*Chemical and Isotopic Variations
of Precipitation in the Los Alamos Region,
New Mexico*

Los Alamos
NATIONAL LABORATORY

*Los Alamos National Laboratory is operated by the University of California
for the United States Department of Energy under contract W-7405-ENG-36.*

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED
PWR

Cover photo: Los Alamos National Laboratory photograph of the precipitation collector at the site near VC-2B, Sulphur Springs.

An Affirmative Action/Equal Opportunity Employer

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither The Regents of the University of California, the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by The Regents of the University of California, the United States Government, or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of The Regents of the University of California, the United States Government, or any agency thereof.

*Chemical and Isotopic Variations
of Precipitation in the Los Alamos Region,
New Mexico*

Andrew I. Adams

Fraser Goff

Dale Counce

MASTER

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

CHEMICAL AND ISOTOPIC VARIATIONS OF PRECIPITATION IN THE LOS ALAMOS REGION, NEW MEXICO

by

Andrew I. Adams, Fraser Goff, and Dale Counce

ABSTRACT

Precipitation collectors were installed at 14 locations on the Pajarito Plateau and surrounding areas to study variations in chemistry, stable isotopes and tritium for the years 1990 to 1993. The volume of precipitation was measured and samples were collected and analyzed every three to four months. All precipitation samples contain <2.50 mg/kg Cl and have pH values ranging from 5.4 to 6.7. The stable isotope ($\delta D/\delta^{18}O$) results record seasonal variations in precipitation as the weather patterns shift from sources in the Pacific Ocean to sources in the Gulf of Mexico. The stable isotope results also show isotopic variations due to elevation differences among the collection points. The tritium contents (3H) in rain samples vary from 6.54 T.U. to 141 T.U. Contouring of high tritium values (e.g. >20 T.U.) from each collection period clearly shows that Laboratory activities release some tritium to the atmosphere. The effect of these releases are well below the limits set by the Environmental Protection Agency for drinking water (about 6200 T.U.). The magnitude of the releases is apparently greatest during the summer months. However, anomalous tritium values are detected as far north as Española, New Mexico for many collection periods. Tritium releases by the Laboratory are not constant; thus, the actual amount of tritium in each release has been diluted in the composite samples of our three to four month collection periods.

INTRODUCTION

In February of 1990 the Geology and Geochemistry group of the Earth and Environmental Sciences Division began a regional study of the background levels of tritium, stable isotopes, and chemistry in precipitation for the Los Alamos region of New Mexico. This investigation is part of the framework studies supporting the Environmental Restoration Program at Los Alamos National Laboratory. The data presented herein include major element, trace element, and isotopic analyses for 155 samples collected from 14 precipitation stations during 1990 to 1993. The major element analyses include 13 elements and the trace element analyses include 28 elements. The isotopic analyses consist of oxygen-18, deuterium, and tritium (the radioactive isotope of hydrogen; half-life = 12.4 years). This study was not intended to measure the amount of precipitation but we have calculated the approximate amount of precipitation falling at each station by dividing the volume of the water collected by the area of the mouth of the collector (Table 1).

Los Alamos is located on the Pajarito Plateau in north central New Mexico (Fig. 1). The sampling area extends from Española in the north to Santa Fe in the south and stretches from the western side of Valles caldera in the Jemez Mountains across the Española Basin to the Santa Fe ski basin in the Sangre de Cristo Range.

FIELD WORK AND ANALYTICAL METHODS

Precipitation was obtained from 14 sites (Table 1) using collectors modified from the design of White et al. (1990). The collectors are made from large metal trash cans containing collection bags. Large, doubled, plastic trash bags were installed in each collector, and the bags were necked down to less than 10 mm and taped to prevent evaporation of precipitation after entering the bags. The doubled bags were taped to the rim of the trash can to hold them in place (Figs. 2 and 3). Samples were obtained from the collectors at each site every three to four months. During each collection the precipitated water was emptied from the collector, the volume of water was measured, samples were collected, and the bags replaced. The chemistry samples were analyzed according to procedures described in Trujillo et al. (1987). The stable isotope samples were collected unfiltered in 30 ml glass bottles with polyseal caps and filled brimful leaving no head space. These

TABLE 1. Field Data for Precipitation Collectors in the Los Alamos Region, New Mexico(a)

Sample No.	Description	Date In	Date Out	Volume (b) (liters)	Rainfall (mm)	Rainfall (inches)
WC-1	Santa Fe Airport	2/90	05/23/90	6.5	54.39	2.14
WC-9	Santa Fe Airport	05/23/90	08/09/90	7.5	62.76	2.47
WC-28	Santa Fe Airport	08/09/90	11/28/90	10	83.68	3.29
WC-46	Santa Fe Airport	11/28/90	04/25/91	5.75	48.12	1.89
WC-51	Santa Fe Airport	04/25/91	07/29/91	24	200.83	7.91
WC-67	Santa Fe Airport	07/29/91	12/04/91	20	167.36	6.59
WC-80	Santa Fe Airport	12/04/91	04/20/92	9.5	79.50	3.13
WC-97	Santa Fe Airport	04/20/92	08/14/92	15.5	129.71	5.11
WC-113	Santa Fe Airport	08/14/92	12/04/92	8.9	74.48	2.93
WC-146	Santa Fe Airport	08/04/93	11/18/93	12	100.42	3.95
WC-2	Tech Area 33	2/90	05/23/90	11.75	98.32	3.87
WC-8	Tech Area 33	05/23/90	08/09/90	14	117.15	4.61
WC-25	Tech Area 33	08/09/90	11/27/90	15	125.52	4.94
WC-37	Tech Area 33	11/27/90	04/23/91	15	125.52	4.94
WC-54	Tech Area 33	04/23/91	08/01/91	20	167.32	6.59
WC-70	Tech Area 33	08/01/91	12/09/91	28.5	238.49	9.39
WC-83	Tech Area 33	12/09/91	04/20/92	12.3	102.93	4.05
WC-102	Tech Area 33	04/20/92	08/20/92	21	175.73	6.92
WC-110	Tech Area 33	08/20/92	12/03/92	9.1	76.15	3.00
WC-125	Tech Area 33	12/03/92	04/28/93	18	150.62	5.93
WC-138	Tech Area 33	04/28/93	08/09/93	13.5	112.97	4.45
WC-149	Tech Area 33	08/09/93	12/03/93	18	150.62	5.93
WC-3	Philomena's	2/90	05/23/90	7	58.58	2.31
WC-19	Philomena's	05/23/90	09/07/90	25	209.02	8.24
WC-33	Philomena's	09/07/90	12/04/90	15	125.52	4.94
WC-42	Philomena's	12/04/90	04/24/91	11.1	92.88	3.66
WC-57	Philomena's	04/24/91	08/05/91	25	209.20	8.24
WC-77	Philomena's	08/05/91	12/19/91	26.5	221.75	8.73
WC-79	Philomena's	12/19/91	03/31/92	13.5(c)	112.97	4.45
WC-99	Philomena's	03/31/92	08/14/92	20	167.63	6.59
WC-107	Philomena's	08/14/92	12/03/92	9.8	82.01	3.23
WC-127	Philomena's	12/03/92	04/29/93	16	133.89	5.27
WC-140	Philomena's	04/29/93	08/13/93	10.5	87.86	3.46
WC-152	Philomena's	08/13/93	11/29/93	13.75	115.06	4.53
WC-4	Pajarito Mountain	2/90	05/23/90	15	125.52	4.94
WC-20	Pajarito Mountain	05/23/90	09/07/90	26.1	218.41	8.60
WC-34	Pajarito Mountain	09/07/90	12/07/90	15	125.52	4.94
WC-45	Pajarito Mountain	12/07/90	04/25/91	8	66.95	2.64
WC-61	Pajarito Mountain	04/25/91	08/06/91	35	292.89	11.53
WC-69	Pajarito Mountain	08/06/91	12/08/91	33	276.15	10.87
WC-90	Pajarito Mountain	12/08/91	05/07/92	25.5	213.39	8.40
WC-93	Pajarito Mountain	05/07/92	08/10/92	28.5	238.48	9.39
WC-116	Pajarito Mountain	08/10/92	12/16/92	17.4	145.61	5.73
WC-130	Pajarito Mountain	12/16/92	05/04/93	23	192.47	7.58
WC-136	Pajarito Mountain	05/04/93	08/09/93	13	108.79	4.28
WC-155	Pajarito Mountain	08/09/93	02/02/94	22.5	188.28	7.41
WC-5	"S" Site	2/90	05/30/90	15.1	126.36	4.97
WC-15	"S" Site	05/30/90	09/05/90	2	16.76	0.66
WC-31	"S" Site	09/05/90	12/04/90	22	184.14	7.25
WC-41	"S" Site	12/04/90	04/24/91	14.1	117.99	4.65
WC-56	"S" Site	04/24/91	08/05/91	29.5	246.86	9.72
WC-78	"S" Site	08/05/91	12/19/91	33	276.15	10.87
WC-87	"S" Site	12/19/91	04/29/92	11.5	96.23	3.79

Sample No.	Description	Date In	Date Out	Volume (b) (liters)	Rainfall (mm)	Rainfall (inches)
WC-103	"S" Site	04/29/92	08/20/92	25.5	213.39	8.40
WC-115	"S" Site	08/20/92	12/16/92	9.1	76.15	3.00
WC-129	"S" Site	12/16/92	04/30/93	24	200.83	7.91
WC-134	"S" Site	04/30/93	08/05/93	15.5	129.71	5.11
WC-153	"S" Site	08/05/93	11/30/93	28	238.48	9.39
WC-6	White Rock "Y"	2/90	05/30/90	7	58.58	2.31
WC-10	White Rock "Y"	05/30/90	08/09/90	19.5	163.18	6.42
WC-32	White Rock "Y"	08/09/90	12/04/90	12	100.42	3.95
WC-43	White Rock "Y"	12/04/90	04/24/91	11.3	94.56	3.72
WC-55	White Rock "Y"	04/24/91	08/01/91	26.25	219.66	8.65
WC-72	White Rock "Y"	08/01/91	12/10/91	21	175.73	6.92
WC-84	White Rock "Y"	12/10/91	04/28/92	14.5	121.34	4.78
WC-98	White Rock "Y"	04/28/92	08/14/92	15.5	129.70	5.11
WC-108	White Rock "Y"	08/14/92	12/03/92	5.8	48.53	1.91
WC-126	White Rock "Y"	12/03/92	04/29/93	18.5	154.81	6.09
WC-137	White Rock "Y"	04/29/93	08/09/93	19	158.99	6.26
WC-148	White Rock "Y"	08/09/93	11/29/93	10.5	87.86	3.46
WC-7	Espanola Ranger Station	2/90	05/30/90	5.1	42.68	1.68
WC-14	Espanola Ranger Station	05/30/90	09/05/90	1.75	14.64	0.58
WC-30	Espanola Ranger Station	09/05/90	11/28/90	12	100.42	3.95
WC-44	Espanola Ranger Station	11/28/90	04/24/91	6.5	54.34	2.14
WC-58	Espanola Ranger Station	04/24/91	08/05/91	15.5	129.71	5.11
WC-71	Espanola Ranger Station	08/05/91	12/10/91	21	175.73	6.92
WC-86	Espanola Ranger Station	12/10/91	04/29/92	10.5	87.87	3.46
WC-101	Espanola Ranger Station	04/29/92	08/20/92	17	142.46	5.60
WC-114	Espanola Ranger Station	08/20/92	12/16/92	8.2	68.62	2.70
WC-128	Espanola Ranger Station	12/16/92	04/30/93	11	92.05	3.62
WC-133	Espanola Ranger Station	04/30/93	08/05/93	7	58.58	2.31
WC-147	Espanola Ranger Station	08/05/93	11/29/93	9	75.31	2.96
WC-11	Boundary Peak Area	07/26/90	09/04/90	7	58.58	2.31
WC-23	Boundary Peak Area	09/04/90	11/26/90	20.5	171.55	6.75
WC-36	Boundary Peak Area	11/26/90	04/23/91	4.7	39.33	1.55
WC-49	Boundary Peak Area	04/23/91	07/29/91	19.3	161.51	6.36
WC-94	Boundary Peak Area	05/07/92	08/10/92	22.25	186.19	7.33
WC-124	Boundary Peak Area	08/10/92	04/28/93	20	167.36	6.59
WC-131	Boundary Peak Area	04/28/93	08/03/93	4	33.47	1.32
WC-143	Boundary Peak Area	08/03/93	11/16/93	11.75	98.33	3.87
WC-12	West of Guaje Mtn.	07/26/90	09/04/90	11	92.05	3.62
WC-24	West of Guaje Mtn.	09/04/90	11/27/90	22	184.40	7.25
WC-39	West of Guaje Mtn.	11/27/90	04/23/91	13.5	112.97	4.45
WC-50	West of Guaje Mtn.	04/23/91	07/29/91	24	200.83	7.91
WC-76	West of Guaje Mtn.	07/29/91	12/18/91	25	209.21	8.24
WC-85	West of Guaje Mtn.	12/18/91	04/29/92	16.5	138.08	5.44
WC-92	West of Guaje Mtn.	04/29/92	08/10/92	6	50.21	1.98
WC-106	West of Guaje Mtn.	08/10/92	12/02/92	12.6	105.44	4.15
WC-119	West of Guaje Mtn.	12/02/92	04/23/93	14	117.15	4.61
WC-135	West of Guaje Mtn.	04/23/93	08/06/93	17.25	144.35	5.68
WC-144	West of Guaje Mtn.	08/06/93	11/17/93	23.3	194.98	7.68
WC-13	Santa Fe Ski Basin	05/23/94	09/05/90	15.5	129.70	5.11
WC-29	Santa Fe Ski Basin	09/05/90	11/28/90	20	167.36	6.59
WC-47	Santa Fe Ski Basin	11/28/90	04/25/91	30	251.04	9.88
WC-52	Santa Fe Ski Basin	04/25/91	07/29/91	33	276.14	10.87
WC-66	Santa Fe Ski Basin	07/29/91	12/04/91	33.5	280.33	11.04

Sample No.	Description	Date In	Date Out	Volume (b) (liters)	Rainfall (mm)	Rainfall (inches)
WC-81	Santa Fe Ski Basin	12/04/91	04/20/92	39.5	330.54	13.01
WC-96	Santa Fe Ski Basin	04/20/92	08/14/92	31	259.41	10.21
WC-112	Santa Fe Ski Basin	08/14/92	12/04/92	20.3	169.87	6.69
WC-123	Santa Fe Ski Basin	12/04/92	04/28/93	21	175.73	6.92
WC-132	Santa Fe Ski Basin	04/28/93	08/04/93	14.5	121.34	4.78
WC-145	Santa Fe Ski Basin	08/04/93	11/18/93	20	167.36	6.59
WC-16	VC-2B, Sulphur Springs	05/24/90	09/06/90	8	66.94	2.64
WC-21	VC-2B, Sulphur Springs	09/06/90	10/24/90	11	92.05	3.62
WC-22	VC-2B, Sulphur Springs	10/24/90	11/26/90	7	58.58	2.31
WC-35	VC-2B, Sulphur Springs	11/26/90	04/23/91	24	200.83	7.91
WC-48	VC-2B, Sulphur Springs	04/23/91	07/29/91	18.5	154.81	6.09
WC-68	VC-2B, Sulphur Springs	07/29/91	12/05/91	28.5	238.49	9.39
WC-89	VC-2B, Sulphur Springs	12/05/91	05/01/92	27.5	230.12	9.06
WC-105	VC-2B, Sulphur Springs	05/01/92	12/02/92	12.6	105.44	4.15
WC-118	VC-2B, Sulphur Springs	12/02/92	04/21/93	17.5	146.44	5.77
WC-130a	VC-2B, Sulphur Springs	04/21/93	08/03/93	9	75.31	2.97
WC-142	VC-2B, Sulphur Springs	08/03/93	11/16/93	21.5	179.91	7.08
WC-17	Tech Area 49	05/24/90	09/06/90	3.5	29.29	1.15
WC-26	Tech Area 49	09/06/90	11/27/90	15	125.52	4.94
WC-38	Tech Area 49	11/27/90	04/23/91	8.75	73.22	2.88
WC-53	Tech Area 49	04/23/91	08/01/91	26	217.57	8.57
WC-73	Tech Area 49	08/01/91	12/16/91	37.5	313.80	12.35
WC-82	Tech Area 49	12/16/91	04/28/92	9.25	77.40	3.05
WC-95	Tech Area 49	04/28/92	08/10/92	20	167.36	6.59
WC-111	Tech Area 49	08/10/92	12/03/92	12.5	104.60	4.12
WC-121	Tech Area 49	12/03/92	04/23/93	13.75	115.06	4.53
WC-150	Tech Area 49	08/09/93	11/29/93	17.5	146.44	5.77
WC-18	Tech Area 51	05/24/90	09/06/90	11.5	96.23	3.79
WC-27	Tech Area 51	09/06/90	11/27/90	16	133.89	5.27
WC-40	Tech Area 51	11/27/90	04/24/91	11.6	97.07	3.82
WC-59	Tech Area 51	04/24/91	08/05/91	34	284.51	11.20
WC-75	Tech Area 51	08/05/91	12/17/91	26.5	221.75	8.73
WC-88	Tech Area 51	12/17/91	04/29/92	11.75	98.32	3.87
WC-100	Tech Area 51	04/29/92	08/14/92	18	150.62	5.93
WC-109	Tech Area 51	08/14/92	12/03/92	12.5	104.60	4.12
WC-122	Tech Area 51	12/03/92	04/23/93	17	142.26	5.60
WC-139	Tech Area 51	04/23/93	08/13/93	19	158.99	6.26
WC-151	Tech Area 51	08/13/93	11/29/93	19.5	163.18	6.42
WC-60	Kim Manley's House	04/24/91	08/05/91	24	200.83	7.91
WC-74	Kim Manley's House	08/05/91	12/15/91	36.75	307.52	12.11
WC-91	Kim Manley's House	12/15/91	05/27/92	13(c)	108.78	4.28
WC-104	Kim Manley's House	05/27/92	08/20/92	23	192.46	7.58
WC-117	Kim Manley's House	08/20/92	12/18/92	16.8	140.58	5.53
WC-120	Kim Manley's House	12/18/92	04/23/93	13	108.78	4.28
WC-141	Kim Manley's House	04/23/93	08/13/93	13	108.78	4.28
WC-154	Kim Manley's House	08/13/93	11/30/93	19	158.99	6.26

(a) Rainfall is calculated from volume divided by surface area

(b) Volume measurements are of varying accuracy but usually ± 0.1 liter

(c) Indicates estimated volume

Figure 1: Location map of Los Alamos region, New Mexico showing sites of 14 precipitation collectors; Sites: GM = Guaje Mountain, KM = Kim Manley's, PM = Pajarito Mountain, BP = Boundary Peak, WRY = White Rock "Y", SS = Sulphur Springs, SFAP = Santa Fe airport, SFSB = Santa Fe Ski Basin (see Table 1).

