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THE CENTRAL CALIFORNIA OZONE STUDY

APPENDIX C: CENTRAL CALIFORNIA OZONE STUDY VOLUME 3: SUMMARY OF FIELD OPERATIONS

PIER FINAL PROJECT REPORT

Prepared For:
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Public Interest Energy Research Program

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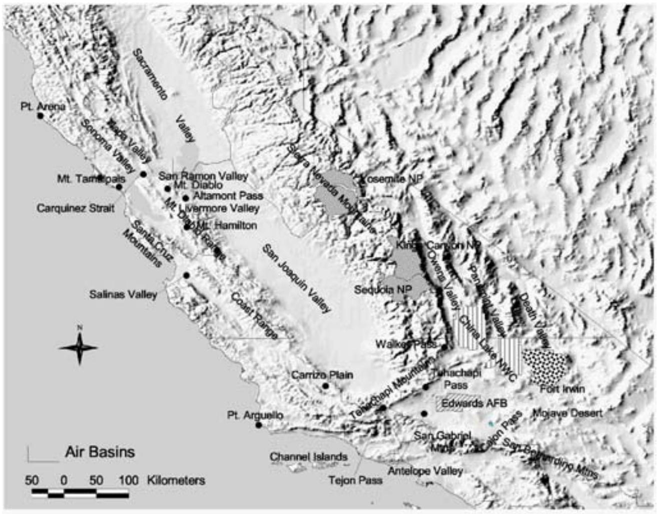

Central California Ozone Study (CCOS)

Volume III:
Summary of Field Operations

FINAL REPORT

February 5, 2001

Central California Ozone Study – Volume III
Summary of Field Operations

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1.0 INTRODUCTION

The Central California Ozone Study (CCOS) is a multi-year program of meteorological and air quality monitoring, emission inventory development, data analysis, and air quality simulation modeling. The goals of CCOS are to: 1) obtain suitable air quality, meteorological and emission databases to evaluate and improve air quality models for representing urban and regional-scale ozone episodes in central and northern California to meet the regulatory requirements for the state 1-hour and pending federal 8-hour ozone standards; 2) determine the contributions of transport and locally generated ozone and the relative benefits of hydrocarbon and nitrogen oxides emission controls in upwind areas; and 3) assess the relative contributions of ozone generated from emissions in one air basin to state and federal exceedances in neighboring air basins. The modeling domain for CCOS covers all of central California and most of northern California, extending from the Pacific Ocean to east of the Sierra Nevada Mountains and from Redding to the Mojave Desert. The selection of this study area reflects the regional nature of the state 1-hour and federal 8-hour ozone exceedances, increasing urbanization of traditionally rural areas, and a need to include all of the major flow features that affect air quality in central California.

The CCOS is a large-scale program involving many sponsors and participants with an extramural research budget of $8.2 million for the summer 2000 field measurement campaign. In addition, the California Air Resources Board (ARB) and local Air Pollution Control Districts (APCD) provided substantial in-kind contributions during the field program. Three entities are involved in the overall management of the Study. The San Joaquin Valleywide Air Pollution Study Agency, a joint powers agency (JPA) formed by the nine counties in the Valley, directs the fund-raising and contracting aspects of the Study. A Policy Committee comprised of four voting blocks: State, local, and federal government, and the private sector, provides guidance on the Study objectives and funding levels. The Policy Committee approved all proposal requests, contracts and reports. A Technical Committee parallels the Policy Committee in membership and provides overall technical guidance on proposal requests, direction and progress of work, contract work statements, and reviews of all technical reports produced from the study. On a day-to-day basis, the California Air Resources Board is responsible for management of the Study.

The goals of CCOS are being met through a process that includes analysis of existing data; execution of a large-scale field study to acquire a comprehensive database to support modeling and data analysis; analysis of the data collected during the field study; and the development, evaluation, and application of an air quality simulation model for northern and central California. The CCOS field measurement program was conducted in the summer of 2000 in conjunction with the California Regional PM_{10}/$PM_{2.5}$ Air Quality Study (CRPAQS), a major study of the origin, nature and extent of excessive levels of fine particles in central California (Watson et al., 1998). Although air quality simulation modeling will be used to address CCOS goals, past experience has demonstrated the need for thorough diagnostic analyses and corroborative data analysis to assess the reliability of outputs from each part of the modeling system (i.e., emissions, meteorological, and air quality models). Corroborative data analysis is used to reinforce current understanding, identify gaps and improve the conceptual model of ozone formation, and to determine if measurement and modeling results are consistent with the conceptual model as revised by CCOS.

Planning for the CCOS Field Study, which began in late 1998, involved regular meetings of the CCOS Technical Committee and Working Groups for over an 18-month-month period and input from local air pollution control districts, academia, and industry reviewers. Members of Committees and Working Groups and participants of the CCOS Field Study are acknowledged on pages ii to iv of this document. The CCOS planning documents consists of a Field Study Plan – CCOS Volume I (Fujita et al., 1999 - version 1, 06/11/99; version 2, 09/07/99; and version 3, 11/24/99) and a Field Operations Plan – CCOS Volume II (Fujita et al., 2000 - version 1, 04/28/00; and version 2, 05/31/00).

The Field Study Plan (CCOS Volume I) describes the goals and technical objectives of the study, and describes alternative experimental, modeling, and data analysis approaches for addressing the study objectives. It presents a summary of the current knowledge of meteorology, emissions, and chemical and physical processes that affect the formation and accumulation of ozone in northern and central California. It also reviews the results from prior SAQM[1] modeling by the ARB, and identifies the remaining uncertainties and their implications for the design of the CCOS field measurement program. The plan describes requirements for the modeling and data analysis approaches that are proposed to address CCOS technical objectives. It specifies the measurements for modeling and data analysis, considers the merits of alternative measurement approaches, and explains the rationale and criteria for measurement decisions.

The Field Operations Plan (CCOS Volume II) specifies the details of the field measurement program that allowed the field study plan to be executed with available resources. It specifies the CCOS measurement parameters, methods, locations, averaging times, and calibration methods. The plan describes the meteorological conditions associated with ozone episodes and transport scenarios of interests, and specifies the daily forecast and intensive operational period (IOP) decision-making protocols. It outlines the activities needed to ensure data quality and describes the data management activities for the study. The plan also summarizes the efforts to develop a temporally and spatially resolved emission inventory for the CCOS modeling domain, and specifies the program schedule and budget.

This document, the Summary of Field Operations (CCOS Volume III), documents the summer 2000 field measurement program. This section lists the primary technical objectives for CCOS and provides an overview of the summer 2000 field measurements. Chapter 2 documents the meteorological and air quality condition during the summer 2000 ozone season and during individual IOPs and Chapter 3 describes the daily forecasting and making-decision protocols for launching intensive operational periods (IOPs). Chapter 4 documents the parameters that were measured, locations, measurement methods, times, and levels of data capture. This document and both planning documents and products of CCOS Working Groups are available at the following web site: http://www.arb.ca.gov/airways/ccos/ccos.htm

[1] SARMAP Air Quality Model

2. METEOROLOGICAL AND AIR QUALITY CHARACTERIZATION OF THE STUDY PERIOD AND INTENSIVE OPERATIONAL PERIODS

This section provides an overview of synoptic meteorology and overall air quality during the CCOS study period and the Intensive Operational Periods (IOPs).

2.1 Climatology During CCOS

Climatology during summer 2000 was a bit cooler than normal. Also, the duration of high pressure ridging, which fosters ozone production, was somewhat shorter than in previous summers. Table 2.2-1 shows selected meteorological parameters for days of interest during the study period and some descriptive statistics for the IOP days, the summer period (6/21/00-9/21/00), and the full study period (06/01/00-09/30/00). The table lists maximum temperature data at Fresno airport (FAT), San Francisco airport (SFO), the pressure gradient (Prgrad) between Reno (RNO) and Fresno, and the 500mb height and 850mb temperature from the morning (0400 PST) Oakland sounding. Table 2.2-2 provides the meteorological scenarios and, where applicable, the type of cluster for the IOP days.

