Oscar Experiment High-Density Network Data Report

Event 1 April 8-9, 1981

M. T. Dana

R. C. Easter

J. M. Thorp

December 1984

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Pacific Northwest Laboratory
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PREFACE

This report is one of a series of four reports that summarize data taken by Pacific Northwest Laboratory at the high-density network component of the Oxidation and Scavenging Characteristics of April Rains (OSCAR) experiment in April 1981. Four storm events were studied during the experiment, and a separate report has been prepared for each event:

- PNL-5152, Pt. 1. Event 1 - April 8-9, 1981
- PNL-5152, Pt. 2. Event 2 - April 13, 1981
- PNL-5152, Pt. 3. Event 3 - April 16-17, 1981
- PNL-5152, Pt. 4. Event 4 - April 21-23, 1981

The OSCAR experiment was a cooperative project, and reports from other participants are noted in the introduction.

SUMMARY

The OSCAR (Oxidation and Scavenging Characteristics of April Rains) experiment, conducted during April 1981, was a cooperative field investigation of wet removal in cyclonic storm systems. The high-density component of OSCAR was located in northeast Indiana and included sequential precipitation chemistry measurements on a 100 by 100 km network, as well as airborne air chemistry and cloud chemistry measurements, surface air chemistry measurements, and supporting meteorological measurements.

Four separate storm events were studied during the experiment. This report summarizes data taken by Pacific Northwest Laboratory (PNL) during the first storm event, April 8-9. The report contains the high-density network precipitation chemistry data, air chemistry data from the PNL aircraft, and meteorological data for the event, including standard National Weather Service products and radar data from the network.

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1.0 INTRODUCTION

The Oxidation and Scavenging Characteristics of April Rains (OSCAR) experiment, conducted during April 1981, was a cooperative field investigation of wet removal by cyclonic storms. The design and operational aspects of the experiment have been described in detail in an earlier report⁽¹⁾, and a brief summary is given below. This report is one of a series of four volumes that present data collected at the high-density network during each of the four OSCAR storm events. This particular report covers the April 8-9, 1981, storm event.

The report is divided into three sections: meteorological data, precipitation chemistry data, and aircraft data. It should be noted that the report is limited in scope to data collected by Pacific Northwest Laboratory (PNL) participants in the experiment. Other relevant data collected at the high density network are being/have been reported elsewhere and include: Brookhaven National Laboratory (BNL) surface air chemistry and aircraft data,^(a) Argonne National Laboratory (ANL) aerosol data,⁽²⁾ and hydrogen-peroxide measurements made by G. Kok.⁽³⁾

The primary design requirement for OSCAR was to characterize, in as much detail as possible, the physicochemical and dynamical features of selected cyclonic (or "frontal") storm systems as they traversed the eastern portion of the North American continent. The formal objectives of the study were:

- To assess spatial and temporal variability of precipitation chemistry in cyclonic storm systems and to test the adequacy of existing networks to characterize this variability
- To provide a comprehensive, high-resolution data base for prognostic, regional deposition model development
- To develop increased understanding of the transport, dynamical, and physicochemical mechanisms that combine to make up the composite

(a) Benkovitz, C. M. et al. Oxidation and Scavenging Characteristics of April Rains Data Report. Report in preparation by Atmospheric Sciences Division of Brookhaven National Laboratory, Upton, Long Island, New York for U.S. Environmental Protection Agency.

wet-removal process, and to identify source areas responsible for deposition at receptor sites.

The OSCAR field experiment was designed to maximize the attainment of these goals, within the practical and financial limitations imposed. Two complementary, sequentially operated precipitation chemistry networks formed the foundation of the experiment. Spatial and temporal resolution were the primary factors considered in network design. A nested high-density and intermediate-density network design was chosen to allow both regional coverage over the MAP3S/RAINE geographical region, and intensive measurements over a limited area to resolve wet-removal mechanisms in cyclonic storms. The networks are depicted schematically in Figures 1.1 and 1.2. The high-density network consisted of 47 stations in a 110 by 110 km area in northeast Indiana/northwest Ohio.

Additional measurements in support of the two networks characterized surface and aloft air chemistry, cloud chemistry, and meteorological variables. The April operational period for OSCAR was chosen so that most precipitation would be rain rather than snow and the storm systems would still be more cyclonic rather than convective in nature.

FIGURE 1.1. OSCAR Intermediate-Density Sampling Station and High-Density Network Position

FIGURE 1.2. Organization of the OSCAR High-Density Precipitation Chemistry Network. Numbers Indicate Sampling Site Locations. Site 62 Coincided With the Surface Air Chemistry Site. The Weather Radar and Rawinsonde Were Located at FWA (Fort Wayne Airport).

2.0 METEOROLOGICAL DATA

This section describes the synoptic weather events that occurred during the April 8-9 storm, with particular emphasis on weather in the high-density network area. Data utilized during the analyses and interpretations include standard National Weather Service (NWS) products and data collected as part of the high-density network experiment. Surface weather charts are shown for intervals of 12, 6, or 3 hours, depending on the proximity of the storm activity to the high-density network (Figures 2.1 through 2.14). Positions of the frontal system at 6-hour intervals are shown as the front traversed the networks and moved out to sea (Figures 2.15 and 2.16). Constant level charts for 850 mb and 700 mb at 12-hour intervals show winds and temperatures at those levels for times preceding and during the sampling operations at the high-density network (Figures 2.17 through 2.21). Photographs from the NWS weather radar at Fort Wayne airport (FWA) during the period of sampling at the high-density network show the progression of precipitation echoes as they crossed the network (Figures 2.23 through 2.25). Plots of hourly precipitation amounts and the total precipitation for each of the high-density network sites are shown for the April 9 rain period (Figures 2.26 through 2.29). Trajectory charts for 24 and 27 hours back in time are drawn to show estimated prefrontal and postfrontal source regions for air parcels transported at 305 m (1000 ft) above ground level (AGL) and at 850 mb (Figures 2.30 and 2.31).

High pressure had dominated the eastern states on April 5 and 6 following a cold front which had traversed the region. The Event 1 storm was expected to be another cold front situation, but was selected for sampling because no warm frontal system had yet occurred over the network areas. Previous low-pressure centers had been following a track across southern Canada, with only cold fronts extending southward into the network area.

At 1200 Greenwich mean time (GMT) on April 7 (Figure 2.1), a deep low-pressure center was located in central Manitoba. A cold front extended through western Lake Superior across southern Minnesota and southwestward. The cold front was forecast to move eastward across the network and the decision was made to sample the event. Figures 2.2 and 2.3 for 0000 and 0600 GMT April 8

show the movement of the cold front and the associated precipitation area as they slowly approached the northwestern sites of the intermediate-density network.

By 1200 GMT, April 8 (Figure 2.4), the cold front extended across Georgian Bay, central lower Michigan, southern Wisconsin and central Iowa to a weak low center in east central Kansas. Scattered showers and thundershowers occurred along the front from Michigan southwestward, but no precipitation reached the westernmost stations (01, 02, and 50) of the intermediate-density network until early afternoon (local time). The FWA radar indicated showers in the vicinity of FWA most of the day, but very few crossed the high-density network. The photographs of the radar echoes surrounding FWA (Figures 2.23 and 2.24) show the transitory character of the precipitation cells as they approached from the southwest. Many of the cells dissipated before reaching the high-density network. Figure 2.22 shows the boundaries of the high-density network in relation to the 230-km range setting of the FWA radar. The precipitation chemistry collectors were activated on the high-density network between 1500 and 2100 GMT, April 8. The BNL aircraft and the two PNL aircraft sampled over the high-density network between 1500 and 1930 GMT, April 8.

At 1500 GMT on the 8th (Figure 2.5), reports from stations in Wisconsin, Michigan and northern Illinois indicated a rather large area of rain and thunderstorms, but very few of these same stations reported rain 3 hours later at 1800 GMT (Figure 2.6). By 2100 GMT, however, most stations in the vicinity of the front northwest of FWA were again experiencing precipitation (Figure 2.7). The FWA radar showed a narrow line of precipitation crossing the northern boundary of the high-density network between 1946 and 2345 GMT (Figure 2.25), but no precipitation from these cells was recorded at the network sites.

At 0000 GMT, April 9 (Figure 2.8), the cold front had reached southern Michigan, northern Illinois and central Missouri. Precipitation was occurring ahead of the front in Michigan, and a line of showers and thundershowers to the rear of the front reached from northern Lake Michigan to southwest Missouri. Showers and thundershowers continued in the frontal zone throughout the night (local time). Figures 2.9 and 2.10 show the frontal positions and accompanying

shower and thundershower areas at 0300 and 0600 GMT. This area of precipitation reached the northwest corner of the high-density network about 0500 GMT (Figure 2.27) and traversed the network during the next few hours. The cold front reached FWA at about 0900 GMT April 9 (Figure 2.11), and by 1000 GMT precipitation had ended at all but the southeastern high-density network sites (Figure 2.29). Figure 2.26 shows the total precipitation amounts recorded at each of the high-density network sites. The southwest corner of the network received more than 25 mm of precipitation, most of which fell between 0700 and 0800 GMT, April 9, just before passage of the cold front.

As the front approached the Appalachian Mountains, the area of accompanying precipitation increased, and by 1200 GMT April 9 (Figure 2.12), rain covered a broad band from eastern New York to northern Tennessee. High pressure from the west was advancing rapidly over Illinois and Indiana behind the front at 1500 GMT (Figure 2.13). By 1800 GMT (Figure 2.14), the cold front reached from central New York, through western Pennsylvania and central Kentucky to a wave in the Texas panhandle. Showers were occurring in Vermont, western New York and Pennsylvania, and southward into Virginia, Tennessee and North Carolina. The Brookhaven (BNL) aircraft sampled over New Jersey between 1700 and 1900 GMT, April 9 in support of the intermediate-density network.

Figure 2.15 shows successive 12 or 6 hourly positions of the front from 1200 GMT April 8 to 1800 GMT April 9 as it moved across the western portion of the intermediate network and beyond the high-density network. By 0000 GMT April 10 (Figure 2.16), it extended from southwest Maine to central Virginia, then westward near the Kentucky-Tennessee border to the Oklahoma panhandle. Showers had reached the eastern stations of the intermediate-density network between New Hampshire and Virginia by this time, but precipitation was spotty in southern portions of the network. By 0600 GMT, April 10, the front had moved well off the East Coast and precipitation had ceased over the intermediate sampling network. The high pressure cell was centered over Indiana and Ohio and moving eastward.

The wind flow and temperature gradient patterns at 850 mb are shown for 1200 GMT, April 8 in Figure 2.17. Strong southwesterly winds were present at this level in advance of a prominent upper trough that was over the western

edge of the intermediate-density network. Warm air advection was occurring at 850 mb, but no FWA rawinsonde data are available for this event, so the thickness of the advancing warm layer is not known. The 700-mb chart for 1200 GMT was not available.

By 0000 GMT, April 9 (Figure 2.18), the 10°C isotherm at 850 mb had advanced from a position over Illinois and Mississippi to New England in 12 hours. The trough at 850 mb had continued to provide strength to the surface front as they moved eastward together. The trough was less sharp at 700 mb, as shown in Figure 2.19, and was situated a little farther to the west. Winds were occurring over the FWA area at this level also.

By 1200 GMT on the 9th (Figure 2.20) the 850-mb chart shows the trough directly over Indiana, and colder air was advancing from the west in the flow behind the trough. Winds at 700 mb had also shifted to the west over the western half of the networks (Figure 2.21).

To obtain a first impression of air-mass trajectories, 24- and 27-hour back trajectories at 305 m (1000 ft) AGL and at 850 mb were calculated and are shown in Figures 2.30 and 2.31. These are presented to give an indication of the prefrontal and postfrontal inflow into the high-density network area. The winds used in calculating the trajectories were from NWS rawinsonde data, without estimates of vertical velocities. Considering the strong southwesterly flow in the prefrontal air, neglecting vertical motion effects in those cases may be not too serious since the boundary layer was probably well mixed. Wind flow maps were constructed for each observation time. Wind speed and direction were vector averaged over intervals of half the map time interval to gain a first estimate of the movement of the air parcel back in time.

Two 27-hour back trajectories for 305 m (1000 ft) AGL were constructed to locate probable source regions for the air parcels that arrived at FWA at 1200 GMT on April 8 and at 0000 GMT, April 9 (Figure 2.30). These trajectories showed that a region in east Texas was a likely source area for the two prefrontal air parcel trajectories. Low-level wind speeds had decreased in the cool high pressure area to the rear of the front. The 305-m back trajectory in this air mass that had spread over the FWA area shows a somewhat meandering

start in northeast Wisconsin at 0900 GMT, April 8. The route became more consistent during the 12 hours preceding arrival of the air parcels in the FWA area at 1200 GMT on April 9. A trajectory model that incorporates effects of vertical motions might have produced a different trajectory in this situation.

The 24-hour back trajectories in prefrontal conditions at 850 mb also show central Texas as being the most likely source of air parcels that arrived over FWA 24 hours later (Figure 2.31). Wind speeds at 850 mb in the air following the front had also decreased from the strong southwesterly winds observed in the prefrontal flow. The 24-hour back trajectory at 850 mb, ending at 1200 GMT on April 9 over FWA, indicated a probable air parcel source region over Iowa.

FIGURE 2.1. Synoptic Weather Map for 1200 GMT, April 7, 1981

FIGURE 2.2. Synoptic Weather Map for 0000 GMT, April 8, 1981

FIGURE 2.3. Synoptic Weather Map for 0600 GMT, April 8, 1981

FIGURE 2.4. Synoptic Weather Map for 1200 GMT, April 8, 1981

FIGURE 2.5. Synoptic Weather Map for 1500 GMT, April 8, 1981

FIGURE 2.6. Synoptic Weather Map for 1800 GMT, April 8, 1981

FIGURE 2.7. Synoptic Weather Map for 2100 GMT, April 8, 1981

FIGURE 2.8. Synoptic Weather Map for 0000 GMT, April 9, 1981

FIGURE 2.9. Synoptic Weather Map for 0300 GMT, April 9, 1981

FIGURE 2.10. Synoptic Weather Map for 0600 GMT, April 9, 1981

FIGURE 2.11. Synoptic Weather Map for 0900 GMT, April 9, 1981

FIGURE 2.12. Synoptic Weather Map for 1200 GMT, April 9, 1981

FIGURE 2.13. Synoptic Weather Map for 1500 GMT, April 9, 1981

FIGURE 2.14. Synoptic Weather Map for 1800 GMT, April 9, 1981

FIGURE 2.15. Time Series of Superimposed Frontal Positions for the Period 1200 GMT, April 18, to 1800 GMT, April 9, 1981

FIGURE 2.16. Time Series of Superimposed Frontal Positions for the Period 0000-0600 GMT, April 10, 1981

FIGURE 2.17. 850-millibar Chart for 1200 GMT, April 8, 1981

FIGURE 2.18. 850-millibar Chart for 0000 GMT, April 9, 1981

FIGURE 2.19. 700-millibar Chart for 0000 GMT, April 9, 1981

FIGURE 2.20. 850-millibar Chart for 1200 GMT, April 9, 1981

FIGURE 2.21. 700-millibar Chart for 1200 GMT, April 9, 1981

FIGURE 2.22. High-Density Network Boundary and the 230-km Range (50-km range marks) of the Fort Wayne, Indiana, Weather Radar

FT. WAYNE WEATHER RADAR - OSCAR EVENT 1, APRIL 1981

8/1352 Z

8/1430 Z

8/1525 Z

8/1545 Z

8/1610 Z

8/1630 Z

FIGURE 2.23. Fort Wayne Radar Echoes of Precipitation. 1352 to 1630 GMT, April 8, 1981.

FT. WAYNE WEATHER RADAR - OSCAR EVENT 1, APRIL 1981

8/1707 Z

8/1743 Z

8/1815 Z

8/1829 Z

8/1900 Z

8/1930 Z

FIGURE 2.24. Fort Wayne Radar Echoes of Precipitation. 1707 to 1930 GMT, April 8, 1981.

FT. WAYNE WEATHER RADAR - OSCAR EVENT 1, APRIL 1981

8/1946 Z

8/2216 Z

8/2230 Z

8/2247 Z

8/2300 Z

8/2345 Z

FIGURE 2.25. Fort Wayne Radar Echoes of Precipitation. 1946 to 2345 GMT, April 8, 1981.

FIGURE 2.26. Precipitation over the High-Density Network from 0500 GMT to 1000 GMT, April 9, 1981. Right Side Shows Precipitation Amounts (mm) at Each Network Site ("x" indicates missing data). Left Side Shows Contours of the Data (contour levels every 5 mm).

FIGURE 2.27. Hourly Precipitation Amounts (mm) Over the High-Density Network for 0500-0600 (left) and 0600-0700 GMT (right), April 9. "-" Indicates No Precipitation, and "x" Indicates Missing Data.

FIGURE 2.28. Hourly Precipitation Amounts (mm) Over the High-Density Network for 0700-0800 (left) and 0800-0900 GMT (right), April 9. "-" Indicates No Precipitation, "T" Indicates Trace Amount, and "x" Indicates Missing Data.

FIGURE 2.29. Hourly Precipitation Amounts (mm) Over the High-Density Network for 0900-1000 GMT, April 9. "-" Indicates No Precipitation, "T" Indicates Trace Amount, and "x" Indicates Missing Data.

