SUMMARY OF DATA FROM ONSITE AND LABORATORY ANALYSES OF PRECIPITATION RUNOFF FROM CARBONATE-STONE SURFACES, NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM, JUNE 1984 TO NOVEMBER 1987

By Michael M. Reddy, Paul F. Schuster, and James J. Harte

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CONVERSION FACTORS

Metric units (International System) in this report may be converted to inch-pound units by using the following conversion factors:

Multiply metric units	*By*	*To obtain inch-pound units*
liter (L)	1.057	quart
milliliter (mL)	0.03382	ounce, fluid
millimeter (mm)	0.03937	inch
Hydrogen ion, microequivalent per liter (μeq/L)	0.001	part per million H^+
Alkalinity (as carbonate), milliequivalent per liter (meq/L)	50.045	part per million Alkalinity (as carbonate)
Calcium ion, milliequivalent per liter (meq/L)	20.04	part per million Ca^{2+}
Magnesium ion, milliequivalent per liter (meq/L)	12.153	part per million Mg^{2+}
Sodium ion, milliequivalent per liter (meq/L)	22.9898	part per million Na^+
Ammonium ion, milliequivalent per liter (meq/L)	18.0383	part per million NH_4^+
Potassium ion, milliequivalent per liter (meq/L)	39.0983	part per million K^+
Sulfate ion, milliequivalent per liter (meq/L)	48.0288	part per million SO_4^{2-}
Nitrate ion, milliequivalent per liter (meq/L)	62.0049	part per million NO_3^-
Chloride ion, milliequivalent per liter (meq/L)	35.453	part per million Cl^-

The following term and abbreviation also are used in this report:

microsiemens per centimeter at 25 degrees Celsius (μS/cm).

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ABSTRACT

This report presents a summary of data collected from June 1984 to November 1987 as part of an experimental research program to quantify the interaction of acid precipitation with a carbonate-stone surface. The work was done in conjunction with the National Acid Precipitation Assessment Program. Precipitation-runoff samples were collected from polypropylene receptacles (blank samples), glass plates, and flat surfaces of two types of carbonate stone: Salem Limestone (from Indiana) and Shelburne Marble (from Vermont). The summary is based on onsite and laboratory measurements for 1,973 samples that are available in a computer-data file. The data file contains sample description and analytical data for precipitation and runoff samples collected at five sites, which are representative of 318 rain events, distilled-water reference samples, and standard reference water samples.

INTRODUCTION

The National Acid Precipitation Assessment Program, Task Group VII Materials and Cultural Resources Effects--was organized, in part, as a 10-year program to measure, document, and quantify acid-precipitation effects on two types of carbonate stone: Salem Limestone (from Indiana) and Shelburne Marble (from Vermont). In 1984, four onsite-research locations were established in the eastern United States at Newcomb, N.Y.; Chester, N.J.; Washington, D.C.; and Research Triangle Park, N.C. In 1986, Steubenville, Ohio replaced Chester, N.J. as an operational site. Precipitation-runoff samples from polypropylene receptacles (blank samples), glass plates, and stone surfaces were analyzed. Details of the onsite and laboratory procedures are described in other reports (Sherwood, 1984; Reddy and others, 1985; Reddy and Werner, 1985). Sample preparation, analytical procedures, and laboratory quality-control protocols used by the U.S. Geological Survey laboratory are described by Fishman and Friedman (1985).

This work has been done as part of the National Acid Precipitation Assessment Program and was funded in part by the National Park Service. The purpose of this report is to update a report authored by See and Reddy (1987); the update includes data collected in 1987. Data and statistics presented in this report do not necessarily indicate the views of the National Acid Precipitation Assessment Program or the National Park Service.

DATA FILE

Precipitation-runoff analysis data are available for samples collected and analyzed from June 1984 to November 1987. Five types of samples were collected from 318 rain events during this period. To evaluate onsite-sampling variability, replicate samples were collected from adjacent stones of the same type. The duplicate samples were submitted to the laboratory to identify variability caused by sample processing and handling. Additional distilled-water reference samples and standard reference water samples (SRWS)[1] were submitted to the laboratory with the onsite samples. Both types of reference samples were processed using the same procedures as the onsite samples. During the indicated period, 1,973 samples were processed; analytical results are available in the data file which is summarized in tables 1 through 18.