When compared to the 30-year climatology for June to September for Fresno and San Francisco, (Table 2.5-1, CCOS Field Study Plan, Fujita et al. 1999), the inland temperatures are statistically cooler during CCOS, while the coastal temperatures are not. For example the study period daily temperature maximum at Fresno, 91.4±0.7 F, is more than three standard deviations below the climatological value of 94.8 F. The study period daily temperature maximum at San Francisco, 71.5±0.7 F, is below but not statistically different from the climatological value of 72.0 F. This can be explained by less high pressure ridges and/or ridging of shorter duration passing over the western United States, where the inland sites are not as influenced by the mitigating effects of the Pacific Ocean.

Inspection of 500-mb (and surface) daily weather maps shows that low pressure troughs, cut-off lows, and zonal flow occurred during the first 7 weeks of the study period, except for one brief incursion of an Eastern Pacific High which brought some ridging over the West Coast. That occurred on June 14-15, which became the Practice IOP in Table 2.2-1. After this slow start to the study period, ridging during IOP#1, July 23-24, brought a Four Corners High. Unfortunately this 500-mb high positioning can also foster monsoonal flow. Too much positive vorticity (lifting) kept ozone concentrations low over much of the study area, in particular the southern San Joaquin. This high persisted the next week and moved over the Great Basin during IOP#2, July 30-Aug 2. By August 6, the high had weakened and moved east leaving troughs or zonal flow over California for almost another week. IOP#3 was conducted on August 14 when the high had broadened to include southern California. But IOP#3 lasted one day only as the high retreated from a trough moving down from the Gulf of Alaska by August 19. As the high retreated further east to Texas, Oklahoma, and Arkansas, a trough remained over the pacific Coast as far south as Northern California, but cut-off lows and zonal flow over southern California kept ozone concentrations relatively low. Because of the lack of suitable episodes during the originally scheduled end of the IOP window of 09/03/00, the study was extended to late September.

On September 11, zonal flow over the Pacific Northwest and a weak cut-off low off the California coast were adjacent to a new high expanding up from the south over Northern Mexico. Due to the slow start in the study period, IOP#4 was called for September 14. Unfortunately, a relatively strong cut-off low developed off-shore of the US-Canadian border and kept the high to the east. As the cut-off low moved east over Idaho, a relatively strong high built in behind it over the eastern Pacific. IOP#5 was initiated on September 17, a ramp-up day, and continued through the 21st when the high had regressed back westward leaving strong northerly flow through a trough axis from Hudson Bay to San Francisco Bay. As the trough gave way to zonal flow over the next week, flights were conducted to monitor boundary conditions during zonal flow conditions during Sep 30 – Oct 2.

Practice IOP – June 14-15, 2000

Amid the unfavorable synoptic conditions that characterized the beginning of the study, one brief incursion of an Eastern Pacific High passed over the West Coast on June 14-15. It was a strong ridge over the Pacific with a 600 dm center at 38^{o}N and 130^{o}W. Oakland 500mb heights in dm reached the high 590s with 850mb temperature over 26 C. However, its influence was short and pollutants didn't have a sufficient chance to build over a multi-day period.

IOP#1 – July 23-24, 2000

Figure 2.2-1 shows the 500mb analysis at 0400 PST on the morning of the second IOP day. An upper air pattern developed with a high amplitude ridge across the west and a mean trough over the east and a series of shortwave troughs embedded within the ridge over the southwestern US. Rotation around a Four Corners High fostered southerly gulf flow bringing in subtropical moisture, and the shortwaves helped to kick-off precipitation events over the southern Great Basin and the Colorado Plateau. The atmosphere generally was less stable than needed for high ozone in the southern San Joaquin, and even some precipitation was observed over California. However, even with these less than favorable conditions, Bakersfield still reached 112 and 119 ppb for daily maximums on July 23 and 24, respectively. Further to the north and further away from the monsoonal influence, Parlier reached 120 and 144 ppb for daily maximums on July 23 and 24, respectively. In the Sacramento Valley, Cool and Sloughhouse both reached 110 ppb on the second day, July 24. Onshore flow kept the Bay Area clean for the two-day period.

IOP#2 – July 30 through August 2, 2000

Figure 2.2-2 shows the 500mb analysis at 0400 PST on the morning of the first IOP day. A typical Great Basin High occurred during this IOP. Figure 2.2-2 shows this strong ridge that brought favorable ozone conditions to the study region. The high persisted for four days before a trough off the Pacific Northwest Coast moved the high eastward, leaving approximately zonal flow over most of the study region by August 3. Favorable off-shore gradients developed during the period, bringing a Cluster 1 day and a 1hr exceedance of 126 ppb at Livermore on July 31. A cluster 3 day occurred on August 1, with calm winds in the southern Sacramento Valley and a 1hr exceedance of 130 ppb to the Sloughhouse monitoring station. On August 2, the southern SJV experienced a 1hr exceedance of 151 ppb at the Edison station, and westerly winds increased somewhat, transporting pollutants into the foothills, bringing a 130 ppb at Grass Valley.

IOP#3 –August 14, 2000

Figure 2.2-3 shows the 500mb analysis at 0400 PST on the morning of IOP#3 on August 14, when a high over New Mexico and the Texas Panhandle had broadened to include southern California. Two 8hr exceedances of 90 ppb were observed at Folsom and Placerville with westerly flow above the high associated with an incoming trough. IOP#3 lasted one day only as the high retreated eastward with the trough moving onshore.

IOP#4 – September 14, 2000

Figure 2.2-4 shows the 500mb analysis at 0400 PST on the morning of IOP#4. On September 11, zonal flow over the Pacific Northwest and a weak cut-off low off the California coast were adjacent to a new high expanding up from the south over Northern Mexico. It was unclear which pattern would win out over the next 2-4 days. Due to the slow start in the study period, IOP#4 were called to begin on September 14. The high expanded on September 13, which was a promising beginning to an episode, with 8hr exceedances over the San Joaquin Valley. Unfortunately, by the 14th, a relatively strong cut-off low developed offshore of the Oregon-California border and kept the high to the east. Operations were suspended after 1 day. This was not a typical summer ozone scenario, and 850mb temperature and 500mb heights at Oakland were very low on September 14.

IOP#5 – September 17-21, 2000

Figure 2.2-5 shows the 500mb analysis at 0400 PST on the morning of the second IOP day. A relatively strong Eastern Pacific High built over the IOP#5 period. September 17 was a relatively clean ramp-up day. The SJV experienced high ozone in the central region, with 1hr exceedances of 171 ppb and 136 ppb at Parlier on September 18 and 19, respectively. Similarly, the southern SJV experienced exceedances at both Arvin and Edison on the 18th and 19th. The offshore gradient strengthened on the 19th and Livermore reached 100 ppb for a daily maximum. Concord did experience a 1hr state exceedance of 95 ppb on the 19th. However, sufficient northwesterly flow continued aloft to reinforce the sea breeze and prevent ozone significant buildup along the coast. Operations continued through the 21st when the high had regressed back westward leaving strong northerly flow through a trough axis from Hudson Bay to San Francisco Bay by September 22.

Boundary Condition Flights – September 30 through October 2, 2000

Three days of flights were conducted to monitor boundary conditions during primarily zonal flow conditions during Sep 30 – Oct 2. On September 30, the zonal flow was over northern California and the Pacific Northwest with a weak cut-off low over San Diego. By October 2, the zonal flow had dropped south to central California with the cut-off low strengthening but also moving south and further offshore.

