

ISOTOPE CONTENT AND TEMPERATURE OF
PRECIPITATION IN SOUTHERN NEVADA,
AUGUST 1983-AUGUST 1986

By W.K. Milne, L.V. Benson, and P.W. McKinley

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CONVERSION FACTORS

The metric units in this report may be converted to inch-pound units by use of the following conversion factors:

<i>Multiply metric units</i>	<i>By</i>	<i>To obtain inch-pound units</i>
kilometer	0.6214	mile
meter	3.281	foot
centimeter	0.3937	inch
square centimeter (cm ²)	0.1550	square inch
milliliter	1.0567×10^{-3}	quart

Degree Celsius (°C) may be converted to degree Fahrenheit (°F) by using the following equation:

$$^{\circ}\text{F} = 9/5^{\circ}\text{C} + 32$$

The following terms and abbreviations also are used in this report:

minute
hour
picocuries per liter (pCi/L)
oxygen-18 ($\delta^{18}\text{O}$)
deuterium (δD)
tritium (^3H)

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ABSTRACT

From August 1983 through August 1986, 429 precipitation samples of 112 precipitation events were collected at 12 stations in southern Nevada. Some of these samples were analyzed for oxygen-18, deuterium, and tritium. The results of these analyses as well as the air temperature and the precipitation measured at the collection sites are tabulated in this report. The sampling program provides a data base for future interpretive studies on the timing and origin of ground-water recharge in the Yucca Mountain region, of southern Nevada.

INTRODUCTION

The stable-isotope composition of precipitation is the result of fractionation processes that occur in the atmosphere. Isotopic trends in precipitation have been phenomenologically related to latitude, altitude, distance from moisture source area, season, precipitation, and air temperature (Dansgaard, 1964; Fritz and Fontes, 1980).

Even though tritium (^3H) concentrations are small and relatively uniform over the oceans throughout the year, over the continents ^3H increases in the lowest 2 kilometers of the troposphere during summer (Ehhalt, 1971, 1974; Fritz and Fontes, 1980). Ehhalt has attributed the occurrence of the summer-precipitation ^3H peak to re-evaporation of continental moisture.

This progress report presents oxygen-18 ($\delta^{18}\text{O}$), deuterium (δD), ^3H and temperature data collected from 12 stations in southern Nevada from August 1983 through August 1986.

ACKNOWLEDGMENTS

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METHODS

Precipitation-sampling stations were established at 12 locations throughout southern Nevada (fig. 1) from August 1983 through August 1986. The location and altitude of each station are given in table 1. Samples usually were obtained within 24 hours of the cessation of precipitation. A large vertical cylinder that contained a plastic bag was used as a precipitation collector. The plastic bag was narrowly constricted to retard evaporation prior to collection (fig. 2). The precipitation collected in the plastic bag (referred to as precipitation collected) was calculated by dividing the volume of precipitation by the area of the collector (1,640 square centimeter).

Sequential rain samplers (Adar and others, 1980), (fig. 3) were placed at two sampling sites. Data from these samplers are being used to determine the change in δO^{18} - δD (amount effect) occurring during a storm. The collection device for the sequential samplers has a surface area of 5,030 square centimeters and the average volume of the collection cylinders is 470 milliliters.

The date and approximate time precipitation began and ended, the amount collected in milliliters, and type of precipitation (rain, snow, hail, and so forth) were recorded at the time of sample collection. These data hereafter are referred to as onsite measurements.

The moisture content of snow was determined by measuring the depth of snow on a snowboard and then pushing an inverted graduated cylinder into an undisturbed area of snow. The snow was allowed to melt at room temperature and the depth of water was measured. Moisture content was recorded as the ratio of depth of water to depth of snow. When moisture content and snow-depth data were both available, equivalent rain was calculated by multiplying moisture content by snow depth.

The calculated equivalent rain was then compared with the equivalent rain collected in the cylinder. The comparison indicated that at snowfalls in excess of 2 centimeters equivalent rain, no correlation exists between the data sets. The lack of correlation for these larger events may be attributed to drifting of snow across the snowboard, or partial snow-melt prior to measurement. Also, if the snow fall was not vertical, the amount collected in the cylinder may be incorrect. Prior to January 26, 1985, no data were collected concerning the amount of snow on the board or the moisture content. For the remaining samples, snowboard and moisture content measurements were not always available.

Samples were bottled, sealed, and sent to one of four laboratories for analysis. Samples collected prior to February 20, 1985, were sent to the U.S. Geological Survey Stable Isotope facility in Reston, Virginia. From February 20 to September 30, 1985, samples were sent to the U.S. Geological Survey Stable Isotope facility in Menlo Park, California. From September 30, 1985 to March 12, 1986, samples from Sandy and Ki stations were sent to Global Geochemistry in Canoga Park, California. All samples collected after March 12, 1986, and samples from stations Kathy, Gail and Lucky collected from September 30, 1985, to March 12, 1986, were sent to the U.S. Geological Survey Stable Isotope facility in Denver, Colorado.

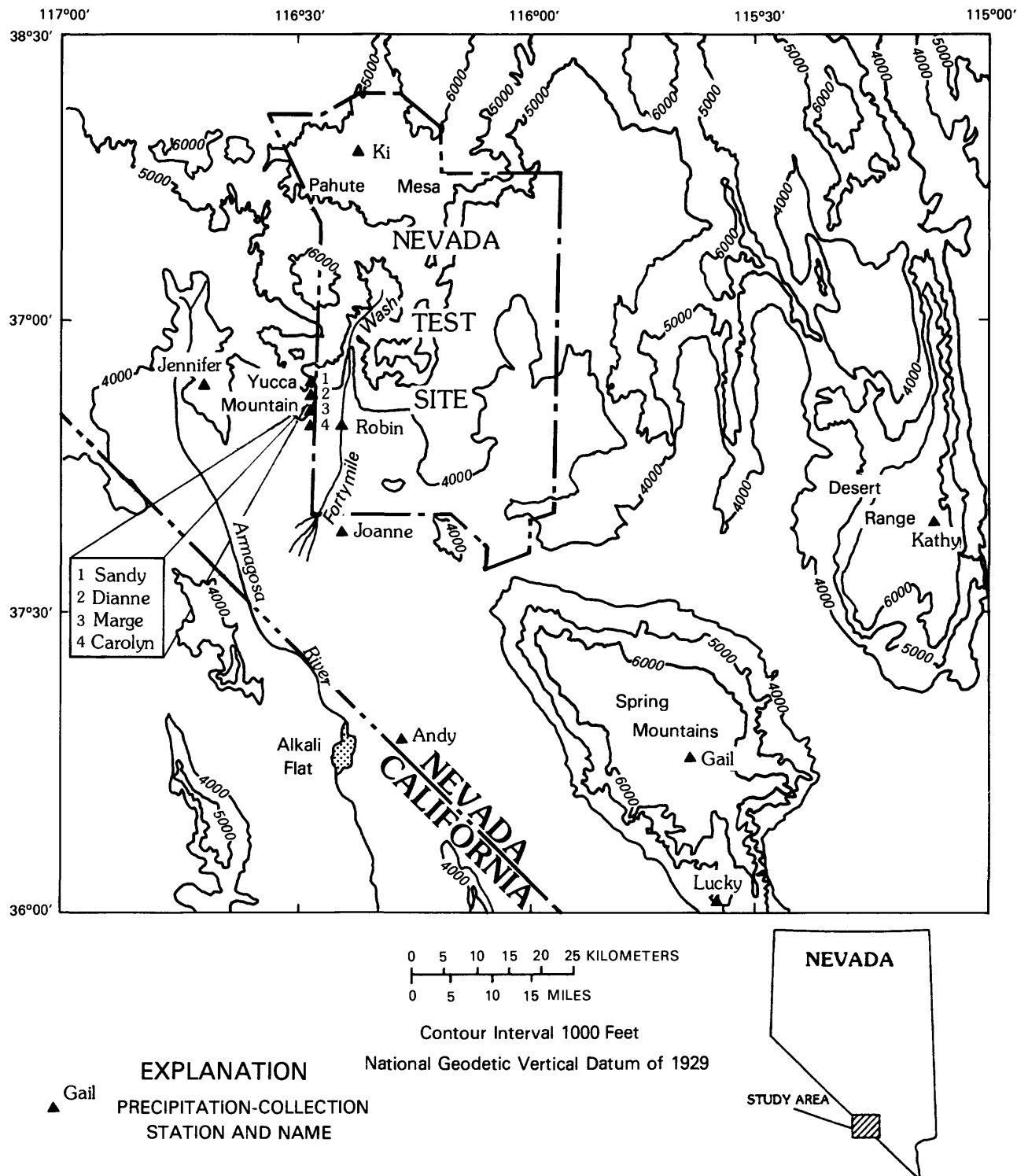


Figure 1.--Location of precipitation-collection stations.

Table 1.--Location and altitude of precipitation-collection stations

Station name	Latitude	Longitude	Altitude (meters)
Carolyn	36°49'06"N	116°27'56"W	1,480
Marge	36°50'13"N	116°27'56"W	1,500
Dianne	36°51'21"N	116°27'56"W	1,475
Sandy	36°52'13"N	116°27'56"W	1,480
Andy	36°16'05"N	116°10'28"W	760
Robin	36°48'55"N	116°23'42"W	1,020
Jennifer	36°53'00"N	116°40'24"W	1,425
Joanne	36°37'59"N	116°20'34"W	855
Ki	37°16'05"N	116°19'00"W	2,145
Lucky	36°01'05"N	115°34'00"W	1,395
Gail	36°15'44"N	115°36'44"W	2,145
Kathy	36°40'15"N	115°05'50"W	1,900

During 1985, factory calibrated Campbell Scientific 21X Microloggers,¹ in addition to temperature probes and tipping-bucket rain gages, were installed at seven stations (fig. 4). The micrologger was used to record Julian date, time, average temperature, maximum temperature, minimum temperature, and the number of rain-gage tips, during 15-minute intervals in digital form. The air temperature was measured approximately 1 meter above ground level. The tipping bucket rain gage recorded one tip each time the bucket filled with 0.025 centimeter of rain. Temperatures were recorded to four significant figures and are assumed accurate to one decimal place.

Digital data were transferred monthly onto cassette tapes. The tapes were translated and data entered into a computer-generated data base. Onsite observations were entered into the data base.

Prior to the installation of microloggers (August 18, 1984), data from the Sandia National Laboratories' meteorological towers at Yucca Mountain (H.W. Church, Sandia National Laboratories, written communication, 1984) were used to determine time and temperature of precipitation at Yucca Mountain stations (Sandy, Dianne, Marge, Carolyn, and Robin). The data included air temperature 3 and 10 meters above ground and the accumulated precipitation at 20-minute intervals. The 3-meter data were used to calculate average temperature, maximum temperature, minimum temperature, and total precipitation.

For each occurrence of precipitation after the installation of microloggers, temperature data were extracted from the micrologger data base. The mean temperature was calculated as the arithmetic mean of the average temperatures recorded while tips were occurring during storm intervals.