The data file is available in ASCII format on a 3½ inch diskette. It has been divided into three subfiles. The first subfile (DATAT.A) contains descriptive information and onsite measurements of pH and specific conductance. The second subfile (DATAT.B) repeats some descriptive information and contains laboratory measurements of pH, specific conductance, alkalinity, and major anions. The third subfile (DATAT.C) also repeats some descriptive information and contains laboratory measurements of major cations. For further information about the availability or use of the diskette, call Michael M. Reddy, Paul F. Schuster, or James J. Harte at (303) 236-3617 or FTS 776-3617 or contact the Chief, Branch of Regional Research, Water Resources Division, Room H-2822, Bldg. 53 (mailing address: Box 25046, mail stop 418, Denver Federal Center, Denver, Co. 80225-0046).

The data file consists of 29 variables. Variable names and codes established for source of samples and sample types are listed in table 1. Variable names and codes established for sample collection and precipitation type are listed in table 2. Variable names for parameters measured onsite and in the laboratory are listed in table 3.

All data has been proofed to eliminate keypunching errors. An additional check on the quality of the data was provided by a verification of summary statistics for the data, sorted by sample type. Samples that have exceptionally large or small values were examined and reanalyzed to determine if the values were accurate or erroneous. The summary statistics for each

[1]SRWS - Standard reference water samples are prepared and used by the U.S. Geological Survey's quality assurance program to ensure that the laboratory is producing analytical data for inorganic constituents that are of acceptable reliability (Schroder and others, 1980).

sample type are listed in tables 4 through 9, 11, and 13. Analytical results, obtained from the U.S. Geological Survey, Quality Assurance Laboratory, for standard reference water samples M-82 and M-4 are given in tables 10 and 12.

The summary statistics are not intended for use in evaluating the effect of acid precipitation on stone samples. The statistical calculations include all entries in the data file including overflow, duplicate, and replicate samples from all of the sites. Tables 4 through 9, 11, and 13 are strictly statistical descriptions of the data file.

Samples that had analytical results less than the detection limits of the selected methods are indicated in the data set by double dashes (--). The detection limits of quantification are listed in tables 14 and 15. Sample parts of the data file are included in tables 16 through 18.

SUMMARY

A total of 1,973 samples from 318 rain events have been analyzed using a protocol designed to minimize errors from handling procedures, laboratory analyses, and data-entry operations. Duplicate samples and standard reference water samples are included in this sample set. Further additions will be made to the data file as sample collection continues, and as laboratory analyses are completed.

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Sherwood, S.I., 1984, The National Park Service program on the effects of air pollution on cultural properties: Annual Air Pollution Control Association Meeting, 77th, San Francisco, 1984, Preprint, p. 1-16.

Table 1.--*Variable names and codes for source of samples and sample types*

Variable name	Abbreviated variable name in data file	Code	Definition
Source of samples	SITE	DC	Washington, D.C.
		LB	Standard reference water samples from U.S. Geological Survey laboratory, Denver, Colo.
		NJ	Chester, N.J.
		NC	Research Triangle Park, N.C.
		NY	Newcomb, N.Y.
		OH	Steubenville, Ohio
Sample type	TYPE	B	Blank (empty receptacle) rack
		G	Glass
		L	Limestone
		M	Marble
		D	Distilled-water reference sample
		M-82	M-82 standard reference water sample
		M-4	M-4 standard reference water sample
		SR-74	SR-74 standard reference water sample
		SR-70	SR-70 standard reference water sample
		SR-74D	SR-74D standard reference water sample
		P-5	P-5 standard reference water sample
		P	Recording precipitation monitor

Table 2.--*Variable names and codes for sample collection and precipitation type*

Variable name	Abbreviated variable name in data file	Code	Definition
Year	YEAR	Two-digit code	Year of collection
Event	EVENT	Two-digit code	Sample-collection sequence
Side	SIDE	Two-digit code	Position of blanks, glass, and stones in racks
Duplicate	DUP	1	Original sample
		2	Split of original sample
Julian day on	JD ON	1-365	Date sample collector was installed
Julian day off	JD OFF	1-365	Date sample collector was removed
Overflow	OVERFLOW	Y	Collector bottle overflowed
		N	Collector bottle did not overflow
		F	Known problems with sample collection
Precipitation type	PRECIP TYPE	RN	Rain
		SN	Snow
		SL	Sleet
		SR	Snow and rain mixed
Filtered volume	FILT VOL	Integer	Volume of filtered sample sent to laboratory for analysis
Unfiltered volume	UNFILT VOL	Integer	Volume of unfiltered sample sent to laboratory
Degree	DEGREE	0-90°	Degree at which blank, glass, or stone is set with respect to horizontal