2.2 Air Quality During CCOS

The highest peak values were also observed in the San Joaquin Valley (SJV), particularly at the Arvin, Parlier, and Fresno area sites where 1-hour levels in excess of 130ppb were repeatedly recorded. The Sacramento Metro area exceeded the 1-hour standard on 1.5% of days and the 8-hour standard on 12% of days, while the SF Bay Area and northern Sacramento Valley (Shasta County) were below the standards on all but a few days. In all areas the 8-hour standard was exceeded more often than the 1-hour standard. High ozone levels were observed throughout the study period, with the exception of intermittent clean periods lasting several days to a week. Timing of ozone episodes appears to be well correlated in all areas except the northern Sacramento Valley. Table 2.2-3 gives a breakdown by site, in the three major air basins, of the seasonal daily 1-hour and 8-hour maximums, the average daily 1-hour and 8-hour maximums, and the number of exceedances of the 1-hour and 8-hour standards during the period June 1 – October 15, 2000. The highest average daily maximum values were recorded in the San Joaquin Valley region, where the 1-hour standard was exceeded on 21% of the study days and the 8-hour standard was exceeded on 53 percent of the study days.

It is interesting to compare the 2000 season with the analysis of historic ozone trends, which was summarized in the Field Operations Plan. For example, Folsom in the eastern Sacramento Valley, had seasonal highs of 160 ppb in 1995 and 1996 and 150 ppb in 1992, 1993 and 1998. Even including the 1997 El Nino season, the 9-year average seasonal high for 1990-1998 was 148 and 120 ppb for the 1-hour and 8-hour averages; the 2000 seasonal highs were 126 and 99 ppb. The 9-year average number of 1-hour and 8-hour exceedances per season was 6.1 and 21.0, respectively; the 2000 number of violations was 1 and 20 for the 1-hour and 8-hour standards, respectively. In downtown Sacramento, the 9-year average seasonal high for 1990-1998 was 147 and 111 ppb for the 1-hour and 8-hour averages; the 2000 seasonal highs were 123 and 96 ppb. The 9-year average number of 1-hour and 8-hour exceedances was 3.3 and 11.4, respectively; the 2000 number of violations was 1 and 8.

In the Bay Area at Livermore, the 9-year average seasonal high for 1990-1998 was 132 and 100 ppb for the 1-hour and 8-hour averages; the 2000 seasonal highs were 126 and 111 ppb. The 9-year average number of 1-hour and 8-hour exceedances was 2.9 and 5.1, respectively; the 2000 number of violations was 1 and 3 for the 1-hour and 8-hour standards, respectively. At San Martin, the 9-year average seasonal high for 1990-1998 was 122 and 95 ppb for the 1-hour and 8-hour averages; the 2000 seasonal highs were 113 and 95 ppb. The 9-year average number of 1-hour and 8-hour exceedances was 1.0 and 4.0, respectively; the 2000 number of violations was 0 and 1 for the 1-hour and 8-hour standards, respectively.

In the SJV at Parlier, the 9-year average seasonal high for 1990-1998 was 149 and 112 ppb for the 1-hour and 8-hour averages; the 2000 seasonal highs were 165 and 115 ppb. The 9-year average number of 1-hour and 8-hour exceedances was 10.2 and 40.7, respectively; the 2000 number of violations was 23 and 64 for the 1-hour and 8-hour standards, respectively. At Arvin, the 9-year average seasonal high for 1990-1998 was 153 and 122 ppb for the 1-hour and 8-hour averages; the 2000 seasonal highs were 146 and 117 ppb. The 9-year average number of 1-hour and 8-hour exceedances was 18.3 and 78.3, respectively; the 2000 number of violations was 15 and 78 for the 1-hour and 8-hour standards, respectively.

The increase in 8-hour violations relative to 1-hour violations may be significant. Also, it is not immediately clear whether the decrease in Bay Area and Sacramento ozone impacts in the 2000 season is due to meteorology or the effectiveness of control strategies.

Table 2.2-1
Selected meteorological parameters for the CCOS study period*

IOP	Date	MaxTemp FAT (F)	MaxTemp SFO (F)	RNO-FAT Prgrad (mb)	500mb Height OAK (dm)	850mb Temp OAK (C)
Practice	14-Jun-00	101	105	-10.5	598	26.6
	15-Jun-00	103	79	-5.8	597	26.2
IOP#1	23-Jul-00	96	71	-3.0	589	19.6
	24-Jul-00	100	70	-3.0	591	21.2
IOP#2	30-Jul-00	100	71	-0.8	590	23.0
	31-Jul-00	97	79	-3.3	591	24.8
	01-Aug-00	101	88	-2.5	596	26.8
	02-Aug-00	102	81	-4.5	593	26.2
IOP#3	14-Aug-00	97	75	9.0	585	21.4
IOP#4	14-Sep-00	89	74	-2.1	582	13.0
IOP#5	17-Sep-00	92	91	-5.7	590	20.2
	18-Sep-00	98	91	1.0	593	22.0
	19-Sep-00	99	93	-8.0	596	25.0
	20-Sep-00	99	79	-8.4	591	24.6
	21-Sep-00	83	73	1.5	580	22.0
Boundary	30-Sep-00	87	76	-6.3	586	23.4
Condition	01-Oct-00	91	60	-3.8	586	22.0
Flights	02-Oct-00	92	67	-0.7	582	20.6
IOP Mean		96.4	79.7	-2.3	589.8	22.3
Summer 2000 Mean		92.8	71.4	-1.9	583.6	18.9
Summer 2000 StDev.		6.1	6.5	2.7	5.7	4.0
Study Period Mean		91.4	71.5	-2.0	583.2	18.1
Study Period StDev.		7.2	7.2	3.2	6.6	4.7
Study Period StErr.		0.7	0.7	0.3	0.6	0.4

*Note: data in this table are preliminary and unvalidated. Aloft measurements are taken at 4:00 a.m. PST.
Aug. 1, 2 – higher moisture aloft (dew point > 8 ^{o}C at 850 mb and > -4 ^{o}C at 700 mb). High pressure over western U.S, but with some zonal flow.
Aug. 14 – synoptic pattern was almost zonal with high centered over eastern Colorado.
Sept. 30 and Oct. 1 – closed low offshore of San Diego, which may be affecting the southern part of study area.
Oct. 2 – flow is disorganized in the region. Zonal flow at the Oregon border.

Table 2.2-2.
Meteorological scenarios and cluster type for the CCOS IOPs

IOP	Date	Meteorological Scenario	Ozone Cluster
Practice	14-Jun-00	Eastern Pacific Hi (IIa)	2
	15-Jun-00	Eastern Pacific Hi (IIa)	2
IOP#1	23-Jul-00	Monsoonal Flow (IIIb)	2 or 3
	24-Jul-00	Monsoonal Flow (IIIb)	2 or 3
IOP#2	30-Jul-00	Western U.S. Hi (Ib)	-
	31-Jul-00	Western U.S. Hi (Ib)	1
	01-Aug-00	Western U.S. Hi (Ib)	3
	02-Aug-00	Western U.S. Hi (Ib)	2
IOP#3	14-Aug-00	Western U.S. Hi (Ic)	-
IOP#4	14-Sep-00	Pre-Frontal (Va)	-
IOP#5	17-Sep-00	Trough Passage (VIb)	-
	18-Sep-00	Eastern Pacific Hi (IIa)	2
	19-Sep-00	Eastern Pacific Hi (IIa)	2
	20-Sep-00	Eastern Pacific Hi (IIa)	2
	21-Sep-00	Trough Passage (VIa)	-
Boundary	30-Sep-00	Zonal (IVc)	-
Condition	01-Oct-00	Zonal (IVc)	-
Flights	02-Oct-00	Zonal (IVc)	-

Table 2.2-3
Ozone Mixing Ratios (ppb) and Exceedances in the CCOS Region, 6/1/00 to 10/15/00*