Figure 2: Photograph of the precipitation collector at the site near VC-2B, Sulphur Springs.

Figure 3: Cutaway diagram of a precipitation collector made from a large trash can, doubled plastic garbage bags, and tape. The bags are necked down with tape wrapped around a pencil to give an entrance diameter of about 1 cm. When the pencil is removed, the plastic expands. Precipitation water (melted snow or rain) can enter but water vapor formed by evaporation primarily condenses inside the bag.

samples were analyzed by the Stable Isotope Laboratory at Southern Methodist University. Tritium samples were collected in 500 ml plastic bottles with polyseal caps allowing no head space and sent to the Tritium Laboratory at the University of Miami for low level tritium analyses.

Because of difficult weather conditions in winter, some stations were collected only twice a year. Large animals (elk or deer?) created problems at the Boundary Peak site during the dry seasons (late spring and fall) by pushing the collector over and tearing the bags apart to get water. Another problem encountered was occasionally finding trash in the collectors at Santa Fe ski basin and at Pajarito Mountain ski hill. The chemistry of the contaminated samples shows elevated levels of chloride, sodium, and aluminum (Tables 2 and 3; sample WC-45). Contaminated samples were never analyzed for tritium and stable isotopes.

RESULTS AND DISCUSSION

Chemistry: We found that the major element chemistry of regional precipitation is typical for most precipitation in the United States (Junge and Werby, 1958; Drever, 1982). Tables 2 and 3 list major and trace element chemistry for all samples collected. Chloride concentrations have been corrected (using blanks) for small amounts of chloride adsorbed on the bags during their manufacture. As can be seen in the tables, regional precipitation contains trace amounts of many constituents and varies from season to season and station to station. When compared to cold groundwaters of the region (Trainer, 1974; Goff and Sayer, 1980; Shevenell et al., 1987; Blake et al., in press), regional precipitation is very dilute. As the moisture in clouds moves away from coastal regions of the continent, the concentrations of sodium and chloride decrease (Junge and Werby, 1958). However, the concentrations we have found are higher than expected for this area. By looking at a plot of sodium versus chloride (Fig. 4), we see a fairly linear trend formed by the data points. The molar ratio of sodium to chloride indicates that these species are contributed from salt in dust, sea salt, or perhaps from salt used on paved roads in the winter months. In contrast, a plot of calcium versus chloride (Fig. 4) shows considerable scatter. In the arid southwest calcium is contributed primarily from dust particles dissolved by precipitation (Junge and Werby, 1958). Sulfate and nitrate are usually indicators of anthropogenic contributions to precipitation (Drever, 1982). As can be seen in Tables 2 and 3, the sulfate and nitrate levels in regional precipitation are low (usually <5 mg/kg sulfate and <3 mg/kg nitrate) and indicate little environmental impact (Drever, 1982).

Stable Isotopes: The stable isotopes of hydrogen and oxygen (expressed as δD and $\delta^{18}O$ in units of per mil) for regional precipitation are listed in Table 4. Most isotope samples plot on or near the world meteoric water line (WMWL; Craig, 1961; Fig. 5) but isotope values vary from season to season and with elevation (Figs. 6 and 7). A few of the sample points plot some distance from the WMWL due probably to storms of unusual isotopic composition or, in some cases, due to evaporation of very small amounts of precipitation in the collectors during dry seasons. The oxygen-18 values of precipitation at a given station are generally heavier (less depleted) in the summer months and lighter (more depleted) in the winter months. The deuterium values show the same basic trend but are not as pronounced as the oxygen values. The seasonal variations are a result of storm tracks shifting from origins in the Pacific Ocean (winter) to origins in the Gulf of Mexico (summer). Elevation also affects the stable isotope values of precipitation among stations; lighter values at higher elevations and heavier values at lower elevations (Hoefs, 1973).

Tritium: The amount of tritium found in precipitation of the Los Alamos region (Table 4) varies from present background levels of about 10 T.U. (Goff et al., 1985; Shevenell et al., 1987; Shevenell and Goff, in press) to almost two orders of magnitude above expected background levels (Adams and Goff, 1991). By drawing a 20 T.U. (Tritium Units; 1 T.U. = about 3.2 pCi/kg H₂O) contour through the data plotted on maps for different collection periods (Figs. 8-23), the areas where anomalous tritium occurs can be examined. The 20 T.U. contour is always centered over Los Alamos National Laboratory. Stations located inside the Laboratory and near Los Alamos town site show elevated tritium levels in precipitation for almost every collection period. Greater than background levels of tritium occur in precipitation as far north as Española during 1990 and 1991. When correlated with wind directions of the region, we observe that the shape of the 20 T.U. contour is elongated to the northeast in the direction of the prevailing winds (Adams and Goff, 1994). Three stations always show normal background levels of tritium in precipitation (Santa Fe ski basin, Santa Fe airport, and

TABLE 2. Major Element Chemistry for Precipitation in the Los Alamos Region, New Mexico (a)

Sample #	Description	Date	B mg/kg	Br mg/kg	Ca mg/kg	Cl (b) mg/kg	F mg/kg	HCO3 mg/kg	K mg/kg	Li mg/kg	Mg mg/kg	Na mg/kg	SiO2 mg/kg	SO4 mg/kg	Sr mg/kg	TDS mg/kg	Cation Sum	Anion Sum	Balance
	Drinking Water Criteria	---	1	---	---	---	2	240-305	---	---	---	---	---	250	---	500	---	---	---
WC-1	Santa Fe Airport	05/23/90	<0.05	<0.05	---	0.00	<0.02	---	0.30	---	---	1.40	---	1.14	---	---	---	---	---
WC-9	Santa Fe Airport	08/09/90	<0.05	<0.05	---	1.16	<0.02	19.5	0.90	---	---	1.30	---	2.37	---	---	---	---	---
WC-28	Santa Fe Airport	11/28/90	<0.02	<0.02	2.80	1.41	<0.02	13.4	1.16	<0.01	0.28	1.50	<0.20	2.90	0.01	28.4	0.388	0.383	0.0116
WC-46	Santa Fe Airport	04/25/91	<0.02	<0.01	1.60	0.01	<0.02	28.1	1.70	<0.01	0.31	0.53	<0.20	1.99	<0.01	41.8	0.349	0.624	-0.5653
WC-51	Santa Fe Airport	07/29/91	<0.05	<0.01	1.40	0.04	<0.01	8.5	0.40	<0.01	0.11	0.40	<0.20	1.59	<0.01	14.2	0.122	0.204	-0.5022
WC-67	Santa Fe Airport	12/04/91	<0.05	<0.01	1.70	5.15	0.18	28.1	3.90	0.02	0.35	13.40	<0.20	5.61	0.03	61.3	0.813	0.789	0.0300
WC-80	Santa Fe Airport	04/20/92	<0.05	<0.02	2.30	1.53	<0.02	36.4	2.80	<0.01	0.33	1.75	<0.20	3.46	0.01	58.2	0.715	0.749	-0.0460
WC-97	Santa Fe Airport	08/14/92	<0.05	<0.02	2.30	0.00	<0.02	1.5	0.90	<0.01	0.18	0.50	0.20	1.89	0.02	16.6	0.239	0.212	0.1224
WC-113	Santa Fe Airport	12/04/92	<0.01	<0.02	1.88	0.71	<0.02	39.4	2.90	<0.01	0.20	1.05	0.32	3.17	<0.01	77.6	1.479	0.921	0.4644
WC-146	Santa Fe Airport	11/18/93	<0.02	0.03	2.00	0.49	<0.01	3.9	5.00	<0.01	0.37	0.35	0.17	1.83	0.02	24.2	0.454	0.262	0.5364
WC-2	Tech Area 33	05/23/90	<0.05	<0.05	---	0.26	<0.02	---	0.70	---	---	2.60	---	1.48	---	---	---	---	---
WC-8	Tech Area 33	08/09/90	0.19	<0.05	---	3.30	<0.02	18.3	1.00	---	---	2.40	---	1.26	---	---	---	---	---
WC-25	Tech Area 33	11/27/90	<0.02	<0.02	0.50	0.07	<0.02	13.4	0.40	<0.01	0.11	0.42	<0.20	0.99	<0.01	17.6	0.084	0.269	-1.0449
WC-37	Tech Area 33	04/23/91	<0.02	<0.01	0.50	0.18	<0.02	20.7	0.40	<0.01	0.10	0.69	<0.20	0.82	<0.01	25.1	0.085	0.390	-1.2856
WC-54	Tech Area 33	08/01/91	<0.05	<0.01	1.10	-0.10	<0.01	7.3	0.10	<0.01	0.11	0.30	<0.20	1.78	<0.01	12.2	0.099	0.180	-0.5764
WC-70	Tech Area 33	12/09/91	<0.05	<0.01	1.00	0.21	<0.01	2.6	0.50	<0.01	0.03	0.60	<0.20	0.69	<0.01	6.9	0.098	0.087	0.1248
WC-83	Tech Area 33	04/20/92	<0.05	<0.02	0.70	-0.30	<0.02	<0.5	0.70	<0.01	0.06	0.34	<0.20	0.98	<0.01	4.0	0.084	0.040	0.7123
WC-102	Tech Area 33	08/20/92	<0.05	<0.02	1.10	-0.10	<0.02	1.7	0.40	<0.01	0.08	0.52	<0.20	1.18	0.03	7.2	0.121	0.085	0.3526
WC-110	Tech Area 33	12/03/92	<0.01	<0.02	0.80	-0.30	<0.02	3.5	0.70	<0.01	0.09	0.18	0.17	1.13	<0.01	9.3	0.156	0.108	0.3658
WC-125	Tech Area 33	04/28/93	<0.01	<0.02	0.32	0.05	<0.02	<0.8	0.20	0.01	0.02	0.50	0.09	0.93	<0.01	3.6	0.062	0.045	0.3134
WC-138	Tech Area 33	08/09/93	<0.01	<0.01	1.69	0.09	<0.01	1.1	0.60	<0.01	0.15	0.53	<0.02	1.94	<0.01	9.3	0.178	0.106	0.5025
WC-149	Tech Area 33	12/03/93	<0.02	<0.01	0.60	0.00	<0.01	<1.0	0.50	<0.01	0.05	0.08	0.15	0.79	<0.01	2.5	0.064	0.020	1.0464
WC-3	Philomena's	05/23/90	<0.05	<0.05	---	0.69	<0.02	---	0.60	---	---	2.30	---	2.08	---	---	---	---	---
WC-19	Philomena's	09/07/90	<0.02	<0.05	---	0.00	<0.02	19.5	0.20	---	---	0.20	---	1.06	---	---	---	---	---
WC-33	Philomena's	12/04/90	<0.02	<0.02	0.70	0.00	<0.02	14.6	0.40	<0.01	0.16	0.38	<0.20	0.95	<0.01	19.0	0.106	0.284	-0.9091
WC-42	Philomena's	04/24/91	<0.02	<0.01	0.40	0.61	<0.02	18.3	0.10	<0.01	0.03	1.06	<0.20	0.77	<0.01	22.9	0.080	0.362	-1.2761
WC-57	Philomena's	08/05/91	<0.05	<0.01	4.50	0.27	<0.01	8.5	0.60	<0.01	0.15	0.50	<0.20	1.19	<0.01	17.1	0.288	0.196	0.3838
WC-77	Philomena's	12/19/91	<0.05	<0.01	0.50	0.00	<0.01	<0.5	0.60	<0.01	<0.01	0.60	<0.20	0.89	<0.01	4.0	0.077	0.044	0.5433
WC-79	Philomena's	03/31/92	<0.05	<0.02	2.30	3.19	0.05	18.0	0.90	<0.01	0.10	3.02	<0.20	7.37	0.01	37.5	0.308	0.580	-0.6130
WC-99	Philomena's	08/14/92	<0.05	<0.02	1.50	0.00	<0.02	1.5	0.60	<0.01	0.09	0.37	<0.20	1.50	<0.01	8.1	0.159	0.087	0.5848
WC-107	Philomena's	12/03/92	0.01	<0.02	0.94	0.00	<0.02	<0.5	0.10	<0.01	0.03	0.11	0.17	1.00	<0.01	3.7	0.074	0.040	0.5858
WC-127	Philomena's	04/29/93	<0.01	<0.02	0.89	0.35	<0.02	<0.8	0.20	<0.01	0.02	0.89	<0.02	1.02	<0.01	5.1	0.107	0.059	0.5817
WC-140	Philomena's	08/13/93	<0.01	<0.01	1.84	0.14	<0.01	3.4	0.60	<0.01	0.17	0.52	<0.02	1.84	<0.01	13.3	0.238	0.157	0.4072
WC-152	Philomena's	11/29/93	<0.02	<0.01	0.65	0.00	<0.01	<1.0	0.20	<0.01	0.04	0.18	0.15	0.87	<0.01	2.4	0.055	0.025	0.7544
WC-4	Pajarito Mountain	05/23/90	<0.05	<0.05	---	0.00	<0.02	---	0.80	---	---	2.00	---	0.93	---	---	---	---	---
WC-20	Pajarito Mountain	09/07/90	<0.02	<0.05	---	0.15	<0.02	20.7	1.10	---	---	0.40	---	1.17	---	---	---	---	---
WC-34	Pajarito Mountain	12/07/90	0.02	<0.02	2.70	1.97	<0.02	24.4	11.12	<0.01	0.67	0.94	<0.20	5.21	<0.01	49.4	0.541	0.634	-0.1577
WC-45	Pajarito Mountain	04/25/91	<0.02	0.02	2.70	31.70	0.05	26.8	10.00	<0.01	0.91	21.60	0.20	2.73	<0.01	98.3	1.466	1.408	0.0408
WC-61	Pajarito Mountain	08/08/91	<0.05	<0.01	0.80	0.12	<0.01	12.2	0.60	<0.01	0.11	0.20	<0.20	1.35	<0.01	17.7	0.155	0.269	-0.5394
WC-69	Pajarito Mountain	12/08/91	<0.05	<0.01	0.60	0.22	<0.01	3.6	0.40	<0.01	<0.01	0.60	<0.20	0.54	<0.01	7.6	0.111	0.095	0.1560
WC-90	Pajarito Mountain	05/07/92	<0.05	<0.02	0.30	0.00	<0.02	<0.5	0.40	<0.01	0.07	0.25	<0.20	0.85	<0.01	2.9	0.059	0.030	0.6358
WC-93	Pajarito Mountain	08/10/92	<0.05	<0.02	1.10	0.00	<0.02	2.3	0.40	<0.01	0.08	0.36	<0.20	1.17	<0.01	7.4	0.124	0.087	0.3526
WC-116	Pajarito Mountain	12/16/92	<0.01	<0.02	0.77	0.00	<0.02	<0.5	0.50	<0.01	0.07	0.25	0.15	0.87	<0.01	4.2	0.096	0.039	0.8432
WC-130	Pajarito Mountain	05/04/93	<0.01	<0.02	0.55	0.00	<0.02	<0.8	0.20	<0.01	0.04	0.32	<0.02	1.23	<0.01	3.9	0.071	0.049	0.3703
WC-136	Pajarito Mountain	08/09/93	0.01	<0.01	1.49	0.21	<0.01	4.0	0.90	<0.01	0.19	0.62	<0.02	1.71	<0.01	14.0	0.259	0.169	0.4214
WC-155	Pajarito Mountain	02/02/94	0.02	<0.01	1.90	2.59	0.03	2.6	1.10	<0.01	0.22	2.07	<0.20	2.58	0.04	15.9	0.267	0.211	0.2310

