1.4	OTHER
06-67	13	94 ✓	0.4	POTENTIOMETRIC; USGS WSP 1454, 012A-1
06-67	14	91 ✓	3.5	DO
06-67	15	92 ✓	2.5	DO
06-67	16	93 ✓	1.4	DO
06-67	17	96 ✓	1.8	DO
06-67	18	94 ✓	0.4	DO
06-67	19	96 ✓	1.8	DO
06-67	20	98 ✓	3.9	DO
06-67	21	96 ✓	1.8	POTENTIOMETRIC; APHA STD. METH., 1905
06-67	22	95 ✓	0.7	POTENTIOMETRIC; USGS WSP 1454, 012A-1
06-67	23	96 ✓	1.8	DO
06-67	24	95 ✓	0.7	DO
06-67	25	73 ✓	22.6	REJECT INDICATOR METHOD; APHA STD. METH., 1905
06-67	26	91 ✓	3.5	DO
06-67	28	96 ✓	1.8	POTENTIOMETRIC; USGS WSP 1454, 012A-1
06-67	29	94 ✓	0.4	DO

TOTAL RANGE 73- 98  
 MEAN 94.3 AVERAGE DEVIATION 1.23  
 STANDARD DEVIATION 1.59 90 PCT.CONF.INTVLOF MEAN 94.3 ± 0.523

SAMPLE 23

HCO3



DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	44	0.4	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D138A-2
06-67	2	44	0.4	VISUAL THORIN, USGS WSP 1454, D138A-1
06-67	3	44	0.4	DO
06-67	4	45	2.7	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D138A-2
06-67	5	44	0.4	DO
06-67	6	44	0.4	DO
07-67	7	42	4.1	DO
06-67	8	40	8.7	GRAVIMETRIC WITH IGNITION, APHA STD. METH., 1965
06-67	9	44	0.4	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D138A-2
06-67	10	44	0.4	VISUAL THORIN, USGS WSP 1454, D138A-1
06-67	11	44	0.4	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D138A-2
06-67	12	45	2.7	OTHER
06-67	13	45	2.7	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D138A-2
06-67	14	44	0.4	DO
06-67	15	42	4.1	GRAVIMETRIC WITH IGNITION, APHA STD. METH., 1965
06-67	16	43	1.9	OTHER
06-67	17	46	5.0	VISUAL THORIN, USGS WSP 1454, D138A-1
06-67	18	44	0.4	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D138A-2
06-67	19	44	0.4	DO
06-67	20	48	9.6	DO
06-67	21	42	4.1	DO
06-67	22	44	0.4	DO
06-67	23	42	4.1	DO
06-67	24	42	4.1	DO
06-67	25	46	5.0	HACH-SULFA VER
06-67	26	37	15.6	REJECT GRAVIMETRIC WITH IGNITION, APHA STD. METH., 1965
06-67	28	42	4.1	SPECTROPHOTOMETRIC THORIN, USGS WSP 1454, D138A-2
06-67	29	45	2.7	GRAVIMETRIC, USGS WSP 1454, D138A-3

TOTAL RANGE 37-48  
MEAN 43.8  
STANDARD DEVIATION 1.62

AVERAGE DEVIATION 1.15  
90 PCT.CONF.INTVLOF MEAN 43.8 ± 0.531

SAMPLE 23

SDA

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	27	0.9	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
06-67	2	26	2.8	DO
06-67	3	32	19.6	DO
06-67	4	26	2.8	DO
06-67	5	23	14.0	✓ PROPOSED VISUAL MERCURIMETRIC (JUNE 1963)
06-67	6	26	2.8	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
07-67	7	25	6.5	PROPOSED SPECTROPHOTOMETRIC MERCURIMETRIC (JUNE 1963)
06-67	8	29	8.4	ARGENTOMETRIC, ANAL. CHEM. 1965
06-67	9	26	2.8	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
06-67	10	25	6.5	DO
06-67	11	28	4.7	DO
06-67	12	26	2.8	OTHER
06-67	13	27	0.9	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
06-67	14	26	2.8	✓ PROPOSED VISUAL MERCURIMETRIC (JUNE 1963)
06-67	15	25	6.5	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
06-67	16	26	2.8	✓ PROPOSED VISUAL MERCURIMETRIC (JUNE 1963)
06-67	17	26	2.8	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
06-67	18	25	6.5	DO
06-67	19	26	2.8	✓ PROPOSED VISUAL MERCURIMETRIC (JUNE 1963)
06-67	20	24	10.3	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
06-67	21	24	10.3	PROPOSED SPECTROPHOTOMETRIC MERCURIMETRIC (JUNE 1963)
06-67	22	26	2.8	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
06-67	23	28	4.7	DO
06-67	24	26	2.8	PROPOSED SPECTROPHOTOMETRIC MERCURIMETRIC (JUNE 1963)
06-67	25	30	12.1	OTHER
06-67	26	33	23.4	MOHR VOLUMETRIC, USGS WSP 1454, D110A-1
06-67	28	28	4.7	DO
06-67	29	30	12.1	DO