Table 3.--*Variable names for onsite- and laboratory-measured parameters*

Variable name	Abbreviated variable name in data file	Units
Volume	VOLUME	Sample volume (milliliters)
Precipitation	RAIN IN	Depth (inches)
	RAIN MM	Depth (millimeters)
Specific conductance (onsite)	CON FLD	Microsiemens per centimeter
Specific conductance (laboratory)	CON LAB	Microsiemens per centimeter
pH (onsite)	PH FLD	Standard units
pH (laboratory)	PH LAB	Standard units
Alkalinity (laboratory)	ALK MEQ	Milliequivalents per liter
Calcium ion (laboratory)	CA MEQ	Milliequivalents per liter
Magnesium ion (laboratory)	MG MEQ	Milliequivalents per liter
Sodium ion (laboratory)	NA MEQ	Milliequivalents per liter
Ammonium ion (laboratory)	NH4 MEQ	Milliequivalents per liter
Potassium ion (laboratory)	K MEQ	Milliequivalents per liter
Sulfate ion (laboratory)	SO4 MEQ	Milliequivalents per liter
Nitrate ion (laboratory)	NO3 MEQ	Milliequivalents per liter
Chloride ion (laboratory)	CL MEQ	Milliequivalents per liter

Table 4.--*Summary statistics for blank samples*

[mL, milliliters; mm, millimeters; µS/cm, microsiemens per centimeter at 25 degrees Celsius; µeq/L, microequivalents per liter; meq/L, milliequivalents per liter; --, indicates that results were less than detection limits for the selected analytical procedures; missing, data unavailable; less than detection, number of samples having results that were less than detection limits for the selected analytical procedures; measured, number of samples having results that were greater than detection limits]

Parameter	Mean	Standard deviation	Range		Number of samples		
			Minimum	Maximum	Missing	Less than detection	Measured
Volume (mL)	1,342	1,260	11	4,240	5	0	204
Precipitation (mm)	15.7	16.8	0.25	127	42	0	167
Specific conductance (onsite, µS/cm)	39.5	36.7	3.0	244.1	81	0	128
Specific conductance (laboratory, µS/cm)	35.5	29.7	3.3	270.0	39	0	170
pH (onsite, standard units)	4.61	0.79	3.39	7.14	81	0	128
Hydrogen ion (onsite, µeq/L)	60.1	73.4	0.072	407	81	0	128
pH (laboratory, standard units)	4.90	0.98	3.13	7.70	40	0	169
Hydrogen ion (laboratory, µeq/L)	44.94	69.37	0.020	741.3	40	0	169
Alkalinity (meq/L, as carbonate)	0.028	0.063	0	0.520	22	0	187
Calcium ion (meq/L)	0.079	0.177	0.002	1.951	34	1	174
Magnesium ion (meq/L)	0.013	0.024	0.001	0.253	36	4	169
Sodium ion (meq/L)	0.028	0.049	--	0.327	36	17	156
Ammonium ion (meq/L, as nitrogen)	0.018	0.014	0.001	0.044	197	0	12
Potassium ion (meq/L)	0.004	0.004	--	0.026	113	1	95
Sulfate ion (meq/L, as sulfate)	0.098	0.105	0.005	1.155	40	0	169
Nitrate ion (meq/L, as nitrate)	0.050	0.061	0.004	0.656	38	1	170
Chloride ion (meq/L)	0.022	0.046	--	0.352	103	4	102

Table 5.--*Summary statistics for glass samples*

[mL, milliliters; mm, millimeters; µS/cm, microsiemens per centimeter at 25 degrees Celsius; µeq/L, microequivalents per liter; meq/L, milliequivalents per liter; --, indicates that results were less than detection limits for the selected analytical procedures; missing, data unavailable; less than detection, number of samples having results that were less than detection limits for the selected analytical procedures; measured, number of samples having results that were greater than detection limits]