¹Use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

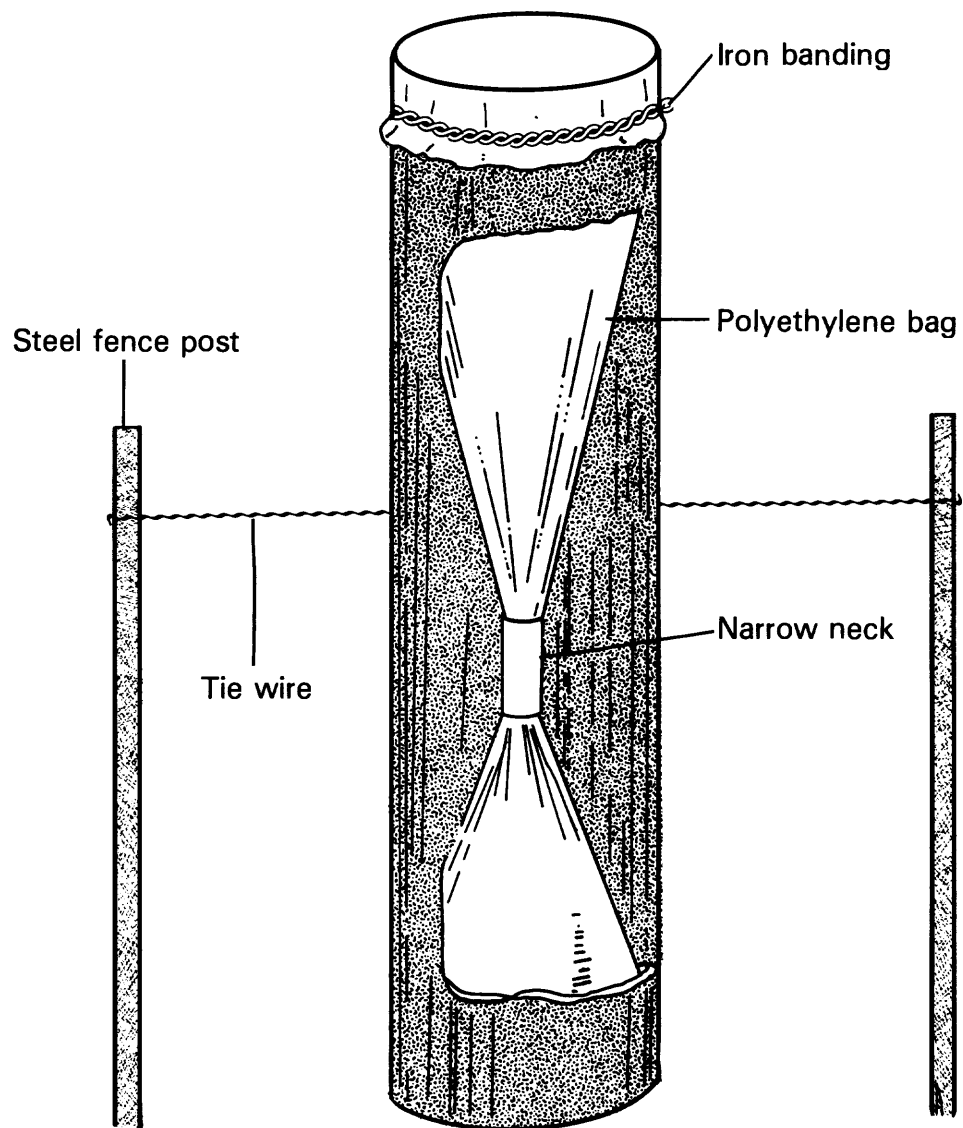


Figure 2.--Precipitation-collection cylinder.

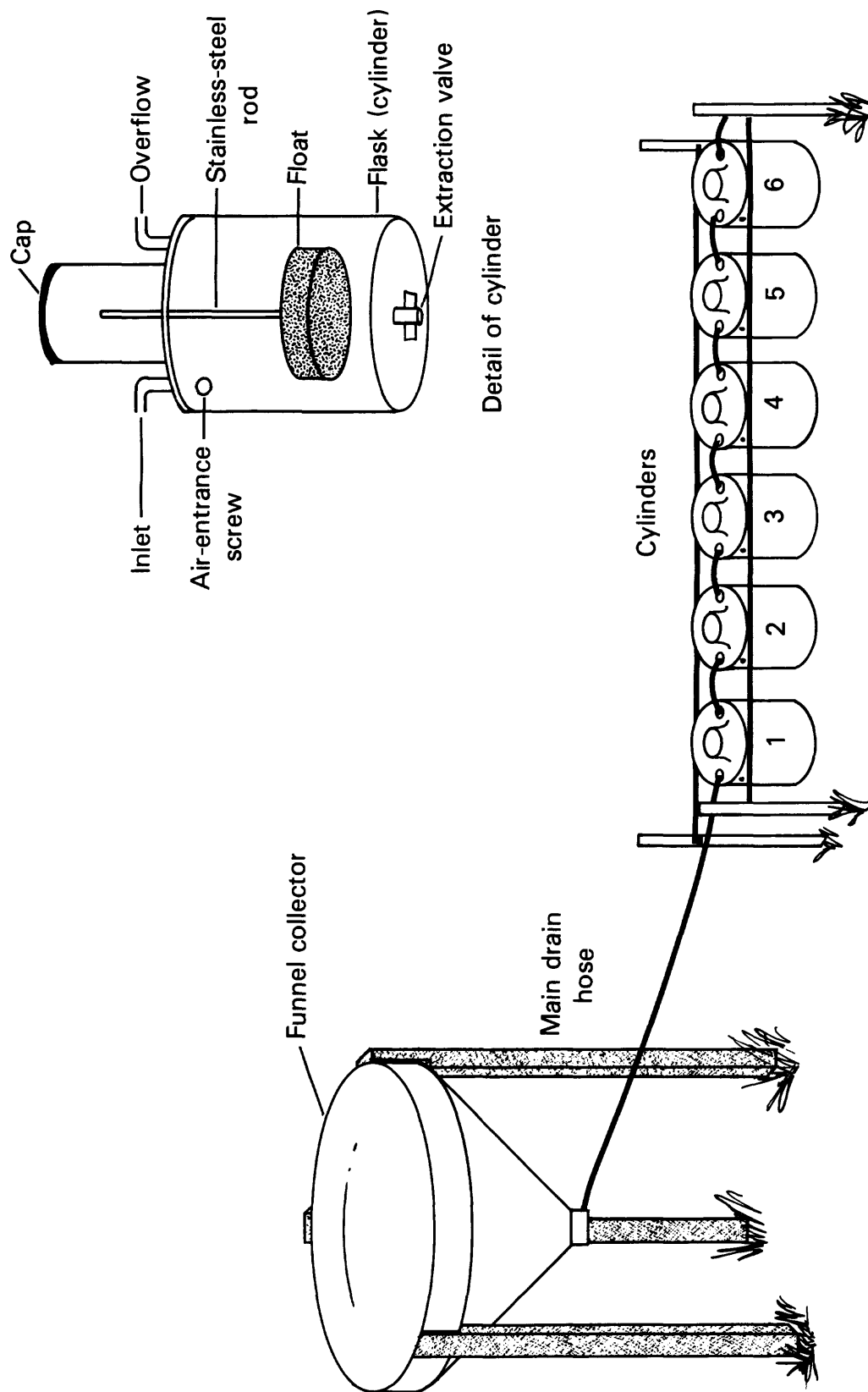


Figure 3.--Sequential rain sampler.

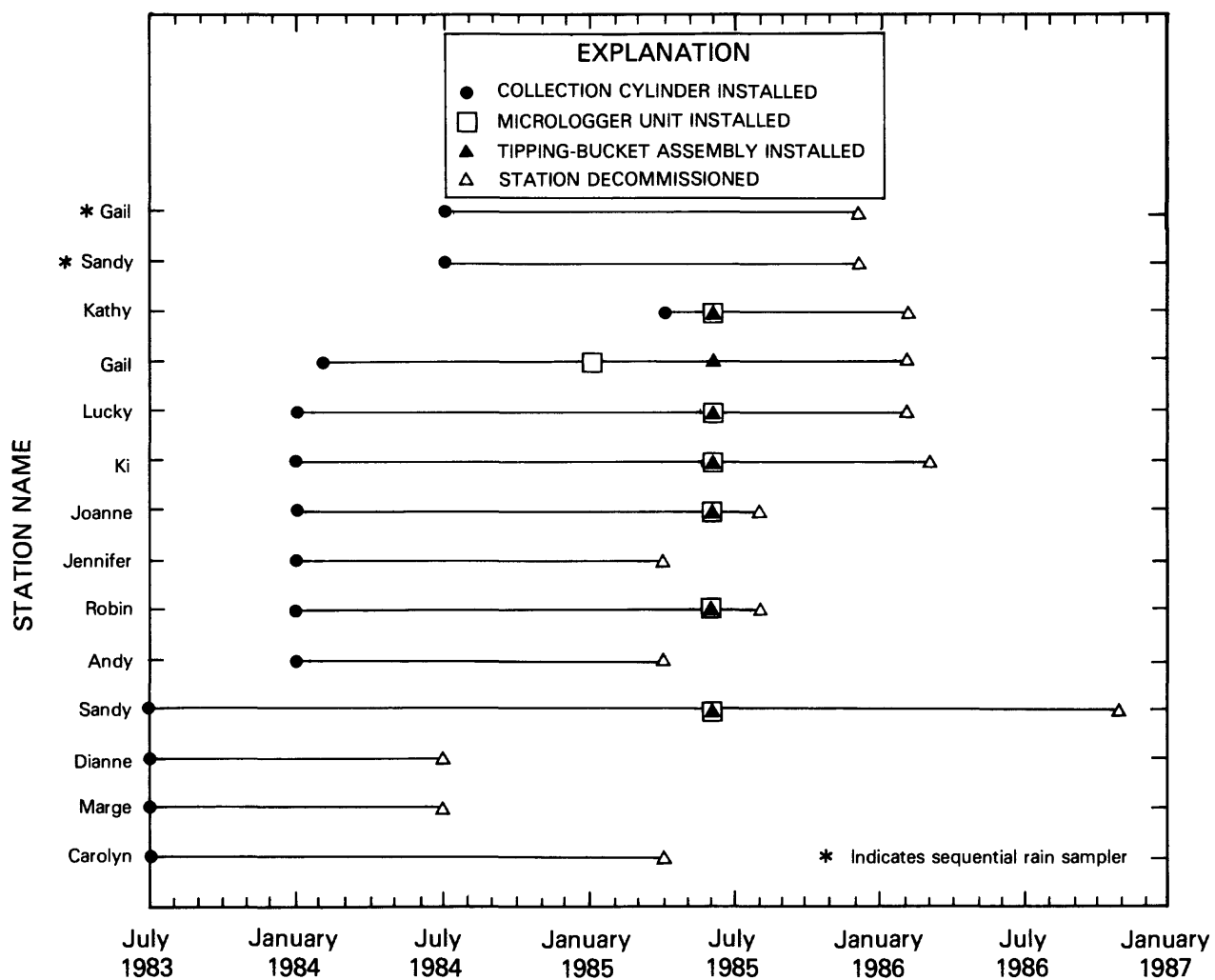


Figure 4.--Time line showing station-installation, equipment-installation, and station-decommissioning dates.