Sample #	Description	Date	B mg/kg	Br mg/kg	Ca mg/kg	Cl (b) mg/kg	F mg/kg	HCO3 mg/kg	K mg/kg	Li mg/kg	Mg mg/kg	Na mg/kg	SiO2 mg/kg	SO4 mg/kg	Sr mg/kg	TDS mg/kg	Cation Sum	Anion Sum	Balance
WC-5	"S" Site	05/30/90	<0.05	<0.05	---	0.24	<0.02	25.6	0.60	---	---	0.80	---	2.20	---	---	---	---	---
WC-15	"S" Site	09/05/90	<0.02	<0.05	---	2.06	0.04	19.5	4.50	---	---	1.60	---	12.0	---	---	---	---	---
WC-31	"S" Site	12/04/90	<0.02	<0.02	0.80	0.00	<0.02	13.4	0.30	<0.01	0.18	0.30	<0.20	1.64	<0.01	19.9	0.159	0.293	-0.5920
WC-41	"S" Site	04/24/91	<0.02	<0.01	0.40	0.00	<0.02	19.5	0.10	<0.01	0.05	0.46	<0.20	0.65	<0.01	22.7	0.056	0.359	-1.4574
WC-56	"S" Site	08/05/91	<0.05	<0.01	1.20	0.00	<0.01	7.3	0.30	<0.01	0.11	0.30	<0.20	1.18	<0.01	11.6	0.103	0.165	-0.4569
WC-78	"S" Site	12/19/91	<0.05	<0.01	0.40	0.00	<0.01	<0.5	0.30	<0.01	<0.01	1.40	<0.20	0.75	<0.01	4.3	0.105	0.039	0.9134
WC-87	"S" Site	04/29/92	<0.05	<0.02	0.90	0.53	<0.02	1.0	0.70	<0.01	0.04	1.09	<0.20	1.29	<0.01	7.6	0.136	0.090	0.4039
WC-103	"S" Site	08/20/92	<0.05	<0.02	1.20	0.00	<0.02	1.2	0.50	<0.01	0.06	0.48	<0.20	1.17	0.03	6.3	0.114	0.070	0.4776
WC-115	"S" Site	12/16/92	<0.01	<0.02	0.29	0.00	<0.02	<0.5	0.10	<0.01	<0.01	0.14	0.11	0.20	<0.01	1.4	0.037	0.011	1.0755
WC-129	"S" Site	04/30/93	<0.01	<0.02	0.45	0.00	<0.02	<0.8	0.10	0.01	0.01	0.36	<0.02	0.78	<0.01	3.2	0.061	0.039	0.4455
WC-134	"S" Site	08/05/93	0.01	<0.01	1.20	0.16	<0.01	<0.8	0.30	<0.01	0.09	0.53	<0.02	1.42	<0.01	6.2	0.130	0.073	0.5642
WC-153	"S" Site	11/30/93	<0.02	<0.01	1.76	0.42	<0.01	4.2	0.40	<0.01	0.06	0.68	0.11	1.03	0.01	10.5	0.159	0.130	0.1985
WC-6	White Rock "Y"	05/30/90	<0.05	<0.05	---	1.55	<0.02	19.5	0.30	---	---	2.00	---	1.91	---	---	---	---	---
WC-10	White Rock "Y"	08/09/90	<0.05	<0.05	---	2.02	<0.02	18.3	0.60	---	---	1.60	---	1.01	---	---	---	---	---
WC-32	White Rock "Y"	12/04/90	0.03	<0.02	2.50	2.02	<0.02	14.6	1.84	<0.01	0.54	1.82	<0.20	6.05	<0.01	36.9	0.395	0.535	-0.3001
WC-43	White Rock "Y"	04/24/91	<0.02	<0.01	0.60	1.03	<0.02	19.5	0.10	<0.01	0.07	1.33	<0.20	0.89	<0.01	25.2	0.107	0.397	-1.1499
WC-55	White Rock "Y"	08/01/91	<0.05	<0.01	0.80	0.00	<0.01	6.1	0.10	<0.01	0.07	0.30	<0.20	1.15	<0.01	9.6	0.074	0.142	-0.6329
WC-72	White Rock "Y"	12/10/91	<0.05	<0.01	0.30	0.00	<0.01	<0.5	0.20	<0.01	<0.01	0.30	<0.20	0.48	<0.01	2.2	0.042	0.027	0.4532
WC-84	White Rock "Y"	04/28/92	<0.05	<0.02	0.80	1.02	<0.02	<0.5	0.70	<0.01	0.05	1.45	<0.20	1.23	<0.01	6.9	0.145	0.083	0.5452
WC-98	White Rock "Y"	08/14/92	<0.05	<0.02	1.80	0.63	<0.02	5.0	0.90	0.06	0.16	1.17	<0.20	2.02	0.01	14.5	0.240	0.177	0.3039
WC-108	White Rock "Y"	12/03/92	0.01	<0.02	0.98	0.02	<0.02	<0.5	0.30	0.01	0.07	0.45	0.19	1.53	<0.01	5.4	0.100	0.063	0.4487
WC-126	White Rock "Y"	04/29/93	<0.01	<0.02	0.37	0.61	<0.02	<0.8	0.20	<0.01	0.01	0.91	0.02	0.90	<0.01	4.5	0.079	0.061	0.2597
WC-137	White Rock "Y"	08/09/93	<0.01	<0.01	1.94	0.00	<0.01	<0.8	0.50	<0.01	0.17	0.40	<0.02	2.08	<0.01	8.3	0.166	0.094	0.5559
WC-148	White Rock "Y"	11/29/93	<0.02	<0.01	0.69	0.00	<0.01	<1.0	0.30	<0.01	0.05	0.21	0.09	1.01	<0.01	3.8	0.074	0.043	0.5275
WC-7	Espanola Rnger Stn.	05/30/90	<0.05	<0.05	---	0.19	<0.02	20.4	1.50	---	---	0.80	---	1.94	---	---	---	---	---
WC-14	Espanola Rnger Stn.	09/05/90	<0.02	<0.05	---	0.00	<0.02	18.3	0.60	---	---	0.90	---	1.38	---	---	---	---	---
WC-30	Espanola Rnger Stn.	11/29/90	<0.02	<0.02	1.30	0.00	<0.02	14.6	0.24	<0.01	0.17	0.33	<0.20	0.92	<0.01	19.1	0.139	0.286	-0.6905
WC-44	Espanola Rnger Stn.	04/24/91	<0.02	<0.01	3.10	0.52	0.02	23.2	0.60	<0.01	0.21	1.03	<0.20	1.75	<0.01	33.5	0.247	0.483	-0.6455
WC-58	Espanola Rnger Stn.	08/05/91	<0.05	<0.01	2.40	0.05	<0.01	11.0	0.70	<0.01	0.15	0.30	<0.20	1.65	0.02	18.0	0.190	0.249	-0.2720
WC-71	Espanola Rnger Stn.	12/10/91	<0.05	<0.01	0.90	0.00	<0.01	2.3	0.20	<0.01	<0.01	0.40	<0.20	0.81	<0.01	6.0	0.078	0.078	0.0016
WC-86	Espanola Rnger Stn.	04/29/92	<0.05	<0.02	2.00	0.63	<0.02	5.2	0.90	0.01	0.05	1.15	<0.20	1.40	0.01	13.5	0.203	0.166	0.1981
WC-101	Espanola Rnger Stn.	08/20/92	<0.05	<0.02	2.80	0.00	<0.02	5.2	0.70	<0.01	0.17	0.57	<0.20	1.58	0.07	13.8	0.238	0.157	0.4125
WC-114	Espanola Rnger Stn.	12/16/92	<0.01	<0.02	1.55	0.00	<0.02	3.3	0.40	<0.01	0.05	0.24	0.24	0.80	0.01	8.2	0.128	0.093	0.3170
WC-128	Espanola Rnger Stn.	04/30/93	<0.01	<0.02	1.75	0.27	<0.02	<0.8	0.40	<0.01	0.08	0.68	0.19	1.31	<0.01	6.9	0.152	0.073	0.7056
WC-133	Espanola Rnger Stn.	08/05/93	0.02	<0.01	3.94	0.61	<0.01	11.7	1.70	<0.01	0.29	0.83	<0.02	3.12	<0.01	38.1	0.657	0.491	0.2893
WC-147	Espanola Rnger Stn.	11/29/93	<0.02	<0.01	1.11	0.00	<0.01	<1	0.20	<0.01	0.06	0.28	0.15	0.65	<0.01	3.6	0.100	0.030	1.0818
WC-11	Boundary Peak Area	09/04/90	<0.02	<0.05	---	1.18	<0.02	22.0	0.90	---	---	1.40	---	1.03	---	---	---	---	---
WC-23	Boundary Peak Area	11/26/90	<0.02	<0.02	0.40	0.03	<0.02	14.6	0.50	<0.01	0.09	0.44	<0.20	0.95	<0.01	18.4	0.071	0.286	-1.2066
WC-36	Boundary Peak Area	04/23/91	<0.02	<0.01	0.20	0.00	<0.02	19.5	0.30	<0.01	0.03	0.33	<0.20	0.37	<0.01	21.6	0.040	0.342	-1.5831
WC-49	Boundary Peak Area	07/29/91	<0.05	<0.01	1.20	0.00	<0.01	6.1	0.80	<0.01	0.14	0.30	<0.20	1.87	<0.01	14.0	0.131	0.206	-0.4492
WC-94	Boundary Peak Area	08/10/92	<0.05	<0.02	1.30	0.00	<0.02	1.9	0.60	<0.01	0.09	0.37	<0.20	1.13	<0.01	7.1	0.129	0.077	0.5055
WC-124	Boundary Peak Area	04/28/93	0.22	<0.02	0.33	0.00	<0.02	<0.8	0.20	0.03	0.05	0.34	0.28	1.10	0.02	4.0	0.071	0.052	0.3042
WC-131	Boundary Peak Area	08/03/93	0.02	<0.01	2.74	0.79	<0.01	8.8	3.60	<0.01	0.42	1.12	<0.02	3.23	<0.01	27.3	0.442	0.342	0.2550
WC-143	Boundary Peak Area	11/16/93	<0.02	<0.01	0.53	0.00	<0.01	<1.0	0.20	<0.01	0.04	0.17	0.13	0.75	<0.01	3.2	0.059	0.035	0.5221
WC-12	West of Guaje Mtn.	09/04/90	<0.02	<0.05	---	0.00	<0.02	19.5	0.10	---	---	0.20	---	0.71	---	---	---	---	---
WC-24	West of Guaje Mtn.	11/27/90	<0.02	<0.02	0.40	0.00	<0.02	14.6	0.42	<0.01	0.11	0.28	<0.20	0.86	<0.01	17.9	0.058	0.280	-1.3094
WC-39	West of Guaje Mtn.	04/23/91	<0.02	<0.01	0.40	0.36	<0.02	19.5	0.50	<0.01	0.08	0.93	<0.20	0.74	<0.01	23.9	0.089	0.371	-1.2267
WC-50	West of Guaje Mtn.	07/29/91	<0.05	<0.01	0.90	0.00	<0.01	8.5	0.30	<0.01	0.09	0.20	<0.20	1.42	<0.01	12.6	0.081	0.188	-0.8002
WC-76	West of Guaje Mtn.	12/18/91	<0.05	<0.01	0.80	0.07	<0.01	<0.5	0.50	<0.01	0.03	1.30	<0.20	1.18	<0.01	5.6	0.123	0.057	0.7310
WC-85	West of Guaje Mtn.	04/29/92	<0.05	<0.02	0.50	0.00	<0.02	<0.5	0.70	<0.01	0.06	0.57	<0.20	1.04	<0.01	4.3	0.086	0.046	0.6022
WC-92	West of Guaje Mtn.	08/10/92	0.08	<0.02	2.60	0.44	<0.02	11.9	1.30	<0.01	0.19	0.95	<0.20	5.47	0.05	26.4	0.364	0.353	0.0324
WC-106	West of Guaje Mtn.	12/02/92	0.02	<0.02	2.18	0.00	<0.02	1.8	0.50	<0.01	0.08	0.29	0.19	1.19	0.01	7.9	0.149	0.084	0.5539
WC-119	West of Guaje Mtn.	04/23/93	<0.01	<0.02	0.45	0.00	<0.02	<0.8	0.20	0.01	0.05	0.20	0.24	1.01	0.02	3.2	0.056	0.037	0.4156
WC-135	West of Guaje Mtn.	08/06/93	0.01	<0.01	1.20	0.26	<0.01	1.5	0.70	<0.01	0.17	0.73	<0.02	1.82	<0.01	9.3	0.170	0.112	0.4131
WC-144	West of Guaje Mtn.	11/17/93	<0.02	<0.01	0.51	0.32	<0.01	<1.0	0.50	<0.01	0.06	0.60	0.17	0.63	<0.01	4.3	0.089	0.046	0.6288