Parameter	Mean	Standard deviation	Range		Number of samples		
			Minimum	Maximum	Missing	Less than detection	Measured
Volume (mL)	3,111	2,626	34	13,253	14	0	337
Precipitation (mm)	20.0	17.7	0.5	108	73	0	278
Specific conductance (onsite, µS/cm)	36.6	27.5	3.5	240.0	36	0	315
Specific conductance (laboratory, µS/cm)	35.8	22.8	3.2	149.8	13	0	338
pH (onsite, standard units)	4.44	0.62	3.46	7.33	40	0	311
Hydrogen ion (onsite, µeq/L)	61.7	50.0	0.047	347	40	0	311
pH (laboratory, standard units)	4.54	0.64	2.97	7.18	15	0	336
Hydrogen ion (laboratory, µeq/L)	53.92	69.50	0.066	1,072	15	0	336
Alkalinity (meq/L, as carbonate)	-0.001	0.029	-0.160	0.110	17	0	334
Calcium ion (meq/L)	0.048	0.075	0.002	0.590	18	0	333
Magnesium ion (meq/L)	0.010	0.021	0.0002	0.280	18	0	333
Sodium ion (meq/L)	0.015	0.023	--	0.240	18	3	330
Ammonium ion (meq/L, as nitrogen)	0.023	0.016	0.006	0.040	340	0	11
Potassium ion (meq/L)	0.007	0.008	0.001	0.030	337	0	14
Sulfate ion (meq/L, as sulfate)	0.100	0.082	0.008	0.460	10	6	335
Nitrate ion (meq/L, as nitrate)	0.046	0.037	0.001	0.250	10	11	330
Chloride ion (meq/L)	0.013	0.026	0.001	0.290	10	31	310

Table 6.--*Summary statistics for limestone samples*

[mL, milliliters; mm, millimeters; µS/cm, microsiemens per centimeter at 25 degrees Celsius; µeq/L, microequivalents per liter; meq/L, milliequivalents per liter; --, indicates that results were less than detection limits for the selected analytical procedures; missing, data unavailable; less than detection, number of samples having results that were less than detection limits for the selected analytical procedures; measured, number of samples having results that were greater than detection limits]

Parameter	Mean	Standard deviation	Range		Number of samples		
			Minimum	Maximum	Missing	Less than detection	Measured
Volume (mL)	1,990	2,226	0	12,745	21	0	520
Precipitation (mm)	19.5	18.5	0.3	127	111	0	430
Specific conductance (onsite, µS/cm)	72.6	36.3	10.0	243.0	124	0	417
Specific conductance (laboratory, µS/cm)	80.9	48.9	12.5	506.0	75	0	466
pH (onsite, standard units)	7.45	0.51	5.37	9.15	128	0	413
Hydrogen ion (onsite, µeq/L)	0.094	0.318	0.001	4.27	128	0	413
pH (laboratory, standard units)	7.06	0.42	5.61	8.12	76	0	465
Hydrogen ion (laboratory, µeq/L)	0.140	0.190	0.008	2.450	76	0	465
Alkalinity (meq/L, as carbonate)	0.520	0.256	0.096	2.600	90	0	451
Calcium ion (meq/L)	0.713	0.407	--	4.170	85	1	455
Magnesium ion (meq/L)	0.035	0.050	0.001	0.420	88	0	453
Sodium ion (meq/L)	0.029	0.045	--	0.510	88	4	449
Ammonium ion (meq/L, as nitrogen)	0.005	0.004	0.001	0.010	530	0	11
Potassium ion (meq/L)	0.010	0.021	0.001	0.190	458	0	83
Sulfate ion (meq/L, as sulfate)	0.201	0.214	0.006	3.060	92	4	445
Nitrate ion (meq/L, as nitrate)	0.065	0.073	0.005	0.630	92	42	407
Chloride ion (meq/L)	0.025	0.047	0.002	0.560	148	14	379

Table 7.--*Summary statistics for marble samples*

[mL, milliliters; mm, millimeters; µS/cm, microsiemens per centimeter at 25 degrees Celsius; µeq/L, microequivalents per liter; meq/L, milliequivalents per liter; --, indicates that results were less than detection limits for the selected analytical procedures; missing, data unavailable; less than detection, number of samples having results that were less than detection limits for the selected analytical procedures; measured, number of samples having results that were greater than detection limits]