7 25.7 ± 1.2

TOTAL RANGE	23- 33				SAMPLE 23
MEAN	26.8	AVERAGE DEVIATION	1.75		
STANDARD DEVIATION	2.32	90 PCT.CONF.INTVL OF MEAN	26.8 ± 0.746		CL

DATE MO-YR	CODE	REPORTED VALUE	PCT. DEV. FROM MEAN	METHOD
06-67	1	0.9	6.2	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	2	1.0	4.2	DD
06-67	3	0.9	6.2	DD
06-67	4	0.9	6.2	DD
06-67	5	1.1	14.7	DD
06-67	6	1.0	4.2	DD
07-67	7	1.1	14.7	DD
06-67	8	0.9	6.2	VISUAL ALIZARIN, APHA STD. METH. 1965
06-67	9	1.0	4.2	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	10	1.0	4.2	DD
06-67	11	0.7	27.0	SPADNS METHOD, APHA STD. METH., 1965
06-67	12	1.0	4.2	DD
06-67	13	1.1	14.7	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	14	1.0	4.2	DD
06-67	15	1.0	4.2	SPADNS METHOD, APHA STD. METH., 1965
06-67	16	1.0	4.2	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	17	1.0	4.2	DD
06-67	18	0.8	16.6	ZIRCONIUM-ALIZARIN, USGS WSP 1454, D:16A-2
06-67	19	0.8	16.6	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	20	0.8	16.6	DD
06-67	21	0.9	6.2	DD
06-67	22	1.0	4.2	DD
06-67	23	1.1	14.7	DD
06-67	24	1.0	4.2	DD
06-67	25			NOT DETERMINED
06-67	26	0.9	6.2	SPADNS METHOD, APHA STD. METH., 1965
06-67	28	1.0	4.2	ZIRCONIUM-ERIOCHROME CYANINE R, USGS WSQ 1454, D:16A-1
06-67	29	1.0	4.2	DD

TOTAL RANGE	0.7- 1.1	AVERAGE DEVIATION	0.081
MEAN	0.959	90 PCT. CONF. INTVL OF MEAN	0.959 ± 0.033
STANDARD DEVIATION	0.101		

SAMPLE 23

F

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	0.05	78.9	ATOMIC ABSORPTION
06-67	2			NOT DETERMINED
06-67	3	0.87	266.7	ATOMIC ABSORPTION
06-67	4			NOT DETERMINED
06-67	5			NOT DETERMINED
06-67	6			NOT DETERMINED
07-67	7	0.18	24.1	ATOMIC ABSORPTION
06-67	8			NOT DETERMINED
06-67	9	0.11	53.6	ATOMIC ABSORPTION
06-67	10			NOT DETERMINED
06-67	11	0.70	195.1	ATOMIC ABSORPTION
06-67	12			NOT DETERMINED
06-67	13	0.25	5.4	ATOMIC ABSORPTION
06-67	14	0.21	11.5	DO
06-67	15			NOT DETERMINED
06-67	16	0.05	78.9	ATOMIC ABSORPTION
06-67	17	0.07	70.5	DO
06-67	18	0.08	66.3	DO
06-67	19	0.08	66.3	DO
06-67	20			NOT DETERMINED
06-67	21	0.06	74.7	ATOMIC ABSORPTION
06-67	22	0.09	62.1	DO
06-67	23	0.32	34.9	DO
06-67	24	0.06	74.7	DO
06-67	25	0.34	43.3	OTHER
06-67	26			NOT DETERMINED
06-67	28	0.15	36.8	ATOMIC ABSORPTION
06-67	29	0.60	152.9	DO

191 ± 146

187  
23  
64

TOTAL RANGE 0.05-0.87  
 MEAN 0.237 AVERAGE DEVIATION 0.184  
 STANDARD DEVIATION 0.245 90 PCT.CONF.INTVLOF MEAN 0.237 ± 0.101