Sample #	Description	Date	B mg/kg	Br mg/kg	Ca mg/kg	Cl (b) mg/kg	F mg/kg	HCO3 mg/kg	K mg/kg	Li mg/kg	Mg mg/kg	Na mg/kg	SiO2 mg/kg	SO4 mg/kg	Sr mg/kg	TDS mg/kg	Cation Sum	Anion Sum	Balance
WC-13	Santa Fe Ski Basin	09/05/90	<0.02	<0.05	---	0.00	<0.02	20.7	0.10	---	---	0.30	---	0.81	---	---	---	---	---
WC-29	Santa Fe Ski Basin	11/28/90	<0.02	<0.02	1.40	0.38	<0.02	14.6	2.03	<0.01	0.34	0.27	<0.20	1.36	<0.01	21.8	0.182	0.302	-0.4927
WC-47	Santa Fe Ski Basin	04/25/91	<0.02	<0.01	0.50	0.00	<0.02	18.3	0.10	<0.01	0.02	0.23	<0.20	0.63	<0.01	20.9	0.048	0.330	-1.4963
WC-52	Santa Fe Ski Basin	07/29/91	<0.05	<0.01	0.70	0.00	<0.01	6.1	0.30	<0.01	0.08	0.30	<0.20	1.08	<0.01	9.6	0.073	0.141	-0.6377
WC-66	Santa Fe Ski Basin	12/04/91	<0.05	<0.01	2.10	0.19	<0.01	2.7	0.30	<0.01	<0.01	0.50	<0.20	0.19	<0.01	6.8	0.139	0.073	0.6231
WC-81	Santa Fe Ski Basin	04/20/92	<0.05	<0.02	0.50	0.00	<0.02	<0.5	<0.02	<0.01	0.04	0.32	<0.20	1.16	<0.01	3.5	0.070	0.042	0.4954
WC-96	Santa Fe Ski Basin	08/14/92	<0.05	<0.02	1.00	0.00	<0.02	1.5	0.70	<0.01	0.12	0.65	<0.20	1.08	0.01	6.9	0.136	0.072	0.6122
WC-112	Santa Fe Ski Basin	12/04/92	0.02	<0.02	1.62	0.00	<0.02	4.5	0.40	<0.01	0.03	0.17	0.17	0.10	0.01	7.6	0.115	0.085	0.3009
WC-123	Santa Fe Ski Basin	04/28/93	<0.01	<0.02	0.79	0.48	<0.02	<0.8	0.50	<0.01	0.26	0.91	0.54	1.85	<0.01	7.6	0.153	0.084	0.5819
WC-132	Santa Fe Ski Basin	08/04/93	0.03	<0.01	1.05	0.00	<0.01	<0.8	0.80	<0.01	0.11	0.29	<0.02	1.39	<0.01	6.1	0.134	0.066	0.6795
WC-145	Santa Fe Ski Basin	11/18/93	<0.02	<0.01	0.67	0.51	<0.01	<1.0	0.60	0.01	0.07	0.66	0.09	0.54	<0.01	4.8	0.100	0.054	0.5877
WC-16	VC-2B, Sul. Spgs.	09/06/90	<0.02	<0.05	---	0.83	<0.02	18.3	2.00	---	---	0.60	---	1.49	---	---	---	---	---
WC-21	VC-2B, Sul. Spgs.	10/24/90	0.15	<0.05	0.60	0.59	<0.02	15.9	1.40	<0.01	0.11	0.67	<0.20	1.70	0.01	29.1	0.185	0.466	-0.8649
WC-22	VC-2B, Sul. Spgs.	11/26/90	<0.02	<0.02	0.20	1.14	<0.02	14.6	0.60	0.01	0.04	1.26	<0.20	0.86	<0.01	20.1	0.108	0.311	-0.9692
WC-35	VC-2B, Sul. Spgs.	04/23/91	<0.02	<0.01	0.30	0.00	0.03	19.5	0.09	<0.01	<0.02	0.23	<0.20	0.63	<0.01	22.0	0.040	0.352	-1.5932
WC-48	VC-2B, Sul. Spgs.	07/29/91	0.31	0.13	2.30	44.10	0.02	6.1	6.80	0.32	0.17	25.50	1.70	2.51	<0.01	108.0	1.609	1.751	-0.0849
WC-68	VC-2B, Sul. Spgs.	12/05/91	<0.05	<0.01	0.60	0.29	<0.01	6.2	0.70	<0.01	0.02	0.30	<0.20	0.63	<0.01	11.6	0.148	0.157	-0.0587
WC-89	VC-2B, Sul. Spgs.	05/01/92	<0.05	<0.02	2.00	0.00	<0.02	<0.5	0.50	<0.01	0.03	0.31	<0.20	1.06	<0.01	5.2	0.160	0.036	1.2666
WC-105	VC-2B, Sul. Spgs.	12/02/92	0.03	<0.02	0.64	0.00	<0.02	4.0	0.10	<0.01	0.08	0.07	0.30	0.11	0.02	5.7	0.054	0.074	-0.3159
WC-118	VC-2B, Sul. Spgs.	04/21/93	<0.01	<0.02	0.53	0.00	<0.02	<0.8	0.20	0.03	0.08	0.32	1.07	1.02	0.07	4.2	0.067	0.038	0.5406
WC-130a	VC-2B, Sul. Spgs.	08/03/93	0.04	<0.01	1.31	0.16	<0.01	2.6	1.40	<0.01	0.21	0.71	<0.02	2.82	<0.01	14.0	0.248	0.175	0.3434
WC-142	VC-2B, Sul. Spgs.	11/16/93	<0.02	<0.01	0.43	0.12	<0.01	<1.0	0.80	<0.01	0.05	0.46	0.15	0.80	<0.01	4.9	0.123	0.042	0.9767
WC-17	Tech Area 49	09/06/90	<0.02	<0.05	---	0.06	<0.02	22.0	1.00	---	---	0.20	---	1.72	---	---	---	---	---
WC-26	Tech Area 49	11/27/90	<0.02	<0.02	0.60	0.00	<0.02	13.4	0.63	<0.01	0.14	0.17	<0.20	1.19	<0.01	18.5	0.118	0.277	-0.8076
WC-38	Tech Area 49	04/23/91	<0.02	<0.01	0.60	0.00	<0.02	19.5	0.20	<0.01	0.06	0.26	<0.20	1.39	<0.01	24.9	0.099	0.396	-1.1989
WC-53	Tech Area 49	08/01/91	<0.05	<0.01	0.80	0.00	<0.01	11.0	0.40	<0.01	0.10	0.30	<0.20	1.64	<0.01	17.2	0.147	0.257	-0.5452
WC-73	Tech Area 49	12/16/91	<0.05	<0.01	0.90	0.55	<0.01	4.3	0.80	<0.01	0.06	0.90	<0.20	0.96	<0.01	11.0	0.160	0.143	0.1145
WC-82	Tech Area 49	04/28/92	<0.05	<0.02	0.90	0.29	<0.02	3.4	0.60	<0.01	0.07	0.86	<0.20	2.00	<0.01	11.2	0.176	0.146	0.1871
WC-95	Tech Area 49	08/10/92	<0.05	<0.02	1.50	0.11	<0.02	19.9	1.00	<0.01	0.19	0.55	<0.20	2.39	0.01	35.1	0.452	0.497	-0.0935
WC-111	Tech Area 49	12/03/92	<0.01	<0.02	1.07	0.13	<0.02	21.5	3.20	<0.01	0.16	0.52	0.24	1.78	<0.01	42.5	0.730	0.518	0.3402
WC-121	Tech Area 49	04/23/93	<0.01	<0.02	0.39	0.00	<0.02	<0.8	0.10	0.01	0.01	0.28	0.04	1.62	<0.01	4.6	0.085	0.063	0.2950
WC-150	Tech Area 49	11/29/93	<0.02	<0.01	0.69	0.06	<0.01	<1.0	1.80	<0.01	0.19	0.24	0.21	1.87	0.01	32.2	0.807	0.393	0.6902
WC-18	Tech Area 51	09/06/90	<0.02	<0.05	---	0.00	<0.02	18.3	0.20	---	---	0.20	---	0.96	---	---	---	---	---
WC-27	Tech Area 51	11/27/90	<0.02	<0.02	0.60	0.00	<0.02	14.6	0.12	<0.01	0.12	0.14	<0.20	0.85	<0.01	17.7	0.071	0.274	-1.1739
WC-40	Tech Area 51	04/24/91	<0.02	<0.01	0.40	0.00	<0.02	19.5	0.10	<0.01	0.06	0.53	<0.20	0.84	<0.01	23.7	0.093	0.369	-1.1916
WC-59	Tech Area 51	08/05/91	<0.05	<0.01	0.80	0.00	<0.01	7.3	0.50	<0.01	0.08	0.30	<0.20	1.05	<0.01	11.2	0.088	0.159	-0.5741
WC-75	Tech Area 51	12/17/91	<0.05	<0.01	0.50	0.47	<0.01	0.6	0.40	<0.01	<0.01	1.00	<0.20	0.76	<0.01	5.1	0.091	0.063	0.3621
WC-88	Tech Area 51	04/29/92	<0.05	<0.02	0.60	0.10	<0.02	<0.5	0.50	<0.01	0.04	0.67	<0.20	1.21	<0.01	5.2	0.100	0.059	0.5115
WC-100	Tech Area 51	08/14/92	<0.05	<0.02	1.30	0.00	<0.02	1.8	0.60	<0.01	0.12	0.40	<0.20	1.38	<0.01	7.7	0.138	0.066	0.4609
WC-109	Tech Area 51	12/03/92	<0.01	<0.02	1.25	0.00	<0.02	<0.5	0.30	<0.01	0.07	0.20	0.28	1.73	<0.01	5.7	0.107	0.063	0.5257
WC-139	Tech Area 51	08/13/93	<0.01	<0.01	1.54	0.00	<0.01	2.8	0.60	<0.01	0.13	0.37	<0.02	1.55	<0.01	12.4	0.210	0.149	0.3395
WC-151	Tech Area 51	11/29/93	<0.02	<0.01	0.41	0.00	<0.01	<1.0	0.20	0.16	0.05	0.18	<0.10	0.80	<0.01	3.5	0.098	0.039	0.8614
WC-60	K. Manley's House	08/05/91	<0.05	<0.01	0.50	0.00	<0.01	6.1	0.50	<0.01	0.04	0.30	<0.20	0.67	<0.01	9.1	0.061	0.133	-0.7384
WC-74	K. Manley's House	12/15/91	<0.05	<0.01	0.80	0.53	<0.01	<0.5	0.60	<0.01	<0.01	1.00	<0.20	0.79	<0.01	5.1	0.108	0.056	0.6409
WC-91	K. Manley's House	05/27/92	<0.05	<0.02	0.60	1.71	<0.02	<0.5	0.90	<0.01	0.07	1.14	<0.20	0.97	<0.01	7.3	0.129	0.098	0.2809
WC-104	K. Manley's House	08/20/92	<0.05	<0.02	1.00	0.11	<0.02	2.3	1.20	<0.01	0.16	0.62	<0.20	1.39	0.04	9.1	0.155	0.106	0.3772
WC-117	K. Manley's House	12/18/92	<0.01	<0.02	0.41	0.00	<0.02	<0.5	0.10	<0.01	<0.01	0.11	0.06	0.06	<0.01	1.1	0.037	0.006	1.4612
WC-120	K. Manley's House	04/23/93	<0.01	<0.02	0.44	0.00	<0.02	<0.8	0.10	0.02	0.03	0.26	0.04	0.85	0.01	2.9	0.056	0.035	0.4462
WC-141	K. Manley's House	08/13/93	<0.01	<0.01	1.27	0.00	<0.01	2.5	1.40	<0.01	0.21	0.36	<0.02	1.62	<0.01	10.7	0.194	0.123	0.4461
WC-154	K. Manley's House	11/30/93	<0.02	<0.01	0.50	0.00	<0.01	<1.0	0.40	<0.01	0.04	0.09	<0.10	0.73	<0.01	3.0	0.059	0.034	0.5469

(a) Analyses by D. Counce and P. E. Trujillo.

(b) Chloride values corrected for chloride leached from bags (determined from blank analyses).

Figure 4: Plots of sodium and calcium versus chloride for precipitation in the Los Alamos region.

TABLE 3. Trace Element Chemistry for Precipitation in the Los Alamos Region, New Mexico (a,b)

Sample #	Description	Date	Ag mg/kg	Al mg/kg	As mg/kg	Ba mg/kg	Cd mg/kg	Co mg/kg	Cr mg/kg	Cs mg/kg	Cu mg/kg	Fe mg/kg	Hg mg/kg	I mg/kg	Mn mg/kg
	Drinking Water Criteria	---	0.1	---	0.05	1	0.01	---	0.1	---	1	0.3	0.002	---	0.05
WC-1	Santa Fe Airport	05/23/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-9	Santa Fe Airport	08/09/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-28	Santa Fe Airport	11/28/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	0.01
WC-46	Santa Fe Airport	04/25/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-51	Santa Fe Airport	07/29/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-67	Santa Fe Airport	12/04/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	---	---	<0.01
WC-80	Santa Fe Airport	04/20/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.010	0.08	---	---	<0.01
WC-97	Santa Fe Airport	08/14/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.005	0.02	---	<0.02	<0.01
WC-113	Santa Fe Airport	12/04/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	<0.002	<0.01	---	<0.01	<0.01
WC-146	Santa Fe Airport	11/18/93	<0.0005	<0.05	0.0006	<0.01	<0.0005	<0.002	<0.002	<0.002	0.010	0.02	<0.0005	<0.01	<0.01
WC-2	Tech Area 33	05/23/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-8	Tech Area 33	08/09/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-25	Tech Area 33	11/27/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-37	Tech Area 33	04/23/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-54	Tech Area 33	08/01/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-70	Tech Area 33	12/09/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	0.01	---	---	<0.01
WC-83	Tech Area 33	04/20/92	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.003	<0.01	---	---	<0.01
WC-102	Tech Area 33	08/20/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	0.003	0.005	<0.01	---	<0.02	<0.01
WC-110	Tech Area 33	12/03/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.002	<0.01	---	<0.01	<0.01
WC-125	Tech Area 33	04/28/93	<0.001	<0.1	<0.05	<0.01	0.003	<0.002	<0.002	<0.002	0.010	<0.01	---	<0.01	<0.01
WC-138	Tech Area 33	08/09/93	<0.0005	<0.1	<0.05	<0.01	0.0009	<0.002	<0.002	<0.002	0.005	0.02	---	<0.01	<0.01
WC-149	Tech Area 33	12/03/93	<0.0005	0.06	0.006	<0.01	<0.0005	<0.002	<0.002	<0.002	0.005	0.01	<0.0005	<0.01	<0.01
WC-3	Philomena's	05/23/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-19	Philomena's	09/07/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-33	Philomena's	12/04/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-42	Philomena's	04/24/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-57	Philomena's	08/05/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	0.02	---	---	<0.01
WC-77	Philomena's	12/19/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	0.01	---	---	0.01
WC-79	Philomena's	03/31/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	0.003	<0.002	0.007	<0.01	---	---	<0.01
WC-99	Philomena's	08/14/92	<0.001	<0.1	<0.05	0.02	<0.001	<0.002	<0.002	0.004	0.005	<0.01	---	<0.02	<0.01
WC-107	Philomena's	12/03/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.004	<0.01	---	<0.01	<0.01
WC-127	Philomena's	04/29/93	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.003	<0.01	---	<0.01	<0.01
WC-140	Philomena's	08/13/93	<0.0005	<0.1	0.12	<0.01	0.0002	<0.002	<0.002	<0.002	0.009	0.05	---	<0.01	0.02
WC-152	Philomena's	11/29/93	<0.0005	<0.05	0.006	<0.01	0.0006	<0.002	<0.002	<0.002	0.008	0.01	<0.0005	<0.01	<0.01
WC-4	Pajarito Mountain	05/23/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-20	Pajarito Mountain	09/07/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-34	Pajarito Mountain	12/07/90	---	<0.1	<0.05	0.01	---	---	---	---	---	<0.01	<0.1	---	0.05
WC-45	Pajarito Mountain	04/25/91	---	0.3	<0.05	<0.01	---	---	---	---	---	0.12	<0.1	---	<0.01

Sample #	Description	Date	Mo mg/kg	NH4 mg/kg	Ni mg/kg	NO2 mg/kg	NO3 mg/kg	Pb mg/kg	PO4 mg/kg	Rb mg/kg	Sb mg/kg	Se mg/kg	Si mg/kg	S2O3 mg/kg	U mg/kg	Zn mg/kg
Drinking Water Criteria			---	---	---	---	45	0.05	---	---	---	0.01	---	---	---	5
WC-1	Santa Fe Airport	05/23/90	---	1.08	---	---	1.18	---	0.17	---	---	---	---	---	---	---
WC-9	Santa Fe Airport	08/09/90	---	0.35	---	9.1	2.99	---	0.26	---	---	---	---	---	---	---
WC-28	Santa Fe Airport	11/28/90	---	1.40	---	0.26	2.83	---	<0.05	---	<0.10	<0.10	<0.1	---	<0.1	1.70
WC-46	Santa Fe Airport	04/25/91	---	3.18	---	0.07	2.18	---	1.63	---	<0.10	<0.10	<0.1	---	<0.1	0.03
WC-51	Santa Fe Airport	07/29/91	---	0.27	---	0.20	0.82	---	<0.02	---	<0.10	---	<0.1	---	---	0.01
WC-67	Santa Fe Airport	12/04/91	---	0.22	---	0.05	1.93	---	0.29	---	---	---	<0.1	---	---	0.02
WC-80	Santa Fe Airport	04/20/92	<0.002	7.56	0.023	0.02	1.48	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.05
WC-97	Santa Fe Airport	08/14/92	<0.002	1.13	<0.002	<0.02	7.01	<0.002	0.58	<0.002	---	---	0.1	<0.02	---	0.05
WC-113	Santa Fe Airport	12/04/92	<0.002	22.50	<0.002	<0.02	1.54	0.002	3.44	<0.002	---	---	0.15	<0.01	---	0.03
WC-146	Santa Fe Airport	11/18/93	<0.002	3.09	0.002	4.16	2.05	0.005	0.24	0.004	<0.001	<0.001	0.08	<0.01	---	0.23
WC-2	Tech Area 33	05/23/90	---	0.29	---	---	1.10	---	<0.1	---	---	---	---	---	---	---
WC-8	Tech Area 33	08/09/90	---	0.47	---	<0.05	1.48	---	<0.1	---	---	---	---	---	---	---
WC-25	Tech Area 33	11/27/90	---	0.37	---	<0.01	0.87	---	<0.05	---	<0.10	<0.1	<0.1	---	<0.1	0.04
WC-37	Tech Area 33	04/23/91	---	0.18	---	<0.01	1.02	---	<0.05	---	<0.10	<0.1	<0.1	---	<0.1	0.03
WC-54	Tech Area 33	08/01/91	---	0.35	---	0.05	0.81	---	<0.02	---	<0.10	---	<0.1	---	---	0.01
WC-70	Tech Area 33	12/09/91	---	0.09	---	<0.01	0.71	---	<0.02	---	---	---	<0.1	---	---	0.04
WC-83	Tech Area 33	04/20/92	<0.002	0.20	0.004	<0.02	0.88	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.04
WC-102	Tech Area 33	08/20/92	<0.002	0.48	<0.002	<0.02	1.47	0.002	<0.05	<0.002	---	---	<0.1	<0.02	---	0.01
WC-110	Tech Area 33	12/03/92	<0.002	1.48	<0.002	<0.02	0.86	0.002	0.20	<0.002	---	---	0.08	<0.01	---	0.02
WC-125	Tech Area 33	04/28/93	<0.002	0.30	<0.002	<0.02	0.75	0.003	<0.02	<0.002	---	---	0.04	<0.01	---	<0.01
WC-138	Tech Area 33	08/09/93	<0.002	0.73	<0.002	0.01	1.98	<0.002	0.02	<0.002	---	---	<0.01	<0.01	---	0.05
WC-149	Tech Area 33	12/03/93	<0.002	0.13	0.002	<0.01	<0.01	0.003	<0.02	<0.002	<0.001	<0.001	0.07	<0.01	---	0.01
WC-3	Philomena's	05/23/90	---	0.90	---	---	1.46	---	0.17	---	---	---	---	---	---	---
WC-19	Philomena's	09/07/90	---	0.42	---	<0.05	1.20	---	<0.10	---	---	---	---	---	---	---
WC-33	Philomena's	12/04/90	---	0.54	---	<0.01	0.84	---	<0.05	---	<0.10	<0.10	<0.1	---	<0.1	0.05
WC-42	Philomena's	04/24/91	---	0.18	---	<0.01	1.06	---	<0.05	---	<0.10	<0.10	<0.1	---	<0.1	0.01
WC-57	Philomena's	08/05/91	---	0.23	---	0.05	0.65	---	<0.02	---	<0.10	---	<0.1	---	---	0.02
WC-77	Philomena's	12/19/91	---	0.17	---	<0.01	0.84	---	<0.02	---	---	---	<0.1	---	---	0.02
WC-79	Philomena's	03/31/92	<0.002	0.55	0.023	<0.02	1.64	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.04
WC-99	Philomena's	08/14/92	<0.002	0.78	<0.002	<0.02	1.51	<0.002	<0.05	<0.002	---	---	<0.1	<0.02	---	0.03
WC-107	Philomena's	12/03/92	<0.002	0.29	<0.002	<0.02	0.93	0.002	<0.05	<0.002	---	---	0.08	<0.01	---	0.05
WC-127	Philomena's	04/29/93	<0.002	0.27	<0.002	<0.02	0.97	0.002	<0.02	<0.002	---	---	<0.01	<0.01	---	0.06
WC-140	Philomena's	08/13/93	<0.002	1.54	<0.002	0.02	2.47	0.002	0.05	<0.002	---	---	<0.01	<0.01	---	0.16
WC-152	Philomena's	11/29/93	<0.002	0.10	0.006	<0.01	<0.01	0.005	<0.02	<0.002	<0.001	<0.001	0.07	<0.01	---	0.05
WC-4	Pajarito Mountain	05/23/90	---	0.18	---	---	0.82	---	<0.1	---	---	---	---	---	---	---
WC-20	Pajarito Mountain	09/07/90	---	0.92	---	<0.05	0.85	---	0.23	---	---	---	---	---	---	---
WC-34	Pajarito Mountain	12/07/90	---	0.36	---	<0.01	0.27	---	1.23	---	<0.1	<0.1	<0.1	---	<0.1	0.12
WC-45	Pajarito Mountain	04/25/91	---	0.22	---	<0.01	<0.02	---	0.23	---	<0.1	<0.1	0.1	---	<0.1	0.05