FIGURE 2.30. Composite of Three 27-hour Back Trajectories from Fort Wayne at 305 m (1000 ft) AGL, April 7-8, 1981

FIGURE 2.31. Composite of Three 24-hour Back Trajectories from Fort Wayne at 850 millibars, April 7-8, 1981

3.0 PRECIPITATION CHEMISTRY DATA

Precipitation samples for chemical analysis were collected at the 47 sites of the OSCAR intensive network as shown in Figure 1.2. Each site was outfitted with a standard weighing rain gauge and an automatic sequential bulk collector (ASBC). Details on collector design and construction and of sampling and handling procedures may be found in the overview report.⁽¹⁾ The ASBC consisted of a 1000 cm² funnel, tubing, and a box containing a manifold of nine collector bottles, or stages. As precipitation occurred, the stages filled in sequence, and, except for the last stage (which was allowed to overflow if necessary), were sealed by hollow floating balls. The first eight stages each contained 67 ml of sample, or about 0.7 mm of precipitation. The ninth stage was much larger (1130 ml), giving a total rainfall capacity of 16.7 mm. All sample contact surfaces in the collector were polyethylene or polystyrene.

Since the ASBC funnels were not automatically exposed, the collectors were deployed as close as possible to the predicted onset of precipitation so as to minimize dry deposition. In the case of event 1, the preraingfall exposure time averaged 13 hours. The unsatisfactorily long exposure time resulted from precipitation beginning much later than expected. As noted in Section 2, showers occurred just west of the network on the afternoon of April 8, but rain did not begin over the network until early morning of April 9.

Soon after the event, the collectors were returned to the central staging area and the stages separated, identified, sealed, and stored at refrigerator temperature. The samples were shipped by air freight to the PNL precipitation chemistry laboratory for chemical analysis. The event 1 samples arrived at the laboratory within a few days of the storm.

Complete location, rainfall, and chemical analysis results for each site are listed in Appendix A. An examination of the chemical stability of the samples during the period of analysis is presented in the data report for event 4.⁽⁴⁾ The following subsections describe the chemical and rainfall results graphically and statistically.

INDIVIDUAL SITE DATA

Figures 3.1 through 3.3 show, for all sites, concentrations of the major ionic species [sulfur, H^+ (from pH), NO_3^- , NH_4^+ , Ca^{++}] and rainfall rate versus stage number. Selected sites' samples contained significant concentrations of sulfur-IV (dissolved SO_2); therefore, "sulfur" or "S" refers to the sum of sulfur-IV and sulfur-VI (sulfate), which is analyzed as sulfate since all sulfur-IV had oxidized by the time of sulfate analysis. Each figure shows results from sites in each north-south "column" of sites (see Figure 1.2). The rainfall rates are stage averages, using stage start and end times derived from the stage volumes and rain gauge chart records.

Figures 3.4 through 3.6 show the same concentration and rainfall data, but plotted versus time (on April 9, 1981). The concentrations are still stage averages, but now the horizontal lengths of the segments reflect the actual time taken for the stages to fill. The rainfall rates here are not stage averages, but are real-time rates determined from rain gauge chart records. Thus, the time segments of the rainfall rate curves (plotted within Figures 3.5a-g) do not necessarily coincide with those of the concentrations.

It should be noted that data for at least one species and stage were rejected from 18 of the 47 network sites. The primary reason for removal from the data base was presence of visible contaminating matter, no doubt from dry deposition during the 13-hour pre-precipitation period.

These two groups of figures show the trends of chemistry and rainfall through the course of the event, but in slightly different ways. The stage plots show changes with increasing rainfall amount in constant increments (up to stage 9), while the time plots demonstrate time and rainfall rate trends and the time span of precipitation for each site.

As with the other OSCAR events, the concentrations of the major species vary considerably at the start of the event. This (in addition to the visible contamination noted above) is a strong indication that some of the sites were affected by local sources of scavenged or dry-deposited material, particularly Ca^{++} and NH_4^+ . It is not surprising to find this effect in the highly

agriculture-oriented region, in a season when many fields were bare. Furthermore, event 1 followed a period of dry and unseasonably warm weather. Blowing dust and organic decay products could easily account for the increased Ca^{++} and NH_4^+ at certain sites. Since these species contribute to neutralization of acid solutions, this contamination may also account for the considerable spatial variability observed in stage 1 free H^+ concentrations. These conditions, which with few exceptions affect the stage 1 chemistry only, are apparent in many of the following data displays.

Although the stage 1 acidity and NH_4^+ show much variation, this is not apparent for sulfate and nitrate, implying that these strong acid anions did not result from local source deposition.

SPATIALLY AVERAGED DATA

Figures 3.7 through 3.9 show volume-weighted concentrations for the stages, averaged over all the active sites. These concentrations, C_j , were calculated using

$$C_j = \frac{\sum_i c_{ji} v_{ji}}{\sum_i v_{ji}} \quad (3.1)$$

where i = site number

j = stage number

c_{ji} = corresponding species concentrations

v_{ji} = stage rain volumes.

The weighted averages, incidentally, are the same as the arithmetic averages for all stages except the "last" stage (frequently the ninth) since all the volumes are the same.

Figures 3.10 through 3.12 are corresponding plots showing spatially averaged major ion concentrations and precipitation rate versus time. The averages are calculated using

$$c(t)' = \frac{\sum_i \bar{c}_i(t') \bar{r}_i(t')}{\sum_i \bar{r}_i(t')} \quad (3.2)$$

where

$\bar{c}_i(t')$ = concentration of the species at site i and time t'

$\bar{r}_i(t')$ = precipitation rate at site i and time t'

The overbar indicates that 0.05-hour time averages of the $\bar{c}_i$ and $\bar{r}_i$ were used in the calculations. The time t' used in the averaging is time from the onset of precipitation at each site.

Several general features, apparent when considering individual sites, become clearer when spatial averages are computed. The relationships among the species concentrations are relatively steady with time, except at the beginning of the event for sulfur, nitrates and calcium. In particular, apparent neutralization by calcium (and to some extent ammonium, although this isn't apparent when spatially averaged) at the beginning prevented the hydrogen ion values from reflecting the substantial strong acid components. The stage- and time-averaged plots for rainfall rate are quite different in appearance. This is a real effect resulting from the considerable variation in rainfall rate spatially and temporally and the methods used for calculation (Equations 3.1 and 3.2).

Figures 3.13 through 3.15 show ratios of selected species for site-composite stages. Of particular note--as with Event 4--is the general increase of the sulfate/nitrate ratio with time, although the most pronounced change occurred between stages 1 and 2.

Simple statistics for single stages and all stages combined are listed in Table 3.1. The number of sites, N , is less than 47 for the single-stage statistics and less than 423 for the combined statistics because of missing values for certain species (see Appendix A for reasons for missing values), and because numerous sites had less than 9 stages of rainfall (see Figure 3.1). Listed are minima, maxima, arithmetic means and standard deviations and geometric means and standard deviations for concentrations. Stages 3 through 8

TABLE 3.1. OSCAR High-Density Network Event 1 Statistics for Single Stages and All Stages Combined. Units Are: $\mu\text{mho/cm}$ for conductivity; $\mu\text{eq/l}$ for H^+ , anion sum, and cation sum; $\mu\text{mol/l}$ for all other species.

Species	Stage	N	Min	Max	Arithmetic		Geometric	
					Mean	S.D.	Mean	S.D.
SO_2	1	5	0.1	1.9	0.8	0.7	0.6	2.6
	2	3	1.6	2.4	2.1	0.5	2.0	1.2
	9	4	0.3	3.2	1.5	1.4	1.0	2.7
	ALL	29	0.1	4.2	1.6	1.1	1.2	2.3
SO_4^-	1	29	26.0	190.0	75.5	38.7	67.7	1.6
	2	40	18.0	70.0	40.3	13.3	38.0	1.4
	9	21	6.1	36.0	19.4	8.5	17.6	1.6
	ALL	309	6.1	190.0	33.5	21.8	28.7	1.7
NO_3^-	1	29	45.0	300.0	125.9	55.6	115.2	1.5
	2	40	16.0	94.0	41.6	19.0	37.8	1.6
	9	21	3.8	27.0	13.0	6.9	11.3	1.7
	ALL	309	3.8	300.0	34.5	37.1	24.1	2.3
Cl^-	1	26	22.0	98.0	40.7	19.1	37.6	1.4
	2	40	6.6	35.0	16.8	7.5	15.1	1.6
	9	21	1.0	15.0	5.1	3.8	4.0	2.0
	ALL	306	1.0	98.0	12.0	11.9	8.6	2.2
Anion Sum	1	26	123.0	778.0	307.7	141.3	283.0	1.5
	2	40	59.6	238.0	138.9	50.0	129.7	1.5
	9	21	19.4	109.0	57.0	26.8	51.0	1.6
	ALL	306	19.4	778.0	111.3	85.0	90.7	1.9
Conductivity	1	29	19.0	97.0	48.4	20.4	44.8	1.5
	2	40	11.0	43.0	23.9	8.0	22.5	1.4
	9	20	7.0	25.0	15.4	5.5	14.4	1.4
	ALL	302	6.5	97.0	22.8	12.6	20.3	1.6
H^+	1	29	0.2	58.9	21.3	15.1	13.3	3.7
	2	40	0.3	44.7	17.5	11.5	12.4	2.8
	9	20	14.8	41.7	26.2	8.0	25.1	1.3
	ALL	303	0.2	58.9	25.4	11.3	21.5	2.1
NH_4^+	1	29	0.3	90.0	27.0	26.5	13.4	4.4
	2	40	1.6	83.0	32.3	20.3	24.2	2.5
	9	21	1.7	42.0	19.0	13.2	14.0	2.4
	ALL	308	0.39	8.0	28.1	21.5	18.3	3.1
Na^+	1	29	23.0	110.0	50.3	23.9	45.8	1.5
	2	40	4.9	41.0	17.6	8.9	15.2	1.8
	9	21	0.7	7.9	2.9	2.1	2.2	2.1
	ALL	308	0.6	110.0	12.6	16.3	7.0	2.9
Ca^{++}	1	29	25.0	150.0	64.8	25.8	60.2	1.5
	2	40	7.7	52.0	21.9	9.4	20.1	1.5
	9	20	1.1	5.8	2.4	1.3	2.2	1.6
	ALL	305	0.5	150.0	14.2	19.6	8.0	2.7
Mg^{++}	1	29	6.1	61.0	25.5	12.2	22.6	1.7
	2	40	1.9	20.0	8.4	4.4	7.5	1.7
	9	20	0.2	2.7	1.0	0.7	0.8	2.2
	ALL	305	0.2	61.0	5.6	8.2	3.0	3.0
87								
Cation Sum	1	29	110.6	534.0	284.2	104.1	267.1	1.4
	2	40	52.7	235.7	129.1	47.6	120.3	1.5
	9	20	22.2	99.5	55.5	24.3	50.3	1.6
	ALL	300	20.9	534.0	106.8	76.8	88.1	1.8

are not listed because the results for these stages follow the general trends shown by the preceding figures, and the statistical variability exhibited by stage 2. The stage 1 statistics should be greatly impacted by the rejection of a number of sites' data. The variances in the "ALL" row are large because the treatment of all the sites includes all the stages, rather than the composites of all the stages for each site. Hydrogen ion and NH_4^+ show considerable scatter in stage 1, while the strong acidic anions are as well behaved as in later stages. This event, unlike the others, shows quite high concentrations of sodium and chloride, particularly in stage 1. Since this event was the earliest of the series, road salt left over from the winter could be the cause.

There are very few data for sulfur-IV, since only selected sites' samples were analyzed. The presence of sulfur-IV indicates that significant SO_2 was in the air at ground level. However, the solubility of SO_2 decrease with increasing temperature and acidity, so the lack of sulfur-IV in other events may reflect these conditions more than the air concentration levels.

Similar statistical calculations were performed on the event average (volume-weighted mean of all stages) concentration data; the results of these are listed in Table 3.2. Since some (or all) stage concentrations from certain sites are missing for various reasons (see Appendix A), those sites whose event average for a species represents less than 80% of the total precipitation collected at the sites were not included in the summary statistics. The average fraction of the total precipitation represented by the averages for each species is listed as "chem coverage."

SCATTER PLOTS AND SPECIES CORRELATIONS

To demonstrate the relationships among species concentrations for individual observations, scatter plots are shown for the major species in Figures 3.16 through 3.19. Presented are plots for stage 1, stage 2, and all stages combined from all sites. Figures 3.20 through 3.23 are plots of weighted average concentrations (cf. eq. 3.1) for each stage including all sites. The stage numbers are shown as the data points exhibiting the trend of the relationships with accumulated rainfall during the event.

TABLE 3.2. OSCAR High-Density Network Event 1 Statistics for Site Event Data. Chem coverage is the fraction of the precipitation for which chemistry data for the corresponding species was available; sites with chem coverage less than 0.80 were not included in the statistics. N is the number of sites used for each species. Units are: mm for precipitation, $\mu\text{mho}/\text{cm}$ for conductivity; $\mu\text{eq}/\ell$ for H^+ , anion sum, and cation sum; $\mu\text{mol}/\ell$ for other species.

Species	N	Min	Max	Arithmetic		Geometric		Chem Coverage	
				Mean	S.D.	Mean	S.D.	Mean	S.D.
Precip.	40	2.8	22.4	9.5	4.7	8.3	1.7		
Conduc.	37	12.3	40.8	22.2	5.9	21.4	1.3	0.96	0.07
SO_4^{--}	38	15.4	64.3	32.4	10.8	30.9	1.4	0.96	0.07
NO_3^-	38	16.7	60.2	32.9	11.7	30.8	1.4	0.96	0.07
Cl^-	37	4.7	26.3	11.5	4.6	10.6	1.5	0.95	0.09
An. Sum	37	56.3	190.7	104.5	30.3	100.5	1.3	0.95	0.09
H^+	37	11.6	37.3	25.2	5.9	24.4	1.3	0.96	0.07
NH_4^+	38	4.7	54.7	26.5	13.3	23.0	1.8	0.96	0.07
Na^+	38	3.1	39.2	12.9	8.5	10.7	1.8	0.96	0.07
Ca^{++}	38	4.0	34.4	13.9	7.4	11.9	1.7	0.96	0.07
Mg^{++}	38	1.2	13.1	5.2	2.8	4.5	1.8	0.96	0.07
Cat. Sum	37	52.7	191.4	101.8	32.1	96.8	1.3	0.95	0.08

The scatter is quite large for stage 1 for the species pairs which include H^+ and NH_4^+ , and, unlike Event 4, it does not decrease greatly after stage 1. Sulfate and nitrate, however, have strong positive correlations for all stages, possibly reflecting their common long-range sources. The site-composite plots for the stages include considerable smoothing of the variations over the sites, but nevertheless only the sulfur-nitrate relationship shows a strong correlation.

SPATIAL DISTRIBUTIONS

In this subsection, the precipitation chemistry data for the April 8-9 storm are examined for spatial patterns in the concentration and deposition. The location of the high-density network in northeastern Indiana was largely chosen because of the absence of strong pollutant sources on or near the net-

work, with the hope that wet deposition would be relatively uniform across the network. The figures of this subsection demonstrate that this was largely the case for this storm event.

Figures 3.24 through 3.28 show the spatial distributions of total sulfur, NO_3^- , H^+ , NH_4^+ , and Ca^{++} concentrations over the network for the entire storm event. The spatial distributions of event total deposition for the same five species are shown in Figures 3.29 through 3.33. Both sets of data show little if any organized patterns. The deposition figures reflect the total precipitation pattern somewhat (Figure 2.26), with higher deposition in the southwest corner of the network, and a band of lower deposition across the northern portion of the network.

Figures 3.34 through 3.38 shown the spatial distributions of the same five ions in the first collector stage. (Many sites show missing data as first stage data were rejected because of probable contamination by windblown material.) The sulfur data show a pattern of higher concentrations in the northwestern portion of the network; this pattern is visible in some of the other species, though much less pronounced.

The overall variability in the patterns is substantial. The geometric standard deviations for the major ions averages 1.5 (see Table 3.2). Besides possible variations in air chemistry over the network, the convective nature of the cold-frontal precipitation would be expected to contribute strongly to the spatial variability in wet deposition.

[Note: The contour lines shown in Figures 3.24 through 3.38 were drawn by a relatively unsophisticated contouring algorithm that utilized a simple $1/r^3$ weighting to interpolate between the sites. The contours have been presented simply to display any dominant spatial patterns in the data (or the lack of them) and are not intended to be a rigorous analysis of the spatial distributions of the data.]

FIGURE 3.1. Sulfate and H^+ (from pH) Versus Stage Number.
a) - g) Show Site Columns, North-South, as
Defined by Figure 1.2.

FIGURE 3.1a.

FIGURE 3.1b.

FIGURE 3.1c.

FIGURE 3.1d.

FIGURE 3.1e.

FIGURE 3.1f.

FIGURE 3.1g.

FIGURE 3.2. Precipitation Rate and Nitrate Versus Stage Number.
a) - g) Show Site Columns, North-South, as
Defined by Figure 1.2

FIGURE 3.2a.

FIGURE 3.2b.

FIGURE 3.2c.

FIGURE 3.2d.

FIGURE 3.2e.

FIGURE 3.2f.

FIGURE 3.2g.

FIGURE 3.3. Ammonium and Calcium Versus Stage Number.
a) - g) Show Site Columns, North-South,
as Defined by Figure 1.2

FIGURE 3.3a.

FIGURE 3.3b.

FIGURE 3.3c.