		Seasonal Max		Average Daily Max		Exceedences	
Site ID	Site Name	1hr	8hr	1hr	8hr	1hr	8hr
San Francisco Bay Area							
SJD	SAN JOSE-PIEDMONT STREET	96	64	38	28	0	0
BTI	BETHEL ISLAND RD	93	84	55	45	0	1
CCD	CONCORD-2975 TREAT BLVD	95	76	49	39	0	0
FFD	FAIRFIELD-BAAPCD	89	68	45	37	0	0
FCW	FREMONT-CHAPEL WAY	102	69	40	30	0	0
HLM	HAYWARD-LA MESA	81	62	39	32	0	0
LGS	LOS GATOS	80	69	41	32	0	0
LVF	LIVERMORE OLD FST ST	126	108	50	39	1	2
LVR	LIVERMORE-RINCON	124	111	51	40	1	3
NJS	NAPA-JEFFERSON AVE	77	60	43	35	0	0
OKA	OAKLAND-ALICE	69	35	22	17	0	0
PBG	PITTSBURG	91	78	52	42	0	0
RED	REDWOOD CITY	83	62	31	25	0	0
SFA	SAN LEANDRO	58	40	28	23	0	0
SJ4	SAN JOSE-4TH ST	73	57	35	27	0	0
SEH	SAN FRANCISCO-10 ARKANSAS	71	51	32	26	0	0
SMM	SAN MARTIN - MURPHY AREA	113	95	48	38	0	1
SRL	SAN RAFAEL	67	59	29	23	0	0
SRF	SANTA ROSA-837 FIFTH ST	78	54	35	28	0	0
VJO	VALLEJO-TUOLUMNE	79	54	34	28	0	0
	All BayArea	**126**	**111**	**60**	**48**	**1**	**2**
San Joaquin Valley							
ARV	ARVIN	146	117	93	80	15	78
BGS	BAKERSFIELD-1128 GOLDEN STATE	116	98	82	71	1	34
CLO	CLOVIS-908 N VILLA AVENUE	153	121	84	70	12	50
EDS	EDISON	151	106	91	76	10	60
FSD	FRESNO-4706 E DRUMMOND	131	98	78	65	2	27
FSF	FRESNO-3425 FIRST STREET	139	120	91	80	11	64
HIR	HANFORD-S IRWIN STREET	124	107	85	75	4	56
M29	MADERA -29 1/2 NO. OF AVE 8	104	93	70	60	1	12
MCS	MARICOPA SCHL-STANISLAUS	122	101	81	72	1	46
MRA	MERCED-385 S COFFEE AVE	120	111	81	71	0	43
M14	MODESTO-814 14TH ST	131	98	65	51	1	5
OLD	OILDALE-3311MANOR	124	104	83	75	1	57
PLR	PARLIER	165	115	95	76	23	64
SHA	SHAFTER - WALKER STREET	123	102	77	67	1	28
SOM	STOCKTON-13521 E MARIPOSA	108	85	58	45	0	1
TPP	TRACY-24371 PATTERSON PASS	122	90	60	48	1	4
TSM	TURLOCK-900 S MINARET	131	105	71	57	1	16
VCS	VISALIA-CHURCH STREET	129	99	82	68	1	36
	All SJV	**165**	**121**	**105**	**85**	**29**	**73**

Table 2.2-3 (Continued)
Ozone Mixing Ratios (ppb) and Exceedances in the CCOS Region, 6/1/00 to 10/15/00*

		Seasonal Max		Average Daily Max		Exceedences	
Site ID	Site Name	1hr	8hr	1hr	8hr	1hr	8hr
Sacramento Metropolitan							
AIR	SACRAMENTO-AIRPORT RD	99	85	60	48	0	1
ELK	ELK GROVE-BRUCEVILLE ROAD	104	91	57	46	0	2
SDP	SACRAMENTO-DEL PASO MANOR	123	96	65	52	1	8
FLN	FOLSOM-NATOMA STREET	126	99	67	55	1	20
SNH	NORTH HIGHLANDS-BLACKFOOT	120	97	66	54	0	10
SLU	SLOUGHHOUSE ROAD	133	106	68	57	2	18
	all SacMetro	**133**	**106**	**75**	**61**	**2**	**16**
Shasta County							
RDH	REDDING-H.D. ROOF	102	88	65	57	0	7
ADN	ANDERSON-2220 NORTH ST	90	82	45	51	0	1
	all Shasta	**102**	**88**	**64**	**56**	**0**	**1**

*Note: data in this table are preliminary and unvalidated.

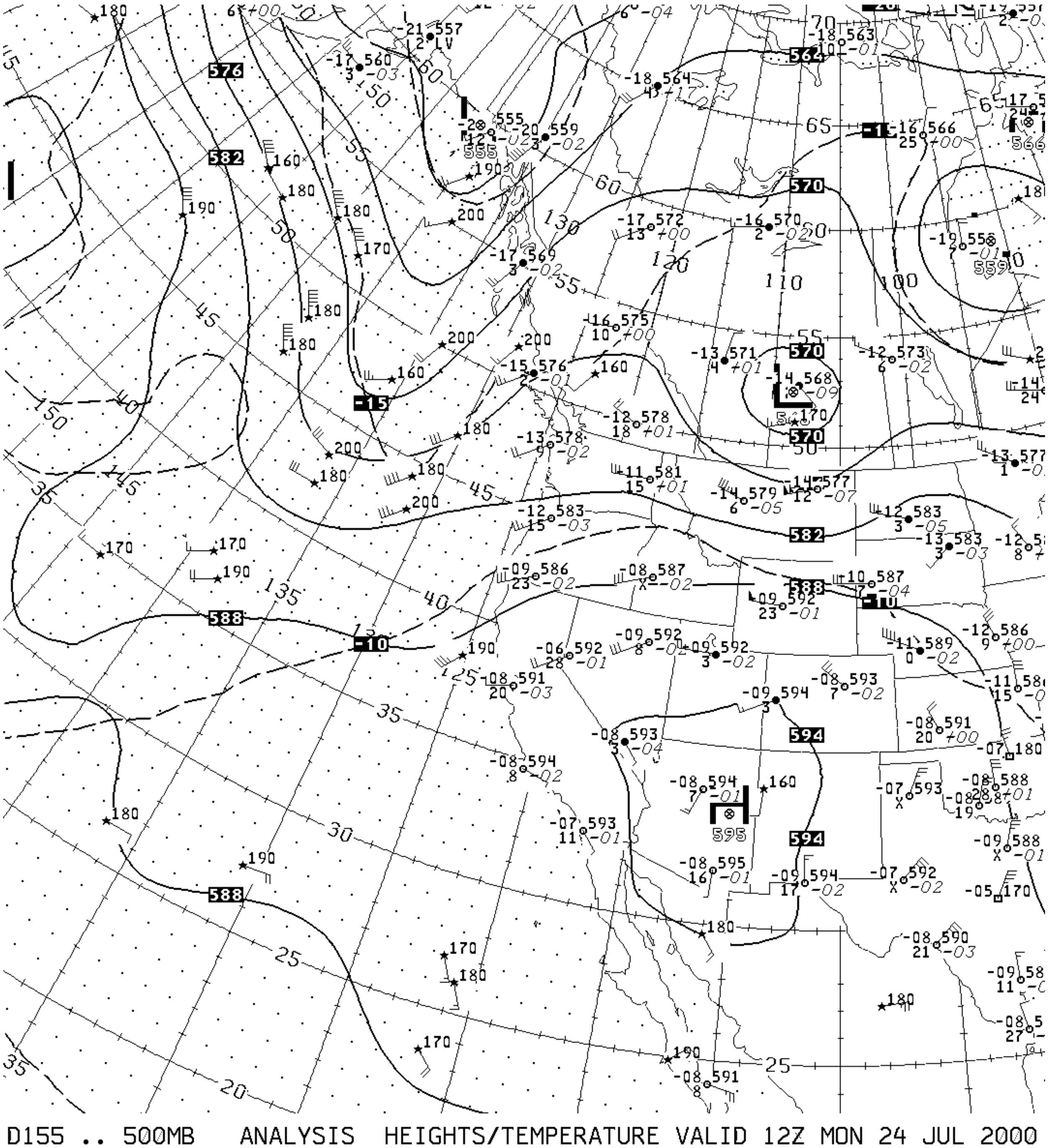


Figure 2.2-1. Western U.S. 500mb analysis from 0400 PST on July 24, 2000 during IOP#1. Note the Four Corners High which can bring subtropical moisture into the southwest with the clockwise rotation around its center. On this day, convection showers dominated the southern Great Basin, with a destabilizing effect on Southern California.