Parameter	Mean	Standard deviation	Range		Number of samples		
			Minimum	Maximum	Missing	Less than detection	Measured
Volume (mL)	2,541	2,305	0	12,756	19	0	558
Precipitation (mm)	18.8	18.3	0.25	127	112	0	465
Specific conductance (onsite, µS/cm)	62.3	38.2	14.0	425.0	104	0	473
Specific conductance (laboratory, µS/cm)	65.0	35.4	17.2	341.0	45	0	532
pH (onsite, standard units)	7.31	0.42	5.49	8.97	106	0	471
Hydrogen ion (onsite, µeq/L)	0.098	0.250	0.001	3.24	106	0	471
pH (laboratory, standard units)	7.02	0.37	5.32	8.00	47	0	530
Hydrogen ion (laboratory, µeq/L)	0.151	0.307	0.010	4.820	47	0	530
Alkalinity (meq/L, as carbonate)	0.412	0.174	0.012	1.480	61	0	516
Calcium ion (meq/L)	0.574	0.304	0.154	3.150	52	1	524
Magnesium ion (meq/L)	0.023	0.023	0.002	0.310	54	0	523
Sodium ion (meq/L)	0.016	0.031	--	0.440	58	16	503
Ammonium ion (meq/L, as nitrogen)	0.007	0.005	0.0004	0.020	565	0	12
Potassium ion (meq/L)	0.016	0.095	0.001	0.920	480	2	95
Sulfate ion (meq/L, as sulfate)	0.163	0.158	0.014	1.710	50	1	526
Nitrate ion (meq/L, as nitrate)	0.055	0.046	0.002	0.560	50	12	515
Chloride ion (meq/L)	0.016	0.022	--	0.220	126	21	430

Table 8.--*Summary statistics for distilled-water reference samples*

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; µeq/L, microequivalents per liter; meq/L, milliequivalents per liter; --, indicates that results were less than detection limits for the selected analytical procedure; -, indicates that analytical results are not available; missing, data unavailable; less than detection, number of samples having results that were less than detection limits for the selected analytical procedures; measured, number of samples having results that were greater than detection limits]

Parameter	Mean	Standard deviation	Range		Number of samples		
			Minimum	Maximum	Missing	Less than detection	Measured
Specific conductance (onsite, µS/cm)	2.8	4.3	0.9	17.0	22	0	13
Specific conductance (laboratory, µS/cm)	2.3	1.3	0.9	5.0	8	0	27
pH (onsite, standard units)	6.10	0.70	5.50	7.56	21	0	14
Hydrogen ion (onsite, µeq/L)	1.58	1.17	0.028	3.16	21	0	14
pH (laboratory, standard units)	6.71	1.41	4.55	8.40	10	0	25
Hydrogen ion (laboratory, µeq/L)	2.144	5.622	0.004	28.25	10	0	25
Alkalinity (meq/L, as carbonate)	0.042	0.033	-0.003	0.110	12	0	23
Calcium ion (meq/L)	0.005	0.006	--	0.020	12	10	13
Magnesium ion (meq/L)	0.001	0.002	--	0.005	9	15	11
Sodium ion (meq/L)	0.011	0.010	0.002	0.034	9	13	13
Ammonium ion (meq/L, as nitrogen)	-	-	-	-	35	0	0
Potassium ion (meq/L)	0.003	0.005	--	0.010	25	3	7
Sulfate ion (meq/L, as sulfate)	0.007	0.004	0.001	0.011	6	23	6
Nitrate ion (meq/L, as nitrate)	0.005	0.004	0.002	0.008	6	27	2
Chloride ion (meq/L)	0.005	0.002	0.003	0.010	15	11	9

Table 9.--*Summary statistics for M-82 standard reference water samples*

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; µeq/L, microequivalents per liter; meq/L, milliequivalents per liter; --, indicates that results were less than detection limits for the selected analytical procedure; -, indicates that analytical results are not available; missing, data unavailable; less than detection, number of samples having results that were less than detection limits for the selected analytical procedures; measured, number of samples having results that were greater than detection limits]

Parameter	Mean	Standard deviation	Range		Number of samples		
			Minimum	Maximum	Missing	Less than detection	Measured
Specific conductance (onsite, µS/cm)	130.7	5.3	122.1	140.0	16	0	9
Specific conductance (laboratory, µS/cm)	139.6	4.9	133.5	148.0	8	0	17
pH (onsite, standard units)	7.54	0.16	7.21	7.72	15	0	10
Hydrogen ion (onsite, µeq/L)	0.031	0.013	0.019	0.062	15	0	10
pH (laboratory, standard units)	7.34	0.50	6.28	8.00	11	0	14
Hydrogen ion (laboratory, µeq/L)	0.090	0.136	0.010	0.525	11	0	14
Alkalinity (meq/L, as carbonate)	0.615	0.171	0.596	0.740	9	0	16
Calcium ion (meq/L)	0.725	0.020	0.698	0.764	9	0	16
Magnesium ion (meq/L)	0.287	0.010	0.270	0.313	6	0	19
Sodium ion (meq/L)	0.276	0.017	0.230	0.301	6	0	19
Ammonium ion (meq/L, as nitrogen)	-	-	-	-	25	0	0
Potassium ion (meq/L)	0.052	0.003	0.049	0.056	19	0	6
Sulfate ion (meq/L, as sulfate)	0.582	0.027	0.549	0.668	6	0	19
Nitrate ion (meq/L, as nitrate)	0.016	0.033	--	0.075	7	11	18
Chloride ion (meq/L)	0.071	0.014	0.025	0.084	11	0	14