(a) Analyses by D. Counce and P.E. Trujillo.

(b) CO3 (mg/kg) not found in all samples.

Sample #	Description	Date	Ag mg/kg	Al mg/kg	As mg/kg	Ba mg/kg	Cd mg/kg	Co mg/kg	Cr mg/kg	Cs mg/kg	Cu mg/kg	Fe mg/kg	Hg mg/kg	I mg/kg	Mn mg/kg
WC-61	Pajarito Mountain	08/06/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	0.02	---	---	<0.01
WC-69	Pajarito Mountain	12/08/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	---	---	<0.01
WC-90	Pajarito Mountain	05/07/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.002	<0.01	---	---	<0.01
WC-93	Pajarito Mountain	08/10/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.003	0.01	---	<0.02	<0.01
WC-116	Pajarito Mountain	12/16/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	0	0.01	<0.01	---	<0.01	<0.01
WC-130	Pajarito Mountain	05/04/93	<0.001	<0.1	<0.05	<0.01	0.003	<0.002	<0.002	0	<0.002	<0.01	---	<0.01	<0.01
WC-136	Pajarito Mountain	08/09/93	<0.0005	<0.1	0.11	<0.01	0.0017	<0.002	<0.002	<0.002	0	0.04	---	<0.01	<0.01
WC-155	Pajarito Mountain	02/02/94	<0.0005	0.07	0.001	0.03	0.0079	0.003	<0.002	<0.002	0.02	0.03	<0.0005	<0.01	0.02
WC-5	"S" Site	05/30/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-15	"S" Site	09/05/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-31	"S" Site	12/04/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-41	"S" Site	04/24/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-56	"S" Site	08/05/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	0.03	---	---	<0.01
WC-78	"S" Site	12/19/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	---	---	0
WC-87	"S" Site	04/29/92	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.004	<0.01	---	---	<0.01
WC-103	"S" Site	08/20/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	0.01	0.002	<0.01	---	<0.02	<0.01
WC-115	"S" Site	12/16/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0	<0.01	---	<0.01	<0.01
WC-129	"S" Site	04/30/93	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.007	0.02	---	<0.01	<0.01
WC-134	"S" Site	08/05/93	<0.0005	<0.1	<0.05	<0.01	0.0003	<0.002	0.005	<0.002	0	0.04	---	<0.01	<0.01
WC-153	"S" Site	11/30/93	<0.0005	<0.05	<0.0005	<0.01	0.0006	<0.002	<0.002	<0.002	0.02	0.01	<0.0005	<0.01	<0.01
WC-6	White Rock "Y"	05/30/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-10	White Rock "Y"	08/09/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-32	White Rock "Y"	12/04/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	0.04
WC-43	White Rock "Y"	04/24/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-55	White Rock "Y"	08/01/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-72	White Rock "Y"	12/10/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	---	---	<0.01
WC-84	White Rock "Y"	04/28/92	<0.001	<0.1	<0.05	<0.01	0.004	<0.002	<0.002	<0.002	0.003	<0.01	---	---	<0.01
WC-98	White Rock "Y"	08/14/92	<0.001	<0.1	<0.05	0.03	0.003	<0.002	<0.002	<0.002	0.009	0.04	---	<0.02	<0.01
WC-108	White Rock "Y"	12/03/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.005	<0.01	---	<0.01	<0.01
WC-126	White Rock "Y"	04/29/93	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	0.002	<0.002	0.005	0.02	---	<0.01	<0.01
WC-137	White Rock "Y"	08/09/93	<0.0005	<0.1	<0.05	0.01	0.0054	<0.002	0.003	<0.002	0.005	0.03	---	<0.01	<0.01
WC-148	White Rock "Y"	11/29/93	<0.0005	<0.05	0.0006	<0.01	<0.0005	<0.002	<0.002	<0.002	0.002	0.01	<0.0005	<0.01	<0.01
WC-7	Espanola Ranger Station	05/30/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-14	Espanola Ranger Station	09/05/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-30	Espanola Ranger Station	11/28/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-44	Espanola Ranger Station	04/24/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-58	Espanola Ranger Station	08/05/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-71	Espanola Ranger Station	12/10/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	---	---	<0.01
WC-86	Espanola Ranger Station	04/29/92	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.007	<0.01	---	---	<0.01
WC-101	Espanola Ranger Station	08/20/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.005	<0.01	---	<0.02	<0.01
WC-114	Espanola Ranger Station	12/16/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.007	<0.01	---	<0.01	<0.01
WC-128	Espanola Ranger Station	04/30/93	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.002	<0.01	---	<0.01	<0.01

Sample #	Description	Date	Mo mg/kg	NH4 mg/kg	Ni mg/kg	NO2 mg/kg	NO3 mg/kg	Pb mg/kg	PO4 mg/kg	Rb mg/kg	Sb mg/kg	Se mg/kg	Si mg/kg	S2O3 mg/kg	U mg/kg	Zn mg/kg
WC-61	Pajarito Mountain	08/06/91	---	0.86	---	0.06	0.61	---	0.34	---	<0.1	---	<0.1	---	---	1.08
WC-69	Pajarito Mountain	12/08/91	---	0.77	---	<0.01	0.40	---	<0.02	---	---	---	<0.1	---	---	0.07
WC-90	Pajarito Mountain	05/07/92	<0.002	0.29	0.01	<0.02	0.66	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.03
WC-93	Pajarito Mountain	08/10/92	<0.002	0.66	<0.002	<0.02	1.10	<0.002	<0.05	<0.002	---	---	<0.1	<0.02	---	0.01
WC-116	Pajarito Mountain	12/16/92	<0.002	0.50	<0.002	<0.02	0.85	0.003	<0.05	<0.002	---	---	0.07	<0.01	---	0.02
WC-130	Pajarito Mountain	05/04/93	<0.002	0.36	<0.002	<0.02	0.92	0.004	<0.02	<0.002	---	---	<0.01	<0.01	---	<0.01
WC-136	Pajarito Mountain	08/09/93	<0.002	2.06	<0.002	0.18	1.79	0.004	0.29	<0.002	---	---	<0.01	<0.01	---	0.09
WC-155	Pajarito Mountain	02/02/94	<0.002	0.38	0.11	<0.02	1.71	0.007	<0.02	<0.002	<0.001	<0.001	<0.1	<0.01	---	0.09
WC-5	"S" Site	05/30/90	---	1.61	---	---	1.37	---	0.45	---	---	---	---	---	---	---
WC-15	"S" Site	09/05/90	---	3.10	---	20.9	8.33	---	3.69	---	---	---	---	---	---	---
WC-31	"S" Site	12/04/90	---	1.31	---	0.05	1.45	---	0.17	---	<0.1	<0.1	<0.1	---	<0.1	0.37
WC-41	"S" Site	04/24/91	---	0.16	---	<0.01	0.89	---	<0.05	---	<0.1	<0.1	<0.1	---	<0.1	0.02
WC-56	"S" Site	08/05/91	---	0.19	---	0.06	0.64	---	<0.02	---	<0.1	---	<0.1	---	---	0.05
WC-78	"S" Site	12/19/91	---	0.28	---	<0.01	0.76	---	<0.02	---	---	---	<0.1	---	---	0.03
WC-87	"S" Site	04/29/92	<0.002	0.38	0.006	<0.02	1.22	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.05
WC-103	"S" Site	08/20/92	<0.002	0.22	<0.002	<0.02	1.09	0.002	<0.05	<0.002	---	---	<0.1	<0.02	---	0.06
WC-115	"S" Site	12/16/92	<0.002	0.25	<0.002	<0.02	0.27	0.002	<0.05	<0.002	---	---	0.05	<0.01	---	0.02
WC-129	"S" Site	04/30/93	<0.002	0.30	<0.002	0.02	0.75	<0.002	<0.02	<0.002	---	---	<0.01	<0.01	---	<0.01
WC-134	"S" Site	08/05/93	<0.002	0.48	<0.002	0.01	1.54	<0.002	0.02	<0.002	---	---	<0.01	<0.01	---	0.09
WC-153	"S" Site	11/30/93	<0.002	0.44	0.01	0.04	0.92	0.007	<0.02	<0.002	<0.001	<0.001	0.05	<0.01	---	0.07
WC-6	White Rock "Y"	05/30/90	---	0.05	---	---	1.35	---	<0.10	---	---	---	---	---	---	---
WC-10	White Rock "Y"	08/09/90	---	0.20	---	<0.05	1.28	---	<0.10	---	---	---	---	---	---	---
WC-32	White Rock "Y"	12/04/90	---	1.58	---	<0.01	5.09	---	0.40	---	<0.1	<0.1	<0.1	---	<0.1	0.35
WC-43	White Rock "Y"	04/24/91	---	0.17	---	<0.01	1.10	---	<0.05	---	<0.1	<0.1	<0.1	---	<0.1	0.07
WC-55	White Rock "Y"	08/01/91	---	0.19	---	0.04	0.59	---	<0.02	---	<0.1	---	<0.1	---	---	0.06
WC-72	White Rock "Y"	12/10/91	---	0.13	---	<0.01	0.55	---	<0.02	---	---	---	<0.1	---	---	0.07
WC-84	White Rock "Y"	04/28/92	<0.002	0.17	0.004	<0.02	1.02	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.37
WC-98	White Rock "Y"	08/14/92	<0.002	0.88	0.004	<0.02	1.39	0.002	<0.05	<0.002	---	---	<0.1	<0.02	---	0.11
WC-108	White Rock "Y"	12/03/92	<0.002	0.24	<0.002	<0.02	1.13	0.002	<0.05	<0.002	---	---	0.09	<0.01	---	0.12
WC-126	White Rock "Y"	04/29/93	<0.002	0.25	<0.002	<0.02	0.79	0.008	<0.02	<0.002	---	---	0.01	<0.01	---	0.03
WC-137	White Rock "Y"	08/09/93	0.002	0.24	0.002	<0.01	2.51	0.003	<0.02	0.002	---	---	<0.01	<0.01	---	0.30
WC-148	White Rock "Y"	11/29/93	<0.002	0.30	0.003	<0.01	0.89	0.006	<0.02	<0.002	<0.001	<0.001	0.04	<0.01	---	0.09
C-7	Espanola Ranger Station	05/30/90	---	0.26	---	---	1.77	---	0.15	---	---	---	---	---	---	---
WC-14	Espanola Ranger Station	09/05/90	---	0.09	---	<0.05	1.72	---	<0.10	---	---	---	---	---	---	---
WC-30	Espanola Ranger Station	11/28/90	---	0.18	---	0.05	0.87	---	<0.05	---	<0.1	<0.1	<0.1	---	<0.1	0.97
WC-44	Espanola Ranger Station	04/24/91	---	0.21	---	0.09	2.25	---	<0.05	---	<0.1	<0.1	<0.1	---	<0.1	0.10
WC-58	Espanola Ranger Station	08/05/91	---	0.16	---	0.33	0.84	---	<0.02	---	<0.1	---	<0.1	---	---	0.56
WC-71	Espanola Ranger Station	12/10/91	---	0.18	---	<0.01	0.95	---	<0.02	---	---	---	<0.1	---	---	0.02
WC-86	Espanola Ranger Station	04/29/92	<0.002	0.44	0.008	0.03	1.31	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.03
WC-101	Espanola Ranger Station	08/20/92	<0.002	0.72	<0.002	<0.02	1.70	0.003	<0.05	<0.002	---	---	<0.1	<0.02	---	0.03
WC-114	Espanola Ranger Station	12/16/92	<0.002	0.46	0.003	<0.02	0.93	0.003	<0.05	<0.002	---	---	0.11	<0.01	---	0.03
WC-128	Espanola Ranger Station	04/30/93	<0.002	0.35	<0.002	0.03	1.33	<0.002	0.09	<0.002	---	---	0.09	<0.01	---	<0.01