COMPARISON OF MICROLOGGER DATA WITH ONSITE MEASUREMENTS

Micrologger data-base files were scanned to determine times when the tipping bucket was activated. It was assumed that precipitation began when the first tip was recorded, and ended when the last tip was recorded. The number of tips, multiplied by 0.025 centimeter, was used to calculate the total precipitation.

The following discrepancies were noted during the comparison of onsite measurements and micrologger data.

1. The tipping bucket sometimes tipped when precipitation did not occur. In these instances, it was assumed that winds caused the bucket to vibrate and tip.
2. The unheated rain gage was not designed to operate during snow storms. Therefore, no time and temperature data are presented for snow storms.
3. Sometimes precipitation that collected in the cylinder was not documented by the micrologger-tipping-bucket assembly. The reason for this is not clear, although the bucket may have become lodged.
4. Difficulties also were encountered when the tipping bucket recorded tips followed by periods when no tips occurred. When intermittent tips of this type were recorded, it was difficult to determine if more than one precipitation event occurred, or if the tipping bucket had malfunctioned. The intermittent tips may represent a sporadic storm, or may indicate that one storm ended and later another storm entered the region. Temperatures were extracted and averaged only for the periods when tips were occurring.
5. Battery failure or electronic malfunctions in the micrologger resulted in data loss. Data also were lost when the memory was filled and overwriting occurred.
6. The observer's estimate of time of precipitation usually was no more precise than the 24 hours preceding the time of sampling.

A comparison of precipitation amounts collected in the plastic bag with precipitation recorded by the tipping-bucket-micrologger system for precipitation intervals, uncomplicated by discrepancies, is shown in figure 5. The comparison indicates a significant degree of correlation ($r^2 = 0.79$) between both systems of measurement. However, note that the regression line is not coincident with the line of equal amounts.

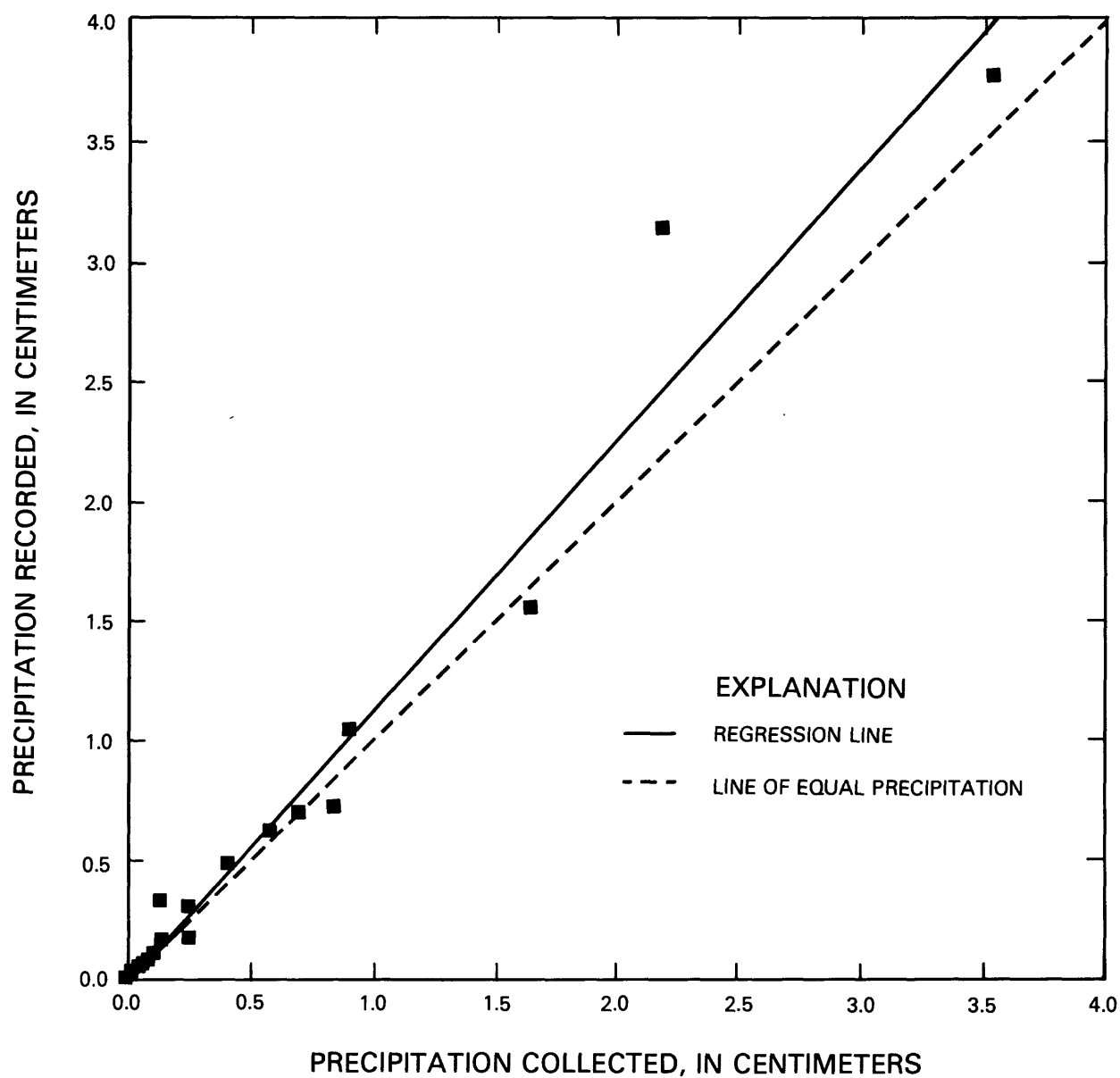


Figure 5.--Precipitation collected in cylinder versus precipitation recorded by tipping bucket for rain after installation of micrologger system.

DATA COLLECTED

Data collected for rainstorms are summarized in tables 2-5. (Tables 2-7 are at the back of this report.) A data code has been assigned that refers to the method used to determine when rain began and ended for storms occurring after the installation of microloggers. If no code is indicated, micrologger and observer data were in agreement. Isotope data and equivalent rain for snowstorms are given in table 6. Isotope data for samples obtained using sequential rain samplers are given in table 7.

SUMMARY

The results of stable-isotope and tritium analysis of precipitation samples from 12 stations in southern Nevada are tabulated in this report. Temperature data are presented also. The sampling program was designed to obtain a data base for future interpretive studies. The data base includes $\delta^{18}\text{O}$, δD , and ^3H content of precipitation samples, with the air temperature corresponding to the precipitation interval. A regression analysis for rain after the installation of micrologger systems is shown in figure 5. The precipitation collected in the cylinder correlated well with the precipitation recorded by the tipping bucket. Therefore, cylinder data alone can be used to record the precipitation when tipping-bucket data are lacking. A comparison of onsite measurements of snow with the amount collected in the cylinder indicates that the data sets are in agreement for storms of less than 2 centimeters equivalent rain. The data are being used to determine the timing and origin of regional ground-water recharge at Yucca Mountain.

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HYDROLOGIC DATA

Table 2.--Date, time, and rain collected prior to installation of micrologger system

[Dashes indicate no data]

Station name	Begin Rain		End Rain		Rain (centimeters)	
	Date	Time	Date	Time	Collected	Recorded
Carolyn	08/09/1983	0550	08/09/1983	1730	0.980	0.640
Dianne	08/09/1983	0550	08/09/1983	1730	1.010	.640
Marge	08/09/1983	0550	08/09/1983	1730	1.130	.640
Sandy	08/09/1983	0550	08/09/1983	1730	.610	.640
Carolyn	08/10/1983	1310	08/10/1983	1350	.160	.051
Dianne	08/10/1983	1310	08/10/1983	1350	.230	.051
Marge	08/10/1983	1310	08/10/1983	1350	.170	.051
Sandy	08/10/1983	1310	08/10/1983	1350	.220	.051
Carolyn	08/15/1983	0930	08/19/1983	1750	3.560	4.978
Dianne	08/15/1983	0930	08/19/1983	1750	4.420	4.978
Marge	08/15/1983	0930	08/19/1983	1750	5.300	4.978
Sandy	08/15/1983	0930	08/19/1983	1750	5.300	4.978
Carolyn	09/25/1983	2210	09/25/1983	2330	.700	.838
Dianne	09/25/1983	2210	09/25/1983	2330	.440	.838
Marge	09/25/1983	2210	09/25/1983	2330	.360	.838
Sandy	09/25/1983	2210	09/25/1983	2330	.790	.838
Carolyn	09/26/1983	0650	09/26/1983	2030	.550	.660
Dianne	09/26/1983	0650	09/26/1983	2030	.550	.660
Marge	09/26/1983	0650	09/26/1983	2030	.440	.660
Sandy	09/26/1983	0650	09/26/1983	2030	.400	.660
Carolyn	09/30/1983	0610	09/30/1983	0910	.220	.203
Dianne	09/30/1983	0610	09/30/1983	0910	.270	.203
Marge	09/30/1983	0610	09/30/1983	0910	.220	.203
Sandy	09/30/1983	0610	09/30/1983	0910	.270	.203
Carolyn	09/30/1983	2110	10/01/1983	2310	.480	.686
Dianne	09/30/1983	2110	10/01/1983	2310	.300	.686
Marge	09/30/1983	2110	10/01/1983	2310	.320	.686
Sandy	09/30/1983	2110	10/01/1983	2310	.800	.686
Carolyn	11/24/1983	2050	11/25/1983	0210	1.140	1.016
Dianne	11/24/1983	2050	11/25/1983	0210	1.020	1.016
Marge	11/24/1983	2050	11/25/1983	0210	.910	1.016
Sandy	11/24/1983	2050	11/25/1983	0210	.670	1.016
Carolyn	03/14/1984	-	03/14/1984	-	.005	-
Gail	03/14/1984	-	03/14/1984	-	.500	-
Ki	03/14/1984	-	03/14/1984	-	.006	-
Lucky	03/14/1984	-	03/14/1984	-	.017	-

Table 2.--Date, time, and rain collected prior to installation of micrologger system--Continued