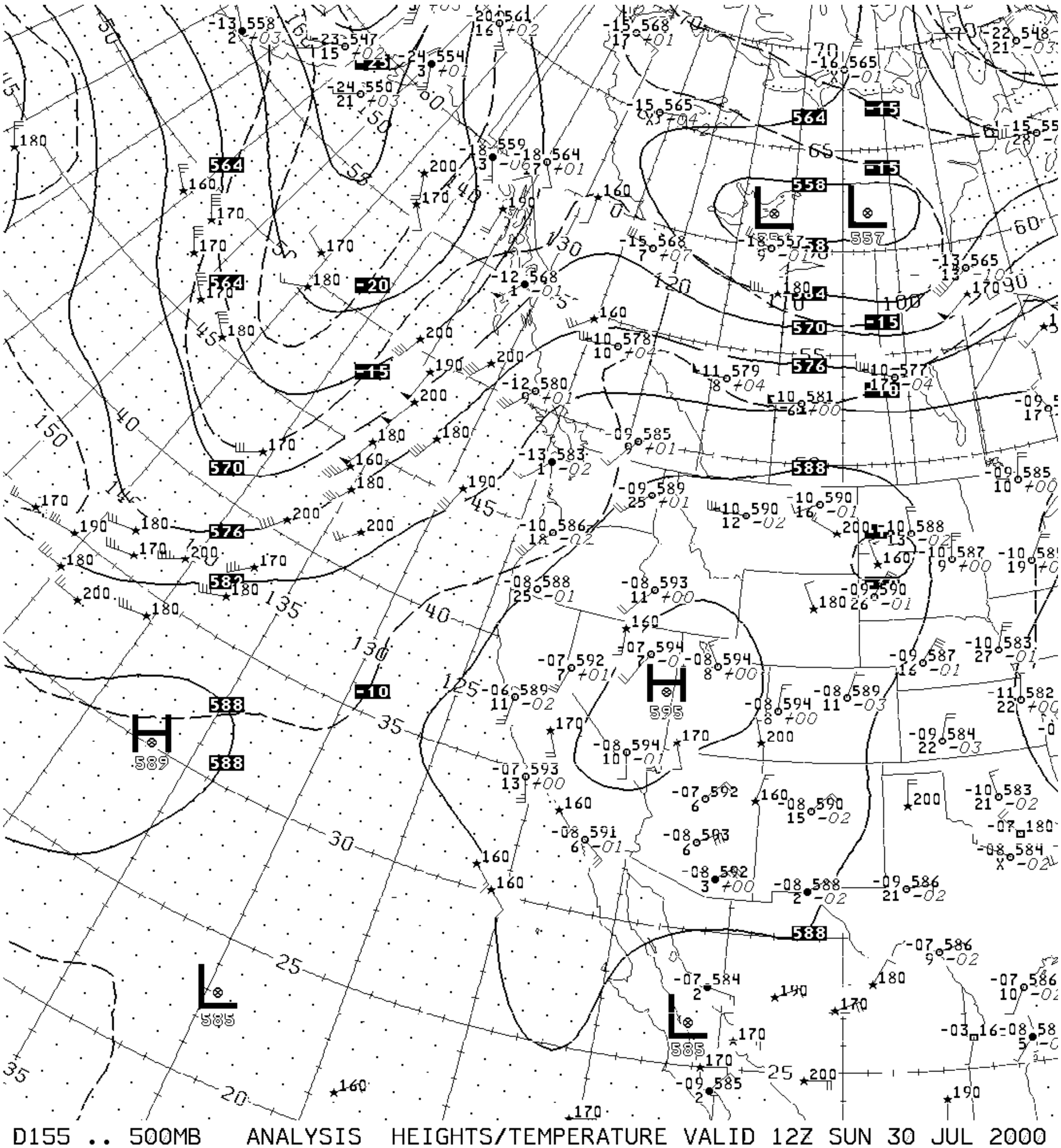


Figure 2.2-2. Western U.S. 500mb analysis from 0400 PST on July 30, 2000 during IOP#2. The Great Basin High fosters off-shore gradients.

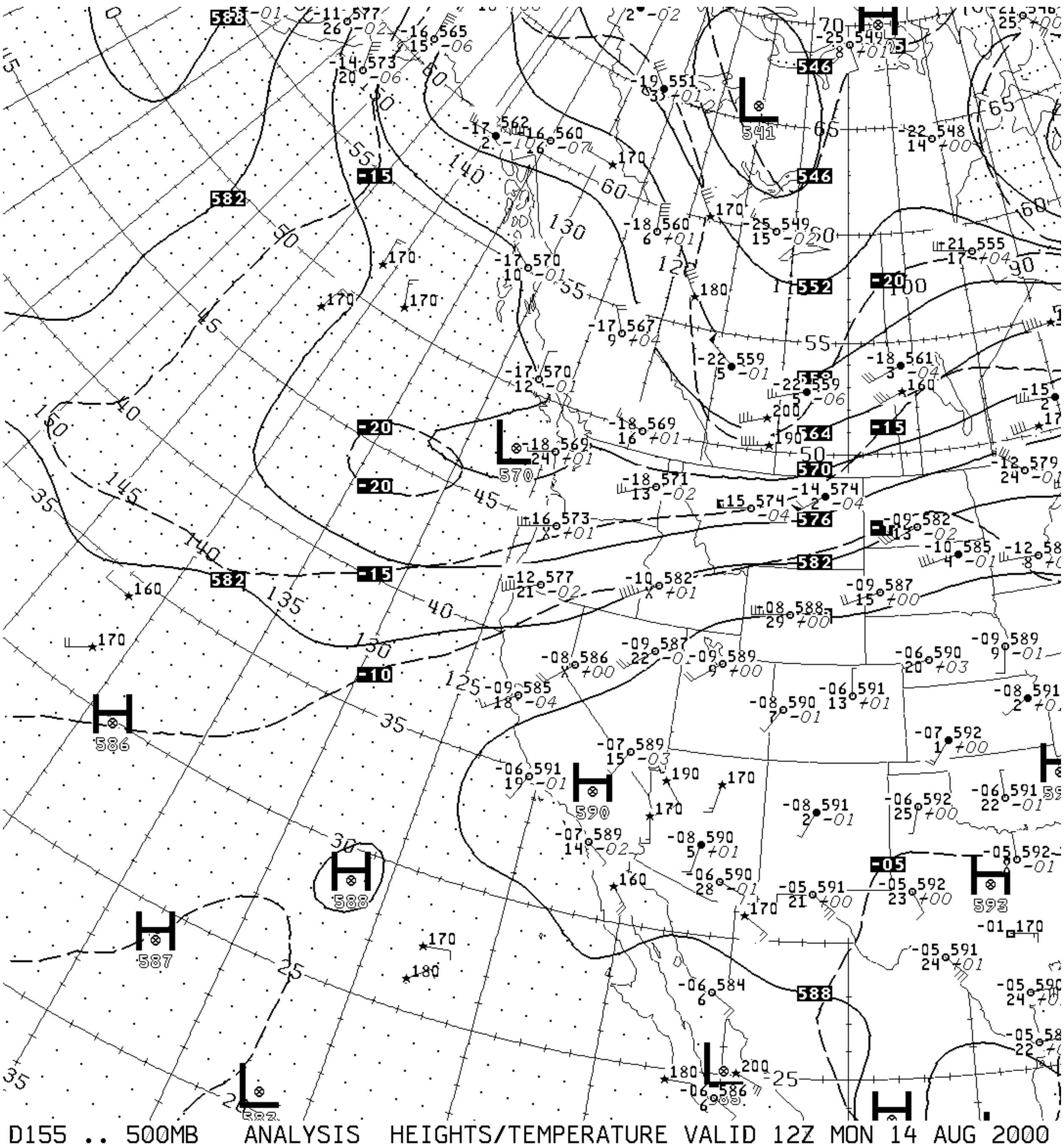


Figure 2.2-3. Western U.S. 500mb analysis from 0400 PST on August 14, 2000 during IOP#3. The area of high pressure extends well across the southern United States to Eastern Tennessee and Mississippi. The slack gradients under this broad system make classification more difficult.