Sample #	Description	Date	Ag mg/kg	Al mg/kg	As mg/kg	Ba mg/kg	Cd mg/kg	Co mg/kg	Cr mg/kg	Cs mg/kg	Cu mg/kg	Fe mg/kg	Hg mg/kg	I mg/kg	Mn mg/kg
WC-133	Espanola Ranger Station	08/05/93	<0.0005	<0.1	<0.05	0.02	<0.0002	<0.002	<0.002	<0.002	0.006	0.02	---	<0.01	<0.01
WC-147	Espanola Ranger Station	11/29/93	<0.0005	<0.05	<0.0005	<0.01	<0.0005	<0.002	<0.002	<0.002	0.007	<0.01	<0.0005	<0.01	<0.01
WC-11	Boundary Peak Area	09/04/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-23	Boundary Peak Area	11/26/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-36	Boundary Peak Area	04/23/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-49	Boundary Peak Area	07/29/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-94	Boundary Peak Area	08/10/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	<0.002	<0.01	---	<0.02	<0.01
WC-124	Boundary Peak Area	04/28/93	<0.001	<0.1	<0.05	0.02	<0.001	<0.002	<0.002	0.010	0.010	0.08	---	<0.01	<0.01
WC-131	Boundary Peak Area	08/03/93	<0.0005	<0.1	<0.05	0.01	0.0003	<0.002	0.002	<0.002	0.012	0.10	---	<0.01	<0.01
WC-143	Boundary Peak Area	11/16/93	<0.0005	<0.05	0.0012	<0.01	<0.0005	<0.002	<0.002	<0.002	0.010	<0.01	<0.0005	<0.01	<0.01
WC-12	West of Guaje Mtn.	09/04/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-24	West of Guaje Mtn.	11/27/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-39	West of Guaje Mtn.	04/23/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-50	West of Guaje Mtn.	07/29/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-76	West of Guaje Mtn.	12/10/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	0.03	---	---	0.02
WC-85	West of Guaje Mtn.	04/29/92	<0.001	<0.1	<0.05	<0.01	0.003	<0.002	<0.002	0.004	0.011	<0.01	---	---	<0.01
WC-92	West of Guaje Mtn.	08/10/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	0.003	<0.002	0.008	0.04	---	<0.02	<0.01
WC-106	West of Guaje Mtn.	2/02/92	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.005	<0.01	---	<0.01	<0.01
WC-119	West of Guaje Mtn.	04/23/93	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.008	<0.01	---	<0.01	<0.01
WC-135	West of Guaje Mtn.	08/06/93	<0.0005	<0.1	<0.05	<0.01	0.0003	<0.002	<0.002	<0.002	0.009	0.06	---	<0.01	<0.01
WC-144	West of Guaje Mtn.	11/17/93	<0.0005	<0.05	<0.0005	<0.01	<0.0005	<0.002	<0.002	<0.002	0.010	0.03	<0.0005	<0.01	<0.01
WC-13	Santa Fe Ski Basin	09/05/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-29	Santa Fe Ski Basin	11/28/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-47	Santa Fe Ski Basin	04/25/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-52	Santa Fe Ski Basin	07/29/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-66	Santa Fe Ski Basin	12/04/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	---	---	<0.01
WC-81	Santa Fe Ski Basin	04/20/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.020	0.09	---	---	0.01
WC-96	Santa Fe Ski Basin	08/14/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	0.002	<0.002	0.078	0.04	---	<0.02	<0.01
WC-112	Santa Fe Ski Basin	12/04/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.002	<0.01	---	<0.01	<0.01
WC-123	Santa Fe Ski Basin	04/28/93	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.11	0.19	---	<0.01	<0.01
WC-132	Santa Fe Ski Basin	08/04/93	<0.0005	<0.1	<0.05	0.02	0.0005	<0.002	0.002	<0.002	0.017	0.02	---	<0.01	<0.01
WC-145	Santa Fe Ski Basin	11/18/93	<0.0005	<0.05	<0.0005	<0.01	0.0006	<0.002	<0.002	<0.002	0.009	<0.01	<0.0005	<0.01	<0.01
WC-16	VC-2B, Sulphur Springs	09/06/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-21	VC-2B, Sulphur Springs	10/24/90	<0.001	<0.1	<0.05	0.01	<0.001	<0.002	0.002	0.002	0.002	<0.01	<0.1	<0.01	<0.01
WC-22	VC-2B, Sulphur Springs	11/26/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-35	VC-2B, Sulphur Springs	04/23/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-48	VC-2B, Sulphur Springs	07/29/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-68	VC-2B, Sulphur Springs	12/05/91	---	<0.1	<0.05	0.01	---	---	---	---	---	<0.01	---	---	<0.01
WC-89	VC-2B, Sulphur Springs	05/01/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	0.005	<0.002	0.003	<0.01	---	---	<0.01
WC-105	VC-2B, Sulphur Springs	2/02/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	0.004	<0.002	0.03	---	<0.01	<0.01
WC-118	VC-2B, Sulphur Springs	04/21/93	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.02	<0.01	---	<0.01	<0.01

Sample #	Description	Date	Mo mg/kg	NH4 mg/kg	Ni mg/kg	NO2 mg/kg	NO3 mg/kg	Pb mg/kg	PO4 mg/kg	Rb mg/kg	Sb mg/kg	Se mg/kg	Si mg/kg	S2O3 mg/kg	U mg/kg	Zn mg/kg
WC-133	Espanola Ranger Station	08/05/93	<0.002	6.37	<0.002	4.92	2.83	0.002	1.23	<0.002	---	---	<0.01	<0.01	---	0.07
WC-147	Espanola Ranger Station	11/29/93	<0.002	0.38	<0.002	<0.01	0.43	0.002	<0.02	<0.002	<0.001	<0.001	0.07	<0.01	---	0.02
WC-11	Boundary Peak Area	09/04/90	---	0.18	---	<0.05	1.14	---	<0.1	---	---	---	---	---	---	---
WC-23	Boundary Peak Area	11/26/90	---	0.15	---	<0.01	0.83	---	<0.05	---	<0.10	<0.1	<0.1	---	<0.1	0.10
WC-36	Boundary Peak Area	04/23/91	---	0.07	---	<0.01	0.40	---	<0.05	---	<0.10	<0.1	<0.1	---	<0.1	0.04
WC-49	Boundary Peak Area	07/29/91	---	0.46	---	1.83	0.78	---	0.13	---	<0.10	---	<0.1	---	---	0.01
WC-94	Boundary Peak Area	08/10/92	<0.002	0.44	<0.002	<0.02	1.02	<0.002	<0.05	<0.002	---	---	<0.1	<0.02	---	0.01
WC-124	Boundary Peak Area	04/28/93	<0.002	0.34	<0.002	<0.02	0.66	0.002	<0.02	<0.002	---	---	0.13	<0.01	---	0.06
WC-131	Boundary Peak Area	08/03/93	<0.002	2.19	0.002	0.03	2.47	0.002	1.32	<0.002	---	---	<0.01	<0.01	---	0.10
WC-143	Boundary Peak Area	11/16/93	<0.002	0.28	0.002	<0.01	0.79	0.006	<0.02	<0.002	<0.001	<0.001	0.06	<0.01	---	0.02
WC-12	West of Guaje Mtn.	09/04/90	---	0.14	---	<0.05	0.83	---	<0.1	---	---	---	---	---	---	---
WC-24	West of Guaje Mtn.	11/27/90	---	0.10	---	<0.01	0.66	---	<0.05	---	<0.10	<0.1	<0.1	---	<0.1	0.03
WC-39	West of Guaje Mtn.	04/23/91	---	0.16	---	<0.01	0.83	---	<0.05	---	<0.10	<0.1	<0.1	---	<0.1	0.04
WC-50	West of Guaje Mtn.	07/29/91	---	0.21	---	0.05	0.59	---	<0.02	---	<0.10	---	<0.1	---	---	0.01
WC-76	West of Guaje Mtn.	12/10/91	---	0.14	---	<0.01	1.13	---	<0.02	---	---	---	<0.1	---	---	0.03
WC-85	West of Guaje Mtn.	04/29/92	<0.002	0.22	0.006	<0.02	0.88	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.05
WC-92	West of Guaje Mtn.	08/10/92	<0.002	2.53	<0.002	<0.02	0.18	<0.002	0.28	<0.002	---	---	<0.1	<0.02	---	0.03
WC-106	West of Guaje Mtn.	12/02/92	<0.002	0.13	0.020	<0.02	1.11	0.002	<0.05	<0.002	---	---	0.09	<0.01	---	0.06
WC-119	West of Guaje Mtn.	04/23/93	<0.002	0.26	0.004	<0.02	0.70	0.002	<0.02	<0.002	---	---	0.11	<0.01	---	<0.01
WC-135	West of Guaje Mtn.	08/06/93	<0.002	0.71	<0.002	<0.01	1.61	0.004	0.08	<0.002	---	---	<0.01	<0.01	---	0.11
WC-144	West of Guaje Mtn.	11/17/93	<0.002	0.30	0.005	<0.01	0.74	0.006	<0.02	<0.002	<0.001	<0.001	0.08	<0.01	---	0.03
WC-13	Santa Fe Ski Basin	09/05/90	---	0.28	---	<0.05	0.88	---	<0.1	---	---	---	---	---	---	---
WC-29	Santa Fe Ski Basin	11/28/90	---	0.26	---	<0.01	0.68	---	<0.05	---	<0.10	<0.1	<0.1	---	<0.1	0.21
WC-47	Santa Fe Ski Basin	04/25/91	---	0.11	---	<0.01	0.83	---	<0.05	---	<0.10	<0.1	<0.1	---	<0.1	0.05
WC-52	Santa Fe Ski Basin	07/29/91	---	0.15	---	0.03	0.49	---	<0.02	---	<0.10	---	<0.1	---	---	0.08
WC-66	Santa Fe Ski Basin	12/04/91	---	0.06	---	0.25	0.11	---	<0.02	---	---	---	<0.1	---	---	0.04
WC-81	Santa Fe Ski Basin	04/20/92	<0.002	0.35	0.033	<0.02	0.88	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.09
WC-96	Santa Fe Ski Basin	08/14/92	<0.002	0.29	<0.002	<0.02	1.06	<0.002	<0.05	<0.002	---	---	<0.1	<0.02	---	0.36
WC-112	Santa Fe Ski Basin	12/04/92	<0.002	0.23	<0.002	<0.02	0.13	0.002	<0.05	<0.002	---	---	0.08	<0.01	---	0.05
WC-123	Santa Fe Ski Basin	04/28/93	<0.002	0.39	<0.002	<0.02	1.22	0.008	<0.02	<0.002	---	---	0.25	<0.01	---	0.29
WC-132	Santa Fe Ski Basin	08/04/93	<0.002	0.51	<0.002	<0.01	1.48	0.003	0.04	<0.002	---	---	<0.01	<0.01	---	0.30
WC-145	Santa Fe Ski Basin	11/18/93	<0.002	0.22	0.002	<0.01	1.04	0.004	<0.02	<0.002	<0.001	<0.001	0.04	<0.01	---	0.10
WC-16	VC-2B, Sulphur Springs	09/06/90	---	0.56	---	<0.05	1.00	---	<0.1	---	---	---	---	---	---	---
WC-21	VC-2B, Sulphur Springs	10/24/90	<0.002	1.43	0.002	4.5	1.13	<0.002	0.45	<0.002	<0.10	<0.10	<0.1	<0.01	<0.1	0.02
WC-22	VC-2B, Sulphur Springs	11/26/90	---	0.36	---	<0.01	0.57	---	<0.05	---	<0.10	<0.10	<0.1	---	<0.1	0.09
WC-35	VC-2B, Sulphur Springs	04/23/91	---	0.15	---	<0.01	0.85	---	<0.05	---	<0.10	<0.10	<0.1	---	<0.1	0.14
WC-48	VC-2B, Sulphur Springs	07/29/91	---	2.70	---	13.0	0.97	---	0.93	---	<0.10	---	0.8	---	---	0.03
WC-68	VC-2B, Sulphur Springs	12/05/91	---	1.54	---	<0.01	0.52	---	0.34	---	---	---	<0.1	---	---	0.01
WC-89	VC-2B, Sulphur Springs	05/01/92	<0.002	0.54	0.006	<0.02	0.66	<0.002	<0.05	<0.002	---	---	<0.1	---	---	0.05
WC-105	VC-2B, Sulphur Springs	12/02/92	<0.002	0.14	<0.002	<0.02	0.15	<0.002	<0.05	<0.002	---	---	0.14	<0.01	---	0.02
WC-118	VC-2B, Sulphur Springs	04/21/93	<0.002	0.18	<0.002	0.02	0.50	0.002	<0.02	<0.002	---	---	0.50	<0.01	---	<0.01

Sample #	Description	Date	Ag mg/kg	Al mg/kg	As mg/kg	Ba mg/kg	Cd mg/kg	Co mg/kg	Cr mg/kg	Cs mg/kg	Cu mg/kg	Fe mg/kg	Hg mg/kg	I mg/kg	Mn mg/kg
WC-130a	VC-2B, Sulphur Springs	08/03/93	<0.0005	<0.1	<0.05	0.02	0.0005	0.002	0.002	<0.002	0.008	0.07	---	<0.01	<0.01
WC-142	VC-2B, Sulphur Springs	11/16/93	<0.0005	<0.05	0.0005	<0.01	<0.0005	<0.002	<0.002	<0.002	0.003	0.01	<0.0005	<0.01	<0.01
WC-17	Tech Area 49	09/06/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-26	Tech Area 49	11/27/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-38	Tech Area 49	04/23/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-53	Tech Area 49	08/01/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-73	Tech Area 49	2/16/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	0.03	---	---	<0.01
WC-82	Tech Area 49	04/28/92	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.014	<0.01	---	---	<0.01
WC-95	Tech Area 49	08/10/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	<0.002	0.02	---	<0.02	<0.01
WC-111	Tech Area 49	2/03/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	0.003	0.005	<0.01	---	<0.01	<0.01
WC-121	Tech Area 49	04/23/93	<0.001	<0.1	<0.05	<0.01	0.003	<0.002	<0.002	0.005	0.006	<0.01	---	<0.01	<0.01
WC-150	Tech Area 49	11/29/93	<0.0005	<0.05	<0.0005	<0.01	0.0007	<0.002	<0.002	<0.002	0.010	0.01	<0.0005	<0.01	<0.01
WC-18	Tech Area 51	09/06/90	---	---	---	---	---	---	---	---	---	---	---	---	---
WC-27	Tech Area 51	11/27/90	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-40	Tech Area 51	04/24/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	<0.1	---	<0.01
WC-59	Tech Area 51	08/05/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	0.02	---	---	<0.01
WC-75	Tech Area 51	12/16/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	<0.01	---	---	0.01
WC-88	Tech Area 51	04/29/92	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	0.003	<0.002	0.003	<0.01	---	---	<0.01
WC-100	Tech Area 51	08/14/92	<0.001	<0.1	<0.05	<0.01	0.002	<0.002	<0.002	0.003	0.011	<0.01	---	<0.02	<0.01
WC-109	Tech Area 51	12/03/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	0.003	0.002	<0.01	---	<0.01	<0.01
WC-122	Tech Area 51	04/23/93	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.010	<0.01	---	<0.01	<0.01
WC-139	Tech Area 51	08/13/93	<0.0005	<0.1	<0.05	<0.01	0.0003	<0.002	<0.002	<0.002	0.005	<0.01	---	<0.01	<0.01
WC-151	Tech Area 51	11/29/93	<0.0005	0.17	0	0.01	0.0006	<0.002	<0.002	<0.002	0.007	0.01	<0.0005	<0.01	<0.01
WC-60	Kim Manley's House	08/05/91	---	<0.1	<0.05	<0.02	---	---	---	---	---	<0.02	---	---	<0.01
WC-74	Kim Manley's House	12/15/91	---	<0.1	<0.05	<0.01	---	---	---	---	---	0.02	---	---	<0.01
WC-91	Kim Manley's House	05/27/92	<0.001	<0.1	<0.05	<0.01	0.001	<0.002	<0.002	<0.002	0.008	<0.01	---	---	<0.01
WC-104	Kim Manley's House	08/20/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.006	0.08	---	<0.02	<0.01
WC-117	Kim Manley's House	12/18/92	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.004	<0.01	---	<0.01	<0.01
WC-120	Kim Manley's House	04/23/93	<0.001	<0.1	<0.05	<0.01	<0.001	<0.002	<0.002	<0.002	0.011	<0.01	---	<0.01	<0.01
WC-141	Kim Manley's House	08/13/93	<0.0005	<0.1	<0.05	<0.01	0.0002	<0.002	<0.002	<0.002	0.009	0.04	---	<0.01	<0.01
WC-154	Kim Manley's House	11/29/93	<0.0005	<0.05	0.0012	<0.01	<0.0005	<0.002	<0.002	<0.002	0.015	<0.01	<0.0005	<0.01	<0.01