FIGURE 3.3d.

FIGURE 3.3e.

FIGURE 3.3f.

FIGURE 3.3g.

FIGURE 3.4. Sulfate and H^+ (from pH) Versus Time (April 9, 1981).
a) - g) Show Site Columns, North-South, as Defined
by Figure 1.2.

FIGURE 3.4a.

FIGURE 3.4b.

FIGURE 3.4c.

FIGURE 3.4d.

FIGURE 3.4e.

FIGURE 3.4f.

FIGURE 3.4g.

FIGURE 3.5. Precipitation Rate and Nitrate Versus Time (April 9, 1982).
a) - g) Show Site Columns, North-South, as Defined by
Figure 1.2.

FIGURE 3.5a.

FIGURE 3.5b.

FIGURE 3.5c.

FIGURE 3.5d.

FIGURE 3.5e.

FIGURE 3.5f.

FIGURE 3.5g.

FIGURE 3.6. Ammonium and Calcium Versus Time (April 9, 1981).
a) - g) Show Site Columns, North-South, as
Defined by Figure 1.2.

FIGURE 3.6a.

FIGURE 3.6b.

FIGURE 3.6c.

FIGURE 3.5d.

FIGURE 3.6e.

FIGURE 3.6f.

FIGURE 3.6g.

FIGURE 3.7. All-Site (Spatial) Volume-Weighted Average H^+ (from pH) and Sulfate Versus Stage Number

FIGURE 3.8. All-Site (Spatial) Volume-Weighted Average for Precipitation Rate and Nitrate Versus Stage Number

FIGURE 3.9. All-Site (Spatial) Volume-Weighted Average for Ammonium and Calcium Versus Stage Number

FIGURE 3.10. All-Site (Spatial) Volume-Weighted Average for H^+ (from (from pH) and Sulfate Versus Time (see Equation 3.2)

FIGURE 3.11. All-Site (Spatial) Volume-Weighted Average for Precipitation Rate and Nitrate Versus Time (see Equation 3.2)

FIGURE 3.12. All-Site (Spatial) Volume-Weighted Average for Ammonium and Calcium Versus Time (see Equation 3.2)

FIGURE 3.13. Sulfate/Ammonium Ratio Versus Stage Number.
Data from Figures 3.7 and 3.9.

FIGURE 3.14. Nitrate/Ammonium Ratio Versus Stage Number.
Data from Figures 3.8 and 3.9.

FIGURE 3.15. Sulfate/Nitrate Ratio Versus Stage Number.
Data from Figures 3.7 and 3.8.

FIGURE 3.16. Species-Pair Plots for Sulfate and H^+ (from pH)

FIGURE 3.16a.

FIGURE 3.16b.

FIGURE 3.15c.

FIGURE 3.17. Species-Pair Plots for Nitrate and Sulfate

FIGURE 3.17a.

FIGURE 3.17b.

FIGURE 3.17c.

FIGURE 3.18. Species-Pair Plots for Nitrate and H^+ (from pH)

FIGURE 3.18a.

FIGURE 3.18b.

FIGURE 3.18c.

FIGURE 3.19. Species-Pair Plots for Sulfate and Ammonium

FIGURE 3.19a.

FIGURE 3.19b.

FIGURE 3.19c.

FIGURE 3.20. Weighted Stage Averages for All Sites for Sulfate and H^+ (from pH). Data Points are Stage Numbers.

FIGURE 3.21. Weighted Stage Averages for All Sites for Nitrate and Sulfate. Data Points are Stage Numbers.

FIGURE 3.22. Weighted Stage Averages for All Sites for Nitrate and H^+ (from pH). Data Points are Stage Numbers.

FIGURE 3.23. Weighted Stage Averages for All Sites for Sulfate and Ammonium. Data Points are Stage Numbers.

FIGURE 3.24. Spatial Distribution of Event SO_4^{2-} Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol/l}$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = $15 \mu\text{mol/l}$).

FIGURE 3.25. Spatial Distribution of Event NO_3^- Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol/l}$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = $15 \mu\text{mol/l}$).

FIGURE 3.26. Spatial Distribution of Event H^+ Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol/l}$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = $10 \mu\text{mol/l}$).

FIGURE 3.27. Spatial Distribution of Event NH_4^+ Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol}/\ell$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = $15 \mu\text{mol}/\ell$).

FIGURE 3.28. Spatial Distribution of Event Ca^{++} Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol/l}$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = $10 \mu\text{mol/l}$).

FIGURE 3.29. Spatial Distribution of Event SO_4 Deposition Across the Network. Right-hand Side Shows Deposition in $\mu\text{mol}/\text{m}^2$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = 125 $\mu\text{mol}/\text{m}^2$).

FIGURE 3.30. Spatial Distribution of Event NO_3^- Deposition Across the Network. Right-hand Side Shows Deposition in $\mu\text{mol/m}^2$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = $125 \mu\text{mol/m}^2$).

FIGURE 3.31. Spatial Distribution of Event H^+ Deposition Across the Network. Right-hand Side Shows Deposition in $\mu\text{mol}/\text{m}^2$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = 125 $\mu\text{mol}/\text{m}^2$).

FIGURE 3.32. Spatial Distribution of Event NH_4^+ Deposition Across the Network. Right-hand Side Shows Deposition in $\mu\text{mol}/\text{m}^2$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = $125 \mu\text{mol}/\text{m}^2$).

FIGURE 3.33. Spatial Distribution of Event Ca^{++} Deposition Across the Network. Right-hand Side Shows Deposition in $\mu\text{mol}/\text{m}^2$ (x's Indicate Sites with Missing or Incomplete Data). Left-hand Side Shows the Data Contoured (Contour Interval = 50 $\mu\text{mol}/\text{m}^2$).

FIGURE 3.34. Spatial Distribution of First Collector Stage SO_4^{2-} Concentration Across the Network. Right-hand Shows Concentration in $\mu\text{mol}/\ell$ (x's Indicate Sites with Missing Data). Left-hand Side Shows the Data Contoured (Contour Interval = 40 $\mu\text{mol}/\ell$).

FIGURE 3.35. Spatial Distribution of First Collector Stage NO_3^- Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol/l}$ (x's Indicate Sites with Missing Data). Left-hand Side Shows the Data Contoured (Contour Interval = 40 $\mu\text{mol/l}$).

FIGURE 3.36. Spatial Distribution of First Collector Stage H^+ Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol/l}$ (x's Indicate Sites with Missing Data). Left-hand Side Shows the Data Contoured (Contour Interval = $20 \mu\text{mol/l}$).

FIGURE 3.37. Spatial Distribution of First Collector Stage NH_4^+ Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol}/\ell$ (x's Indicate Sites with Missing Data). Left-hand Side Shows the Data Contoured (Contour Interval = $20 \mu\text{mol}/\ell$).

FIGURE 3.38. Spatial Distribution of First Collector Stage Ca^{++} Concentration Across the Network. Right-hand Side Shows Concentration in $\mu\text{mol/l}$ (x's Indicate Sites with Missing Data). Left-hand Side Shows the Data Contoured (Contour Interval = 20 $\mu\text{mol/l}$).

4.0 AIRCRAFT DATA

During the April 8 - 9 storm event, three aircraft made sampling flights over or near the high-density network: the PNL Douglas DC3, the PNL Cessna 411, and the BNL Islander. The aircraft and their sampling instrumentation are described in the OSCAR overview report⁽¹⁾. The aircraft were utilized only for clear-air sampling during this event, to measure trace gas and aerosol concentrations in low-level inflow areas of the storm. The severe convective activity associated with the storm precluded any in-cloud sampling.

Each aircraft made a single sampling flight in the high-density network area on April 8. The DC3 sampled from 1540 to 1920 GMT. The Cessna sampled from 1630 to 1750 GMT. The BNL Islander made a clear-air sampling flight between 1730 and 1920 GMT before moving east to sample over other portions of the intermediate density network. On this flight, the Islander sampled about 25 km south of the high-density network. The Islander's data have been reported elsewhere⁽²⁾. These flights were all conducted shortly before the forecast onset of precipitation over the network. As noted in Section 2, on the afternoon of April 8, the precipitation in the area never quite reached the high-density network. The precipitation received by the network did not begin until 0500 GMT on April 9, 10 to 12 hours after the aircraft sampling.

Most of the important clear-air measurements aboard the aircraft involved filters (for aerosols, SO_2 , and HNO_3) or real-time, trace-gas analyzers (for SO_2 , O_3 , and NO_x). On the April 8 flights, the DC3 collected three sets of filter samples, and the Cessna collected one set. The data from these filter samples, along with data from the operational real-time instruments (averaged over the filter collection periods), are presented in Table 4.1. (The Cessna real-time instrumentation was not operational for this event). The aircraft flight tracks during this sampling are shown in Figure 4.1.

Real-time measurements made aboard the DC3 during its first filter collection are shown in Figures 4.2a, b, and c. The flight was made north and east of Fort Wayne, and winds at the sampling elevation were predominantly from the southwest. The data (except for condensation nuclei) show little variation over the area which was sampled.

Real-time measurements made aboard the DC3 during its second and third filter collections are shown in Figures 4.3a and b, and 4.4a and b, respectively. The sampling locations for both were along the southern boundary of the network, but the two collections were made at different altitudes. The data all show significantly lower concentrations in the western portion of the sampling area; the SO₂ concentrations vary by more than a factor of two from west to east.

FIGURE 4.1. Aircraft Flight Tracks for the DC3 and Cessna During Filter Sample Collections on April 8. Dashed Line Shows DC3 Position from 1637 to 1715 GMT; Dotted Line Shows DC3 Position for 1748 to 1830 GMT; Solid Line Shows DC3 Position from 1840 to 1915 GMT; Dot-dash Line Shows Approximate Cessna Position from 1639 to 1739 GMT. Small Squares Show Positions at Start of Each Time Segment. "FWA" is Fort Wayne Airport, and the Large (dashed) Square Outlines the High-Density Network (see Figure 1.2).

TABLE 4.1. Summary of Clear Air Measurements by Cessna and DC3 on April 9.

Aircraft:	Cessna	DC3	DC3	DC3
Sampling Period (GMT):	1639-1739	1637-1715	1748-1830	1840-1915
Altitude (m MSL):	1890	850	850	1350
Temperature (°C):	--	12	13	9
Relative Humidity (%):	--	70	69	84

Filter Pack Measurements

H ⁺ (μg/m ³ as H ₂ SO ₄):	0.	0.	0.	--
(μmol/m ³):	0.	0.	0.	--
NH ₄ ⁺ (μg/m ³):	1.1	1.6	1.3	1.4
(μmol/m ³):	.059	.086	.073	.075
NO ₃ ⁻ (μg/m ³):	1.6	1.7	1.3	1.0
(μmol/m ³):	.026	.027	.021	.015
HNO ₃ (μg/m ³):	0.	--	--	--
(μmol/m ³):	0.	--	--	--
SO ₄ ²⁻ (μg/m ³):	2.0	3.5	3.5	4.0
(μmol/m ³):	.021	.037	.037	.042
SO ₂ (μg/m ³):	1.8	5.4	5.1	1.3
(μmol/m ³):	.029	.084	.079	.020

Real-Time Measurements⁽²⁾

SO ₂ (ppb):	--	2.9	3.4	2.3
(μmol/m ³):	--	.11	.13	.084
NO _x (ppb):	--	--	2.6	1.6
(μmol/m ³):	--	--	.10	.059
O ₃ (ppb):	--	78.	87.	80.
bscat (10 ⁻⁴ m ⁻¹):	--	.7	.8	.7
CNC ^(b) (cm ⁻³):	--	23,000	12,000	5,800

(a) Measurements were averaged over the filter collections period. Averages may not correspond exactly to the filter data because of sections of missing data or calibration checks.

(b) Condensation or Aitken nuclei.

FIGURE 4.2a. Real-time Measurements Aboard the DC3 from 1637 to 1650 GMT on April 8. This Time Segment Corresponds to the Initial Leg (SE to NW) of the (dashed) Flight Path Shown in Figure 4.1.

FIGURE 4.2b. Real-time Measurements Aboard the DC3 from 1650 to 1701 GMT on April 8. This Time Segment Corresponds to the Middle Leg (NW to SE) of the (dashed) Flight Path Shown in Figure 4.1.

FIGURE 4.2c. Real-time Measurements Aboard the DC3 from 1701 to 1715 GMT on April 8. This Time Segment Corresponds to the Final Leg (SE to NW) of the (dashed) Flight Path Shown in Figure 4.1.

FIGURE 4.3a. Real-time Measurements Aboard the DC3 from 1748 to 1811 GMT on April 8. This Time Segment Corresponds to the Initial Leg (west to east) of the (dotted) Flight Path Shown in Figure 4.1.

FIGURE 4.3b. Real-time Measurements Aboard the DC3 from 1811 to 1830 GMT on April 8. This Time Segment Corresponds to the Final Leg (east to west) of the (dotted) Flight Path Shown in Figure 4.1.

FIGURE 4.4a. Real-time Measurements Aboard the DC3 from 1840 to 1859 GMT on April 8. This Time Segment Corresponds to the Initial Leg (west to east) of the (solid) Flight Path Shown in Figure 4.1.

FIGURE 4.4b. Real-time Measurements Aboard the DC3 from 1859 to 1915 GMT on April 8. This Time Segment Corresponds to the Final Leg (east to west) of the (solid) Flight Path Shown in Figure 4.1.

The data in this report were obtained from a series of tests conducted at the University of California, San Diego, in the Department of Mechanical Engineering, under the supervision of Professor R. W. Fox. The tests were conducted in the Department of Mechanical Engineering, University of California, San Diego, in the Department of Mechanical Engineering, under the supervision of Professor R. W. Fox.

5.0 REFERENCES

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APPENDIX A

DATA TABULATIONS

APPENDIX A

DATA TABULATIONS

OSCAR intensive network site locations are shown in Figure 1.2 and detailed in Table A.1.

Complete precipitation chemistry and rainfall data for Event 2 are listed in Table A.2. Each page contains data from one of the 47 sites. The collection efficiency is the total rainfall collected by the sequential collector, divided by the total rainfall measured by the accompanying weighing rain gauge. For sites where the collector overflowed, and thus collection efficiency was impossible to compute, "OVF" is printed. "START" is the day and time of the start of filling of each stage, "DT" is the duration of each stage, and "R-RATE" is the rainfall rate (stage volume/DT). "ION BAL" is the ion balance check, given by

$$(\text{Cation Sum} - \text{Anion Sum}) / 0.5(\text{Cation Sum} + \text{Anion Sum})$$

(difference of ion totals divided by the mean). The AVG figures are volume-weighted averages for all stages (equivalent to the event-average values), calculated using Equation 3.1. Additional codes, generally following those used by the MAP3S Precipitation Chemistry Network, are listed below.

<	Less than detection limit (given)
NAP	No analysis performed
ISA	Insufficient sample for analysis
RPC	Rejected--probable contamination

TABLE A.1. High-Density Precipitation Chemistry Site Positions

<u>Site No.</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Site No.</u>	<u>Latitude</u>	<u>Longitude</u>
11	41.591	85.603	45	41.129	84.862
12	41.639	85.378	46	41.175	84.646
13	41.638	85.199	51	40.995	85.659
14	41.575	85.038	52	41.001	85.423
15	41.561	84.849	53	41.032	85.293
16	41.588	84.720	54	40.966	84.966
21	41.377	85.624	55	40.986	84.817
22	41.430	85.403	56	41.058	84.710
23	41.439	85.194	57	40.929	84.561
24	41.443	85.059	58	41.015	84.391
25	41.394	84.892	61	40.806	85.679
26	41.409	84.701	62	40.844	85.464
27	41.435	84.482	63	40.914	85.231
31	41.276	85.582	64	40.798	85.153
32	41.331	85.464	65	40.791	84.966
33	41.305	85.178	66	40.860	84.756
34	41.306	85.069	67	40.810	84.521
35	41.251	84.859	71	40.663	85.693
36	41.309	84.564	72	40.665	85.466
37	41.338	84.431	73	40.665	85.303
41	41.175	85.645	74	40.668	85.092
42	41.136	85.489	75	40.665	84.858
43	41.143	85.152	76	40.644	84.628
44	41.198	85.019			

TABLE A.2 OSCAR HIGH-DENSITY NETWORK PRECIPITATION CHEMISTRY
AND RAINFALL DATA.

SITE 11

COLLECTION EFFICIENCY = 0.77

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4-	9	5.67	0.01	60.96	4.24	91.0
2	4-	9	5.68	0.01	60.96	4.39	43.0
3	4-	9	5.69	0.01	60.96	5.00	17.0
4	4-	9	5.71	0.03	26.84	4.92	15.0
5	4-	9	5.74	0.05	16.00	4.83	14.0
6	4-	9	5.79	0.05	16.00	4.66	17.0
7	4-	9	5.85	0.05	16.00	4.81	11.0
8	4-	9	5.90	0.05	16.00	4.81	12.0
9	4-	9	5.96	2.09	2.42	4.76	8.4
AVG				5.01	4.68	19.4	0.14

	S02	S04	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	NAP	140.0	NAP	220.0	88.0	<0.2	588.
2	NAP	57.0	NAP	83.0	30.0	<0.2	227.
3	NAP	29.0	NAP	25.0	13.0	<0.2	96.
4	NAP	25.0	NAP	21.0	10.0	<0.2	81.
5	NAP	25.0	NAP	19.0	9.1	<0.2	78.
6	NAP	23.0	NAP	18.0	8.7	<0.2	73.
7	NAP	13.0	NAP	9.7	5.1	<0.2	41.
8	NAP	15.0	NAP	9.7	4.3	<0.2	44.
9	NAP	8.3	NAP	3.8	<2.0	<0.2	20.
AVG	--	27.1	--	30.8	12.1	--	97.