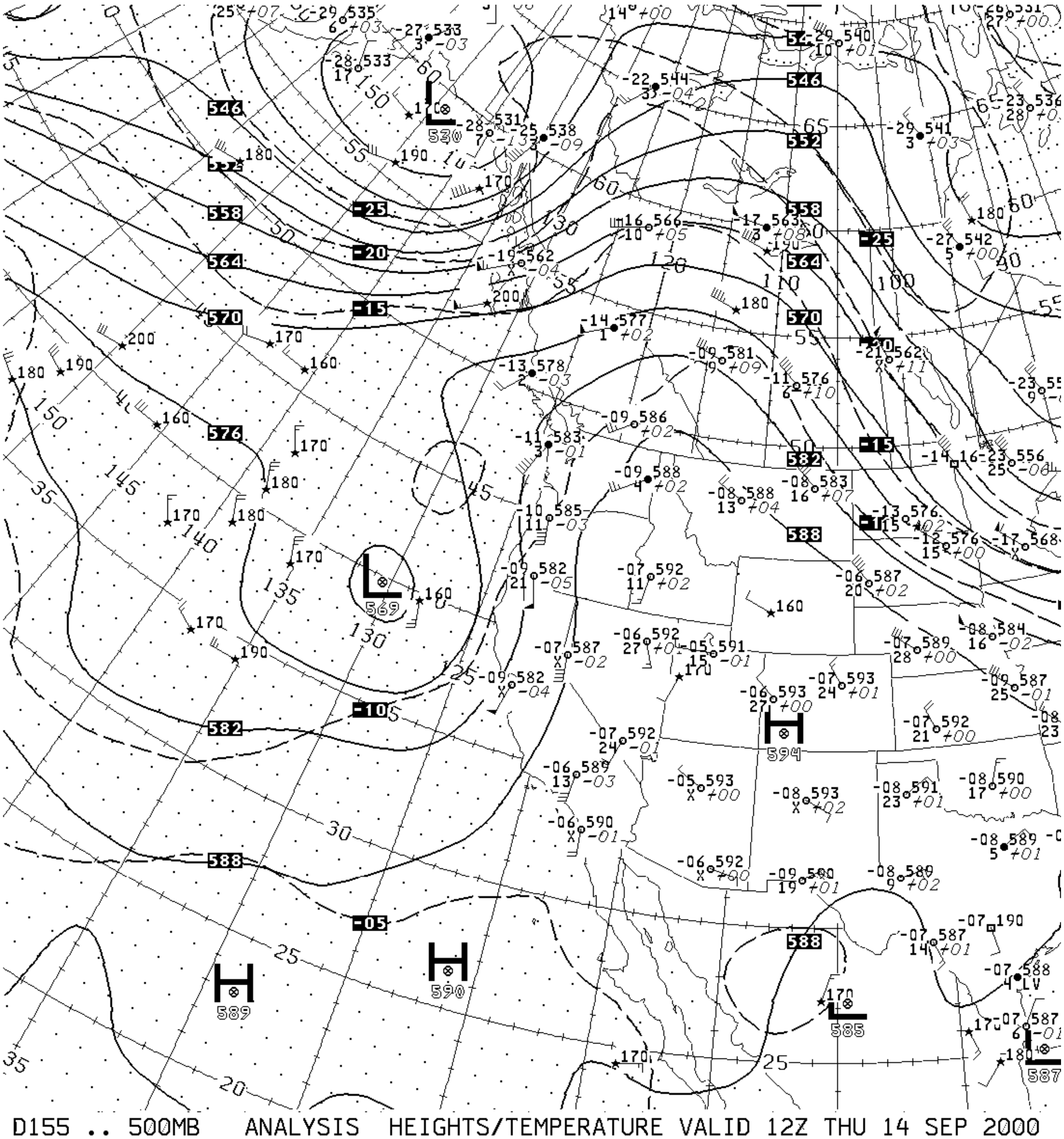


Figure 2.2-4. Western U.S. 500mb analysis from 0400 PST on September 14, 2000 during IOP#4. The strong cut-of low off the northern California coast kept 500mb heights and 850mb temperatures low. The high had moved too far east.

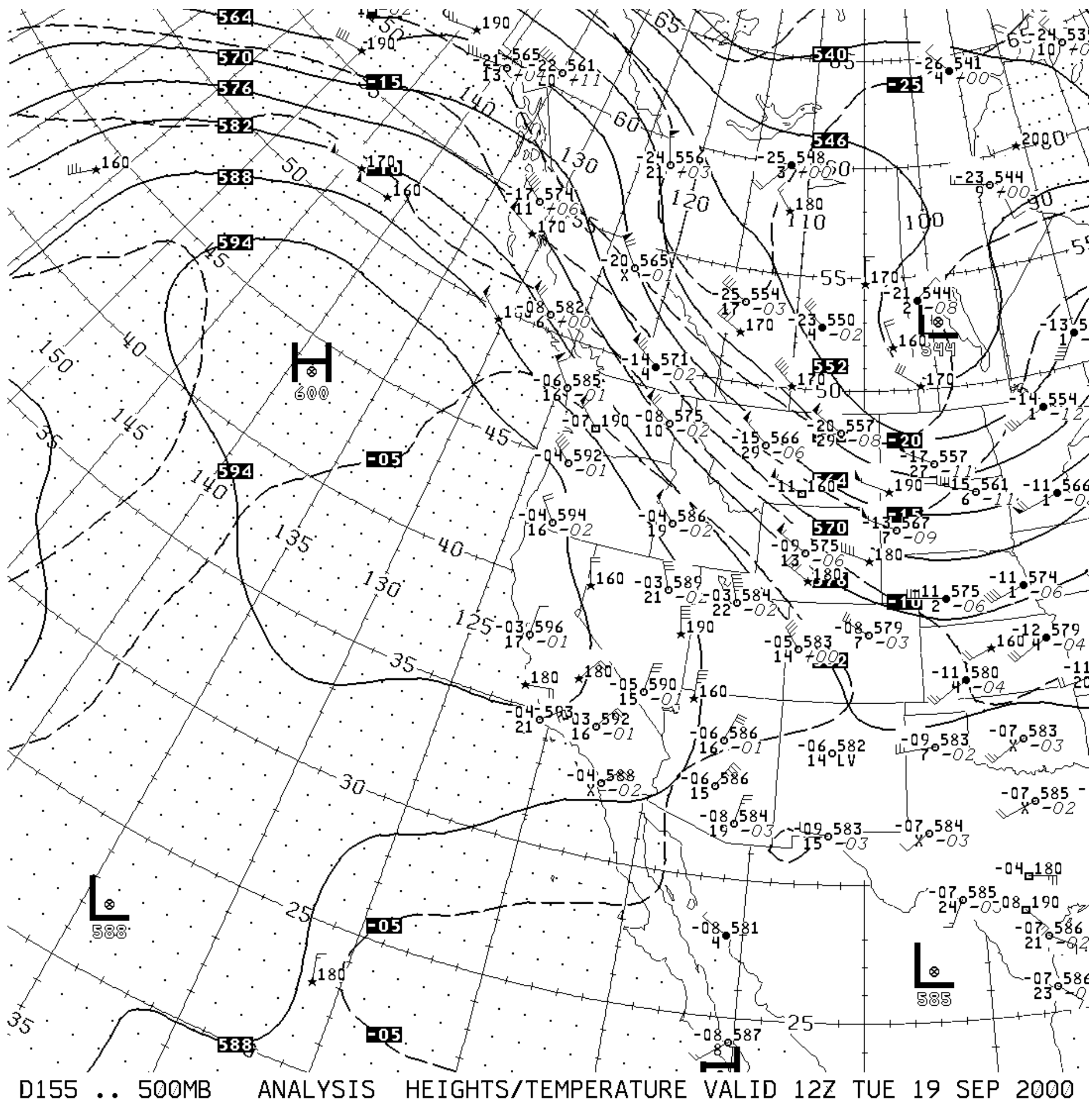
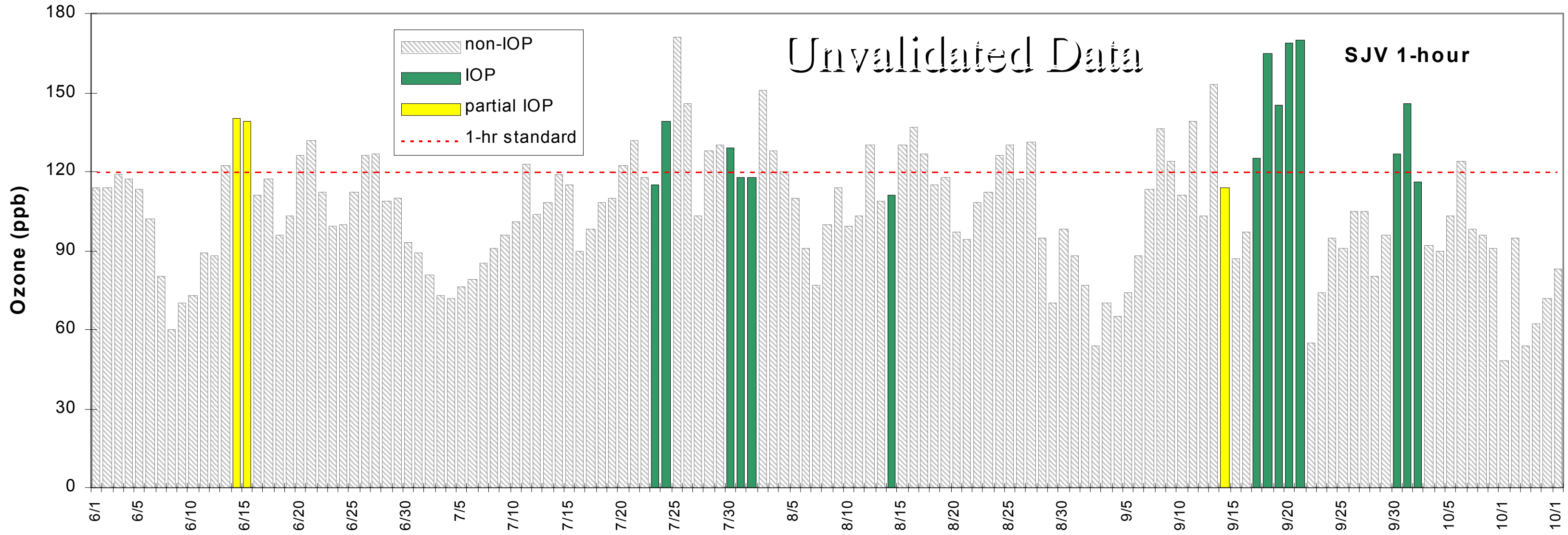