Table 10.--*Analytical results for standard reference water sample M-82 (obtained from the U.S. Geological Survey, Quality Assurance Laboratory, Denver, Colorado)*

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; meq/L, milliequivalents per liter]

Parameter	Mean	Standard deviation	Total number of analyses
Specific conductance (µS/cm)	138.3	8.6	43
pH (standard units)	6.9	0.39	42
Alkalinity (meq/L as carbonate)	0.6614	0.0420	37
Calcium ion (meq/L)	0.6891	0.0349	43
Magnesium ion (meq/L)	0.2954	0.0189	44
Sodium ion (meq/L)	0.2749	0.0135	41
Sulfate ion (meq/L)	0.5836	0.0373	39
Chloride ion (meq/L)	0.0739	0.0133	42

Table 11.--*Summary statistics for M-4 standard reference water samples*

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; µeq/L, microequivalents per liter; meq/L, milliequivalents per liter; missing, data unavailable; less than detection, number of samples having results that were less than detection limits for the selected analytical procedures; measured, number of samples having results that were greater than detection limits]

Parameter	Mean	Standard deviation	Range		Number of samples		
			Minimum	Maximum	Missing	Less than detection	Measured
Specific conductance (onsite, µS/cm)	101.9	6.8	97.6	112.0	70	0	4
Specific conductance (laboratory, µS/cm)	109.6	9.8	42.7	115.5	23	0	51
pH (onsite, standard units)	7.64	0.05	7.60	7.70	70	0	4
Hydrogen ion (onsite, µeq/L)	0.023	0.002	0.020	0.025	70	0	4
pH (laboratory, standard units)	7.32	0.23	6.54	7.91	26	0	48
Hydrogen ion (laboratory, µeq/L)	0.055	0.040	0.012	0.288	26	0	48
Alkalinity (meq/L, as carbonate)	0.535	0.014	0.501	0.566	11	0	63
Calcium ion (meq/L)	0.513	0.060	0.322	0.624	9	0	65
Magnesium ion (meq/L)	0.222	0.019	0.162	0.261	9	0	65
Sodium ion (meq/L)	0.186	0.032	0.102	0.221	9	0	65
Sulfate ion (meq/L, as sulfate)	0.423	0.037	0.366	0.475	10	0	64
Nitrate ion (meq/L, as nitrate)	0.012	0.001	0.010	0.015	10	3	61
Chloride ion (meq/L)	0.082	0.009	0.073	0.113	10	2	62

Table 12.--*Analytical results for standard reference water sample M-4 (obtained from the U.S. Geological Survey, Quality Assurance Laboratory, Denver, Colorado)*

[μS/cm, microsiemens per centimeter at 25 degrees Celsius; meq/L, milliequivalents per liter]

Parameter	Mean	Standard deviation	Total number of analyses
Specific conductance (μS/cm)	111.0	5.0	55
pH (standard units)	7.58	0.22	56
Alkalinity (meq/L as carbonate)	0.540	0.022	48
Calcium ion (meq/L)	0.569	0.040	57
Magnesium ion (meq/L)	0.247	0.021	56
Sodium ion (meq/L)	0.200	0.013	54
Sulfate ion (meq/L)	0.412	0.052	53
Nitrate ion (meq/L)	0.014	0.003	50
Chloride ion (meq/L)	0.079	0.014	51

Table 13.--*Summary statistics for samples collected using the recording precipitation monitor*

[mL, milliliters; mm, millimeters; µS/cm, microsiemens per centimeter at 25 degrees Celcius; µeq/L, microequivalents per liter; milliequivalents per liter; --, indicates that results were less than detection limits for the selected analytical procedure; -, indicates that analytical results are not available; missing, data unavailable; less than detection, results that were less than detection limits for the selected analytical procedures; measured, number of samples having results that were greater than detection limits]