	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	57.5	39.0	100.0	15.0	110.0	36.0	504.
2	40.7	83.0	34.0	<6.0	28.0	11.0	236.
3	10.0	60.0	13.0	<2.0	11.0	4.3	114.
4	12.0	51.0	7.6	<3.5	5.6	2.3	86.
5	14.8	39.0	6.0	<3.0	3.9	1.5	71.
6	21.9	45.0	7.4	<3.0	4.1	1.5	85.
7	15.5	23.0	3.4	<1.5	2.6	1.0	49.
8	15.5	21.0	3.4	<1.5	2.6	1.0	47.
9	17.4	4.8	1.0	<0.8	1.1	0.4	26.
AVG	20.9	28.0	13.0	1.1	12.5	4.4	97.

TABLE A.2, CONTINUED.

SITE 12

COLLECTION EFFICIENCY = 0.70

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	5.85	0.08	12.23	RPC	RPC	--
2	4- 9	5.92	0.02	52.66	4.85	26.0	-0.15
3	4- 9	5.94	0.01	73.40	4.70	30.0	-0.15
4	4- 9	5.95	0.01	73.40	4.71	24.0	-0.13
5	4- 9	5.97	0.01	73.40	4.71	20.0	-0.08
6	4- 9	5.98	0.01	73.40	4.68	19.0	-0.08
7	4- 9	5.99	0.01	73.40	4.78	15.0	-0.11
8	4- 9	6.01	0.03	29.95	4.80	14.0	-0.12
9	4- 9	6.04	0.47	13.58	4.75	12.0	-0.11
AVG				21.03	4.75	16.6	-0.12

	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UMOL/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	52.0	NAP	42.0	21.0	<0.2	167.
3	NAP	50.0	NAP	52.0	21.0	<0.2	173.
4	0.4	36.0	NAP	40.0	15.0	<0.2	127.
5	NAP	32.0	NAP	30.0	10.0	<0.2	104.
6	NAP	29.0	NAP	27.0	10.0	<0.2	95.
7	NAP	23.0	NAP	20.0	8.2	<0.2	74.
8	NAP	20.0	NAP	16.0	7.8	<0.2	64.
9	0.5	14.0	NAP	11.0	4.6	<0.2	44.
AVG	0.5	24.4	--	21.8	9.0	--	80.

	FREE H	NH4	NA	K	CA	MG	CAT SUM UMOL/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	14.1	40.0	23.0	<2.0	27.0	6.1	143.
3	20.0	71.0	19.0	<1.0	15.0	4.1	148.
4	19.5	64.0	9.8	<1.0	6.7	2.2	111.
5	19.5	54.0	10.0	1.3	4.3	1.4	96.
6	20.9	51.0	7.1	<1.0	3.2	1.1	88.
7	16.6	39.0	4.1	<1.0	2.7	0.8	67.
8	15.8	31.0	4.4	<1.0	1.9	0.7	56.
9	17.8	16.0	1.9	<1.0	1.2	0.4	39.
AVG	17.9	33.2	6.5	0.1	5.0	1.4	70.

TABLE A.2, CONTINUED.

SITE 13

COLLECTION EFFICIENCY = 0.81

UNITS ARE $\mu\text{MOL/L}$ UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	5.87	0.13	6.10	4.42	97.0	-0.37
2	4- 9	6.00	0.05	17.29	5.09	32.0	-0.12
3	4- 9	6.05	0.02	44.03	4.40	39.0	-0.08
4	4- 9	6.07	0.02	44.03	4.52	26.0	-0.03
5	4- 9	6.08	0.02	44.03	4.56	20.0	-0.04
6	4- 9	6.10	0.02	44.03	4.63	15.0	0.03
7	4- 9	6.12	0.02	44.03	4.63	13.0	0.32
8	4- 9	6.14	0.02	44.03	4.66	12.0	-0.02
9	4- 9	6.16	1.13	5.50	4.71	9.5	-0.12
AVG				8.96	4.64	20.9	-0.08
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	NAP	190.0	NAP	300.0	98.0	<0.2	778.
2	NAP	70.0	NAP	64.0	30.0	<0.2	234.
3	NAP	60.0	NAP	66.0	25.0	<0.2	211.
4	NAP	37.0	NAP	39.0	16.0	<0.2	129.
5	NAP	26.0	NAP	25.0	11.0	<0.2	88.
6	NAP	19.0	NAP	16.0	8.5	<0.2	63.
7	NAP	11.0	NAP	8.9	3.5	0.3	35.
8	NAP	14.0	NAP	7.2	5.2	<0.2	40.
9	NAP	11.0	NAP	5.3	2.9	<0.2	30.
AVG	--	32.7	--	36.3	14.0	0.0	116.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	38.0	12.0	80.0	20.0	150.0	42.0	534.
2	8.1	55.0	33.0	5.1	40.0	13.0	207.
3	39.8	82.0	24.0	<0.0	18.0	6.4	195.
4	30.2	61.0	9.7	<0.4	8.7	3.4	125.
5	27.5	35.0	5.5	<2.0	6.1	2.3	85.
6	23.4	26.0	3.7	<0.4	4.1	1.4	64.
7	23.4	17.0	2.2	<1.5	2.3	0.7	49.
8	21.9	12.0	1.5	<0.4	1.7	0.4	40.
9	19.5	4.4	0.7	<0.4	1.1	<0.4	27.
AVG	23.1	21.4	10.6	1.6	15.3	4.5	96.

TABLE A.2, CONTINUED.

SITE 14

COLLECTION EFFICIENCY = 0.39

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	TON BAL
1	4- 9	6.12	0.14	12.19	MOE	MOE	--
2	4- 9	6.25	0.13	12.91	MOE	MOE	--
3	4- 9	6.38	0.10	17.58	MOE	MOE	--
4	4- 9	6.48	0.10	17.58	MOE	MOE	--
5	4- 9	6.57	0.34	4.90	MOE	MOE	--
AVG				10.48	--	--	--
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	MOE	MOE	MOE	MOE	MOE	MOE	MOE
2	MOE	MOE	MOE	MOE	MOE	MOE	MOE
3	MOE	MOE	MOE	MOE	MOE	MOE	MOE
4	MOE	MOE	MOE	MOE	MOE	MOE	MOE
5	MOE	MOE	MOE	MOE	MOE	MOE	MOE
AVG	--	--	--	--	--	--	--
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	MOE	MOE	MOE	MOE	MOE	MOE	MOE
2	MOE	MOE	MOE	MOE	MOE	MOE	MOE
3	MOE	MOE	MOE	MOE	MOE	MOE	MOE
4	MOE	MOE	MOE	MOE	MOE	MOE	MOE
5	MOE	MOE	MOE	MOE	MOE	MOE	MOE
AVG	--	--	--	--	--	--	--

TABLE A.2, CONTINUED.

SITE 15

COLLECTION EFFICIENCY = 0.82

UNITS ARE $\mu\text{MOL/L}$ UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND $\mu\text{MHO/CM}$	ION BAL
1	4- 9	6.55	0.23	3.52	RPC	RPC	--
2	4- 9	6.78	0.08	10.16	4.47	33.0	-0.12
3	4- 9	6.86	0.08	10.16	4.79	25.0	-0.06
4	4- 9	6.94	0.09	8.84	4.63	20.0	-0.01
5	4- 9	7.03	0.50	1.63	4.63	17.0	0.12
6	4- 9	7.52	0.26	1.09	4.77	13.0	0.16
AVG				3.50	4.63	22.9	-0.01
	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	40.0	NAP	87.0	18.0	<0.2	185.
3	NAP	43.0	NAP	50.0	15.0	<0.2	151.
4	NAP	29.0	NAP	31.0	9.7	<0.2	99.
5	NAP	23.0	NAP	17.0	6.3	<0.2	69.
6	NAP	18.0	NAP	11.0	4.2	<0.2	51.
AVG	--	32.5	--	43.4	11.6	--	120.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	33.9	4.4	19.0	2.2	38.0	14.0	163.
3	16.2	72.0	12.0	<0.4	15.0	5.9	142.
4	23.4	45.0	5.5	<0.4	8.7	3.0	97.
5	23.4	35.0	4.1	<1.0	5.9	1.9	78.
6	17.0	22.0	2.7	<1.0	7.2	2.0	60.
AVG	23.7	37.7	9.6	0.5	16.1	5.9	115.

TABLE A.2, CONTINUED.

SITE 16

COLLECTION EFFICIENCY = 0.72

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.62	0.20	4.69	4.70	44.0	-0.37
2	4- 9	6.81	0.08	11.20	4.84	24.0	-0.23
3	4- 9	6.89	0.07	13.45	4.64	24.0	-0.04
4	4- 9	6.96	0.07	13.45	4.52	24.0	-0.04
5	4- 9	7.03	0.07	13.45	4.54	22.0	-0.01
6	4- 9	7.10	0.75	1.23	4.68	16.0	-0.08
7	4- 9	7.84	0.06	15.24	4.65	16.0	-0.05
8	4- 9	7.90	0.01	15.24	ISA	ISA	--
AVG				5.08	4.64	24.3	-0.12
	S02	S04	NO2	NO3	CL	P04	AN SUM UEQ/L
1	NAP	81.0	NAP	160.0	37.0	<0.2	359.
2	NAP	49.0	NAP	60.0	16.0	<0.2	174.
3	NAP	34.0	NAP	38.0	12.0	<0.2	118.
4	NAP	31.0	NAP	34.0	11.0	<0.2	107.
5	NAP	26.0	NAP	28.0	7.5	<0.2	88.
6	NAP	19.0	NAP	21.0	5.3	<0.2	64.
7	NAP	17.0	NAP	19.0	4.3	<0.2	57.
8	NAP	26.0	NAP	31.0	5.1	<0.2	88.
AVG	--	36.4	--	50.9	13.1	--	137.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	20.0	16.0	42.0	4.0	65.0	17.0	246.
2	14.5	64.0	16.0	<1.0	17.0	4.7	138.
3	22.9	56.0	9.4	<1.0	10.0	2.8	114.
4	30.2	52.0	6.4	<1.0	5.5	1.5	103.
5	28.8	44.0	4.6	<1.0	3.7	1.1	87.
6	20.9	29.0	2.7	<1.0	2.5	0.7	59.
7	22.4	20.0	2.8	<1.0	3.8	0.9	55.
8	ISA	37.0	2.3	<1.0	7.2	1.2	ISA
AVG	22.8	40.1	11.7	0.6	15.1	4.0	114.

TABLE A.2, CONTINUED.

SITE 21

COLLECTION EFFICIENCY = 0.91

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	5.62	0.14	5.33	4.23	97.0	--
2	4- 9	5.75	0.14	5.33	4.54	42.0	-0.08
3	4- 9	5.89	0.14	5.33	4.44	32.0	-0.02
4	4- 9	6.02	0.14	5.33	4.46	26.0	-0.06
5	4- 9	6.16	0.28	2.57	4.57	19.0	-0.15
6	4- 9	6.44	0.67	0.46	4.73	12.0	-0.17
AVG				2.62	4.45	40.8	-0.08
	SD2	SD4	NO2	NO3	CL	P04	AN SUM UEQ/L
1	NAP	150.0	NAP	150.0	NAP	6.0	NAP
2	NAP	68.0	NAP	67.0	35.0	<0.2	238.
3	NAP	46.0	NAP	40.0	17.0	<0.2	149.
4	NAP	31.0	NAP	26.0	11.0	<0.2	99.
5	NAP	21.0	NAP	21.0	8.8	<0.2	72.
6	NAP	14.0	NAP	12.0	5.7	<0.2	46.
AVG	--	59.4	--	57.0	16.8	1.1	130.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	58.9	87.0	110.0	10.0	93.0	24.0	500.
2	28.8	64.0	41.0	2.6	34.0	8.0	220.
3	36.3	48.0	21.0	1.5	16.0	3.6	146.
4	34.7	29.0	9.7	<1.0	8.1	2.0	94.
5	26.9	15.0	5.5	0.5	5.8	1.3	62.
6	18.6	5.8	2.4	<0.4	5.0	0.9	39.
AVG	35.7	45.3	34.7	2.7	29.3	7.2	191.

TABLE A.2, CONTINUED.

SITE 22

COLLECTION EFFICIENCY = 0.72

UNITS ARE $\mu\text{MOL/L}$ UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	CONC $\mu\text{MOL/CM}$	ION BAL
1	4- 9	5.83	0.21	4.35	4.87	46.0	-0.02
2	4- 9	6.04	0.17	5.42	4.50	28.0	-0.04
3	4- 9	6.21	0.16	5.59	4.50	21.0	-0.03
4	4- 9	6.38	0.16	5.59	4.67	14.0	-0.11
5	4- 9	6.54	1.03	0.65	4.75	14.0	-0.03
AVG				2.49	4.63	25.2	-0.05
	S02	S04	N02	N03	CL	P04	AN SUM $\mu\text{EQ/L}$
1	NAP	92.0	NAP	98.0	54.0	<0.2	336.
2	NAP	44.0	NAP	42.0	18.0	<0.2	148.
3	NAP	27.0	NAP	25.0	9.7	<0.2	89.
4	NAP	20.0	NAP	17.0	6.2	<0.2	63.
5	NAP	19.0	NAP	18.0	6.7	<0.2	63.
AVG	--	41.6	--	41.3	19.6	--	144.
	FREE H	NH4	NA	K	CA	MG	CAT SUM $\mu\text{EQ/L}$
1	13.5	77.0	64.0	7.7	60.0	23.0	328.
2	31.6	35.0	21.0	1.2	20.0	6.9	143.
3	31.6	21.0	9.2	<1.0	9.1	3.2	86.
4	21.4	12.0	5.3	<1.0	6.7	2.3	57.
5	17.8	19.0	5.2	<1.0	7.1	2.3	61.
AVG	23.5	33.6	21.8	1.9	21.4	7.8	139.

TABLE A.2, CONTINUED.

SITE 23

COLLECTION EFFICIENCY = 0.69

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.17	0.21	4.57	6.04	58.0	--
2	4- 9	6.38	0.21	4.57	4.76	22.0	-0.17
3	4- 9	6.59	0.91	0.96	4.77	14.0	-0.21
AVG				2.10	4.94	31.9	-0.19
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	NAP	130.0	0.8	120.0	NAP	<0.2	NAP
2	NAP	39.0	NAP	38.0	15.0	<0.2	131.
3	NAP	20.0	0.2	19.0	6.3	<0.2	66.
AVG	--	64.3	0.5	60.2	10.9	--	100.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	0.9	90.0	91.0	13.0	70.0	23.0	RPC
2	17.4	20.0	18.0	1.2	21.0	6.0	111.
3	17.0	4.3	5.6	0.6	10.0	2.8	53.
AVG	11.6	39.2	39.2	5.1	34.4	10.8	83.

TABLE A.2, CONTINUED.

SITE 24

COLLECTION EFFICIENCY = 0.79

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.25	0.05	17.78	RPC	RPC	--
2	4- 9	6.30	0.05	17.78	5.01	24.0	-0.07
3	4- 9	6.34	0.19	4.32	4.54	25.0	0.05
4	4- 9	6.54	0.21	3.91	4.62	16.0	0.50
5	4- 9	6.75	0.21	3.91	4.79	11.0	0.53
6	4- 9	6.97	0.03	3.91	ISA	ISA	0.59
AVG				5.76	4.71	19.0	0.26
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	36.0	<0.1	51.0	17.0	<0.2	140.
3	NAP	33.0	<0.1	31.0	15.0	<0.2	112.
4	NAP	16.0	0.2	16.0	11.0	<0.2	59.
5	NAP	13.0	0.2	12.0	4.5	<0.2	43.
6	NAP	19.0	ISA	20.0	6.5	<0.2	65.
AVG	--	24.3	0.1	27.2	11.7	--	88.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UFQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	9.8	2.0	19.0	2.0	34.0	15.0	131.
3	28.8	26.0	16.0	1.4	17.0	5.5	117.
4	24.0	6.7	45.0	<0.4	8.8	2.6	98.
5	16.2	3.7	33.0	<0.4	8.0	2.3	74.
6	ISA	15.0	71.0	1.5	12.0	3.5	119.
AVG	19.7	9.8	29.8	0.9	16.8	6.2	105.

TABLE A.2, CONTINUED.

SITE 25

COLLECTION EFFICIENCY = 0.89

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.60	0.16	4.58	4.75	50.0	-0.02
2	4- 9	6.76	0.16	4.58	4.70	16.0	-0.03
3	4- 9	6.92	0.16	4.58	4.82	10.0	-0.04
4	4- 9	7.08	0.50	1.48	4.94	22.0	-0.37
AVG				3.00	4.79	24.5	-0.12
	S02	S04	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	0.7	82.0	NAP	100.0	40.0	<0.2	304.
2	1.6	23.0	NAP	25.0	8.2	<0.2	79.
3	1.7	14.0	NAP	13.0	3.8	<0.2	45.
4	1.5	26.0	NAP	24.0	6.0	<0.2	82.
AVG	1.4	36.3	--	40.5	14.5	--	128.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	17.8	4.5	39.0	17.0	77.0	33.0	298.
2	20.0	12.0	6.7	1.1	14.0	4.5	77.
3	15.1	5.0	2.1	<1.0	7.8	2.5	43.
4	11.5	18.0	3.5	<1.0	8.7	3.0	56.
AVG	16.1	9.9	12.8	4.5	26.9	10.8	119.