Figure 2.2-5. Western U.S. 500mb analysis from 0400 PST on September 19, 2000 during IOP#5. The Eastern Pacific High brought favorable conditions for ozone formation to the study region. Bay Area ozone was low despite the favorable offshore gradients on September 18 and 19.

Figure 2.2-6a. Daily maximum 1-hour and 8-hour average ozone mixing ratios in the Bay Area from 06/01/00 to 10/15/00.



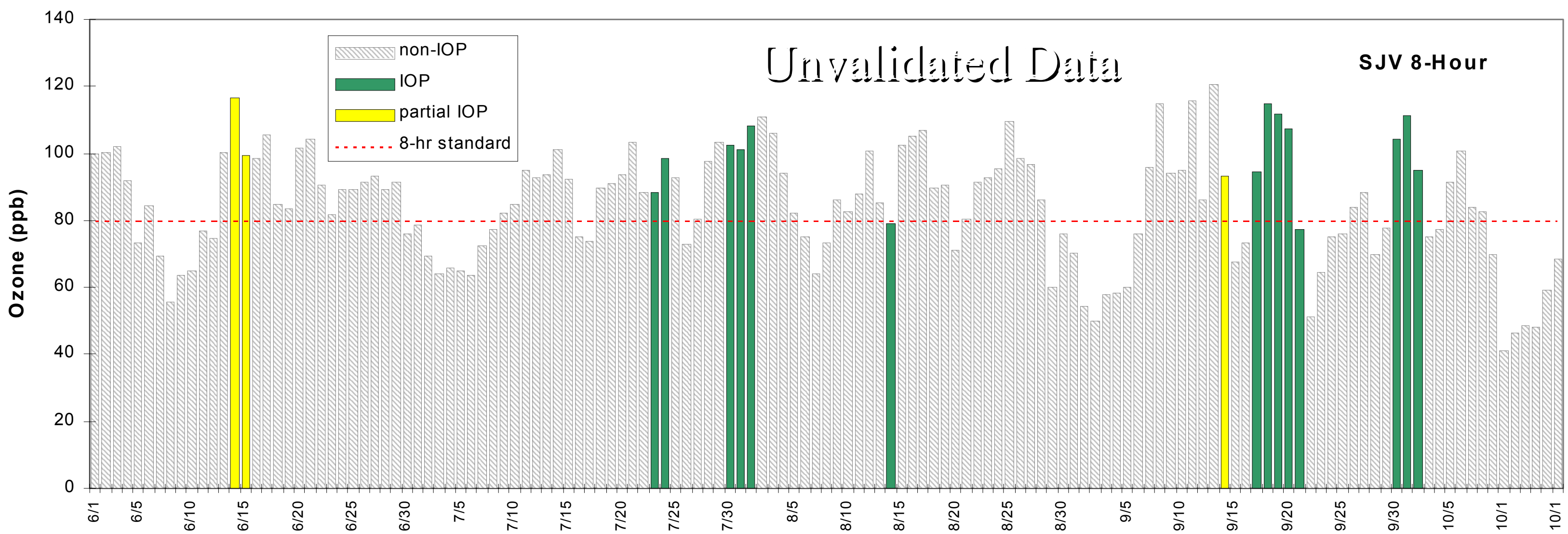


Figure 2.2-6b. Daily maximum 1-hour and 8-hour average ozone mixing ratios in the San Joaquin Valley from 06/01/00 to 10/15/00.