Station name	Begin Rain		End Rain		Rain (centimeters)	
	Date	Time	Date	Time	Collected	Recorded
Andy	04/06/1984	-	04/06/1984	-	0.046	-
Carolyn	04/06/1984	-	04/06/1984	-	.100	-
Dianne	04/06/1984	-	04/06/1984	-	.060	-
Joanne	04/06/1984	-	04/06/1984	-	.032	-
Lucky	04/06/1984	-	04/06/1984	-	.530	-
Robin	04/06/1984	-	04/06/1984	-	.030	-
Sandy	04/06/1984	-	04/06/1984	-	.130	-
Carolyn	04/19/1984	-	04/19/1984	-	.008	-
Gail	06/14/1984	-	06/14/1984	-	.170	-
Gail	06/23/1984	-	06/24/1984	-	.170	-
Gail	06/30/1984	-	07/01/1984	-	.580	-
Ki	06/30/1984	-	07/01/1984	-	.037	-
Gail	07/02/1984	-	07/02/1984	-	.120	-
Ki	07/02/1984	-	07/02/1984	-	.270	-
Marge	07/02/1984	1950	07/02/1984	2030	.160	.279
Sandy	07/02/1984	1950	07/02/1984	2030	.210	.279
Andy	07/13/1984	-	07/15/1984	-	.274	-
Gail	07/13/1984	-	07/15/1984	-	6.100	-
Jennifer	07/13/1984	-	07/15/1984	-	.043	-
Joanne	07/13/1984	-	07/15/1984	-	.120	-
Ki	07/13/1984	-	07/15/1984	-	.040	-
Lucky	07/13/1984	-	07/15/1984	-	1.730	-
Robin	07/13/1984	0010	07/13/1984	0030	.024	.178
Sandy	07/12/1984	2239	07/13/1984	0410	.640	.660
Dianne	07/16/1984	1459	07/16/1984	1519	.046	.508
Marge	07/16/1984	1459	07/16/1984	1519	.146	.508
Gail	07/17/1984	-	07/17/1984	-	1.550	-
Carolyn	07/19/1984	1459	07/22/1984	1650	-	9.068
Dianne	07/19/1984	1459	07/22/1984	1650	11.760	9.068
Gail	07/19/1984	-	07/19/1984	-	.990	-
Ki	07/18/1984	-	07/20/1984	-	1.400	-
Lucky	07/18/1984	-	07/22/1984	-	4.150	-
Marge	07/19/1984	1459	07/22/1984	1650	9.630	9.068
Robin	07/19/1984	2115	07/22/1984	1915	7.320	8.560
Sandy	07/19/1984	1459	07/22/1984	1650	-	9.068

Table 2.--Date, time, and rain collected prior to installation of micrologger system--Continued

Station name	Begin Rain		End Rain		Rain (centimeters)	
	Date	Time	Date	Time	Collected	Recorded
Andy	07/21/1984	-	07/22/1984	-	0.840	-
Gail	07/21/1984	-	07/22/1984	-	.180	-
Jennifer	07/21/1984	-	07/22/1984	-	4.270	-
Joanne	07/21/1984	-	07/22/1984	-	.021	-
Ki	07/21/1984	-	07/22/1984	-	3.290	-
Gail	07/25/1984	-	07/25/1984	-	1.170	-
Gail	07/26/1984	-	07/27/1984	-	9.910	-
Ki	07/26/1984	-	07/27/1984	-	.150	-
Andy	07/27/1984	-	07/27/1984	-	.250	-
Jennifer	07/27/1984	-	07/27/1984	-	.300	-
Lucky	07/27/1984	-	07/27/1984	-	6.100	-
Carolyn	07/27/1984	2319	07/28/1984	0950	.830	.533
Dianne	07/27/1984	2319	07/28/1984	0950	.820	.533
Marge	07/27/1984	2319	07/28/1984	0950	.460	.533
Robin	07/27/1984	2355	07/28/1984	0935	.190	.483
Sandy	07/27/1984	2319	07/28/1984	0950	1.350	.533
Gail	07/28/1984	-	07/28/1984	-	1.370	-
Jennifer	07/28/1984	-	07/31/1984	-	.660	-
Joanne	07/28/1984	-	07/31/1984	-	1.420	-
Lucky	07/28/1984	-	07/29/1984	-	1.360	-
Gail	07/29/1984	-	07/29/1984	-	.085	-
Ki	07/29/1984	-	07/30/1984	-	.910	-
Andy	07/30/1984	-	07/31/1984	-	.230	-
Gail	07/30/1984	-	07/31/1984	-	6.550	-
Ki	07/30/1984	-	07/31/1984	-	.800	-
Lucky	07/30/1984	-	07/31/1984	-	.220	-
Robin	07/30/1984	-	07/30/1984	-	.018	-
Carolyn	07/31/1984	1719	07/31/1984	1739	1.110	.686
Dianne	07/31/1984	1719	07/31/1984	1739	.960	.686
Marge	07/31/1984	1719	07/31/1984	1739	.690	.686
Robin	07/31/1984	1715	07/31/1984	1735	.007	.152
Sandy	07/31/1984	1719	07/31/1984	1739	.900	.686
Gail	08/01/1984	-	08/01/1984	-	.210	-
Carolyn	08/10/1984	1159	08/10/1984	1219	.040	.025
Dianne	08/10/1984	1159	08/10/1984	1219	.030	.025
Sandy	08/10/1984	1159	08/10/1984	1219	.030	.025

Table 2.--Date, time, and rain collected prior to installation of micrologger system--Continued

Station name	Begin Rain		End Rain		Rain (centimeters)	
	Date	Time	Date	Time	Collected	Recorded
Andy	08/14/1984	-	08/14/1984	-	1.130	-
Carolyn	08/14/1984	0710	08/15/1984	1130	5.085	3.657
Dianne	08/14/1984	0710	08/15/1984	1130	3.900	3.657
Gail	08/14/1984	-	08/15/1984	-	4.220	-
Jennifer	08/14/1984	-	08/15/1984	-	4.880	-
Joanne	08/14/1984	-	08/15/1984	-	1.100	-
Lucky	08/14/1984	-	08/15/1984	-	5.560	-
Marge	08/14/1984	0710	08/15/1984	1130	2.400	3.657
Robin	08/14/1984	1230	08/15/1984	1010	.130	4.724
Sandy	08/14/1984	0710	08/15/1984	1130	5.930	3.657
Gail	08/15/1984	-	08/20/1984	-	3.730	-
Ki	08/16/1984	-	08/16/1984	-	.450	-
Lucky	08/15/1984	-	08/19/1984	-	11.050	-
Andy	08/18/1984	-	08/19/1984	-	2.880	-
Carolyn	08/18/1984	1850	08/19/1984	1030	3.060	2.896
Dianne	08/18/1984	1850	08/19/1984	1030	3.730	2.896
Jennifer	08/18/1984	-	08/19/1984	-	2.570	-
Joanne	08/18/1984	-	08/19/1984	-	1.490	-
Ki	08/18/1984	-	08/19/1984	-	1.390	-
Marge	08/18/1984	1850	08/19/1984	1059	-	2.896
Robin	08/18/1984	1830	08/19/1984	0930	2.024	4.064
Sandy	08/18/1984	1850	08/19/1984	1059	3.300	2.896
Gail	08/25/1984	-	08/25/1984	-	.030	-
Andy	11/22/1984	-	11/24/1984	-	2.620	-
Carolyn	11/22/1984	-	11/24/1984	-	3.540	-
Dianne	11/22/1984	-	11/24/1984	-	2.200	-
Jennifer	11/22/1984	-	11/24/1984	-	3.170	-
Joanne	11/22/1984	-	11/24/1984	-	1.740	-
Lucky	11/22/1984	-	11/24/1984	-	6.160	-
Marge	11/22/1984	-	11/24/1984	-	2.200	-
Robin	11/22/1984	-	11/24/1984	-	.640	-
Sandy	11/22/1984	-	11/24/1984	-	-	-
Carolyn	11/26/1984	-	12/11/1984	-	.521	-
Jennifer	11/26/1984	-	12/10/1984	-	.250	-
Joanne	11/26/1984	-	12/10/1984	-	.113	-
Lucky	11/26/1984	-	12/10/1984	-	.655	-
Robin	11/26/1984	-	12/11/1984	-	.307	-
Sandy	11/26/1984	-	12/11/1984	-	.607	-

Table 2.--Date, time, and rain collected prior to installation of micrologger system--Continued

Station name	Begin Rain		End Rain		Rain (centimeters)	
	Date	Time	Date	Time	Collected	Recorded
Andy	12/18/1984	-	12/20/1984	-	2.930	-
Carolyn	12/18/1984	-	12/27/1984	-	3.110	-
Joanne	12/18/1984	-	12/20/1984	-	5.240	-
Lucky	12/18/1984	-	12/20/1984	-	2.200	-
Robin	12/18/1984	-	12/20/1984	-	4.270	-
Sandy	12/18/1984	-	12/27/1984	-	2.990	-
Robin	12/20/1984	-	12/27/1984	-	1.490	-
Andy	01/07/1985	-	01/07/1985	-	1.830	-
Carolyn	01/07/1985	-	01/07/1985	-	.770	-
Jennifer	01/07/1985	-	01/07/1985	-	2.070	-
Joanne	01/07/1985	-	01/07/1985	-	2.440	-
Lucky	01/07/1985	-	01/07/1985	-	1.520	-
Robin	01/07/1985	-	01/07/1985	-	.930	-
Sandy	01/07/1985	-	01/07/1985	-	1.130	-
Carolyn	01/26/1985	-	01/27/1985	-	.220	-
Jennifer	01/26/1985	-	01/27/1985	-	.220	-
Lucky	01/26/1985	-	01/27/1985	-	.100	-
Robin	01/26/1985	-	01/27/1985	-	.380	-
Sandy	01/26/1985	-	01/27/1985	-	.120	-
Andy	02/03/1985	-	02/03/1985	-	.005	-
Sandy	02/03/1985	-	02/03/1985	-	.040	-
Lucky	02/20/1985	-	02/20/1985	-	.018	-
Gail	03/11/1985	-	03/11/1985	-	.604	-
Lucky	03/14/1985	-	03/14/1985	-	.159	-
Andy	03/18/1985	-	03/18/1985	-	.204	-
Carolyn	03/18/1985	-	03/18/1985	-	.029	-
Joanne	03/18/1985	-	03/18/1985	-	.018	-
Lucky	03/18/1985	-	03/18/1985	-	.107	-
Robin	03/18/1985	-	03/18/1985	-	.082	-
Sandy	03/18/1985	-	03/18/1985	-	.207	-
Lucky	03/27/1985	-	03/27/1985	-	.152	-
Andy	03/28/1985	-	03/28/1985	-	.107	-
Carolyn	03/28/1985	-	03/28/1985	-	.067	-
Robin	03/28/1985	-	03/28/1985	-	.099	-
Sandy	03/28/1985	-	03/28/1985	-	.108	-
Gail	04/18/1985	-	04/18/1985	-	.893	-
Kathy	04/18/1985	-	04/18/1985	-	.023	-
Lucky	04/18/1985	-	04/18/1985	-	1.189	-

Table 2.--Date, time, and rain collected prior to installation of micrologger system--Continued