TABLE A.2, CONTINUED.

SITE 26

COLLECTION EFFICIENCY = 0.90

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.92	0.12	6.10	5.05	54.0	-0.31
2	4- 9	7.04	0.12	6.10	5.76	12.0	-0.01
3	4- 9	7.16	0.12	6.10	5.01	9.4	-0.05
4	4- 9	7.28	0.12	6.10	4.77	9.8	-0.11
5	4- 9	7.40	0.33	2.20	4.62	14.0	-0.10
6	4- 9	7.73	0.23	3.14	4.27	32.0	-0.12
7	4- 9	7.96	0.09	2.03	4.41	24.0	-0.01
AVG				4.03	4.70	21.9	-0.11
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	NAP	73.0	<0.1	210.0	37.0	5.0	408.
2	NAP	21.0	NAP	23.0	6.8	<0.2	72.
3	NAP	15.0	<0.1	15.0	4.1	<0.2	49.
4	NAP	12.0	NAP	9.4	2.7	<0.2	36.
5	NAP	16.0	<0.1	12.0	3.1	<0.2	47.
6	NAP	39.0	0.2	35.0	7.3	<0.2	120.
7	NAP	35.0	NAP	30.0	5.2	<0.2	105.
AVG	--	29.6	0.0	49.9	10.0	0.8	121.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	8.9	2.9	44.0	16.0	72.0	42.0	300.
2	1.7	15.0	5.8	0.7	15.0	8.8	71.
3	9.8	9.0	2.7	0.6	8.1	4.1	47.
4	17.0	2.3	1.2	<0.4	4.1	1.9	32.
5	24.0	5.4	1.5	1.0	3.9	1.5	43.
6	53.7	30.0	4.5	1.9	5.9	2.3	107.
7	38.9	46.0	4.1	2.0	5.1	1.7	105.
AVG	19.9	12.1	9.7	3.3	17.7	9.8	100.

TABLE A.2, CONTINUED.

SITE 27

COLLECTION EFFICIENCY = 0.80

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	OT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.83	0.18	4.61	RPC	RPC	--
2	4- 9	7.01	0.18	4.61	4.91	16.0	-0.09
3	4- 9	7.19	0.18	4.61	4.95	9.4	-0.19
4	4- 9	7.37	0.18	4.61	4.74	10.0	-0.31
5	4- 9	7.55	0.32	2.56	4.60	13.0	-0.20
6	4- 9	7.87	0.83	0.99	4.32	27.0	-0.18
7	4- 9	8.70	1.30	0.51	4.44	21.0	-0.15
AVG				1.76	4.61	15.9	-0.19
	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	26.0	NAP	28.0	9.4	<0.2	89.
3	NAP	16.0	NAP	14.0	4.0	<0.2	50.
4	NAP	15.0	NAP	9.8	8.3	<0.2	48.
5	NAP	18.0	NAP	11.0	3.4	<0.2	50.
6	NAP	36.0	NAP	31.0	5.9	<0.2	109.
7	NAP	29.0	NAP	25.0	5.4	<0.2	88.
AVG	--	23.1	--	19.6	6.1	--	72.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	12.3	21.0	8.4	<1.0	15.0	5.1	82.
3	11.2	3.8	2.5	<1.0	8.9	2.9	41.
4	18.2	1.6	1.5	<1.0	5.3	1.7	35.
5	25.1	3.8	1.3	<1.0	4.4	1.2	41.
6	47.9	26.0	2.5	<1.0	5.7	1.7	91.
7	36.3	23.0	2.0	<1.0	5.6	1.8	76.
AVG	24.8	12.9	3.1	--	7.5	2.4	61.

TABLE A.2, CONTINUED.

SITE 31

COLLECTION EFFICIENCY = 0.93

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	5.75	0.14	5.08	4.61	70.0	--
2	4- 9	5.89	0.13	5.71	4.44	35.0	0.11
3	4- 9	6.02	0.07	10.16	4.71	22.0	0.09
4	4- 9	6.09	0.07	10.16	4.66	15.0	0.07
5	4- 9	6.16	0.07	10.16	4.56	17.0	-0.33
6	4- 9	6.23	0.18	4.00	4.56	17.0	-0.17
7	4- 9	6.40	0.93	0.77	4.56	17.0	-0.19
8	4- 9	7.33	0.17	0.51	ISA	ISA	--
AVG				2.90	4.58	27.6	-0.07

	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	NAP	94.0	NAP	110.0	NAP	1.9	NAP
2	NAP	48.0	NAP	40.0	23.0	<0.2	159.
3	NAP	33.0	2.1	25.0	14.0	<0.2	107.
4	NAP	17.0	NAP	11.0	5.9	<0.2	51.
5	NAP	21.0	0.2	16.0	6.4	<0.2	65.
6	NAP	19.0	NAP	16.0	4.2	<0.2	58.
7	NAP	21.0	0.2	15.0	3.6	<0.2	61.
8	NAP	19.0	ISA	14.0	3.5	<0.2	56.
AVG	--	35.9	0.8	33.0	9.4	0.3	83.

	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	24.5	31.0	82.0	21.0	77.0	38.0	389.
2	36.3	53.0	25.0	5.4	22.0	7.2	178.
3	19.5	39.0	15.0	2.2	15.0	5.9	117.
4	21.9	11.0	5.4	<1.5	6.1	2.1	55.
5	27.5	11.0	3.9	<0.4	0.5	1.4	46.
6	27.5	8.7	2.9	<0.4	3.9	1.0	49.
7	27.5	9.8	2.1	<0.4	4.4	1.0	50.
8	ISA	12.0	7.6	1.0	8.0	1.5	ISA
AVG	26.4	23.2	19.3	4.0	18.2	8.0	126.

TABLE A.2, CONTINUED.

SITE 32

COLLECTION EFFICIENCY = 0.86

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	5.97	0.12	6.17	4.66	74.0	-0.13
2	4- 9	6.10	0.12	6.17	4.73	27.0	-0.15
3	4- 9	6.22	0.12	6.17	4.54	23.0	-0.10
4	4- 9	6.35	0.12	6.17	4.57	18.0	0.06
5	4- 9	6.47	0.04	6.17	4.58	17.0	--
AVG				6.17	4.62	34.2	-0.08
	S02	S04	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	NAP	130.0	NAP	120.0	74.0	5.3	470.
2	NAP	51.0	<0.1	43.0	22.0	<0.2	167.
3	NAP	30.0	NAP	26.0	11.0	3.4	107.
4	NAP	20.0	NAP	16.0	5.3	<0.2	61.
5	NAP	17.0	NAP	13.0	3.5	<0.2	51.
AVG	--	54.9	--	48.6	26.3	2.0	191.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	21.9	37.0	89.0	29.0	80.0	38.0	413.
2	18.6	29.0	24.0	2.6	26.0	8.4	143.
3	28.8	24.0	11.0	1.5	12.0	3.9	97.
4	26.9	14.0	3.9	<0.4	7.9	2.3	65.
5	26.3	7.6	2.4	0.9	ISA	ISA	ISA
AVG	24.2	24.7	29.9	7.8	31.5	13.1	180.

TABLE A.2, CONTINUED.

SITE 33

COLLECTION EFFICIENCY = 0.96

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.30	0.15	4.52	4.56	49.0	-0.10
2	4- 9	6.45	0.15	4.52	5.37	13.0	-0.11
3	4- 9	6.61	0.16	4.25	4.67	14.0	-0.13
4	4- 9	6.77	0.66	1.05	4.65	15.0	-0.11
5	4- 9	7.42	0.58	0.51	4.49	25.0	--
AVG				1.79	4.69	23.0	-0.11
	S02	S04	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	1.9	68.0	NAP	99.0	33.0	2.6	276.
2	NAP	26.0	<0.1	22.0	8.1	<0.2	82.
3	NAP	18.0	NAP	14.0	4.2	<0.2	54.
4	2.0	21.0	0.2	15.0	4.3	<0.2	62.
5	NAP	36.0	NAP	33.0	6.7	<0.2	112.
AVG	1.9	33.5	0.1	37.1	11.9	0.6	118.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	27.5	14.0	35.0	10.0	55.0	27.0	251.
2	4.3	16.0	7.0	0.7	16.0	6.7	73.
3	21.4	3.0	2.4	<0.4	8.2	2.1	47.
4	22.4	8.0	2.4	<0.4	8.9	2.3	55.
5	32.4	30.0	5.1	0.6	ISA	3.9	ISA
AVG	20.2	12.1	11.1	2.5	22.0	9.0	107.

TABLE A.2, CONTINUED.

SITE 34

NO DATA - COLLECTOR MALFUNCTION

TABLE A.2, CONTINUED.

SITE 35

COLLECTION EFFICIENCY = 0.65

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.50	0.13	7.84	RPC	RPC	--
2	4- 9	6.63	0.13	7.84	5.62	21.0	0.03
3	4- 9	6.76	0.13	7.84	4.45	28.0	-0.06
4	4- 9	6.89	0.13	7.84	4.40	27.0	-0.05
5	4- 9	7.02	0.09	11.55	4.50	19.0	0.03
6	4- 9	7.10	0.04	24.38	4.40	25.0	-0.02
7	4- 9	7.14	0.04	24.38	4.36	28.0	-0.16
8	4- 9	7.19	0.04	24.38	4.53	16.0	-0.16
9	4- 9	7.23	1.44	3.56	4.51	16.0	0.08
AVG				6.10	4.50	20.3	0.00

	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	41.0	NAP	33.0	19.0	<0.2	134.
3	NAP	46.0	NAP	35.0	16.0	<0.2	143.
4	NAP	38.0	NAP	32.0	12.0	<0.2	120.
5	NAP	26.0	NAP	19.0	7.0	<0.2	78.
6	NAP	33.0	NAP	28.0	8.1	<0.2	102.
7	NAP	43.0	NAP	36.0	9.3	<0.2	131.
8	NAP	26.0	NAP	17.0	4.2	<0.2	73.
9	NAP	19.0	NAP	12.0	3.4	<0.2	53.
AVG	--	28.9	--	21.6	7.7	--	87.

	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	2.4	19.0	22.0	1.2	30.0	17.0	139.
3	35.5	41.0	16.0	<1.0	14.0	7.4	135.
4	39.8	32.0	13.0	1.3	10.0	4.2	115.
5	31.6	22.0	8.2	<1.0	6.3	2.9	80.
6	39.8	36.0	8.6	<1.0	5.4	2.6	100.
7	43.7	47.0	7.9	<1.0	4.4	2.2	112.
8	29.5	23.0	2.6	<1.0	2.5	1.2	63.
9	30.9	21.0	1.7	<1.0	1.5	0.7	58.
AVG	31.4	27.0	7.2	0.2	6.6	3.4	86.

TABLE A.2, CONTINUED.

SITE 36

COLLECTION EFFICIENCY = 0.40

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.85	0.31	5.39	5.54	21.0	0.01
2	4- 9	7.16	0.12	13.75	4.82	27.0	-0.05
3	4- 9	7.27	0.11	14.63	4.32	34.0	-0.01
4	4- 9	7.39	0.11	14.63	4.26	41.0	0.03
5	4- 9	7.50	0.21	7.81	4.39	29.0	0.00
6	4- 9	7.71	1.20	1.37	4.32	31.0	-0.02
7	4- 9	8.91	0.09	1.46	ISA	ISA	--
AVG				4.65	4.46	30.5	0.00
	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	NAP	39.0	NAP	49.0	22.0	<0.2	149.
2	NAP	51.0	NAP	51.0	26.0	<0.2	179.
3	NAP	49.0	NAP	47.0	20.0	<0.2	165.
4	NAP	56.0	NAP	63.0	22.0	<0.2	197.
5	NAP	42.0	NAP	42.0	13.0	<0.2	139.
6	NAP	42.0	NAP	42.0	13.0	<0.2	139.
7	NAP	43.0	NAP	46.0	14.0	<0.2	146.
AVG	--	46.5	--	49.0	19.3	--	161.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	2.9	35.0	28.0	1.1	29.0	13.0	151.
2	15.1	49.0	31.0	1.6	26.0	11.0	171.
3	47.9	54.0	22.0	<1.0	14.0	5.9	164.
4	55.0	75.0	28.0	3.1	15.0	6.3	204.
5	40.7	57.0	15.0	<1.0	8.6	4.8	140.
6	47.9	58.0	13.0	<1.0	5.4	3.2	136.
7	ISA	ISA	ISA	ISA	8.5	3.2	ISA
AVG	34.9	54.7	22.8	1.0	16.2	7.3	161.

TABLE A.2, CONTINUED.

SITE 37

COLLECTION EFFICIENCY = 0.66

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.98	0.09	10.67	RPC	RPC	--
2	4- 9	7.08	0.09	10.67	5.77	31.0	0.06
3	4- 9	7.17	0.09	10.67	4.49	20.0	-0.23
4	4- 9	7.26	0.07	15.17	4.43	26.0	-0.10
5	4- 9	7.33	0.03	33.53	4.25	37.0	0.03
6	4- 9	7.36	0.03	33.53	4.43	22.0	0.07
7	4- 9	7.39	0.15	6.68	4.49	16.0	0.06
8	4- 9	7.54	0.07	14.48	4.44	18.0	0.10
9	4- 9	7.61	1.38	2.69	4.44	18.0	0.13
AVG				5.84	4.46	22.1	0.04
	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UEG/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	25.0	NAP	24.0	10.0	<0.2	84.
3	NAP	28.0	NAP	46.0	8.8	<0.2	111.
4	NAP	38.0	NAP	32.0	13.0	<0.2	121.
5	NAP	49.0	NAP	50.0	19.0	<0.2	167.
6	NAP	28.0	NAP	23.0	8.5	<0.2	88.
7	NAP	19.0	NAP	11.0	6.8	<0.2	56.
8	NAP	21.0	NAP	11.0	3.5	<0.2	57.
9	NAP	19.0	NAP	11.0	2.8	<0.2	52.
AVG	--	26.0	--	22.2	7.5	--	82.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEG/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	1.7	11.0	10.0	1.1	23.0	9.5	89.
3	32.4	24.0	7.5	<1.0	8.6	3.5	88.
4	37.2	39.0	11.0	<1.0	7.7	3.4	109.
5	56.2	54.0	21.0	<1.0	16.0	4.5	172.
6	37.2	27.0	7.7	<1.0	8.4	2.6	94.
7	32.4	13.0	3.0	<0.4	4.2	1.2	59.
8	36.3	15.0	2.0	2.2	2.6	0.7	62.
9	36.3	16.0	1.3	<0.4	2.0	0.6	59.
AVG	34.4	22.6	6.3	0.3	7.3	2.6	83.

TABLE A.2, CONTINUED.

SITE 41

COLLECTION EFFICIENCY = 0.85

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	5.67	0.20	3.81	4.90	56.0	-0.44
2	4- 9	5.87	0.14	5.55	4.85	25.0	-0.14
3	4- 9	6.01	0.03	28.19	4.75	25.0	-0.03
4	4- 9	6.04	0.03	28.19	4.75	17.0	-0.09
5	4- 9	6.06	0.03	28.19	4.66	17.0	-0.07
6	4- 9	6.09	0.03	28.19	4.55	20.0	-0.10
7	4- 9	6.12	0.03	28.19	4.56	20.0	-0.32
8	4- 9	6.15	0.03	28.19	4.56	21.0	-0.11
9	4- 9	6.17	1.33	7.40	4.56	17.0	-0.05
AVG				8.73	4.60	20.1	-0.09
	S02	S04	NO2	NO3	CL	P04	AN SUM UEQ/L
1	NAP	91.0	NAP	220.0	59.0	<0.2	461.
2	NAP	47.0	NAP	38.0	27.0	<0.2	159.
3	NAP	44.0	NAP	34.0	19.0	<0.2	141.
4	NAP	27.0	NAP	21.0	11.0	<0.2	86.
5	NAP	23.0	NAP	17.0	7.4	<0.2	70.
6	NAP	27.0	NAP	20.0	8.1	<0.2	82.
7	NAP	26.0	NAP	19.0	26.0	<0.2	97.
8	NAP	28.0	NAP	21.0	11.0	<0.2	88.
9	NAP	22.0	NAP	16.0	10.0	<0.2	70.
AVG	--	28.6	--	28.7	14.3	--	100.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	12.6	<0.6	59.0	18.0	67.0	36.0	296.
2	14.1	38.0	25.0	3.7	20.0	8.4	138.
3	17.8	41.0	22.0	3.7	19.0	7.5	137.
4	17.8	16.0	12.0	1.4	11.0	4.6	78.
5	21.9	16.0	8.1	1.2	6.8	2.5	66.
6	28.2	22.0	8.1	<1.0	5.9	2.0	74.
7	27.5	22.0	6.4	1.0	5.1	1.7	71.
8	27.5	35.0	5.8	<1.0	3.8	1.4	79.
9	27.5	26.0	5.3	1.0	2.4	0.9	67.
AVG	25.0	25.1	10.3	2.0	8.2	3.7	86.

TABLE A.2, CONTINUED.