Sample #	Description	Date	Mo mg/kg	NH4 mg/kg	Ni mg/kg	NO2 mg/kg	NO3 mg/kg	Pb mg/kg	PO4 mg/kg	Rb mg/kg	Sb mg/kg	Se mg/kg	Si mg/kg	S2O3 mg/kg	U mg/kg	Zn mg/kg
WC-130a	VC-2B, Sulphur Springs	08/03/93	<0.002	1.66	0.002	0.02	2.03	0.004	0.54	<0.002	---	---	<0.01	<0.01	---	0.11
WC-142	VC-2B, Sulphur Springs	11/16/93	<0.002	1.00	0.002	<0.01	0.63	0.006	<0.02	0	<0.001	<0.001	0.07	<0.01	---	0.03
WC-17	Tech Area 49	09/06/90	---	2.01	---	<0.05	1.87	---	0.77	---	---	---	---	---	---	---
WC-26	Tech Area 49	11/27/90	---	0.76	---	0.02	1.06	---	0.09	---	<0.1	<0.1	<0.1	---	<0.1	0.35
WC-38	Tech Area 49	04/23/91	---	0.59	---	0.02	1.67	---	0.30	---	<0.1	<0.1	<0.1	---	<0.1	0.53
WC-53	Tech Area 49	08/01/91	---	1.28	---	0.19	0.75	---	0.37	---	<0.1	---	<0.1	---	---	0.15
WC-73	Tech Area 49	12/16/91	---	0.76	---	0.03	1.10	---	0.15	---	---	---	<0.1	---	---	0.22
WC-82	Tech Area 49	04/28/92	<0.002	0.88	0.006	<0.02	1.75	0.002	<0.05	<0.002	---	---	<0.1	---	---	0.82
WC-95	Tech Area 49	08/10/92	<0.002	5.49	<0.002	0.13	1.61	<0.002	1.80	<0.002	---	---	<0.1	<0.02	---	0.23
WC-111	Tech Area 49	12/03/92	<0.002	10.00	<0.002	<0.02	1.29	0.002	2.15	<0.002	---	---	0.11	<0.01	---	0.16
WC-121	Tech Area 49	04/23/93	<0.002	0.50	<0.002	<0.02	1.25	0.005	0.02	<0.002	---	---	0.02	<0.01	---	0.63
WC-150	Tech Area 49	11/29/93	<0.002	12.50	0.005	10.60	1.47	0.006	2.13	<0.002	<0.001	<0.001	0.10	<0.01	---	0.24
WC-18	Tech Area 51	09/06/90	---	0.32	---	<0.05	1.07	---	<0.1	---	---	---	---	---	---	---
WC-27	Tech Area 51	11/27/90	---	0.36	---	0.01	0.71	---	<0.05	---	<0.1	<0.1	<0.1	---	<0.1	0.08
WC-40	Tech Area 51	04/24/91	---	0.77	---	0.02	0.95	---	0.12	---	<0.1	<0.1	<0.1	---	<0.1	0.03
WC-59	Tech Area 51	08/05/91	---	0.24	---	0.03	0.58	---	<0.02	---	<0.1	---	<0.1	---	---	0.04
WC-75	Tech Area 51	12/16/91	---	0.18	---	<0.01	0.73	---	<0.02	---	---	---	<0.1	---	---	0.05
WC-88	Tech Area 51	04/29/92	<0.002	0.42	0.005	<0.02	1.17	0.002	<0.05	<0.002	---	---	<0.1	---	---	0.05
WC-100	Tech Area 51	08/14/92	<0.002	0.52	0.002	<0.02	1.24	0.002	<0.05	<0.002	---	---	<0.1	<0.02	---	0.04
WC-109	Tech Area 51	12/03/92	<0.002	0.40	<0.002	<0.02	1.35	<0.002	<0.05	<0.002	---	---	0.13	<0.01	---	0.05
WC-122	Tech Area 51	04/23/93	<0.002	0.29	<0.002	<0.02	0.73	0.002	<0.02	<0.002	---	---	<0.01	<0.01	---	0.02
WC-139	Tech Area 51	08/13/93	<0.002	1.58	<0.002	<0.01	3.25	0.002	0.22	<0.002	---	---	<0.01	<0.01	---	0.11
WC-151	Tech Area 51	11/29/93	<0.002	0.32	0.005	0.02	0.92	0.004	<0.02	<0.002	<0.001	<0.001	<0.05	<0.01	---	0.03
WC-60	Kim Manley's House	08/05/91	---	0.12	---	0.04	0.48	---	<0.02	---	<0.1	---	<0.1	---	---	0.01
WC-74	Kim Manley's House	12/15/91	---	0.13	---	<0.01	0.75	---	<0.02	---	---	---	<0.1	---	---	0.03
WC-91	Kim Manley's House	05/27/92	<0.002	0.35	0.05	<0.02	1.07	<0.002	<0.05	0.005	---	---	<0.1	---	---	0.02
WC-104	Kim Manley's House	08/20/92	<0.002	0.50	<0.002	<0.02	1.14	<0.002	0.13	<0.002	---	---	<0.1	<0.02	---	0.03
WC-117	Kim Manley's House	12/18/92	<0.002	0.16	0.003	<0.02	0.09	0.002	<0.05	<0.002	---	---	0.03	<0.01	---	<0.01
WC-120	Kim Manley's House	04/23/93	<0.002	0.24	<0.002	<0.02	0.68	0.003	<0.02	<0.002	---	---	0.02	<0.01	---	<0.01
WC-141	Kim Manley's House	08/13/93	<0.002	1.03	<0.002	<0.01	1.54	0.002	0.30	<0.002	---	---	<0.01	<0.01	---	0.07
WC-154	Kim Manley's House	11/29/93	<0.002	0.30	0.004	0.02	0.72	0.005	<0.02	<0.002	<0.001	<0.001	<0.05	<0.01	---	0.01

Stable Isotopes in the Los Alamos Region

Figure 5: Plot of deuterium versus oxygen-18 for precipitation in the Los Alamos region. The line shown is the World Meteoric Water Line of Craig (1961), $\delta D = 8\delta^{18}O + 10$.

Figure 6: Plot of oxygen-18 versus elevation of sampling stations for precipitation in the Los Alamos region.

Figure 7: Plot of deuterium versus elevation of sampling stations for precipitation in the Los Alamos region.

TABLE 4. Isotope Data for Precipitation in the Los Alamos Region, New Mexico (a)

Sample #	Description	Date	δD (‰)	$\delta^{18}O$ (‰)	3H (T.U.)	Elevation (m)
WC-1	Santa Fe Airport	05/23/90	-77.3	-9.60	11.30	1910
WC-9	Santa Fe Airport	08/09/90	-40.5	-5.40	11.80	1910
WC-28	Santa Fe Airport	11/28/90	-25.4	-0.29	14.00	1910
WC-46	Santa Fe Airport	04/25/91	-112.1	-15.48	9.81	1910
WC-51	Santa Fe Airport	07/29/91	-51.7	-7.83	10.30	1910
WC-67	Santa Fe Airport	12/04/91	-53.8	-8.72	17.40	1910
WC-80	Santa Fe Airport	04/20/92	-129.6	-17.77	10.80	1910
WC-97	Santa Fe Airport	08/14/92	-44.7	-6.91	11.80	1910
WC-113	Santa Fe Airport	12/04/92	-67.3	-9.35	8.51	1910
WC-146	Santa Fe Airport	11/18/93	-59.9	-9.03	7.07	1910
WC-2	Tech Area-33	05/23/90	-84.2	-12.96	27.20	1960
WC-8	Tech Area-33	08/09/90	-55.0	-7.59	55.30	1960
WC-25	Tech Area-33	11/27/90	-58.6	-8.84	36.70	1960
WC-37	Tech Area-33	04/23/91	-120.4	-17.03	75.30	1960
WC-54	Tech Area-33	08/01/91	-48.6	-7.12	26.10	1960
WC-70	Tech Area-33	12/09/91	-76.2	-10.62	18.90	1960
WC-83	Tech Area-33	04/20/92	-93.6	-16.81	47.40	1960
WC-102	Tech Area-33	08/20/92	-46.2	-7.03	35.30	1960
WC-110	Tech Area-33	12/03/92	-69.6	-10.29	29.20	1960
WC-125	Tech Area-33	04/28/93	-111.8	-15.93	18.70	1960
WC-138	Tech Area-33	08/09/93	-57.3	-8.66	27.60	1960
WC-149	Tech Area-33	12/03/93	-66.8	-10.24	17.70	1960
WC-3	Philomena's	05/23/90	-89.2	-12.58	89.60	2110
WC-19	Philomena's	09/07/90	-55.8	-8.06	74.40	2110
WC-33	Philomena's	12/04/90	-82.0	-10.38	80.70	2110
WC-42	Philomena's	04/24/91	-127.5	-16.56	89.60	2110
WC-57	Philomena's	08/05/91	-62.8	-9.32	36.70	2110
WC-77	Philomena's	12/19/91	-87.9	-12.36	45.20	2110
WC-79	Philomena's	03/31/92	-123.4	-16.53	95.50	2110
WC-99	Philomena's	08/14/92	-50.9	-7.29	63.40	2110
WC-107	Philomena's	12/03/92	-67.1	-10.18	70.90	2110
WC-127	Philomena's	04/29/93	-116.7	-16.80	40.20	2110
WC-140	Philomena's	08/13/93	-53.7	-8.04	43.70	2110
WC-152	Philomena's	11/29/93	-61.9	-8.99	45.30	2110
WC-4	Pajarito Mountain	05/23/90	-96.8	-13.86	14.20	3180
WC-20	Pajarito Mountain	09/07/90	-47.0	-7.05	33.60	3180
WC-34	Pajarito Mountain	12/07/90	-96.4	-10.53	9.97	3180
WC-45	Pajarito Mountain	04/25/91	--	--	--	3180
WC-61	Pajarito Mountain	08/06/91	-62.1	-9.61	15.80	3180
WC-69	Pajarito Mountain	12/08/91	-70.9	-11.11	8.50	3180
WC-90	Pajarito Mountain	05/07/92	-115.2	-15.86	16.50	3180
WC-93	Pajarito Mountain	08/10/92	-64.1	-10.02	18.80	3180
WC-116	Pajarito Mountain	12/16/92	-75.5	-12.08	14.30	3180
WC-130	Pajarito Mountain	05/04/93	-110.1	-15.42	10.60	3180
WC-136	Pajarito Mountain	08/09/93	-64.2	-10.02	21.10	3180
WC-155	Pajarito Mountain	02/02/94	-78.4	-11.59	18.20	3180
WC-5	"S" Site	05/30/90	-87.9	-12.48	39.90	2380
WC-15	"S" Site	09/05/90	-35.6	-4.14	58.70	2380
WC-31	"S" Site	12/04/90	-70.3	-11.03	18.60	2380
WC-41	"S" Site	04/24/91	-122.2	-16.53	25.50	2380

Sample #	Description	Date	δD (‰)	$\delta^{18}O$ (‰)	3H (T.U.)	Elevation (m)
WC-56	"S" Site	08/05/91	-55.2	-8.61	22.20	2380
WC-78	"S" Site	12/19/91	-76.5	-11.16	17.70	2380
WC-87	"S" Site	04/29/92	-92.5	-12.97	34.70	2380
WC-103	"S" Site	08/20/92	-59.1	-8.96	28.40	2380
WC-115	"S" Site	12/16/92	-72.4	-10.49	32.20	2380
WC-129	"S" Site	04/30/93	-114.3	-16.27	20.10	2380
WC-134	"S" Site	08/05/93	-67.2	-10.08	13.30	2380
WC-153	"S" Site	11/30/93	-64.3	-9.67	11.20	2380
WC-6	White Rock "Y"	05/30/90	-94.1	-12.70	141.00	1950
WC-10	White Rock "Y"	08/09/90	-57.6	-7.86	51.90	1950
WC-32	White Rock "Y"	12/04/90	-57.8	-4.87	82.50	1950
WC-43	White Rock "Y"	04/24/91	-124.5	-17.06	117.00	1950
WC-55	White Rock "Y"	08/01/91	-63.2	-9.05	24.40	1950
WC-72	White Rock "Y"	12/10/91	-78.7	-10.37	22.20	1950
WC-84	White Rock "Y"	04/28/92	-119.3	-16.76	34.00	1950
WC-98	White Rock "Y"	08/14/92	-49.9	-7.18	30.50	1950
WC-108	White Rock "Y"	12/03/92	-63.5	-9.80	28.20	1950
WC-126	White Rock "Y"	04/29/93	-118.9	-16.76	15.70	1950
WC-137	White Rock "Y"	08/09/93	-57.0	-8.28	25.10	1950
WC-148	White Rock "Y"	11/29/93	-60.7	-9.12	31.40	1950
WC-7	Espanola Ranger Station	05/30/90	-82.4	-11.67	37.10	1775
WC-14	Espanola Ranger Station	09/05/90	-41.3	-5.01	30.60	1775
WC-30	Espanola Ranger Station	11/28/90	-69.7	-9.99	14.80	1775
WC-44	Espanola Ranger Station	04/24/91	-112.9	-15.16	37.00	1775
WC-58	Espanola Ranger Station	08/05/91	-56.4	-7.99	13.20	1775
WC-71	Espanola Ranger Station	12/10/91	-75.3	-9.29	12.10	1775
WC-86	Espanola Ranger Station	04/29/92	-125.1	-16.85	12.70	1775
WC-101	Espanola Ranger Station	08/20/92	-60.2	-8.22	16.20	1775
WC-114	Espanola Ranger Station	12/16/92	-78.9	-12.11	11.50	1775
WC-128	Espanola Ranger Station	04/30/93	-107.4	-15.10	10.00	1775
WC-133	Espanola Ranger Station	08/05/93	-54.7	-7.35	13.80	1775
WC-147	Espanola Ranger Station	11/29/93	-55.3	-8.41	10.90	1775
WC-11	Boundary Peak Trail	09/04/90	-50.6	-7.67	20.80	2500
WC-23	Boundary Peak Trail	11/26/90	-95.6	-9.65	10.60	2500
WC-36	Boundary Peak Trail	04/23/91	-119.4	-15.92	27.00	2500
WC-49	Boundary Peak Trail	07/29/91	-57.0	-6.55	12.50	2500
WC-94	Boundary Peak Trail	08/10/92	-63.3	-9.26	23.00	2500
WC-124	Boundary Peak Trail	04/28/93	-106.9	-15.43	15.00	2500
WC-131	Boundary Peak Trail	08/03/93	-60.6	-9.15	14.40	2500
WC-143	Boundary Peak Trail	11/16/93	-65.4	-9.97	9.03	2500
WC-12	West of Guaje Mtn.	09/04/90	-56.3	-8.73	47.30	2360
WC-24	West of Guaje Mtn.	11/27/90	-67.7	-10.36	25.60	2360
WC-39	West of Guaje Mtn.	04/23/91	-122.9	-16.60	48.10	2360
WC-50	West of Guaje Mtn.	07/29/91	-60.1	-8.68	24.60	2360
WC-76	West of Guaje Mtn.	12/18/91	-65.5	-9.95	31.30	2360
WC-85	West of Guaje Mtn.	04/29/92	-109.0	-15.33	87.10	2360
WC-92	West of Guaje Mtn.	08/10/92	-43.5	-6.98	30.10	2360
WC-106	West of Guaje Mtn.	12/02/92	-74.4	-11.59	32.40	2360
WC-119	West of Guaje Mtn.	04/23/93	-110.9	-14.80	51.30	2360
WC-135	West of Guaje Mtn.	08/06/93	-68.8	-9.52	23.50	2360
WC-144	West of Guaje Mtn.	11/17/93	-56.8	-8.38	19.70	2360

Sample #	Description	Date	δD (‰)	$\delta^{18}O$ (‰)	3H (T.U.)	Elevation (m)
WC-13	Santa Fe Ski Basin	09/05/90	-43.5	-6.73	15.00	3360
WC-29	Santa Fe Ski Basin	11/28/90	-80.0	-11.98	7.92	3360
WC-47	Santa Fe Ski Basin	04/25/91	-138.8	-18.25	14.60	3360
WC-52	Santa Fe Ski Basin	07/29/91	-51.7	-7.83	9.61	3360
WC-66	Santa Fe Ski Basin	12/04/91	-75.6	-9.90	10.60	3360
WC-81	Santa Fe Ski Basin	04/20/92	-123.5	-16.68	10.30	3360
WC-96	Santa Fe Ski Basin	08/14/92	-65.7	-10.00	13.10	3360
WC-112	Santa Fe Ski Basin	12/04/92	-42.4	-11.34	8.37	3360
WC-123	Santa Fe Ski Basin	04/28/93	-116.5	-16.42	8.60	3360
WC-132	Santa Fe Ski Basin	08/04/93	-65.6	-10.55	15.00	3360
WC-145	Santa Fe Ski Basin	11/18/93	-64.8	-8.56	7.66	3360
WC-16	CSDP corehole VC-2B	09/06/90	-47.6	-7.51	15.30	2610
WC-21	CSDP corehole VC-2B	10/24/90	-59.8	-9.09	--	2610
WC-22	CSDP corehole VC-2B	11/26/90	-97.1	-12.33	8.71	2610
WC-35	CSDP corehole VC-2B	04/23/91	-116.4	-15.79	8.24	2610
WC-48	CSDP corehole VC-2B	07/29/91	-62.4	-8.99	11.40	2610
WC-68	CSDP corehole VC-2B	12/05/91	-79.2	-11.86	10.00	2610
WC-89	CSDP corehole VC-2B	05/01/92	-126.4	-17.80	7.43	2610
WC-105	CSDP corehole VC-2B	12/02/92	-71.3	-11.10	7.42	2610
WC-118	CSDP corehole VC-2B	04/21/93	-113.1	-16.02	5.85	2610
WC-130a	CSDP corehole VC-2B	08/03/93	-61.2	-9.28	12.00	2610
WC-142	CSDP corehole VC-2B	11/16/93	-65.6	-9.96	6.54	2610
WC-17	Tech Area-49	09/06/90	-47.0	-6.67	64.50	2200
WC-26	Tech Area-49	11/27/90	-58.0	-7.84	20.80	2200
WC-38	Tech Area-49	04/23/91	-120.2	-16.35	42.10	2200
WC-53	Tech Area-49	08/01/91	-57.5	-8.44	20.40	2200
WC-73	Tech Area-49	12/16/91	-80.6	-11.24	17.60	2200
WC-82	Tech Area-49	04/28/92	-104.7	-14.46	49.00	2200
WC-95	Tech Area-49	08/10/92	-56.6	-8.32	33.70	2200
WC-111	Tech Area-49	12/03/92	-56.1	-8.85	25.60	2200
WC-121	Tech Area-49	04/23/93	-116.5	-16.42	22.70	2200
WC-150	Tech Area-49	11/29/93	-63.8	-9.85	14.80	2200
WC-18	Tech Area-51	09/06/90	-56.4	-8.01	89.40	2110
WC-27	Tech Area-51	11/27/90	-65.8	-10.43	26.50	2110
WC-40	Tech Area-51	04/24/91	-125.3	-16.81	63.40	2110
WC-59	Tech Area-51	08/05/91	-61.8	-8.29	31.90	2110
WC-75	Tech Area-51	12/17/91	-80.6	-11.98	12.10	2110
WC-88	Tech Area-51	04/29/92	-104.0	-14.45	58.40	2110
WC-100	Tech Area-51	08/14/92	-50.3	-7.81	43.10	2110
WC-109	Tech Area-51	12/03/92	-62.3	-9.71	40.40	2110
WC-122	Tech Area-51	04/23/93	-121.5	-17.01	25.20	2110
WC-139	Tech Area-51	08/13/93	-62.0	-9.16	30.00	2110
WC-151	Tech Area-51	11/29/93	-67.5	-10.03	21.10	2110
WC-60	Kim Manley's House	08/05/91	-62.8	-9.41	25.10	2250
WC-74	Kim Manley's House	12/15/91	-79.5	-11.73	36.80	2250
WC-91	Kim Manley's House	05/27/92	-94.2	-13.65	81.20	2250
WC-104	Kim Manley's House	08/20/92	-61.1	-8.50	49.20	2250
WC-117	Kim Manley's House	12/18/92	-83.5	-11.89	115.90	2250
WC-120	Kim Manley's House	04/23/93	-112.9	-16.12	49.10	2250
WC-141	Kim Manley's House	08/13/93	-53.6	-8.39	23.40	2250
WC-154	Kim Manley's House	11/29/93	-64.8	-9.06	23.10	2250

(a) Stable isotope analyses from M. Colucci; Southern Methodist University
Tritium analyses from H. Gote Ostlund; University of Miami

TRITIUM IN RAIN, FEB.-MAY 1990

Figure 8: Map of sampling stations showing area of anomalous tritium for Feb.-May 1990. Numbers shown in boxes are tritium values in T.U. Adjacent numbers are station elevations in meters. These symbols are used in Figs. 9 to 23.