Station name	Begin Rain		End Rain		Rain (centimeters)	
	Date	Time	Date	Time	Collected	Recorded
Gail	05/09/1985	-	05/09/1985	-	0.496	-
Joanne	05/09/1985	-	05/09/1985	-	.062	-
Ki	05/09/1985	-	05/09/1985	-	.292	-
Gail	05/10/1985	-	05/10/1985	-	.735	-
Kathy	05/10/1985	-	05/10/1985	-	.743	-
Ki	05/10/1985	-	05/10/1985	-	.976	-
Lucky	05/10/1985	-	05/10/1985	-	.122	-
Robin	05/10/1985	-	05/10/1985	-	.418	-
Sandy	05/10/1985	-	05/10/1985	-	.646	-
Gail	06/03/1985	-	06/03/1985	-	.064	-
Kathy	06/03/1985	-	06/03/1985	-	.004	-
Ki	06/03/1985	-	06/03/1985	-	1.152	-
Lucky	06/03/1985	-	06/03/1985	-	.012	-

Table 3.--*Stable-isotope and tritium content, and temperature of rain prior to installation of micrologger system*

[$\delta^{18}\text{O}$, oxygen-18; δD , deuterium; ‰, per mil, relative to SMOW (standard mean ocean water; pCi/L, picocuries per liter; °C, degrees Celsius; dashes indicate no data]

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Tritium (pCi/L)	Temperature (°C)		
					Average	Maximum	Minimum
Carolyn	08/09/1983	-2.0	-15.0	-	19.7	22.3	18.0
Dianne	08/09/1983	-1.7	-15.5	-	19.7	22.3	18.0
Marge	08/09/1983	-1.7	-13.5	-	19.7	22.3	18.0
Sandy	08/09/1983	-1.2	-11.5	-	19.7	22.3	18.0
Carolyn	08/10/1983	-3.7	-22.0	-	18.0	18.0	17.9
Dianne	08/10/1983	-4.1	-21.5	-	18.0	18.0	17.9
Marge	08/10/1983	-3.4	-22.0	-	18.0	18.0	17.9
Sandy	08/10/1983	-3.7	-20.0	-	18.0	18.0	17.9
Carolyn	08/15/1983	-17.3	-126.5	-	16.1	22.3	13.9
Dianne	08/15/1983	-17.3	-126.5	-	16.1	22.3	13.9
Marge	08/15/1983	-17.4	-128.0	-	16.1	22.3	13.9
Sandy	08/15/1983	-16.5	-119.0	-	16.1	22.3	13.9
Carolyn	09/25/1983	-12.1	-80.5	-	15.2	18.6	13.8
Dianne	09/25/1983	-12.8	-87.0	-	15.2	18.6	13.8
Marge	09/25/1983	-12.4	-84.5	-	15.2	18.6	13.8
Sandy	09/25/1983	-12.1	-81.0	-	15.2	18.6	13.8
Carolyn	09/26/1983	-13.3	-97.5	-	12.9	16.0	11.1
Dianne	09/26/1983	-12.5	-94.0	-	12.9	16.0	11.1
Marge	09/26/1983	-13.1	-99.5	-	12.9	16.0	11.1
Sandy	09/26/1983	-12.2	-91.0	-	12.9	16.0	11.1
Carolyn	09/30/1983	-8.5	-57.0	-	8.2	8.6	8.0
Dianne	09/30/1983	-8.5	-58.5	-	8.2	8.6	8.0
Marge	09/30/1983	-8.4	-56.5	-	8.2	8.6	8.0
Sandy	09/30/1983	-8.3	-58.0	-	8.2	8.6	8.0
Carolyn	09/30/1983	-5.7	-39.0	-	9.5	11.5	8.0
Dianne	09/30/1983	-4.5	-34.0	-	9.5	11.5	8.0
Marge	09/30/1983	-2.8	-8.0	-	9.5	11.5	8.0
Sandy	09/30/1983	-2.8	-8.0	-	9.5	11.5	8.0
Carolyn	11/24/1983	-11.2	-75.5	-	1.8	3.2	1.1
Dianne	11/24/1983	-11.5	-79.5	-	1.8	3.2	1.1
Marge	11/24/1983	-11.2	-74.5	-	1.8	3.2	1.1
Sandy	11/24/1983	-11.3	-75.5	38.0	1.8	3.2	1.1
Carolyn	03/14/1984	-1.9	-44.5	-	-	-	-
Gail	03/14/1984	-10.1	-74.0	32.2	-	-	-
Ki	03/14/1984	-5.5	-54.0	-	-	-	-
Lucky	03/14/1984	-6.5	-55.0	-	-	-	-

Table 3.--*Stable-isotope and tritium content, and temperature of rain prior to installation of micrologger system*--Continued

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Tritium (pCi/L)	Temperature (°C)		
					Average	Maximum	Minimum
Andy	04/06/1984	-4.9	-41.0	-	-	-	-
Carolyn	04/06/1984	-7.0	-59.0	-	-	-	-
Dianne	04/06/1984	-6.6	-57.5	-	-	-	-
Joanne	04/06/1984	-4.4	-47.0	-	-	-	-
Lucky	04/06/1984	-10.4	-70.0	57.1	-	-	-
Robin	04/06/1984	-5.6	-55.5	-	-	-	-
Sandy	04/06/1984	-9.7	-70.0	79.9	-	-	-
Carolyn	04/19/1984	-16.1	-129.5	-	-	-	-
Gail	06/14/1984	-10.5	-77.5	52.0	-	-	-
Gail	06/23/1984	-7.2	-77.5	39.6	-	-	-
Gail	06/30/1984	-10.3	-73.5	107.0	-	-	-
Ki	06/30/1984	-6.0	-52.0	-	-	-	-
Gail	07/02/1984	-7.6	-58.5	-	-	-	-
Ki	07/02/1984	-5.2	-50.0	86.4	-	-	-
Marge	07/02/1984	-3.5	-45.0	73.0	25.2	27.8	25.6
Sandy	07/02/1984	-2.8	-42.0	70.4	25.2	27.8	25.6
Andy	07/13/1984	-6.6	-51.0	44.1	-	-	-
Gail	07/13/1984	-9.3	-63.5	57.0	-	-	-
Jennifer	07/13/1984	-0.1	-12.0	-	-	-	-
Joanne	07/13/1984	-1.3	-25.5	-	-	-	-
Ki	07/13/1984	-4.1	-41.0	-	-	-	-
Lucky	07/13/1984	-5.9	-49.5	44.1	-	-	-
Robin	07/13/1984	-0.1	-16.5	-	22.2	24.8	19.6
Sandy	07/12/1984	-3.3	-28.0	102.0	19.4	22.2	16.8
Dianne	07/16/1984	-7.8	-60.5	-	26.0	26.0	26.0
Marge	07/16/1984	-7.9	-64.0	-	26.0	26.0	26.0
Gail	07/17/1984	-13.1	-91.5	41.0	-	-	-
Carolyn	07/19/1984	-13.1	-93.0	-	21.7	25.2	19.0
Dianne	07/19/1984	-11.0	-77.0	-	21.7	25.2	19.0
Gail	07/19/1984	-9.8	-69.0	34.0	-	-	-
Ki	07/18/1984	-10.7	-74.5	41.5	-	-	-
Lucky	07/18/1984	-11.9	-87.5	-	-	-	-
Marge	07/19/1984	-10.7	-76.5	-	21.7	25.2	19.0
Robin	07/19/1984	-11.5	-81.0	-	18.0	22.2	16.1
Sandy	07/19/1984	-11.8	-82.0	60.2	21.7	25.2	19.0
Andy	07/21/1984	-10.7	-76.0	37.9	-	-	-
Gail	07/21/1984	-12.8	-91.0	39.6	-	-	-
Jennifer	07/21/1984	-10.3	-74.5	43.1	-	-	-
Joanne	07/21/1984	-10.5	-85.5	-	-	-	-
Ki	07/21/1984	-11.4	-80.0	38.8	-	-	-

Table 3.--Stable-isotope and tritium content, and temperature of rain prior to installation of micrologger system--Continued

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Tritium (pCi/L)	Temperature (°C)		
					Average	Maximum	Minimum
Gail	07/25/1984	-9.3	-59.0	35.3	-	-	-
Gail	07/26/1984	-8.9	-59.0	-	-	-	-
Ki	07/26/1984	-6.9	-46.0	-	-	-	-
Andy	07/27/1984	-2.2	-15.5	-	-	-	-
Jennifer	07/27/1984	-4.3	-24.5	-	-	-	-
Lucky	07/27/1984	-7.8	-48.5	-	-	-	-
Carolyn	07/27/1984	-4.3	-26.5	54.4	16.5	18.5	15.8
Dianne	07/27/1984	-	-	53.8	16.5	18.5	15.8
Marge	07/27/1984	-	-	55.5	16.5	18.5	15.8
Robin	07/27/1984	-3.4	-19.0	-	18.5	19.3	18.0
Sandy	07/27/1984	-5.6	-36.0	-	16.5	18.5	15.8
Gail	07/28/1984	-8.3	-52.0	62.2	-	-	-
Jennifer	07/28/1984	-5.3	-29.5	64.8	-	-	-
Joanne	07/28/1984	-4.6	-43.5	68.9	-	-	-
Lucky	07/28/1984	-8.4	-56.5	-	-	-	-
Gail	07/29/1984	-10.4	-68.5	-	-	-	-
Ki	07/29/1984	-6.7	-43.0	112.0	-	-	-
Andy	07/30/1984	-8.8	-64.0	-	-	-	-
Gail	07/30/1984	-6.9	-47.5	-	-	-	-
Ki	07/30/1984	-6.7	-45.5	48.6	-	-	-
Lucky	07/30/1984	-3.0	-28.5	-	-	-	-
Robin	07/30/1984	-4.3	-37.5	-	-	-	-
Carolyn	07/31/1984	-8.9	-59.0	56.4	18.3	18.3	18.3
Dianne	07/31/1984	-	-	50.7	18.3	18.3	18.3
Marge	07/31/1984	-	-	53.1	18.3	18.3	18.3
Robin	07/31/1984	-	-	-	23.3	25.4	21.2
Sandy	07/31/1984	-8.9	-59.5	53.5	18.3	18.3	18.3
Gail	08/01/1984	-4.1	-29.5	51.5	-	-	-
Carolyn	08/10/1984	7.4	29.0	-	21.0	21.0	21.0
Dianne	08/10/1984	6.0	22.0	-	21.0	21.0	21.0
Sandy	08/10/1984	7.1	27.0	-	21.0	21.0	21.0
Andy	08/14/1984	-4.0	-36.0	35.3	-	-	-
Carolyn	08/14/1984	-10.3	-69.5	41.4	17.5	24.5	16.0
Dianne	08/14/1984	-	-	38.9	17.5	24.5	16.0
Gail	08/14/1984	-12.3	-83.5	44.9	-	-	-
Jennifer	08/14/1984	-12.0	-82.5	34.2	-	-	-
Joanne	08/14/1984	-7.9	-59.0	46.5	-	-	-
Lucky	08/14/1984	-7.0	-48.0	48.7	-	-	-
Marge	08/14/1984	-	-	41.8	17.5	24.5	16.0
Robin	08/14/1984	-9.6	-68.0	-	19.1	22.0	18.3
Sandy	08/14/1984	-	-	41.9	17.5	24.5	16.0

Table 3.--Stable-isotope and tritium content, and temperature of rain prior to installation of micrologger system--Continued