SITE 42

COLLECTION EFFICIENCY = 0.82

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.22	0.10	8.13	4.33	41.0	-0.01
2	4- 9	6.32	0.10	8.13	5.56	29.0	0.09
3	4- 9	6.41	0.07	12.18	4.55	15.0	0.01
4	4- 9	6.48	0.03	28.96	4.37	25.0	0.02
5	4- 9	6.51	0.03	28.96	4.37	30.0	-0.07
6	4- 9	6.53	0.03	28.96	4.40	25.0	-0.06
7	4- 9	6.56	0.03	28.96	4.43	22.0	-0.09
8	4- 9	6.59	0.03	28.96	4.42	22.0	-0.09
9	4- 9	6.62	1.68	2.83	4.39	24.0	-0.13
AVG				5.36	4.43	25.2	-0.07

	SO2	SO4	NO2	NO3	CL	P04	AM SUM UEQ/L
1	NAP	51.0	NAP	100.0	23.0	<0.2	225.
2	NAP	55.0	NAP	68.0	25.0	<0.2	203.
3	NAP	19.0	NAP	10.0	4.7	<0.2	53.
4	NAP	34.0	NAP	28.0	8.6	<0.2	105.
5	NAP	47.0	NAP	38.0	13.0	<0.2	145.
6	NAP	39.0	NAP	29.0	12.0	<0.2	119.
7	NAP	32.0	NAP	19.0	13.0	<0.2	96.
8	NAP	34.0	NAP	22.0	8.9	<0.2	99.
9	NAP	36.0	NAP	27.0	10.0	<0.2	109.
AVG	--	37.6	--	34.0	12.0	--	121.

	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	46.8	30.0	26.0	7.6	44.0	12.0	222.
2	2.8	54.0	25.0	5.9	52.0	15.0	222.
3	28.2	8.2	2.7	<0.4	5.4	1.6	53.
4	42.7	43.0	7.8	<0.4	4.9	1.9	107.
5	42.7	73.0	9.3	<1.0	3.2	2.1	136.
6	39.8	58.0	6.4	<1.0	2.3	1.5	112.
7	37.2	41.0	3.8	<1.0	1.7	1.0	87.
8	38.0	43.0	4.3	<1.0	1.7	1.0	91.
9	40.7	40.0	5.2	<1.0	3.2	1.5	95.
AVG	37.3	42.2	8.3	1.0	9.6	3.2	114.

TABLE A.2, CONTINUED.

SITE 43

COLLECTION EFFICIENCY = 0.74

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.63	0.11	8.47	4.52	43.0	-0.19
2	4- 9	6.74	0.07	12.97	4.70	18.0	-0.11
3	4- 9	6.81	0.04	21.10	4.48	23.0	0.01
4	4- 9	6.85	0.04	21.10	4.58	17.0	0.05
5	4- 9	6.89	0.04	21.10	4.53	16.0	0.05
6	4- 9	6.93	0.04	21.10	4.53	16.0	0.04
7	4- 9	6.98	0.04	20.09	4.45	20.0	0.02
8	4- 9	7.02	0.05	19.05	4.33	34.0	0.02
9	4- 9	7.07	1.38	2.18	4.41	25.0	0.06
AVG				5.59	4.47	23.9	0.01
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	0.6	59.0	NAP	130.0	39.0	<0.2	287.
2	2.3	33.0	NAP	24.0	11.0	<0.2	101.
3	2.3	30.0	NAP	22.0	10.0	<0.2	92.
4	3.9	22.0	NAP	10.0	5.3	<0.2	59.
5	4.2	19.0	NAP	6.4	3.5	<0.2	48.
6	NAP	20.0	NAP	6.8	3.8	<0.2	51.
7	NAP	25.0	NAP	12.0	5.3	<0.2	67.
8	NAP	44.0	NAP	37.0	11.0	<0.2	136.
9	NAP	32.0	NAP	22.0	7.6	<0.2	94.
AVG	2.6	31.6	--	28.4	10.1	--	102.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	30.2	1.9	43.0	2.1	55.0	25.0	237.
2	20.0	16.0	11.0	<1.0	15.0	6.8	91.
3	33.1	16.0	8.9	<1.0	12.0	5.5	93.
4	26.3	8.7	4.6	<1.0	7.5	3.9	62.
5	29.5	5.6	2.5	<1.0	4.3	2.0	50.
6	29.5	8.3	2.4	<1.0	4.1	2.2	53.
7	35.5	18.0	4.3	<1.0	3.8	1.8	69.
8	46.8	66.0	10.0	<1.0	5.4	2.8	139.
9	38.9	38.0	5.6	<1.0	5.8	2.7	100.
AVG	33.6	23.6	9.3	0.2	11.1	5.2	99.

TABLE A.2, CONTINUED.

SITE 44

COLLECTION EFFICIENCY = 0.80

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT)		DT	R-RATE	LAB PH	COND	ION BAL
	DAY	HR	HR	MM/HR		UMHO/CM	
1	4- 9	6.20	0.45	1.82	6.72	54.0	0.34
2	4- 9	6.65	0.04	19.04	5.07	25.0	-0.06
3	4- 9	6.69	0.04	19.04	5.17	12.0	0.07
4	4- 9	6.74	0.04	19.04	4.62	14.0	0.11
5	4- 9	6.78	0.03	26.33	4.49	18.0	0.09
6	4- 9	6.81	0.03	26.41	4.39	26.0	-0.10
7	4- 9	6.84	0.03	26.41	4.38	28.0	-0.10
8	4- 9	6.87	0.03	26.41	4.31	33.0	-0.10
9	4- 9	6.90	2.13	3.11	4.38	23.0	-0.06
AVG				4.66	4.47	24.6	-0.02
	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	<0.2	43.0	NAP	130.0	27.0	<0.2	243.
2	NAP	48.0	NAP	40.0	22.0	<0.2	158.
3	3.0	23.0	NAP	11.0	7.6	<0.2	65.
4	NAP	19.0	NAP	5.0	3.9	<0.2	47.
5	2.5	21.0	NAP	7.1	4.5	<0.2	54.
6	NAP	36.0	NAP	31.0	11.0	<0.2	114.
7	2.3	40.0	NAP	35.0	11.0	<0.2	126.
8	NAP	47.0	NAP	41.0	11.0	<0.2	146.
9	3.2	31.0	NAP	21.0	6.4	<0.2	89.
AVG	2.8	32.8	--	29.2	9.3	--	104.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	0.2	<0.6	31.0	4.7	92.0	61.0	342.
2	8.5	38.0	23.0	0.8	26.0	13.0	148.
3	6.8	13.0	6.4	1.4	13.0	7.8	69.
4	24.0	6.3	3.3	<1.0	5.9	3.4	52.
5	32.4	9.6	3.5	<1.0	4.6	2.1	59.
6	40.7	28.0	12.0	<1.0	7.2	3.9	103.
7	41.7	46.0	11.0	<1.0	4.8	3.0	114.
8	49.0	64.0	8.7	<1.0	3.2	2.2	132.
9	41.7	32.0	3.9	<1.0	2.0	1.2	84.
AVG	33.6	28.8	8.1	0.4	10.8	6.6	106.

TABLE A.2, CONTINUED.

SITE 45

COLLECTION EFFICIENCY = ? (NO RAINGAUGE DATA)

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	MOE	MOE	MOE	MOE	RPC	RPC	--
2	MOE	MOE	MOE	MOE	4.69	24.0	-0.17
3	MOE	MOE	MOE	MOE	4.93	29.0	-0.17
4	MOE	MOE	MOE	MOE	5.34	18.0	-0.12
5	MOE	MOE	MOE	MOE	4.80	15.0	-0.10
6	MOE	MOE	MOE	MOE	4.54	16.0	-0.11
7	MOE	MOE	MOE	MOE	4.60	13.0	-0.03
8	MOE	MOE	MOE	MOE	4.63	13.0	-0.05
AVG				--	4.74	18.5	-0.11
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	37.0	NAP	48.0	17.0	<0.2	139.
3	NAP	62.0	NAP	66.0	18.0	<0.2	208.
4	NAP	43.0	NAP	34.0	8.6	<0.2	129.
5	NAP	29.0	NAP	18.0	4.9	<0.2	81.
6	NAP	24.0	NAP	12.0	3.7	<0.2	64.
7	NAP	18.0	NAP	5.5	2.9	<0.2	44.
8	NAP	17.0	NAP	11.0	3.8	<0.2	49.
AVG	--	33.4	--	28.4	8.6	--	104.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	20.4	25.0	16.0	<1.0	19.0	8.7	117.
3	11.7	73.0	19.0	<1.0	22.0	14.0	176.
4	4.6	48.0	7.3	<1.0	15.0	12.0	114.
5	15.8	30.0	3.1	<1.0	6.8	5.3	73.
6	28.8	18.0	1.8	<1.0	2.5	1.6	57.
7	25.1	8.2	0.6	<1.0	3.0	1.5	43.
8	23.4	9.9	1.3	<1.0	3.8	2.0	46.
AVG	18.4	31.0	7.2	--	10.5	6.6	91.

TABLE A.2, CONTINUED.

SITE 46

NO DATA - COLLECTOR MALFUNCTION

TABLE A.2, CONTINUED.

SITE 51

COLLECTION EFFICIENCY = 0.63

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	5.77	0.07	15.24	RPC	RPC	--
2	4- 9	5.84	0.07	15.24	6.56	20.0	0.15
3	4- 9	5.90	0.30	3.44	4.73	25.0	-0.09
4	4- 9	6.21	0.25	4.19	4.92	23.0	-0.11
5	4- 9	6.46	0.18	5.93	4.37	38.0	-0.03
6	4- 9	6.63	0.05	20.32	4.39	40.0	-0.06
7	4- 9	6.68	0.05	20.32	4.41	36.0	-0.06
8	4- 9	6.73	0.05	20.32	4.52	24.0	-0.03
9	4- 9	6.79	1.31	3.12	4.59	21.0	-0.17
AVG				5.33	4.58	26.4	-0.08
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	31.0	NAP	27.0	18.0	<0.2	107.
3	NAP	38.0	NAP	32.0	18.0	<0.2	126.
4	NAP	41.0	NAP	32.0	18.0	<0.2	132.
5	NAP	50.0	NAP	46.0	20.0	<0.2	166.
6	NAP	54.0	NAP	50.0	22.0	<0.2	180.
7	NAP	47.0	NAP	46.0	25.0	<0.2	165.
8	NAP	32.0	NAP	26.0	10.0	<0.2	100.
9	NAP	33.0	NAP	24.0	12.0	<0.2	102.
AVG	--	38.7	--	32.3	16.3	--	126.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	0.3	23.0	19.0	<1.0	21.0	20.0	124.
3	18.6	30.0	22.0	<1.0	14.0	8.4	115.
4	12.0	32.0	18.0	<1.0	16.0	12.0	118.
5	42.7	59.0	23.0	<1.0	12.0	6.5	162.
6	40.7	79.0	20.0	<1.0	9.7	5.5	170.
7	38.9	66.0	21.0	<1.0	9.2	5.2	155.
8	30.2	34.0	15.0	2.2	5.1	2.9	97.
9	25.7	42.0	7.9	<1.0	3.1	2.1	86.
AVG	26.0	44.7	15.5	0.2	9.1	6.3	117.

TABLE A.2, CONTINUED.

SITE 52

NO DATA - COLLECTOR MALFUNCTION

TABLE A.2, CONTINUED.

SITE 53

COLLECTION EFFICIENCY = 0.71

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.08	0.08	10.89	6.20	32.0	-0.01
2	4- 9	6.17	0.43	2.13	4.57	28.0	-0.14
3	4- 9	6.60	0.03	30.48	4.57	19.0	-0.03
4	4- 9	6.63	0.03	30.48	4.48	22.0	-0.14
5	4- 9	6.66	0.33	2.80	4.38	31.0	-0.08
6	4- 9	6.99	0.05	18.76	4.50	27.0	-0.19
7	4- 9	7.04	0.05	18.76	4.48	27.0	-0.09
8	4- 9	7.09	0.05	18.76	4.47	29.0	-0.09
9	4- 9	7.14	1.31	2.89	4.53	22.0	-0.13
AVG				4.72	4.54	25.2	-0.11
	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	NAP	52.0	0.4	63.0	34.0	<0.2	201.
2	NAP	41.0	0.1	38.0	18.0	<0.2	138.
3	NAP	26.0	NAP	20.0	8.4	<0.2	80.
4	NAP	28.0	NAP	23.0	8.7	<0.2	88.
5	NAP	42.0	NAP	37.0	13.0	<0.2	134.
6	NAP	49.0	<0.1	41.0	12.0	<0.2	151.
7	NAP	40.0	NAP	33.0	13.0	<0.2	126.
8	NAP	43.0	NAP	36.0	14.0	<0.2	136.
9	NAP	29.0	0.3	23.0	15.0	<0.2	96.
AVG	--	36.4	0.2	31.8	15.1	--	120.
	FREE H	NH4	NA	K	CA	MG	CAT SUM MEQ/L
1	0.6	34.0	44.0	3.1	37.0	22.0	200.
2	26.9	32.0	19.0	<1.0	15.0	6.3	121.
3	26.9	12.0	15.0	1.4	8.0	3.2	78.
4	33.1	17.0	7.8	<1.0	6.9	2.4	77.
5	41.7	49.0	12.0	<1.0	7.2	3.2	123.
6	31.6	58.0	14.0	<1.0	7.5	3.4	125.
7	33.1	60.0	9.0	<1.0	4.5	2.1	115.
8	33.9	70.0	9.2	<1.0	3.6	1.8	124.
9	29.5	41.0	5.2	<1.0	2.9	1.4	84.
AVG	28.8	41.3	12.5	0.4	8.4	4.1	108.

TABLE A.2, CONTINUED.

SITE 54

COLLECTION EFFICIENCY = 0.94

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	7.19	0.13	5.36	RPC	RPC
2	4- 9	7.32	0.13	5.36	5.10	30.0
3	4- 9	7.45	0.04	15.97	4.48	28.0
4	4- 9	7.49	0.03	26.25	4.37	31.0
5	4- 9	7.52	0.03	26.25	4.46	21.0
6	4- 9	7.55	0.03	26.25	4.53	17.0
7	4- 9	7.57	0.03	26.25	4.74	10.0
8	4- 9	7.60	0.03	26.25	4.60	12.0
9	4- 9	7.63	1.31	5.38	4.58	15.0
AVG				7.24	4.57	17.6
	S02	S04	NO2	NO3	CL	PO4
						AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	55.0	NAP	94.0	29.0	<0.2
3	NAP	47.0	NAP	43.0	15.0	<0.2
4	NAP	49.0	NAP	43.0	13.0	<0.2
5	NAP	26.0	NAP	17.0	5.7	<0.2
6	NAP	19.0	NAP	11.0	3.9	<0.2
7	NAP	13.0	NAP	4.9	2.2	<0.2
8	NAP	13.0	NAP	4.1	2.0	<0.2
9	NAP	17.0	NAP	11.0	3.5	<0.2
AVG	--	23.0	--	19.2	6.2	--
	FREE H	NH4	NA	K	CA	MG
						CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC
2	7.9	27.0	28.0	6.0	39.0	19.0
3	33.1	42.0	12.0	<1.0	15.0	7.7
4	42.7	48.0	11.0	<1.0	9.6	5.9
5	34.7	29.0	5.3	<1.0	4.1	2.8
6	29.5	13.0	2.9	<1.0	2.9	2.1
7	18.2	4.5	1.9	<1.0	1.1	1.2
8	25.1	5.1	1.4	<1.0	1.2	0.7
9	26.3	15.0	5.9	2.1	2.2	0.9
AVG	26.7	18.7	7.1	1.6	5.6	2.9

TABLE A.2, CONTINUED.

SITE 55

COLLECTION EFFICIENCY = 0.56

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	7.33	0.14	8.69	RPC	RPC	--
2	4- 9	7.47	0.07	16.38	RPC	RPC	--
3	4- 9	7.54	0.05	22.20	5.62	17.0	0.00
4	4- 9	7.59	0.05	22.20	5.00	17.0	-0.10
5	4- 9	7.65	0.05	22.20	5.03	11.0	-0.10
6	4- 9	7.70	0.11	10.77	5.32	7.6	-0.05
7	4- 9	7.81	0.63	1.86	4.87	9.0	0.08
8	4- 9	8.44	0.24	4.83	4.64	14.0	-0.12
9	4- 9	8.69	0.10	4.83	4.65	13.0	0.00
AVG				6.82	4.95	12.6	-0.04
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	RPC	RPC	RPC	RPC	RPC	RPC	RPC
3	NAP	37.0	NAP	40.0	12.0	<0.2	126.
4	NAP	30.0	NAP	46.0	7.7	<0.2	114.
5	NAP	22.0	NAP	14.0	4.3	<0.2	62.
6	NAP	17.0	NAP	9.5	3.0	<0.2	47.
7	NAP	14.0	NAP	6.7	3.1	<0.2	38.
8	NAP	22.0	NAP	13.0	4.5	<0.2	62.
9	NAP	18.0	NAP	8.2	3.4	<0.2	48.
AVG	--	23.3	--	20.7	5.6	--	73.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	RPC	RPC	RPC	RPC	RPC	RPC	RPC
3	2.4	26.0	8.2	<2.0	29.0	16.0	127.
4	10.0	2.0	3.2	<0.4	28.0	16.0	103.
5	9.3	11.0	2.6	<1.0	11.0	5.8	57.
6	4.8	6.2	1.4	<0.4	10.0	5.9	44.
7	13.5	7.2	1.5	<0.4	6.5	3.0	41.
8	22.9	11.0	1.7	<0.4	6.5	3.0	55.
9	22.4	10.0	1.4	<0.4	4.8	2.1	48.
AVG	11.2	10.5	3.0	--	14.5	7.9	70.