23-1-1  
 SAMPLE 23

ZN

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	0.4	6.1	PHENOLDISULFONIC ACID, USGS WSP 1454, D:256-1
06-67	2	0.0	100.0	DO
06-67	3	0.7	85.7	DO
06-67	4	0.4	6.1	DO
06-67	5	0.0	100.0	DO
06-67	6	0.2	46.9	DO
07-67	7	0.5	32.7	DIAZOTIZATION, JAWWA, 56, 633-638, (1964)
06-67	8	1.1	191.8	PHENOLDISULFONIC ACID, APHA STD. METH., 1965
06-67	9	0.4	6.1	PHENOLDISULFONIC ACID, USGS WSP 1454, D:256-1
06-67	10			NOT DETERMINED
06-67	11	0.6	59.2	PHENOLDISULFONIC ACID, USGS WSP 1454, D:256-1
06-67	12	0.5	32.7	PHENOLDISULFONIC ACID, APHA STD. METH., 1965
06-67	13	0.6	59.2	PHENOLDISULFONIC ACID, USGS WSP 1454, D:256-1
06-67	14	0.2	46.9	DO
06-67	15	0.4	6.1	PHENOLDISULFONIC ACID, APHA STD. METH., 1965
06-67	16	0.5	32.7	PHENOLDISULFONIC ACID, USGS WSP 1454, D:256-1
06-67	17	0.2	46.9	DO
06-67	18	0.0	100.0	DO
06-67	19	0.4	6.1	DO
06-67	20	0.3	20.4	DO
06-67	21	0.6	59.2	DO
06-67	22	0.5	32.7	DO
06-67	23	0.6	59.2	DO
06-67	24	0.0	100.0	DO
06-67	25			NOT DETERMINED
06-67	26	0.3	20.4	BRUCINE, ANAL. CHEM., 36, 610 (1964)
06-67	28	0.0	100.0	PHENOLDISULFONIC ACID, USGS WSP 1454, D:256-1
06-67	29	0.4	6.1	DO

"21"

TOTAL RANGE	0.0- 1.1	AVERAGE DEVIATION	0.198
MEAN	* 0.377	90 PCT.CONF.INTVLOF MEAN	0.377 ± 0.088
STANDARD DEVIATION	0.261		

SAMPLE 23

N03

DETERMINATION	NO. LABS REPORTING	PCT. OF VALUES REJECTED	PCT. OF UNREJECTED VALUES WITHIN		
			90 PCT. CI	X ± 1STD	X ± 2STD
CO <sub>2</sub> D	28	4	30	81	93
PH	28	0	29	68	89
SiO <sub>2</sub>	26	4	20	72	92
MN	22	5	14	81	95
CA	28	0	0	57	96
MG	28	4	19	63	93
HA	25	4	0	83	92
K	25	4	17	79	95
HCO <sub>3</sub>	23	4	26	67	89
SO <sub>4</sub>	23	4	44	53	93
CL	23	0	7	75	93
F	27	0	0	70	96
NO <sub>3</sub>	26	0	31	73	96
ZN	18	0	28	83	94

DATE MO-YR	CODE	REPORTED VALUE	PCT.DEV. FROM MEAN	METHOD
06-67	1	7.8	0.3	INSTRUMENT METHOD (NOT METROMETRIC)
06-67	2	7.6	0.3	DO
06-67	3	7.8	0.3	DO
06-67	4	8.2	5.4	DO
06-67	5	7.4	4.9	DO
06-67	6	7.8	0.3	DO
07-67	7	8.0	2.8	DO
06-67	8	7.1	8.7	DO
06-67	9	7.9	1.6	DO
06-67	10	8.0	2.8	DO
06-67	11	8.0	2.8	DO
05-67	12	8.1	4.1	OTHER
06-67	13	7.8	0.3	INSTRUMENT METHOD (NOT METROMETRIC)
06-67	14	7.1	8.7	DO
06-67	15	8.1	4.1	DO
05-67	16	8.0	2.8	DO
05-67	17	7.1	8.7	DO
06-67	18	7.4	4.9	DO
06-67	19	7.9	1.6	DO
06-67	20	7.8	0.3	DO
06-67	21	8.1	4.1	DO
06-67	22	8.0	2.8	DO
05-67	23	7.7	1.0	DO
06-67	24	7.6	2.3	DO
05-67	25	8.0	2.8	DO
06-67	26	8.0	2.8	DO
06-67	28	7.6	2.3	DO
06-67	29	7.7	1.0	DO

TOTAL RANGE	7.1 - 8.2	AVERAGE DEVIATION	0.236
MEAN	7.78	90 PCT.CONF.INTVLOF MEAN	7.78 ± 0.100
STANDARD DEVIATION	0.311		

SAMPLE 23

PH