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Tritium (pCi/L)	Temperature (°C)		
					Average	Maximum	Minimum
Gail	08/15/1984	-11.9	-78.5	43.0	-	-	-
Ki	08/16/1984	-9.4	-74.0	37.1	-	-	-
Lucky	08/15/1984	-10.1	-66.5	42.0	-	-	-
Andy	08/18/1984	-10.3	-73.0	47.2	-	-	-
Carolyn	08/18/1984	-10.6	-71.5	45.2	16.1	18.1	15.0
Dianne	08/18/1984	-10.1	-69.5	46.4	16.1	18.1	15.0
Jennifer	08/18/1984	-9.3	-66.0	49.6	-	-	-
Joanne	08/18/1984	-8.8	-63.5	51.6	-	-	-
Ki	08/18/1984	-9.0	-62.5	57.3	-	-	-
Marge	08/18/1984	-	-	-	-	-	-
Robin	08/18/1984	-9.5	-64.5	53.2	17.9	19.5	16.9
Sandy	08/18/1984	-10.4	-72.5	63.5	16.1	18.1	15.0
Gail	08/25/1984	-5.9	-39.0	-	-	-	-
Andy	11/22/1984	-8.5	-53.5	-	-	-	-
Carolyn	11/22/1984	-10.7	-64.0	-	-	-	-
Dianne	11/22/1984	-	-	-	-	-	-
Jennifer	11/22/1984	-11.6	-75.0	-	-	-	-
Joanne	11/22/1984	-8.8	-53.5	-	-	-	-
Lucky	11/22/1984	-9.4	-57.0	-	-	-	-
Marge	11/22/1984	-	-	-	-	-	-
Robin	11/22/1984	-12.4	-84.5	-	-	-	-
Sandy	11/22/1984	-	-	101.0	-	-	-
Carolyn	11/26/1984	-14.7	-107.5	-	-	-	-
Jennifer	11/26/1984	-16.1	-122.0	-	-	-	-
Joanne	11/26/1984	-8.6	-73.0	-	-	-	-
Lucky	11/26/1984	-15.5	-119.5	-	-	-	-
Robin	11/26/1984	-11.1	-80.5	-	-	-	-
Sandy	11/26/1984	-14.4	-101.5	55.1	-	-	-
Andy	12/18/1984	-10.4	-63.5	-	-	-	-
Carolyn	12/18/1984	-15.4	-109.5	-	-	-	-
Joanne	12/18/1984	-11.1	-80.5	-	-	-	-
Lucky	12/18/1984	-9.8	-61.0	-	-	-	-
Robin	12/18/1984	-12.1	-77.5	-	-	-	-
Sandy	12/18/1984	-14.7	-103.0	-	-	-	-
Robin	12/20/1984	-18.6	-143.5	-	-	-	-
Andy	01/07/1985	-15.2	-116.0	-	-	-	-
Carolyn	01/07/1985	-16.9	-125.0	-	-	-	-
Jennifer	01/07/1985	-19.8	-148.0	-	-	-	-
Joanne	01/07/1985	-16.4	-126.0	-	-	-	-
Lucky	01/07/1985	-17.9	-139.0	-	-	-	-
Robin	01/07/1985	-15.5	-115.0	-	-	-	-
Sandy	01/07/1985	-17.1	-125.5	44.1	-	-	-

Table 3.--*Stable-isotope and tritium content, and temperature of rain prior to installation of micrologger system*--Continued

Station name	Begin date	$\delta^{18}\text{O}$ ($^{\circ}/\text{oo}$)	δD ($^{\circ}/\text{oo}$)	Tritium (pCi/L)	Temperature ($^{\circ}\text{C}$)		
					Average	Maximum	Minimum
Carolyn	01/26/1985	-14.3	-102.0	-	-	-	-
Jennifer	01/26/1985	-15.6	-111.0	-	-	-	-
Lucky	01/26/1985	-11.4	-79.5	-	-	-	-
Robin	01/26/1985	-14.6	-104.5	-	-	-	-
Sandy	01/26/1985	-14.2	-103.0	93.6	-	-	-
Andy	02/03/1985	-8.4	-73.0	-	-	-	-
Sandy	02/03/1985	-18.2	-141.5	-	-	-	-
Lucky	02/20/1985	-4.4	-64.5	-	-	-	-
Gail	03/11/1985	-9.4	-62.0	-	-	-	-
Lucky	03/14/1985	-9.6	-66.5	-	-	-	-
Andy	03/18/1985	-8.7	-77.8	-	-	-	-
Carolyn	03/18/1985	-7.5	-80.4	-	-	-	-
Joanne	03/18/1985	.7	-16.1	-	-	-	-
Lucky	03/18/1985	-7.5	-61.6	-	-	-	-
Robin	03/18/1985	-2.0	-18.7	-	-	-	-
Sandy	03/18/1985	-9.7	-85.2	123.0	-	-	-
Lucky	03/27/1985	-4.2	-29.6	-	-	-	-
Andy	03/28/1985	-5.8	-44.2	-	-	-	-
Carolyn	03/28/1985	-10.0	-84.2	-	-	-	-
Robin	03/28/1985	-10.9	-75.3	-	-	-	-
Sandy	03/28/1985	-10.5	-70.1	-	-	-	-
Gail	04/18/1985	-12.2	-78.3	-	-	-	-
Kathy	04/18/1985	-6.2	-46.4	-	-	-	-
Lucky	04/18/1985	-10.5	-74.2	-	-	-	-
Gail	05/09/1985	-12.3	-93.0	-	-	-	-
Joanne	05/09/1985	-10.7	-90.1	-	-	-	-
Ki	05/09/1985	-10.4	-78.9	-	-	-	-
Gail	05/10/1985	-14.6	-102.9	-	-	-	-
Kathy	05/10/1985	-8.4	-70.3	-	-	-	-
Ki	05/10/1985	-14.0	-126.4	-	-	-	-
Lucky	05/10/1985	-14.3	-146.1	-	-	-	-
Robin	05/10/1985	-14.7	-110.7	-	-	-	-
Sandy	05/10/1985	-16.9	-118.9	81.3	-	-	-
Gail	06/03/1985	-12.9	-107.7	-	-	-	-
Kathy	06/03/1985	-	-	-	-	-	-
Ki	06/03/1985	-15.4	-113.8	-	-	-	-
Lucky	06/03/1985	-11.6	-105.9	-	-	-	-

Table 4.--Date, time, and rain recorded after installation of micrologger system

[NT, no tips recorded; ND, no temperature data; dashes indicate no data]

Station name	Begin Rain		End Rain		Rain (centimeters)		
	Date	Time	Date	Time	Collected	Recorded	Code
Gail	06/24/1985	1415	06/24/1984	1430	0.111	0.125	
Kathy	06/24/1985	1545	06/24/1985	1600	.591	.050	
Ki	06/24/1985	1330	06/24/1985	1515	.091	.075	
Joanne	06/24/1985	-	06/24/1985	-	.043	-	NT
Sandy	06/24/1985	-	06/24/1985	-	.006	-	NT
Gail	07/08/1985	-	07/08/1985	-	.092	-	ND
Gail	07/10/1985	-	07/10/1985	-	.337	-	ND
Lucky	07/10/1985	-	07/10/1985	-	.442	-	ND
Gail	07/11/1985	-	07/11/1985	-	.044	-	ND
Gail	07/18/1985	-	07/18/1985	-	.274	-	ND
Joanne	07/18/1985	-	07/18/1985	-	.032	-	ND
Kathy	07/18/1985	-	07/18/1985	-	.970	-	ND
Ki	07/18/1985	-	07/18/1985	-	.473	-	ND
Lucky	07/18/1985	-	07/18/1985	-	.561	-	ND
Robin	07/18/1985	-	07/18/1985	-	.040	-	ND
Sandy	07/18/1985	-	07/18/1985	-	.040	-	ND
Gail	07/19/1985	-	07/19/1985	-	.915	-	ND
Gail	07/19/1985	-	07/19/1985	-	6.159	-	ND
Kathy	07/19/1985	-	07/19/1985	-	.134	-	ND
Ki	07/19/1985	-	07/19/1985	-	.784	-	ND
Lucky	07/19/1985	-	07/19/1985	-	.137	-	ND
Lucky	07/19/1985	-	07/19/1985	-	1.402	-	ND
Joanne	07/20/1985	-	07/20/1985	-	.122	-	ND
Ki	07/20/1985	-	07/20/1985	-	.976	-	ND
Robin	07/20/1985	-	07/20/1985	-	1.415	-	ND
Sandy	07/20/1985	-	07/20/1985	-	.854	-	ND
Kathy	07/21/1985	-	07/21/1985	-	2.241	-	ND
Lucky	07/25/1985	1600	07/25/1985	1615	.038	.050	
Kathy	07/28/1985	1245	07/28/1985	1330	.701	.700	
Lucky	08/26/1985	1600	08/26/1985	1615	.046	.050	
Lucky	09/05/1985	1200	09/05/1985	1300	.061	.075	
Gail	09/06/1985	1345	09/06/1985	1445	.030	.300	
Kathy	09/06/1985	-	09/08/1985	-	2.012	-	NT
Ki	09/06/1985	-	09/06/1985	-	.018	-	ND
Gail	09/18/1985	1245	09/19/1985	1430	3.537	3.775	
Kathy	09/18/1985	1400	09/19/1985	1000	.915	1.050	
Ki	09/18/1985	1500	09/18/1985	1730	.854	.725	
Lucky	09/18/1985	1300	09/19/1985	1030	2.195	2.875	
Sandy	09/18/1985	1330	09/19/1985	0300	1.646	1.575	

Table 4.--Date, time, and rain recorded after installation of micrologger system--Continued