TABLE A.2, CONTINUED.

SITE 56

COLLECTION EFFICIENCY = 0.79

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	P-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	7.33	0.31	2.65	5.37	40.0	-0.07
2	4- 9	7.65	0.08	11.07	4.76	24.0	-0.10
3	4- 9	7.72	0.01	95.25	5.01	21.0	-0.07
4	4- 9	7.73	0.01	95.25	4.77	17.0	-0.09
5	4- 9	7.74	0.01	95.25	4.96	14.0	-0.09
6	4- 9	7.75	0.01	95.25	4.64	15.0	-0.07
7	4- 9	7.76	0.01	95.25	4.56	16.0	-0.23
8	4- 9	7.77	0.01	95.25	4.59	15.0	-0.06
9	4- 9	7.78	1.19	3.57	4.63	12.0	0.04
AVG				6.69	4.71	17.0	-0.04
	S02	S04	NO2	NO3	CL	P04	AN SUM UEQ/L
1	NAP	63.0	NAP	130.0	39.0	<0.2	295.
2	NAP	46.0	NAP	47.0	13.0	<0.2	152.
3	NAP	43.0	NAP	36.0	9.3	<0.2	131.
4	NAP	32.0	NAP	21.0	4.9	<0.2	90.
5	NAP	27.0	NAP	16.0	4.9	<0.2	75.
6	NAP	23.0	NAP	12.0	3.3	<0.2	61.
7	NAP	25.0	NAP	13.0	4.9	<0.2	68.
8	NAP	21.0	NAP	12.0	4.4	<0.2	58.
9	NAP	13.0	NAP	8.6	2.6	<0.2	37.
AVG	--	26.4	--	25.3	7.4	--	86.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	4.3	17.0	36.0	4.9	77.0	29.0	274.
2	17.4	54.0	12.0	<5.0	20.0	7.3	138.
3	9.8	56.0	7.5	<2.0	17.0	7.8	123.
4	17.0	36.0	2.9	<2.0	9.3	4.0	82.
5	11.0	25.0	1.8	<1.5	10.0	5.2	68.
6	22.9	18.0	1.4	<1.5	5.1	2.3	57.
7	27.5	16.0	1.6	<1.0	3.1	1.3	54.
8	25.7	18.0	2.0	<1.0	3.4	1.3	55.
9	23.4	7.8	1.4	<0.6	2.3	0.7	39.
AVG	19.5	21.4	5.5	0.4	12.0	4.7	80.

TABLE A.2, CONTINUED.

SITE 57

COLLECTION EFFICIENCY = 0.93

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	7.62	0.06	11.43	4.52	38.0	-0.06
2	4- 9	7.68	0.06	11.43	4.68	14.0	-0.04
3	4- 9	7.74	0.21	3.39	4.60	13.0	-0.02
4	4- 9	7.95	0.23	3.05	4.51	17.0	-0.01
5	4- 9	8.19	0.23	3.05	4.55	14.0	0.10
6	4- 9	8.42	0.20	3.60	4.55	14.0	0.38
7	4- 9	8.62	0.11	6.28	4.63	11.0	0.12
8	4- 9	8.73	0.11	6.28	4.80	7.5	0.12
9	4- 9	8.84	0.32	2.01	4.83	7.0	0.13
AVG				4.10	4.61	15.1	0.08
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	NAP	46.0	NAP	110.0	30.0	<0.2	232.
2	NAP	20.0	NAP	16.0	7.3	<0.2	63.
3	NAP	16.0	NAP	12.0	5.6	<0.2	50.
4	NAP	19.0	NAP	18.0	6.4	<0.2	62.
5	NAP	15.0	NAP	11.0	2.7	<0.2	44.
6	NAP	14.0	NAP	11.0	2.1	<0.2	41.
7	NAP	11.0	NAP	7.6	1.7	<0.2	31.
8	NAP	7.1	NAP	5.2	1.2	<0.2	21.
9	NAP	6.1	NAP	5.8	1.4	<0.2	19.
AVG	--	17.2	--	22.0	6.5	--	63.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	30.2	13.0	23.0	3.8	55.0	19.0	218.
2	20.9	10.0	5.1	<1.0	9.6	2.9	61.
3	25.1	5.3	3.8	<1.0	5.7	1.4	48.
4	30.9	10.0	4.2	<1.0	6.7	1.7	62.
5	28.2	5.9	2.5	<1.0	4.6	1.2	48.
6	28.2	5.4	17.0	<1.0	3.9	0.9	60.
7	23.4	3.7	1.8	<1.0	2.4	0.7	35.
8	15.8	0.9	0.9	<1.0	2.3	0.4	23.
9	14.8	1.7	0.7	<1.0	2.0	0.5	22.
AVG	24.3	6.3	6.6	0.4	10.3	3.2	65.

TABLE A.2. CONTINUED.

SITE 58

COLLECTION EFFICIENCY = 0.59

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	7.85	0.20	5.74	4.77	19.0	-0.11
2	4- 9	8.04	0.34	3.29	4.67	13.0	-0.12
3	4- 9	8.38	0.29	3.88	4.61	13.0	-0.13
4	4- 9	8.67	0.24	4.72	4.71	11.0	-0.09
5	4- 9	8.91	0.13	4.72	4.58	12.0	0.17
6	4- 9	9.04	0.24	4.72	4.87	6.5	0.04
7	4- 9	9.28	0.04	4.72	4.97	ISA	--
AVG				4.36	4.71	12.5	-0.06
	S02	S04	N02	N03	CL	P04	AN SUM UMOL/L
1	NAP	26.0	NAP	45.0	26.0	<0.2	123.
2	NAP	18.0	NAP	17.0	6.6	<0.2	60.
3	NAP	17.0	NAP	16.0	5.7	<0.2	56.
4	NAP	14.0	NAP	11.0	4.1	<0.2	43.
5	NAP	10.0	NAP	7.6	2.8	<0.2	30.
6	NAP	6.6	NAP	4.7	2.1	<0.2	20.
7	NAP	6.3	NAP	4.7	2.6	<0.2	20.
AVG	--	15.4	--	17.3	8.1	--	56.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UMOL/L
1	17.0	6.6	24.0	0.8	25.0	6.1	111.
2	21.4	7.2	4.9	<1.0	7.7	1.9	53.
3	24.5	6.3	3.4	<1.0	6.0	1.4	49.
4	19.5	5.1	2.1	<0.4	4.8	1.5	39.
5	26.3	1.8	1.1	<0.4	2.8	0.7	36.
6	13.5	0.6	1.3	<0.4	2.3	0.4	21.
7	10.7	<0.6	1.7	<0.4	ISA	ISA	ISA
AVG	19.6	4.7	6.4	0.1	8.5	2.1	53.

TABLE A.2, CONTINUED.

SITE 61

COLLECTION EFFICIENCY = ? (NO RAINGAUGE DATA)
 UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	MOE	MOE	MOE	MOE	MOE	MOE	--
2	MOE	MOE	MOE	MOE	MOE	MOE	--
3	MOE	MOE	MOE	MOE	MOE	MOE	--
4	MOE	MOE	MOE	MOE	MOE	MOE	--
5	MOE	MOE	MOE	MOE	MOE	MOE	--
6	MOE	MOE	MOE	MOE	MOE	MOE	--
7	MOE	MOE	MOE	MOE	MOE	MOE	--
AVG				--	--	--	--
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	MOE	MOE	MOE	MOE	MOE	MOE	MOE
2	MOE	MOE	MOE	MOE	MOE	MOE	MOE
3	MOE	MOE	MOE	MOE	MOE	MOE	MOE
4	MOE	MOE	MOE	MOE	MOE	MOE	MOE
5	MOE	MOE	MOE	MOE	MOE	MOE	MOE
6	MOE	MOE	MOE	MOE	MOE	MOE	MOE
7	MOE	MOE	MOE	MOE	MOE	MOE	MOE
AVG	--	--	--	--	--	--	--
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	MOE	MOE	MOE	MOE	MOE	MOE	MOE
2	MOE	MOE	MOE	MOE	MOE	MOE	MOE
3	MOE	MOE	MOE	MOE	MOE	MOE	MOE
4	MOE	MOE	MOE	MOE	MOE	MOE	MOE
5	MOE	MOE	MOE	MOE	MOE	MOE	MOE
6	MOE	MOE	MOE	MOE	MOE	MOE	MOE
7	MOE	MOE	MOE	MOE	MOE	MOE	MOE
AVG	--	--	--	--	--	--	--

TABLE A.2, CONTINUED.

SITE 62

COLLECTION EFFICIENCY = ? (NO RAINGAUGE DATA)
UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHD/CM	ION BAL
1	MOE	MOE	MOE	MOE	RPC	RPC	--
2	MOE	MOE	MOE	MOE	4.88	17.0	-0.34
3	MOE	MOE	MOE	MOE	4.44	27.0	-0.32
4	MOE	MOE	MOE	MOE	4.38	30.0	-0.29
5	MOE	MOE	MOE	MOE	4.32	40.0	-0.26
6	MOE	MOE	MOE	MOE	4.61	27.0	-0.12
7	MOE	MOE	MOE	MOE	4.50	24.0	-0.17
8	MOE	MOE	MOE	MOE	4.44	29.0	-0.11
9	MOE	MOE	MOE	MOE	4.59	17.0	-0.01
AVG				--	4.53	22.5	-0.12
	SO2	SD4	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	2.4	32.0	<0.1	28.0	10.0	<0.2	102.
3	1.2	41.0	<0.1	38.0	12.0	<0.2	132.
4	1.0	43.0	NAP	41.0	11.0	<0.2	138.
5	0.3	56.0	<0.1	56.0	16.0	<0.2	184.
6	0.8	45.0	NAP	41.0	11.0	<0.2	142.
7	1.1	28.0	<0.1	24.0	26.0	<0.2	106.
8	0.9	45.0	NAP	32.0	9.0	<0.2	131.
9	0.3	20.0	NAP	18.0	3.8	<0.2	62.
AVG	0.7	31.1	--	27.9	8.9	--	99.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	13.2	15.0	9.6	0.8	11.0	6.0	73.
3	36.3	23.0	9.2	<1.0	9.6	3.7	95.
4	41.7	31.0	9.2	<1.0	7.9	2.7	103.
5	47.9	52.0	14.0	<1.0	10.0	3.7	141.
6	24.5	51.0	12.0	<1.0	13.0	6.5	127.
7	31.6	37.0	7.4	<1.0	4.7	1.9	89.
8	36.3	58.0	9.6	<1.0	4.7	1.9	117.
9	25.7	25.0	3.4	<1.0	2.5	1.1	61.
AVG	29.5	31.8	6.9	0.1	5.7	2.5	85.

TABLE A.2, CONTINUED.

SITE 63

COLLECTION EFFICIENCY = 0.46

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.67	0.24	5.99	4.50	41.0	-0.17
2	4- 9	6.91	0.23	6.11	4.73	20.0	-0.18
3	4- 9	7.14	0.13	11.08	4.59	20.0	-0.15
4	4- 9	7.27	0.13	11.08	4.44	28.0	-0.11
5	4- 9	7.40	0.52	2.72	4.41	36.0	-0.10
6	4- 9	7.92	0.23	6.10	4.47	24.0	-0.07
7	4- 9	8.16	0.23	6.10	4.46	23.0	-0.07
8	4- 9	8.39	0.11	6.10	4.49	22.0	-0.08
AVG				5.82	4.50	27.1	-0.12
	SO2	SO4	NO2	NO3	CL	P04	AN SUM UEQ/L
1	NAP	61.0	NAP	120.0	37.0	<0.2	279.
2	NAP	36.0	NAP	40.0	16.0	<0.2	128.
3	NAP	36.0	NAP	29.0	10.0	<0.2	111.
4	NAP	46.0	NAP	43.0	13.0	<0.2	148.
5	NAP	65.0	NAP	57.0	16.0	<0.2	203.
6	NAP	43.0	NAP	32.0	8.6	<0.2	127.
7	NAP	38.0	NAP	26.0	7.1	<0.2	109.
8	NAP	37.0	NAP	25.0	7.2	<0.2	106.
AVG	--	45.8	--	48.0	14.9	--	155.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	31.6	41.0	37.0	7.7	41.0	18.0	235.
2	18.6	29.0	14.0	<1.0	16.0	6.5	107.
3	25.7	30.0	8.1	<1.0	11.0	4.8	95.
4	36.3	55.0	12.0	<1.0	11.0	3.7	133.
5	38.9	98.0	17.0	<1.0	10.0	4.9	184.
6	33.9	57.0	13.0	<1.0	4.8	2.5	118.
7	34.7	50.0	5.8	<1.0	4.1	1.4	101.
8	32.4	43.0	6.0	<1.0	6.5	1.9	98.
AVG	31.4	50.9	14.7	1.0	13.5	5.7	137.

TABLE A.2, CONTINUED.

SITE 64

COLLECTION EFFICIENCY = 0.43

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.96	0.15	10.03	RPC	RPC	--
2	4- 9	7.11	0.15	10.03	RPC	RPC	--
3	4- 9	7.26	0.15	10.03	4.50	24.0	-0.06
4	4- 9	7.42	0.29	5.31	4.83	15.0	-0.42
5	4- 9	7.70	0.22	6.93	4.50	19.0	-0.05
6	4- 9	7.92	0.21	7.12	4.51	17.0	-0.04
7	4- 9	8.14	0.21	7.12	4.54	16.0	-0.08
8	4- 9	8.35	0.59	2.56	4.45	19.0	0.00
9	4- 9	8.94	0.02	1.53	ISA	ISA	--
AVG				6.10	4.54	18.3	-0.11
	S02	S04	NO2	NO3	CL	P04	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	RPC	RPC	RPC	RPC	RPC	RPC	RPC
3	NAP	34.0	NAP	29.0	11.0	<0.2	108.
4	NAP	33.0	NAP	21.0	7.9	<0.2	95.
5	NAP	24.0	NAP	17.0	5.8	<0.2	71.
6	NAP	20.0	NAP	13.0	4.6	<0.2	58.
7	NAP	18.0	NAP	10.0	4.0	<0.2	50.
8	NAP	22.0	NAP	15.0	3.7	<0.2	63.
9	NAP	17.0	NAP	11.0	2.5	<0.2	48.
AVG	--	25.1	--	17.5	6.2	--	74.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	RPC	RPC	RPC	RPC	RPC	RPC	RPC
3	31.6	23.0	7.9	<1.0	14.0	5.6	102.
4	14.8	27.0	3.6	<1.0	4.6	3.6	62.
5	31.6	15.0	4.4	<1.0	5.7	2.3	67.
6	30.9	7.5	4.0	<1.0	4.8	1.8	56.
7	28.8	7.1	3.3	<1.0	2.5	1.0	46.
8	35.5	16.0	2.5	<1.0	3.2	1.2	63.
9	ISA	12.0	1.6	<1.0	ISA	ISA	ISA
AVG	28.9	15.9	4.3	--	5.8	2.6	66.

TABLE A.2, CONTINUED.

SITE 65

COLLECTION EFFICIENCY = 0.89

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	7.37	0.09	8.30	4.67	46.0	0.00
2	4- 9	7.46	0.09	8.30	5.55	11.0	0.06
3	4- 9	7.55	0.09	8.30	4.51	21.0	-0.08
4	4- 9	7.64	0.13	5.58	4.48	23.0	0.02
5	4- 9	7.77	0.03	25.28	4.50	30.0	-0.02
6	4- 9	7.80	0.03	25.27	4.46	26.0	0.02
7	4- 9	7.83	0.03	25.28	4.45	24.0	-0.05
8	4- 9	7.86	0.03	25.27	4.51	20.0	-0.06
9	4- 9	7.89	1.36	5.13	4.65	14.0	-0.08
AVG				6.87	4.61	19.1	-0.05
	S02	S04	NO2	NO3	CL	P04	AN SUM UEQ/L
1	0.8	55.0	NAP	150.0	32.0	<0.2	292.
2	NAP	20.0	NAP	20.0	6.7	<0.2	67.
3	NAP	26.0	NAP	22.0	9.0	<0.2	83.
4	1.3	31.0	NAP	26.0	9.2	<0.2	97.
5	NAP	48.0	NAP	47.0	15.0	<0.2	158.
6	NAP	39.0	NAP	34.0	8.6	<0.2	121.
7	NAP	34.0	NAP	26.0	6.4	<0.2	100.
8	NAP	28.0	NAP	19.0	7.6	<0.2	83.
9	2.1	19.0	NAP	11.0	2.8	<0.2	52.
AVG	1.9	26.4	--	25.7	6.9	--	86.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	21.4	1.4	44.0	3.1	75.0	36.0	292.
2	2.8	1.6	6.4	<1.0	19.0	11.0	71.
3	30.9	14.0	6.5	<1.0	9.3	3.4	77.
4	33.1	29.0	9.2	<1.0	10.0	3.9	99.
5	31.6	65.0	19.0	<1.0	14.0	6.0	156.
6	34.7	52.0	17.0	<1.0	6.5	3.2	123.
7	35.5	42.0	5.2	<1.0	4.5	2.1	96.
8	30.9	33.0	4.5	<1.0	3.2	1.3	77.
9	22.4	11.0	2.2	<1.0	4.2	1.8	48.
AVG	24.8	19.6	7.6	0.2	10.4	4.8	83.