Parameter	Mean	Standard deviation	Range		Number of samples		
			Minimum	Maximum	Missing	Less than detection	Measured
Volume (mL)	982	913	0	4,000	2	0	151
Precipitation (mm)	19.9	18.6	0.5	127	22	0	131
Specific conductance (onsite, µS/cm)	530.8	888.5	10.7	6,000	40	0	113
Specific conductance (laboratory, µS/cm)	385.6	805.4	1.7	6,960	40	0	113
pH (onsite, standard units)	4.54	0.73	3.31	6.87	41	0	112
Hydrogen ion onsite, µeq/L)	57.0	59.0	0.135	490	41	0	112
pH (laboratory, standard units)	5.07	0.96	3.47	7.20	41	0	112
Hydrogen ion (laboratory µeq/L)	33.35	45.48	0.063	340.4	41	0	112
Alkalinity (meq/L, as carbonate)	0.024	0.075	-0.157	0.454	42	0	111
Calcium ion (meq/L)	0.041	0.169	0.001	1.497	47	0	106
Magnesium ion (meq/L)	0.005	0.009	--	0.074	47	3	103
Sodium ion (meq/L)	0.047	0.110	0.001	0.795	47	11	95
Ammonium ion (meq/L, as nitrogen)	-	-	-	-	153	0	0
Potassium ion (meq/L)	1.578	3.410	0.010	18.42	117	0	36
Sulfate ion (meq/L, as sulfate)	0.051	0.034	0.004	0.173	80	2	71
Nitrate ion (meq/L, as nitrate)	0.064	0.129	0.001	0.657	81	6	66
Chloride ion (meq/L)	0.241	0.098	0.025	0.480	120	2	31

Table 14.--*Detection limits for laboratory analyses (1984-86)*

[meq/L, milliequivalents per liter]

Parameter	Units	Detection limit	Method of analysis
Calcium ion	(meq/L as Calcium)	0.0004	Inductively coupled plasma
Magnesium ion	(meq/L as Magnesium)	0.0002	Inductively coupled plasma
Sodium ion	(meq/L as Sodium)	0.0034	Inductively coupled plasma
Ammonium ion	(meq/L as Nitrogen)	0.00003	Automated colorimetric analysis
Potassium ion	(meq/L as Potassium)	0.0001	Atomic absorption
Sulfate ion	(meq/L as Sulfate)	0.002	Ion chromatography
Nitrate ion	(meq/L as Nitrate)	0.0026	Ion chromatography
Chloride ion	(meq/L as Chloride)	0.0007	Ion chromatography

Table 15.--*Detection limits for laboratory analyses (1987)*

[meq/L, milliequivalents per liter]

Parameter	Units	Detection limit	Method of analysis
Calcium ion	(meq/L as Calcium)	0.0001	Inductively coupled plasma
Magnesium ion	(meq/L as Magnesium)	0.00004	Inductively coupled plasma
Sodium ion	(meq/L as Sodium)	0.00023	Inductively coupled plasma
Sulfate ion	(meq/L as Sulfate)	0.020	Ion chromatography
Nitrate ion	(meq/L as Nitrate)	0.010	Ion chromatography
Chloride ion	(meq/L as Chloride)	0.002	Ion chromatography

Table 16.--*Sample data set of DATAT.A*

[See tables 1 through 3 for definition of abbreviations;
-, indicates results not available]

SITE	TYPE	YEAR	EVENT	SIDE	DUP	JD ON	JD OFF	VOLUME	OVER FLOW	RAIN IN	RAIN MM	PRECIP TYPE	PH FLD	CON FLD	FILT VOL	UNFILT VOL	DEG-REE
DC	L	84	4	4	1	290	299	830	N	-	-	-	7.520	88.00	-	-	30
DC	M	87	11	7	1	239	240	2,035	N	-	-	RN	6.640	47.90	250	250	30
LB	D	85	0	0	1	-	-	-	-	-	-	-	-	-	-	-	-
NC	B	84	16	1	1	208	212	3,943	N	2.150	54.610	-	4.490	18.50	-	-	30
NC	L	85	21	3	1	207	210	575	N	0.400	10.160	-	6.230	71.00	-	-	30
NC	L	85	21	3	2	207	210	-	N	-	-	-	-	-	-	-	30
NJ	G	86	7	6	1	191	196	3,700	N	0.700	17.780	RN	-	-	-	999	30
NJ	M	85	6	7	1	91	102	290	N	-	-	-	-	-	-	-	30
OH	M	86	2	6	1	288	301	2,490	N	0.640	16.256	RN	7.200	136.50	250	250	30
OH	L	87	2	10	1	235	242	1,940	N	1.160	29.464	RN	8.640	50.20	250	250	30
OH	M	87	3	7	1	242	256	4,620	N	1.290	32.766	RN	7.500	104.70	250	250	30
LB	M-4	87	1	0	1	-	-	-	-	-	-	-	-	-	-	-	-
NY	L	86	10	3	1	171	174	862	N	0.360	9.144	RN	7.840	40.00	250	250	30
NY	G	85	9	6	1	280	284	650	N	0.070	1.778	-	3.650	66.00	-	-	30
NY	P	85	12	0	1	295	301	440	N	0.350	8.890	-	4.570	75.00	-	-	30
NY	M	87	32	8	1	279	282	720	N	0.420	10.668	SR	7.640	36.70	250	250	30