Station name	Begin Rain		End Rain		Rain (centimeters)	
	Date	Time	Date	Time	Collected	Recorded
Gail	09/27/1985	1515	09/27/1985	1545	0.152	0.325
Ki	09/27/1985	1730	09/27/1985	2145	.265	.300
Gail	09/28/1985	-	09/28/1985	-	.476	- NT
Gail	10/01/1985	-	10/01/1985	-	.046	- ND
Kathy	10/01/1985	-	10/01/1985	-	1.189	- NT
Lucky	10/01/1985	-	10/01/1985	-	.015	- NT
Gail	10/07/1985	-	10/08/1985	-	.436	- ND
Kathy	10/07/1985	-	10/07/1985	-	.134	- ND
Ki	10/07/1985	-	10/07/1985	-	.793	- NT
Sandy	10/07/1985	2230	10/08/1985	0015	.146	.150
Kathy	10/08/1985	-	10/08/1985	-	1.738	- ND
Ki	10/09/1985	1930	10/09/1985	2115	.244	.150
Gail	10/10/1985	-	10/10/1985	-	.655	- ND
Kathy	10/10/1985	-	10/10/1985	-	.457	- ND
Ki	10/21/1985	1715	10/22/1985	1230	.427	.475
Lucky	10/21/1985	-	10/21/1985	-	.122	- ND
Gail	10/28/1985	-	10/28/1985	-	.162	- ND
Kathy	11/24/1985	-	11/24/1985	-	.915	- NT
Lucky	11/24/1985	1615	11/24/1985	1800	.854	.475
Lucky	11/29/1985	1345	12/02/1985	0945	1.520	1.600
Sandy	11/29/1985	1315	12/02/1985	0815	2.740	1.825
Gail	01/04/1986	2315	01/05/1986	0845	.026	- NT
Kathy	01/04/1986	2315	01/05/1986	0845	.142	- NT
Ki	01/04/1986	2315	01/05/1986	0845	.473	- NT
Lucky	01/04/1986	2315	01/05/1986	0845	.076	- NT
Sandy	01/04/1986	2315	01/05/1986	0845	.701	.700
Kathy	01/15/1986	-	01/15/1986	-	.076	- NT
Lucky	01/15/1986	-	01/15/1986	-	.191	- NT
Sandy	01/29/1986	2230	01/30/1986	1700	1.677	2.175
Gail	01/30/1986	0415	01/30/1986	0945	5.854	- NT
Kathy	01/30/1986	-	01/30/1986	-	2.137	- NT
Ki	01/30/1986	-	01/30/1986	-	1.829	- NT
Lucky	01/30/1986	0415	01/30/1986	0945	.488	.975
Lucky	02/03/1986	-	02/03/1986	-	.059	- NT
Kathy	02/13/1986	-	02/16/1986	-	1.834	- NT
Ki	02/13/1986	0100	02/13/1986	0500	.338	- NT
Lucky	02/13/1986	0015	02/13/1986	1315	1.988	.300
Sandy	02/13/1986	0100	02/13/1986	0500	.168	.175

Table 4.--Date, time, and rain recorded after installation of micrologger system--Continued

Station name	Begin Rain		End Rain		Rain (centimeters)		
	Date	Time	Date	Time	Collected	Recorded	
Ki	02/16/1986	-	02/16/1986	-	1.677	-	NT
Sandy	02/16/1986	-	02/16/1986	-	1.387	-	NT
Gail	02/18/1986	-	02/18/1986	-	1.530	-	NT
Gail	02/19/1986	-	02/19/1986	-	.030	-	NT
Gail	03/02/1986	-	03/02/1986	-	.213	-	NT
Kathy	03/08/1986	-	03/10/1986	-	.915	-	NT
Sandy	03/08/1986	-	03/08/1986	-	1.067	-	NT
Lucky	03/10/1986	0130	03/10/1986	1815	1.524	1.675	
Sandy	03/10/1986	-	03/10/1986	-	1.113	-	NT
Sandy	03/12/1986	-	03/12/1986	-	.076	-	ND
Lucky	03/14/1986	-	03/14/1986	-	.488	-	ND
Lucky	03/15/1986	-	03/16/1986	-	.854	-	ND
Ki	03/29/1986	-	03/29/1986	-	.030	-	NT
Sandy	04/06/1986	0945	04/06/1986	2330	.259	.275	
Ki	04/16/1986	-	04/16/1986	-	.095	-	NT
Sandy	05/06/1986	0815	05/06/1986	1030	.198	.200	
Ki	05/06/1986	-	05/06/1986	-	.119	-	NT
Sandy	05/06/1986	1415	05/06/1986	2100	.107	.150	
Sandy	05/31/1986	-	06/01/1986	-	.009	-	NT
Sandy	07/14/1986	-	07/15/1986	-	.140	-	NT
Sandy	07/21/1986	1615	07/23/1986	0100	.671	.750	
Sandy	07/23/1986	2145	07/23/1986	2245	.396	.525	
Sandy	08/10/1986	2200	08/10/1986	2345	.381	.375	
Sandy	08/18/1986	1730	08/18/1986	1845	.427	.275	
Sandy	08/27/1986	0245	08/27/1986	0515	.854	.300	

Table 5.--*Stable-isotope content and temperature of rain recorded after installation of micrologger system*

[$\delta^{18}\text{O}$, oxygen-18; δD , deuterium; ‰, per mil, relative to SMOW (standard mean ocean water); dashes indicate no data; °C, degrees Celsius]

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Temperature (°C)		
				Average	Maximum	Minimum
Gail	06/24/1985	-8.0	-54.0	13.6	15.5	12.4
Kathy	06/24/1985	-8.1	-52.4	12.9	17.9	8.8
Ki	06/24/1985	-2.7	-29.9	15.4	18.3	12.5
Joanne	06/24/1985	-1.4	-46.3	-	-	-
Sandy	06/24/1985	-4.3	-45.7	-	-	-
Gail	07/08/1985	.6	-10.3	-	-	-
Gail	07/10/1985	-1.9	-19.2	-	-	-
Lucky	07/10/1985	1.6	-3.8	-	-	-
Gail	07/11/1985	2.1	5.0	-	-	-
Gail	07/18/1985	-2.9	-17.4	-	-	-
Joanne	07/18/1985	1.8	6.4	-	-	-
Kathy	07/18/1985	-3.4	-16.9	-	-	-
Ki	07/18/1985	-4.4	-18.6	-	-	-
Lucky	07/18/1985	-2.2	-11.2	-	-	-
Robin	07/18/1985	-	3.6	-	-	-
Sandy	07/18/1985	.3	2.9	-	-	-
Gail	07/19/1985	-7.8	-48.5	-	-	-
Gail	07/19/1985	-8.7	-58.1	-	-	-
Kathy	07/19/1985	-7.8	-55.2	-	-	-
Ki	07/19/1985	-4.0	-28.6	-	-	-
Lucky	07/19/1985	-2.4	-20.1	-	-	-
Lucky	07/19/1985	-8.0	-53.2	-	-	-
Joanne	07/20/1985	-4.2	-33.2	-	-	-
Ki	07/20/1985	-5.2	-37.6	-	-	-
Robin	07/20/1985	-5.2	-29.4	-	-	-
Sandy	07/20/1985	-5.7	-33.4	-	-	-
Kathy	07/21/1985	-6.8	-47.8	-	-	-
Lucky	07/25/1985	1.0	-16.9	22.3	23.8	19.0
Kathy	07/28/1985	-8.9	-60.1	16.3	24.8	12.6
Lucky	08/26/1985	-1.4	-17.0	29.8	31.2	27.0
Lucky	09/05/1985	-8.6	-63.2	12.8	13.6	12.3
Gail	09/06/1985	-13.5	-95.6	7.6	9.4	6.8
Kathy	09/06/1985	-7.3	-48.3	-	-	-
Ki	09/06/1985	-7.9	-70.7	-	-	-
Gail	09/18/1985	-14.4	-97.8	5.3	8.1	1.9
Kathy	09/18/1985	-12.3	-81.6	7.6	10.5	6.1
Ki	09/18/1985	-14.0	-94.6	5.3	8.9	4.3
Lucky	09/18/1985	-12.3	-80.2	9.5	16.5	8.5
Sandy	09/18/1985	-11.8	-82.6	9.3	14.6	7.8

Table 5.--*Stable-isotope content and temperature of rain recorded after installation of micrologger system--Continued*

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Temperature (°C)		
				Average	Maximum	Minimum
Gail	09/27/1985	-13.6	-103.0	11.2	13.0	9.6
Ki	09/27/1985	-6.7	-58.0	10.3	15.0	8.6
Gail	09/28/1985	-8.8	-66.0	-	-	-
Gail	10/01/1985	-4.8	-48.0	-	-	-
Kathy	10/01/1985	-10.9	-81.0	-	-	-
Lucky	10/01/1985	-	-20.0	-	-	-
Gail	10/07/1985	-9.8	-70.0	-	-	-
Kathy	10/07/1985	-5.7	-46.0	-	-	-
Ki	10/07/1985	-14.3	-101.0	-	-	-
Sandy	10/07/1985	-5.1	-40.0	10.2	12.4	9.5
Kathy	10/08/1985	-9.5	-61.0	-	-	-
Ki	10/09/1985	-10.7	-72.0	1.0	1.0	.8
Gail	10/10/1985	-13.0	-87.0	-	-	-
Kathy	10/10/1985	-9.8	-69.0	-	-	-
Ki	10/21/1985	-11.6	-76.0	4.7	9.6	-2.0
Lucky	10/21/1985	-4.8	-59.0	-	-	-
Gail	10/28/1985	-8.9	-58.0	-	-	-
Kathy	11/24/1985	-12.4	-88.0	-	-	-
Lucky	11/24/1985	-11.6	-87.0	4.4	7.7	2.8
Lucky	11/29/1985	-13.1	-94.0	3.7	7.3	.8
Sandy	11/29/1985	-12.6	-86.0	3.5	5.6	1.8
Gail	01/04/1986	-11.0	-	1.2	3.7	.5
Kathy	01/04/1986	-11.6	-	2.9	3.7	2.3
Ki	01/04/1986	-15.9	-123.0	2.2	3.0	.4
Lucky	01/04/1986	-8.7	-	7.8	8.5	7.2
Sandy	01/04/1986	-14.7	-108.0	5.9	6.2	5.1
Kathy	01/15/1986	-8.6	-	-	-	-
Lucky	01/15/1986	-9.2	-	-	-	-
Gail	01/30/1986	-15.5	-	1.6	3.1	.3
Kathy	01/30/1986	-12.3	-	-	-	-
Ki	01/30/1986	-14.9	-107.0	-	-	-
Lucky	01/30/1986	-13.2	-	8.2	11.8	7.3
Sandy	01/29/1986	-10.5	-74.0	5.1	8.5	4.1
Lucky	02/03/1986	-8.2	-	-	-	-
Kathy	02/13/1986	-12.2	-	-	-	-
Ki	02/13/1986	-8.6	-47.0	-0.4	-0.3	-0.7
Lucky	02/13/1986	-9.5	-	4.8	6.0	4.1
Sandy	02/13/1986	-4.7	-31.0	2.8	3.1	2.6

Table 5.--*Stable-isotope content and temperature of rain recorded after installation of micrologger system*--Continued

Station name	Begin date	$\delta^{18}\text{O}$ ($^{\circ}/\text{oo}$)	δD ($^{\circ}/\text{oo}$)	Temperature ($^{\circ}\text{C}$)		
				Average	Maximum	Minimum
Ki	02/16/1986	-11.0	-73.0	-	-	-
Sandy	02/16/1986	-10.7	-69.0	-	-	-
Gail	02/18/1986	-7.6	-	-	-	-
Gail	02/19/1986	-3.7	-	-	-	-
Gail	03/02/1986	-7.4	-	-	-	-
Kathy	03/08/1986	-11.4	-	-	-	-
Sandy	03/08/1986	-13.2	-97.0	-	-	-
Lucky	03/10/1986	-10.8	-	3.2	6.7	0.6
Sandy	03/10/1986	-10.6	-72.0	-	-	-
Sandy	03/12/1986	-10.7	-81.0	-	-	-
Lucky	03/14/1986	-14.1	-	-	-	-
Lucky	03/15/1986	-13.2	-	-	-	-
Ki	03/29/1986	-2.2	-	-	-	-
Sandy	04/06/1986	-5.7	-	-	-	-
Ki	04/16/1986	-10.6	-	-	-	-
Sandy	05/06/1986	-11.4	-	2.25	4.14	1.63
Ki	05/06/1986	-5.6	-	-	-	-
Sandy	05/06/1986	-12.7	-	-	-	-
Sandy	05/31/1986	3.0	-	-	-	-
Sandy	07/14/1986	-6.9	-	-	-	-
Sandy	07/21/1986	-8.6	-	16.24	20.10	14.57
Sandy	07/23/1986	-10.0	-	14.93	21.95	13.93
Sandy	08/10/1986	1.2	-	18.71	22.23	17.50
Sandy	08/18/1986	.7	-	18.84	22.48	17.63
Sandy	08/27/1986	-3.2	-	16.57	17.88	15.28