TABLE A.2, CONTINUED.

SITE 66

COLLECTION EFFICIENCY = 0.54

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	7.47	0.07	17.04	4.70	41.0	-0.07
2	4- 9	7.54	0.36	3.44	4.80	15.0	-0.09
3	4- 9	7.90	0.08	15.06	4.63	14.0	-0.13
4	4- 9	7.98	0.13	9.47	4.49	18.0	0.01
5	4- 9	8.11	0.25	4.84	4.68	11.0	-0.14
6	4- 9	8.37	0.25	4.84	4.68	11.0	-0.10
7	4- 9	8.62	0.40	3.07	4.53	15.0	-0.25
8	4- 9	9.02	0.04	2.98	ISA	ISA	--
AVG				5.49	4.63	17.9	-0.11
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	NAP	54.0	NAP	140.0	32.0	<0.2	280.
2	NAP	25.0	NAP	24.0	8.1	<0.2	82.
3	NAP	18.0	NAP	15.0	5.0	<0.2	56.
4	NAP	20.0	NAP	18.0	5.3	<0.2	63.
5	NAP	14.0	NAP	7.5	2.0	<0.2	38.
6	NAP	13.0	NAP	7.2	2.1	<0.2	35.
7	NAP	19.0	NAP	14.0	3.3	<0.2	55.
8	NAP	18.0	NAP	14.0	3.0	<0.2	53.
AVG	--	23.2	--	32.0	8.2	--	87.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	20.0	5.5	45.0	2.8	67.0	27.0	261.
2	15.8	13.0	8.4	<1.0	14.0	5.0	75.
3	23.4	3.2	4.3	<1.0	7.1	2.1	49.
4	32.4	12.0	4.1	<1.0	6.0	1.6	64.
5	20.9	0.9	2.0	<0.4	3.4	1.0	33.
6	20.9	0.6	1.6	<0.4	3.5	0.9	32.
7	29.5	3.0	1.7	<1.0	3.4	0.9	43.
8	ISA	9.1	2.1	<1.0	2.8	ISA	ISA
AVG	23.3	5.5	9.5	0.4	14.8	5.5	80.

TABLE A.2, CONTINUED.

SITE 67

COLLECTION EFFICIENCY = 0.59

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION HAL
1	4- 9	7.70	0.59	1.91	5.03	24.0	-0.06
2	4- 9	8.29	0.11	10.40	4.38	33.0	0.00
3	4- 9	8.40	0.11	10.40	4.47	19.0	-0.15
4	4- 9	8.51	0.11	10.40	4.57	13.0	-0.05
5	4- 9	8.61	0.11	10.40	4.59	12.0	0.19
6	4- 9	8.72	0.50	2.24	4.78	8.1	-0.08
7	4- 9	9.22	0.47	2.18	4.67	11.0	-0.15
AVG				3.90	4.60	17.2	-0.04
	SO2	SO4	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	NAP	42.0	NAP	58.0	26.0	<0.2	168.
2	NAP	48.0	NAP	49.0	17.0	<0.2	162.
3	NAP	25.0	NAP	19.0	6.2	<0.2	75.
4	NAP	14.0	NAP	8.1	3.3	<0.2	39.
5	NAP	10.0	NAP	5.7	3.7	<0.2	29.
6	NAP	8.2	NAP	4.4	2.1	<0.2	23.
7	NAP	12.0	NAP	9.6	3.3	<0.2	37.
AVG	--	22.9	--	22.1	8.9	--	77.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	9.3	27.0	33.0	1.3	35.0	8.8	158.
2	41.7	51.0	24.0	<1.0	18.0	4.8	162.
3	33.9	12.0	4.4	<1.0	5.7	1.6	65.
4	26.9	1.7	1.9	<0.4	2.8	0.7	37.
5	25.7	3.6	1.5	0.4	1.8	0.4	36.
6	16.6	<0.6	1.3	<0.4	1.6	<0.4	21.
7	21.4	2.9	1.2	<1.0	2.6	0.5	32.
AVG	25.1	14.2	9.7	0.3	9.7	2.4	74.

TABLE A.2, CONTINUED.

SITE 71

COLLECTION EFFICIENCY = 0.32

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.05	0.79	2.56	4.65	31.0	-0.05
2	4- 9	6.84	0.07	27.43	4.35	34.0	-0.06
3	4- 9	6.92	0.07	27.43	4.52	19.0	-0.20
4	4- 9	6.99	0.07	27.43	4.69	11.0	0.10
5	4- 9	7.06	0.48	4.26	4.65	11.0	0.19
6	4- 9	7.54	0.17	12.19	4.48	20.0	-0.07
7	4- 9	7.71	0.27	7.56	4.46	24.0	-0.08
8	4- 9	7.98	0.69	2.95	4.44	22.0	-0.12
AVG				6.21	4.52	21.5	-0.04
	S02	S04	NO2	NO3	CL	PO4	AN SUM UEQ/L
1	NAP	51.0	NAP	77.0	31.0	<0.2	210.
2	NAP	52.0	NAP	47.0	20.0	<0.2	171.
3	NAP	23.0	NAP	15.0	6.2	<0.2	67.
4	NAP	12.0	NAP	7.1	3.6	<0.2	35.
5	NAP	12.0	NAP	4.9	2.2	<0.2	31.
6	NAP	31.0	NAP	23.0	7.8	<0.2	93.
7	NAP	39.0	NAP	31.0	9.4	<0.2	118.
8	NAP	34.0	NAP	26.0	7.6	<0.2	102.
AVG	--	31.8	--	28.9	11.0	--	103.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	22.4	11.0	43.0	2.7	48.0	12.0	199.
2	44.7	51.0	20.0	<1.0	18.0	4.4	160.
3	30.2	2.5	5.2	<0.4	6.8	1.8	55.
4	20.4	5.8	2.1	<0.4	4.1	0.9	38.
5	22.4	6.0	1.5	<0.4	3.3	0.7	38.
6	33.1	36.0	5.5	<1.0	4.6	1.2	86.
7	34.7	56.0	6.4	<1.0	4.8	1.4	109.
8	36.3	37.0	5.2	<1.0	4.7	1.3	91.
AVG	30.5	25.7	11.1	0.3	11.8	3.0	97.

TABLE A.2, CONTINUED.

SITE 72

COLLECTION EFFICIENCY = OVF

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	6.67	0.07	9.14	RPC	RPC	--
2	4- 9	6.74	0.07	9.14	4.56	27.0	-0.13
3	4- 9	6.81	0.07	9.14	4.56	21.0	0.04
4	4- 9	6.88	0.07	9.14	4.64	13.0	-0.02
5	4- 9	6.96	0.07	9.14	4.42	21.0	-0.12
6	4- 9	7.03	0.11	5.75	4.42	22.0	-0.11
7	4- 9	7.14	0.15	4.51	4.38	28.0	-0.10
8	4- 9	7.29	0.01	54.86	4.42	27.0	-0.10
9	4- 9	7.30	0.32	35.13	4.60	14.0	-0.05
AVG				17.35	4.56	16.5	-0.06
	S02	S04	ND2	NO3	CL	P04	AN SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	NAP	56.0	NAP	48.0	19.0	<0.2	179.
3	NAP	34.0	NAP	25.0	6.9	<0.2	100.
4	NAP	17.0	NAP	10.0	3.9	<0.2	48.
5	NAP	32.0	NAP	22.0	7.7	<0.2	94.
6	NAP	32.0	NAP	23.0	8.8	<0.2	96.
7	NAP	50.0	NAP	41.0	13.0	<0.2	154.
8	NAP	50.0	NAP	39.0	12.0	<0.2	151.
9	NAP	21.0	NAP	12.0	3.4	<0.2	57.
AVG	--	26.1	--	17.1	5.4	--	75.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	RPC	RPC	RPC	RPC	RPC	RPC	RPC
2	27.5	50.0	19.0	<1.0	23.0	7.1	157.
3	27.5	30.0	10.0	<1.0	14.0	4.3	104.
4	22.9	7.5	2.8	<1.0	5.2	1.6	47.
5	38.0	23.0	5.8	<1.0	6.5	1.7	83.
6	38.0	23.0	6.6	<1.0	7.2	1.8	86.
7	41.7	59.0	13.0	<3.0	9.5	3.1	139.
8	38.0	68.0	11.0	<2.5	7.2	2.4	136.
9	25.1	23.0	3.1	<3.0	1.4	0.4	55.
AVG	27.5	27.1	5.0	--	4.0	1.2	70.

TABLE A.2, CONTINUED.

SITE 73

COLLECTION EFFICIENCY = 0.72

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	TION BAL
1	4-	9	6.94	0.21	4.28	4.61	40.0
2	4-	9	7.15	0.20	4.49	5.03	12.0
3	4-	9	7.35	0.04	23.09	4.33	33.0
4	4-	9	7.39	0.04	23.09	4.59	17.0
5	4-	9	7.43	0.04	23.09	4.64	19.0
6	4-	9	7.47	0.04	23.09	4.61	16.0
7	4-	9	7.51	0.04	23.09	4.63	13.0
8	4-	9	7.55	0.04	23.09	4.63	12.0
9	4-	9	7.59	1.42	10.57	4.76	8.4
AVG				10.76	4.70	12.3	-0.11
	S02	S04	NO2	NO3	CL	P04	AN SUM UEQ/L
1	NAP	67.0	NAP	140.0	38.0	<0.2	312.
2	NAP	27.0	NAP	22.0	7.4	<0.2	83.
3	NAP	54.0	NAP	49.0	18.0	<0.2	175.
4	NAP	29.0	NAP	21.0	7.1	<0.2	86.
5	NAP	35.0	NAP	27.0	7.1	<0.2	104.
6	NAP	27.0	NAP	19.0	4.9	<0.2	78.
7	NAP	21.0	NAP	13.0	3.2	<0.2	58.
8	NAP	16.0	NAP	9.1	2.3	<0.2	43.
9	NAP	11.0	NAP	6.6	1.6	<0.2	30.
AVG	--	18.7	--	16.7	4.7	--	59.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	24.5	17.0	45.0	6.9	67.0	20.0	267.
2	9.3	14.0	6.4	<3.0	15.0	4.9	70.
3	46.8	49.0	18.0	<4.0	19.0	4.8	161.
4	25.7	21.0	12.0	<2.0	9.2	2.5	82.
5	22.9	51.0	5.8	<1.0	9.0	3.0	104.
6	24.5	35.0	3.0	<1.0	4.6	1.2	74.
7	23.4	20.0	1.7	<1.0	3.8	0.9	55.
8	23.4	7.8	1.2	<1.0	3.2	0.5	40.
9	17.4	5.3	0.9	<1.0	1.5	<0.4	27.
AVG	19.9	12.4	4.4	0.3	6.4	1.5	53.

TABLE A.2, CONTINUED.

SITE 74

COLLECTION EFFICIENCY = 0.45

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4-	9	7.75	0.06	22.86	4.83	40.0
2	4-	9	7.81	0.06	22.86	4.71	22.0
3	4-	9	7.88	0.06	22.86	4.53	25.0
4	4-	9	7.94	0.06	22.86	4.64	15.0
5	4-	9	8.00	0.06	22.86	4.52	18.0
6	4-	9	8.07	0.06	22.86	4.50	17.0
7	4-	9	8.13	0.06	22.86	4.56	15.0
8	4-	9	8.20	0.12	12.21	4.62	12.0
9	4-	9	8.31	0.94	3.30	4.68	11.0
AVG					9.82	4.62	18.5
	S02	S04	NO2	NO3	CL	P04	AN SUM UEQ/L
1	NAP	65.0	NAP	105.0	36.0	<0.2	271.
2	NAP	41.0	NAP	39.0	12.0	<0.2	133.
3	NAP	42.0	NAP	38.0	11.0	<0.2	133.
4	NAP	24.0	NAP	20.0	5.3	<0.2	73.
5	NAP	25.0	NAP	18.0	5.2	<0.2	73.
6	NAP	23.0	NAP	16.0	11.0	<0.2	73.
7	NAP	19.0	NAP	12.0	11.0	<0.2	61.
8	NAP	14.0	NAP	7.9	6.1	<0.2	42.
9	NAP	12.0	NAP	5.5	6.3	<0.2	36.
AVG	--	27.5	--	26.4	11.0	--	92.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	14.8	41.0	40.0	1.7	65.0	25.0	277.
2	19.5	54.0	14.0	<1.0	16.0	5.8	131.
3	29.5	63.0	11.0	<1.0	9.0	3.9	129.
4	22.9	27.0	5.5	<1.0	5.1	2.2	70.
5	30.2	26.0	4.4	<1.0	3.1	1.0	69.
6	31.6	23.0	5.6	<1.0	3.5	1.1	69.
7	27.5	18.0	4.6	<1.0	2.8	0.8	57.
8	24.0	10.0	6.5	1.2	1.7	0.5	46.
9	20.9	6.2	1.2	<0.4	1.2	<0.4	31.
AVG	24.1	27.2	9.3	0.3	10.7	4.0	90.

TABLE A.2, CONTINUED.

SITE 75

COLLECTION EFFICIENCY = 0.42

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START DAY	(GMT) HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	7.46	0.72	2.21	4.70	30.0	0.00
2	4- 9	8.18	0.07	22.35	4.74	25.0	0.02
3	4- 9	8.25	0.07	22.35	5.43	26.0	0.07
4	4- 9	8.32	0.07	22.35	4.62	19.0	0.04
5	4- 9	8.39	0.28	5.68	4.58	18.0	-0.04
6	4- 9	8.67	0.61	1.60	4.61	15.0	0.06
AVG				4.88	4.72	22.6	0.02
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	NAP	35.0	NAP	100.0	30.0	<0.2	200.
2	NAP	46.0	NAP	43.0	18.0	<0.2	153.
3	NAP	55.0	NAP	57.0	21.0	<0.2	188.
4	NAP	30.0	NAP	25.0	9.0	<0.2	94.
5	NAP	26.0	NAP	20.0	7.1	<0.2	79.
6	NAP	18.0	NAP	12.0	5.0	<0.2	53.
AVG	--	36.1	--	44.9	15.7	--	133.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	20.0	11.0	37.0	3.1	48.0	16.0	199.
2	18.2	56.0	20.0	<1.0	24.0	6.8	156.
3	3.7	94.0	27.0	<1.0	27.0	11.0	201.
4	24.0	44.0	9.3	<1.0	7.6	2.7	98.
5	26.3	30.0	6.1	<1.0	5.0	1.9	76.
6	24.5	19.0	3.8	<1.0	3.4	1.1	56.
AVG	19.1	43.9	18.1	0.6	20.2	7.0	136.

TABLE A.2, CONTINUED.

SITE 76

COLLECTION EFFICIENCY = 1.09

UNITS ARE UMOL/L UNLESS NOTED

STAGE	START (GMT) DAY	HR	DT HR	R-RATE MM/HR	LAB PH	COND UMHO/CM	ION BAL
1	4- 9	8.45	0.02	29.93	4.72	38.0	0.01
2	4- 9	8.47	0.02	29.93	4.81	17.0	-0.01
3	4- 9	8.49	0.02	29.93	4.69	14.0	0.06
4	4- 9	8.51	0.07	9.76	4.68	13.0	0.04
5	4- 9	8.58	0.24	2.77	4.68	13.0	-0.01
6	4- 9	8.82	0.21	2.77	4.57	16.0	0.01
AVG				6.65	4.69	18.5	0.02
	S02	S04	N02	N03	CL	P04	AN SUM UEQ/L
1	NAP	60.0	NAP	97.0	36.0	<0.2	253.
2	NAP	29.0	NAP	25.0	9.9	<0.2	93.
3	NAP	19.0	NAP	16.0	7.3	<0.2	61.
4	NAP	19.0	NAP	13.0	5.7	<0.2	57.
5	NAP	17.0	NAP	11.0	5.2	<0.2	50.
6	NAP	22.0	NAP	15.0	6.1	<0.2	65.
AVG	--	27.8	--	29.8	11.8	--	97.
	FREE H	NH4	NA	K	CA	MG	CAT SUM UEQ/L
1	19.1	79.0	46.0	4.5	42.0	12.0	257.
2	15.5	40.0	10.0	<1.0	10.0	3.4	92.
3	20.4	24.0	6.3	<1.0	5.5	1.7	65.
4	20.9	23.0	4.5	1.7	3.5	1.0	59.
5	20.9	19.0	3.5	<1.0	2.6	0.7	50.
6	26.9	24.0	3.6	<1.0	4.6	1.1	66.
AVG	20.5	35.0	12.5	1.1	11.5	3.3	99.

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	D. H. Slade Physical and Technological Research Division Office of Health and Environmental Research ER-74 (GTN) U.S. Department of Energy Washington, DC 20545	30	<u>Pacific Northwest Laboratory</u> M. T. Dana (5) D. W. Dragnich R. C. Easter (5) J. M. Hales N. S. Laulainen (5) W. G. N. Slinn J. M. Thorp (5) Publishing Coordination (2) Technical Information (5)
27	DOE Technical Information Center J. D. Shannon Environmental Research Division Argonne National Laboratory 9700 South Cass Avenue Argonne, IL 60439		
2	C. M. Benkovitz Energy & Environment, Bldg. 051 Brookhaven National Laboratory Upton, NY 11973 F. Binkowski U.S. Environmental Protection Agency ESRL MD-80 Research Triangle Park, NC 27711 F. A. Schiermeier U.S. Environmental Protection Agency ESRL MD-80 Research Triangle Park, NC 27711		