Table 17.--*Sample data set of DATAT.B*

[See tables 1 through 3 for definition of abbreviations; -, indicates results not available; --, indicates results were less than detection limits for selected analytical procedures]

SITE	TYPE	YEAR	EVENT	SIDE	DUP	PH LAB	CON LAB	ALK MEQ	CL MEQ	NO3 MEQ	SO4 MEQ
DC	L	84	4	4	1	7.422	92.50	0.72000	-	0.044000	0.229000
DC	M	87	11	7	1	6.900	50.90	0.15210	0.01608	0.069010	0.237990
LB	D	85	0	0	1	8.000	4.00	0.	0.00400	--	0.001000
NC	B	84	16	1	1	4.583	15.75	0.	-	0.047100	0.047890
NC	L	85	21	3	1	6.829	76.50	0.59200	0.02652	0.057440	0.173890
NC	L	85	21	3	2	-	-	-	-	-	-
NJ	G	86	7	6	1	3.730	88.50	0.	0.01633	0.100380	0.189890
NJ	M	85	6	7	1	6.730	217.00	1.18000	0.06502	0.174090	0.733380
OH	M	86	2	6	1	6.820	140.00	0.38600	0.02930	0.093700	0.721200
OH	L	87	2	10	1	7.060	42.10	0.22160	0.00284	--	0.194900
OH	M	87	3	7	1	6.980	76.60	0.29710	0.01109	0.052720	0.378070
LB	M-4	87	1	0	1	-	-	0.55500	0.08487	0.015170	0.429800
NY	L	86	10	3	1	6.930	42.50	0.33800	--	0.011920	0.046390
NY	G	85	9	6	1	-	59.60	0.	0.01117	0.081110	0.124030
NY	P	85	12	0	1	5.900	-	0.	-	0.040000	0.016000
NY	M	87	32	8	1	6.800	44.60	0.37240	0.00472	0.017740	0.044120

Table 18.--*Sample data set of DATAT.C*

[See tables 1 through 3 for definition of abbreviations; -, indicates results not available; --, indicates results were less than detection limits for selected analytical procedures]

SITE	TYPE	YEAR	EVENT	SIDE	DUP	CA MEQ	MG MEQ	NA MEQ	NH4 MEQ	K MEQ
DC	L	84	4	4	1	0.89800000	0.0280000	0.01900000	-	0.0060000
DC	M	87	11	7	1	0.72854000	0.0205100	0.00818000	-	-
LB	D	85	0	0	1	-	0.0020000	--	-	0.0010000
NC	B	84	16	1	1	0.00416000	0.0006000	-	-	0.0033300
NC	L	85	21	3	1	0.69610000	0.0361400	0.04147000	-	-
NC	L	85	21	3	2	0.69960000	0.0362200	0.02734000	-	-
NJ	G	86	7	6	1	0.02552000	0.0058800	0.02624000	-	-
NJ	M	85	6	7	1	2.06885000	0.0495100	0.03977000	-	-
OH	M	86	2	6	1	1.20658200	0.0653880	0.01001805	-	-
OH	L	87	2	10	1	0.37862000	0.0059100	0.01596000	-	-
OH	M	87	3	7	1	0.66170000	0.0362200	0.02131000	-	-
LB	M-4	87	1	0	1	0.55788000	0.2368300	0.20341000	-	-
NY	L	86	10	3	1	0.37290000	0.0055400	0.00271000	-	-
NY	G	85	9	6	1	0.02197000	0.0048800	0.01679000	0.04100	0.0054230
NY	P	85	12	0	1	0.01185000	0.0029600	0.04989000	-	-
NY	M	87	32	8	1	0.44225000	0.0146200	0.00314000	-	-

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