Table 6.--*Stable-isotope and tritium content of snow*

[$\delta^{18}\text{O}$, oxygen-18; δD , deuterium; ‰, per mil, relative to SMOW (standard mean ocean water); pCi/L, picocuries per liter; dashes indicate no data]

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Tritium (pCi/L)	Equivalent rain (centimeters)	
					cylinder	snowboard
Carolyn	12/03/1983	-12.4	-87.0	-	1.100	-
Dianne	12/03/1983	-12.4	-86.0	-	3.050	-
Marge	12/03/1983	-12.6	-88.5	-	2.980	-
Sandy	12/03/1983	-9.1	-60.5	-	-	-
Andy	02/10/1984	-10.7	-80.5	-	.015	-
Carolyn	02/10/1984	-8.8	-63.5	-	.018	-
Jennifer	02/10/1984	-12.6	-91.5	-	.034	-
Joanne	02/10/1984	-11.5	-81.5	56.0	.100	-
Lucky	02/10/1984	-7.5	-69.0	-	.009	-
Robin	02/10/1984	-11.2	-80.0	50.0	.107	-
Ki	02/13/1984	-15.1	-107.0	-	.295	-
Lucky	02/13/1984	-10.1	-75.5	-	.018	-
Robin	02/14/1984	-7.8	-62.0	-	.037	-
Andy	02/16/1984	-9.0	-53.0	-	-	-
Dianne	02/16/1984	-	-	-	-	-
Gail	02/16/1984	-11.1	-73.0	48.2	-	-
Jennifer	02/16/1984	-8.9	-60.0	-	-	-
Sandy	02/16/1984	-10.0	-75.0	-	.150	-
Gail	03/29/1984	-13.8	-112.0	-	.022	-
Gail	04/01/1984	-13.7	-115.5	-	.020	-
Sandy	04/01/1984	-22.2	-179.0	130.0	.040	-
Gail	04/06/1984	-13.3	-94.0	67.3	.640	-
Gail	04/19/1984	-8.5	-61.5	56.9	.290	-
Ki	04/19/1984	-10.2	-75.0	-	.050	-
Gail	11/22/1984	-11.6	-76.0	-	6.220	-
Ki	11/22/1984	-11.9	-76.0	-	2.200	-
Ki	11/26/1984	-13.6	-100.5	-	.564	-
Jennifer	12/18/1984	-12.2	-83.5	-	.730	-
Gail	12/18/1984	-13.7	-94.0	-	-	-
Ki	12/18/1984	-15.3	-109.5	-	1.662	-
Gail	01/07/1985	-20.3	-158.5	-	1.660	-
Ki	01/07/1985	-19.6	-149.5	-	.530	-
Gail	01/26/1985	-15.8	-113.5	-	.740	-
Ki	01/26/1985	-15.9	-114.5	-	.870	-
Gail	02/02/1985	-18.7	-140.5	-	.170	-
Jennifer	02/03/1985	-16.5	-123.5	-	.030	-
Ki	02/03/1985	-19.4	-149.5	-	.160	-
Lucky	02/03/1985	-13.8	-98.5	-	.230	-
Gail	02/20/1985	-20.0	-152.5	-	.319	-
Ki	02/20/1985	-14.7	-110.0	47.9	.135	-

Table 6.--Stable-isotope and tritium content of snow--Continued

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Tritium (pCi/L)	Equivalent rain (centimeters)	
					cylinder	snowboard
Gail	03/14/1985	-13.6	-92.0	-	1.235	-
Jennifer	03/14/1985	-9.8	-89.4	-	.006	-
Ki	03/14/1985	-12.8	-96.9	-	.245	-
Gail	03/18/1985	-10.5	-64.5	-	.677	-
Gail	03/18/1985	-10.9	-68.6	-	.110	-
Ki	03/18/1985	-10.9	-65.6	-	.609	-
Ki	03/18/1985	-13.8	-99.2	-	.261	-
Gail	03/27/1985	-9.6	-69.8	-	.210	-
Gail	03/28/1985	-10.5	-71.5	-	.427	-
Jennifer	03/28/1985	-7.5	-55.4	-	.023	-
Ki	03/28/1985	-12.8	-94.4	-	.061	-
Lucky	03/28/1985	-8.0	-55.6	-	.006	-
Gail	11/11/1985	-13.5	-91.0	-	2.713	-
Kathy	11/11/1985	-11.0	-71.0	-	1.067	-
Ki	11/11/1985	-18.5	-130.0	-	2.134	-
Lucky	11/11/1985	-8.8	-73.0	-	1.280	-
Sandy	11/11/1985	-12.8	-83.0	-	4.192	-
Ki	11/24/1985	-	-	-	1.120	5.03
Gail	11/30/1985	-15.3	-117.0	-	7.650	6.16
Kathy	11/30/1985	-12.0	-92.0	-	3.310	-
Ki	11/30/1985	-14.8	-105.0	-	.780	3.22
Kathy	12/16/1985	-12.9	-	-	.035	-
Gail	12/30/1985	-13.6	-	-	.732	-
Gail	01/15/1986	-11.5	-	-	.580	.19
Gail	02/03/1986	-11.8	-	-	.159	-
Ki	02/03/1986	-10.5	-70.0	-	.091	-
Gail	02/05/1986	-9.9	-	-	.046	-
Ki	02/05/1986	-10.5	-71.0	-	.015	-
Gail	02/13/1986	-11.7	-	-	11.037	2.08
Gail	03/08/1986	-11.9	-	-	6.128	3.52
Ki	03/08/1986	-12.1	-89.0	-	1.037	-
Gail	03/12/1986	-10.7	-	-	.152	-
Gail	03/14/1986	-1.6	-	-	.732	3.17
Kathy	03/14/1986	-17.2	-	-	1.067	-
Ki	03/14/1986	-19.1	-	-	.274	-
Sandy	03/14/1986	-16.7	-	-	.500	.64
Gail	03/15/1986	-15.8	-	-	1.085	1.69
Kathy	03/15/1986	-12.4	-	-	1.098	1.90
Ki	03/15/1986	-14.2	-	-	.476	1.69
Sandy	03/15/1986	-12.2	-	-	.793	-
Ki	04/06/1986	- 9.4	-	-	.848	-

Table 7.--*Stable-isotope and tritium content of samples collected using sequential rain samplers*

[$\delta^{18}\text{O}$, oxygen-18; δD , deuterium; ‰, per mil, relative to SMOW (standard mean ocean water); pCi/L, picocuries per liter; dashes indicate no data; CYL1, cylinder number 1]

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Tritium (pCi/L)
Gail CYL1	07/25/1984	-9.8	-63.5	38.0
Gail CYL2	07/25/1984	-9.6	-63.0	38.6
Gail CYL3	07/25/1984	-9.2	-59.0	41.0
Sandy CYL1	07/27/1984	-7.5	-49.0	48.1
Sandy CYL2	07/27/1984	-7.8	-53.0	49.2
Sandy CYL3	07/27/1984	-6.2	-41.5	50.1
Sandy CYL4	07/27/1984	-5.2	-34.0	52.5
Sandy CYL1	07/31/1984	-6.8	-45.0	60.7
Sandy CYL2	07/31/1984	-9.0	-56.5	61.6
Sandy CYL3	07/31/1984	-9.5	-65.5	61.0
Sandy CYL4	07/31/1984	-10.4	-67.0	54.4
Sandy CYL5	07/31/1984	-9.4	-68.0	77.0
Gail CYL1	08/14/1984	-5.5	-36.5	51.9
Gail CYL2	08/14/1984	-11.4	-72.5	40.3
Gail CYL3	08/14/1984	-14.5	-93.5	40.5
Gail CYL4	08/14/1984	-13.2	-90.0	41.0
Sandy CYL1	08/14/1984	-7.3	-46.5	54.9
Sandy CYL2	08/14/1984	-8.4	-51.5	53.5
Sandy CYL3	08/14/1984	-9.1	-59.0	49.4
Sandy CYL4	08/14/1984	-9.7	-60.5	45.7
Sandy CYL5	08/14/1984	-9.9	-64.5	45.6
Sandy CYL6	08/14/1984	-10.0	-68.5	47.2
Sandy CYL1	05/10/1985	-15.5	-111.3	-
Sandy CYL2	05/10/1985	-16.3	-108.0	-
Sandy CYL3	05/10/1985	-16.1	-112.7	-
Sandy CYL4	05/10/1985	-16.8	-122.4	-
Sandy CYL5	05/10/1985	-17.1	-123.1	-
Gail CYL1	06/03/1985	-12.8	-97.2	-
Sandy CYL1	06/03/1985	-	-	102.0
Sandy CYL1	07/18/1985	.7	1.8	-
Gail CYL1	07/18/1985	-2.4	-18.9	-
Gail CYL2	07/18/1985	-4.1	-28.6	-
Gail CYL1	07/19/1985	-4.6	-27.4	-
Gail CYL2	07/19/1985	-6.6	-41.1	-
Gail CYL3	07/19/1985	-8.7	-49.1	-

Table 7.--*Stable-isotope and tritium content of samples collected using sequential rain samplers*--Continued

Station name	Begin date	$\delta^{18}\text{O}$ (‰)	δD (‰)	Tritium (pCi/L)
Sandy CYL1	07/20/1985	-4.9	-36.0	-
Sandy CYL2	07/20/1985	-7.2	-53.0	-
Sandy CYL1	09/18/1985	-9.8	-74.0	-
Sandy CYL2	09/18/1985	-9.7	-64.0	-
Sandy CYL3	09/18/1985	-11.6	-79.0	-
Gail CYL1	09/18/1985	-11.6	-87.0	-
Gail CYL2	09/18/1985	-12.5	-89.0	-
Gail CYL3	09/18/1985	-14.1	-96.0	-
Gail CYL4	09/18/1985	-14.8	-99.0	-
Gail CYL5	09/18/1985	-14.7	-98.0	-
Gail CYL6	09/18/1985	-14.3	-95.0	-
Gail CYL1	09/27/1985	-13.3	-93.0	-
Sandy CYL1	09/28/1985	-5.5	-52.0	-
Gail CYL1	09/28/1985	-10.0	-74.0	-
Gail CYL2	09/28/1985	-11.3	-77.0	-