TRITIUM IN RAIN, MAY-SEPT. 1990

Figure 9: Map of sampling stations showing area of anomalous tritium for May-Sept. 1990.

TRITIUM IN RAIN, SEPT.-DEC. 1990

Figure 10: Map of sampling stations showing area of anomalous tritium for Sept.- Dec. 1990.

TRITIUM IN RAIN, DEC. 1990 - APR. 1991

Figure 11: Map of sampling stations showing area of anomalous tritium for Dec. 1990 - April 1991.

TRITIUM IN RAIN, APRIL-AUG. 1991

Figure 12: Map of sampling stations showing area of anomalous tritium for April-Aug. 1991.

TRITIUM IN RAIN, AUG. - DEC. 1991

Figure 13: Map of sampling stations showing area of anomalous tritium for Aug.-Dec. 1991.

TRITIUM IN RAIN, DEC. 91 - APR. 92

Figure 14: Map of sampling stations showing area of anomalous tritium for Dec.1991-April 1992.

TRITIUM IN RAIN, APR. - AUG. 1992

Figure 15: Map of sampling stations showing area of anomalous tritium for April -Aug. 1992.

TRITIUM IN RAIN, AUG. 1992 - DEC. 1992

Figure 16: Map of sampling stations showing area of anomalous tritium for Aug.-Dec. 1992.

TRITIUM IN RAIN, DEC. 1992 - APR. 1993

Figure 17: Map of sampling stations showing area of anomalous tritium for Dec. 1992 - April 1993.

TRITIUM IN RAIN, APR.-AUG. 1993

Figure 18: Map of sampling stations showing area of anomalous tritium for April -Aug. 1993.

TRITIUM IN RAIN, AUG.-NOV. 1993

Figure 19: Map of sampling stations showing area of anomalous tritium for Aug.-Dec. 1993.

Weighted Mean Tritium Values for Precipitation in the Los Alamos Region 1990

Figure 20: Map of sampling stations using weighted mean tritium values for 1990.

Weighted Mean Tritium Values for Precipitation in the Los Alamos Region 1991

Figure 21: Map of sampling stations using weighted mean tritium values for 1991.

Weighted Mean Tritium Values for Precipitation in the Los Alamos Region 1992

Figure 22: Map of sampling stations using weighted mean tritium values for 1992.

Weighted Mean Tritium Values for Precipitation in the Los Alamos Region 1993

Figure 23: Map of sampling stations using weighted mean tritium values for 1993.

Sulphur Springs in Valles caldera; Table 4 and Figs. 8-23) and are located outside the influence of the Laboratory. Although tritium values >20 T.U. are considered anomalous when compared to present background levels in precipitation for this region, all tritium levels measured in this study are less than the Environmental Protection Agency (EPA) threshold value of 6200 T.U. (20,000 pCi/liter H₂O) for drinking water.

Weighted Mean Isotope Values: The data presented in this report may be useful to other projects within the Environmental Restoration and Surveillance programs of the Laboratory or for research projects related to groundwater and precipitation. Isotope data for precipitation, particularly tritium data, is usually reported as yearly weighted mean values, I_{wm} , in which

$$I_{wm} = \frac{\sum(I \times V)}{\sum V_{tot}} \quad (1)$$

where I = an analysis determined for an isotope parameter at a given sampling point, V = the volume of water measured at the sampling point where the isotope analysis is determined, and V_{tot} = the total volume of water measured for the year at the sampling point. The yearly weighted mean values for the deuterium, oxygen-18, and tritium determinations of this study are given in Table 5. Some values calculated for the data at some sampling stations are slightly biased to one collection period relative to another because of missing or contaminated samples as mentioned above.

The stable isotope values of precipitation are quite variable depending on climate, weather patterns, elevation, and latitude (Hoefs, 1973). To obtain a good value for the average composition of precipitation at any sampling point requires several years of continuous data collection; thus, the isotope data generated by this investigation provide a good start on determination of average compositions, reported as composite weighted means 1990 - 1993 (Table 5). When the composite values for the 14 precipitation stations are examined, they show that elevation difference is generally the most important long-term variable controlling stable isotope composition of precipitation in this region. For example, precipitation at the Santa Fe airport (1910 m) has composite mean $dD/d^{18}O$ values of -60.7‰ and -8.56‰ whereas Santa Fe ski basin (3360 m) has composite mean values of -83.2‰ and -12.4‰. Higher elevation results in more depleted isotope values if all other variables are held constant. We note, however, that the site with the lowest elevation in this study (Española ranger station) has composite mean stable isotope values of -76.8‰ and -10.6‰, suggesting that other variables have significant effects over relatively short time periods.

Regional tritium variations in groundwaters have been discussed previously by Vuataz and Goff (1986) and Shevenell and Goff (in press). The "pre-bomb" background value of tritium in precipitation for the Los Alamos region was about 6 T.U. At the height of atmospheric nuclear testing, the 1963 tritium level in precipitation reached an average value of 2800 T.U. for the southwestern United States. Because tritium has a short half-life (12.4 yr), the anthropogenic level of tritium in precipitation has decayed rapidly to the present regional value of about 10 T.U. observed in samples from the three stations located outside of Laboratory influence. For those three stations (and for most stations), there is a general decrease in yearly weighted mean tritium content and, all variables being equal, the weighted mean values should asymptotically approach 6 T.U. as time goes on. Local contamination of present atmospheric tritium by other anthropogenic sources, such as produced by Laboratory activities, will no doubt prolong the life of the semi-circular tritium anomaly observed in the Los Alamos region. Based on our data, the dimensions and magnitude of this anomaly are decreasing with time.

CONCLUSIONS

The chemistry and stable isotopes values measured in this investigation clearly show that precipitation in the Los Alamos region is relatively normal. However, elevated tritium levels measured in many samples (especially when correlated with the prevailing winds of the region) show that Los Alamos National Laboratory

TABLE 5. Isotopes in Precipitation in the Los Alamos Region, New Mexico
Weighted Mean Averages by Year

	Del D	Del 180	Tritium	Comments
Santa Fe Airport				
1990	-44.2	-4.41	12.58	
1991	-59.5	-9.07	13.10	
1992	-74.4	-10.59	10.66	
1993	-59.9	-9.17	7.07	1 collection in 1993
Composite weighted means 1990-1993	-60.7	-8.56		
Tech Area 33				
1990	-64.7	-9.60	40.35	
1991	-77.9	-11.03	34.49	
1992	-65.0	-10.57	37.64	
1993	-80.6	-11.88	20.76	
Composite weighted means 1990-1993	-73.1	-10.99		
Philomena's				
1990	-69.1	-9.47	78.67	
1991	-84.9	-11.89	49.68	
1992	-77.2	-10.82	75.11	
1993	-81.5	-11.85	42.86	
Composite weighted means 1990-1993	-78.6	-11.45		
Pajarito Mtn.				
1990	-73.5	-9.80	22.09	
1991	-66.4	-10.34	10.96	
1992	-85.1	-12.61	16.88	
1993	-87.7	-12.75	16.57	
Composite weighted means 1990-1993	-77.7	-11.21		
S Site				
1990	-75.3	-11.24	28.88	
1991	-76.7	-11.12	20.87	
1992	-70.1	-10.26	30.72	
1993	-82.7	-12.11	14.85	
Composite weighted means 1990-1993	-76.9	-11.26		
White Rock Y				
1990	-64.3	-7.81	77.64	
1991	-80.6	-11.07	25.93	
1992	-80.2	-11.48	31.54	
1993	-81.7	-11.73	22.86	
Composite weighted means 1990-1993	-74.5	-10.46		
Espanola Ranger Station				
1990	-70.5	-9.98	22.30	
1991	-74.2	-9.71	16.26	
1992	-83.6	-11.65	14.09	
1993	-76.4	-10.86	11.29	
Composite weighted means 1990-1993	-76.8	-10.59		
Boundary Peak Area				
1990	-84.1	-9.15	13.61	2 collections in 1990
1991	-69.2	-8.38	15.91	1 collection in 1991
1992	-63.3	-9.26	23.00	1 collection in 1992
1993	-88.1	-12.93	12.97	Last collection of 93 was collected 2/94
Composite weighted means 1990-1993	-77.9	-10.19		

	Del D	Del 180	Tritium	Comments
West of Guaje Mtn.				
1990	-63.9	-9.82	33.23	2 collections in 1990
1991	-75.8	-10.90	32.36	
1992	-85.4	-12.56	57.72	
1993	-74.5	-10.39	29.01	
Composite weighted means 1990-1993	-74.9	-11.01		
Santa Fe Ski Basin				
1990	-64.1	-9.69	11.82	2 collections in 1990
1991	-87.1	11.79	11.50	
1992	-85.6	-13.21	10.82	
1993	-84.6	-12.05	9.93	
Composite weighted means 1990-1993	-83.2	-12.35		
VC-2B Sulphur Springs				
1990	-66.1	-9.48	7.05	2 collections in 1992
1991	-87.4	-12.44	9.77	
1992	-109.1	-15.69	7.67	
1993	-82.1	-9.76	7.31	
Composite weighted means 1990-1993	-87.7	-12.85		
Tech Area 49				
1990	-55.9	-7.62	29.46	2 collections in 1990
1991	-77.1	-10.85	21.57	
1992	-67.1	-9.84	34.66	2 collections in 1993
1993	-86.9	-12.74	19.38	
Composite weighted means 1990-1993	-74.0	-10.59		
Tech Area 51				
1990	-61.9	-9.42	53.51	2 collections in 1990
1991	-78.9	-11.02	29.69	
1992	-68.8	-10.22	46.56	
1993	-82.2	-11.87	25.40	
Composite weighted means 1990-1993	-75.3	-11.03		
K.M. House				
1991	-72.9	-10.81	32.60	2 collections in 1991
1992	-76.4	-10.85	78.30	
1993	-75.5	-10.91	30.70	
Composite weighted means 1991-1993	-74.8	-10.82		

is releasing tritium to the atmosphere. This anomalous tritium is being added to background levels of tritium present in the atmosphere and the combined tritium is precipitated locally. The dimensions and magnitude of the tritium anomaly are apparently decreasing with time. Fortunately, the amount of tritium in regional precipitation is very low when compared to the EPA threshold value of drinking water (about 6200 T.U.).

ACKNOWLEDGMENTS

The authors gratefully appreciate the encouragement and support of Micheline Devaurs, David Broxton, and Jamie Gardner (Los Alamos National Laboratory) who helped get this project off the ground and kept it alive. Many thanks to Kim Manley (Los Alamos), John Corbin (Sulphur Springs), and authorities at Santa Fe ski basin, Santa Fe airport, Pajarito Mountain ski hill, and Española ranger station for protecting our precipitation collectors during the investigation. The draft manuscript was reviewed by James A. Stimac (Los Alamos National Laboratory). Financial support came primarily from the Environmental Restoration Program of Los Alamos National Laboratory.

REFERENCES

- Adams, A.I., and Goff, F., 1991, "A Regional Study of Stable Isotopes and Tritium in Precipitation in the Los Alamos Region of New Mexico," *Geol. Soc. Amer., Abs. w/Programs*, v. 23(5), p. 115.
- Adams, A.I., and Goff, F., 1994, "Environmental Surveillance at Los Alamos during 1992," Los Alamos National Laboratory Rept. LA-12764-ENV, p. IV83 - IV86.
- Blake, W.D., Goff, F., Adams, A.I., and Counce D., in press, "Environmental Geochemistry for Surface and Subsurface Waters in the Pajarito Plateau and Outlying Areas, New Mexico," Los Alamos National Laboratory Rept., MS-series.
- Craig, H., 1961, "Isotopic Variations in Meteoric Waters," *Science*, v. 133, p. 1702-1703.
- Drever, J.I., 1982, "The Geochemistry of Natural Waters," Prentice Hall, Inc., N.J., 388 pp.
- Goff, F. and Sayer, S., 1980, "A Geothermal Investigation of Spring and Well Waters of the Los Alamos Region, New Mexico," Los Alamos Scientific Laboratory Rept. LA-8326-MS, 21 pp.
- Goff, F., Gardner, J.N., Vidale, R., and Charles, R., 1985, "Geochemistry and Isotopes of Fluids from Sulphur Springs, Valles Caldera, New Mexico," *Jour. Volcanol. Geotherm. Res.*, v. 23, p. 273-297.
- Hoefs, J., 1973, "Stable Isotope Geochemistry," Springer-Verlag, N.Y., 140 pp.
- Junge, C.E., and Werby, R.T., 1958, "The Concentration of Chloride, Sodium, Potassium, Calcium, and Sulfate in Rain Water over the United States," *Jour. Meteorol.*, v. 15, p. 417-425.
- Shevenell, L., Goff, F., Vuataz, F., Trujillo, P.E., Counce, D., Janik, C.J., and Evans, W., 1987, "Hydrogeochemical Data for Thermal and Nonthermal Waters and Gases of the Valles Caldera-Southern Jemez Mountains Region, New Mexico," Los Alamos National Laboratory Rept. LA-10923-OBES, 100 pp.
- Shevenell, L., and Goff, F., in press, "The Use of Tritium in Groundwater to Determine Fluid Mean Residence Times of Valles Caldera Hydrothermal Fluids, New Mexico, USA," *Jour. Volcanol. Geotherm. Res.*
- Trainer, F.W., 1974, "Ground-water in the Southern Part of the Jemez Mountains Volcanic Region, New Mexico," *New Mexico Geol. Soc. Guidebook*, 25th Field Conf., p. 337-345.
- Trujillo, P.E., Counce, D., Grigsby, C.O., Goff, F., and Shevenell, L., 1987, "Chemical Analysis and Sampling Techniques for Geothermal Fluids and Gases at the Fenton Hill Laboratory," Los Alamos National Laboratory Rept. LA-11006-MS, 84 pp.
- White, A.F., Peterson, M.L., Wollenberg, H., and Flexser, S., 1990, "Sources and Fractionation Processes Influencing the Isotopic Distribution of H, O, and C in the Long Valley Hydrothermal System, California, U.S.A.," *Applied Geochem.*, v. 5, p. 571-585.
- Vuataz, F.-D., and Goff, F., 1986, "Isotope Geochemistry of Thermal and Nonthermal Waters in the Valles Caldera, Jemez Mountains, Northern New Mexico," *Jour. Geophys. Res.*, v. 91(B2), p. 1835-1853.