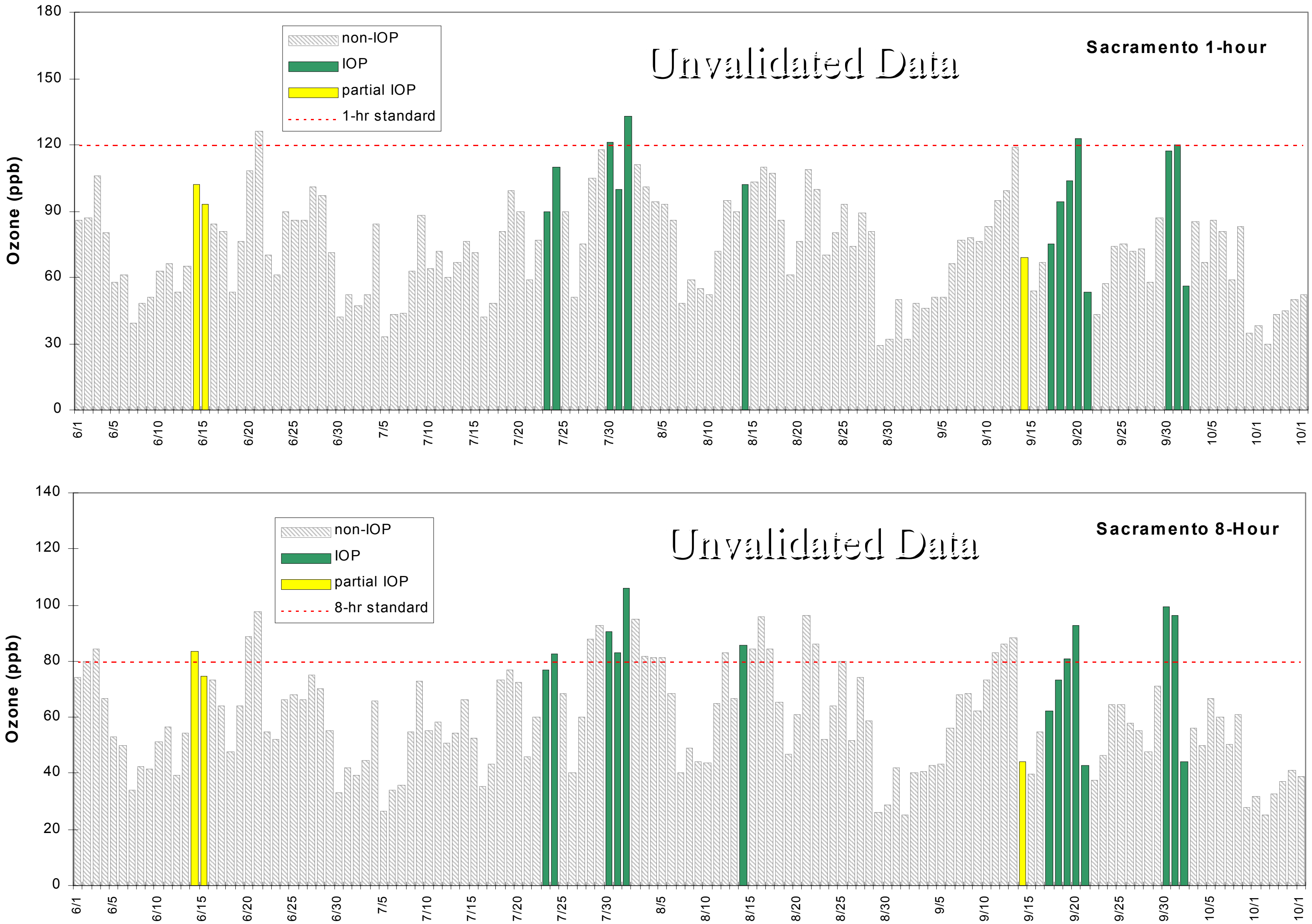


Figure 2.2-6c. Daily maximum 1-hour and 8-hour average ozone mixing ratios in the Sacramento Metropolitan Area from 06/01/00 to 10/15/00.

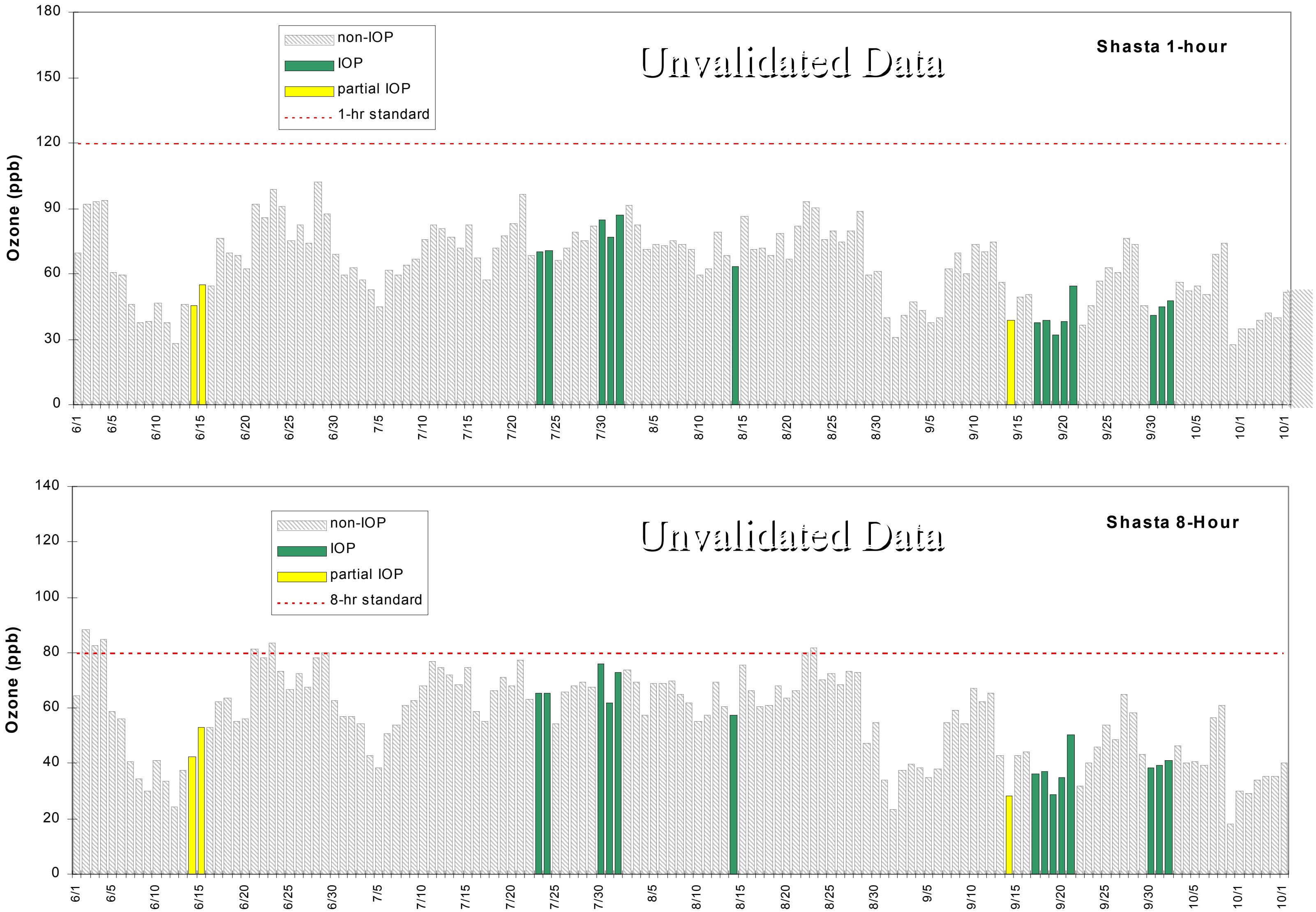


Figure 2.2-6d. Daily maximum 1-hour and 8-hour average ozone mixing ratios in the Shasta County from 06/01/00 to 10/15/00.

3.0 SUMMARY OF THE CCOS FIELD MEASUREMENT PROGRAM

The CCOS field measurement program was conducted during a four-month period from 06/01/00 to 10/02/00. During this study period, a network of upper-air and surface meteorological monitoring stations supplemented the existing routine meteorological and air quality monitoring network. Supplemental air quality measurements were phased in during June and early July and continued through 09/21/00, and were phased out over a period extending into October. Intensive Operational Period (IOP) measurements were made on 07/23 and 07/24 (IOP #1), 07/30, 07/31, 08/01, and 08/02 [1] (IOP #2), 08/14 (IOP #3), 09/14 [2] (IOP #4), and 09/17, 09/18, 09/19, 09/20, and 09/21 (IOP #5). In addition, a "shake-down" IOP was called on 06/14 and 6/15, and additional boundary condition flights were made during 09/30, 10/1, and 10/2. This section documents the protocols for forecasting and decision-making, and the parameters that were measured, locations, measurement methods, times, and levels of data capture.

3.1 Forecast and Decision-Making Protocols

The decision to declare an IOP was based on daily meteorological and air quality forecasts, and other information on current conditions and operational status. Intensive Operational Periods (IOP) were forecasted during periods that corresponded to meteorological conditions associated with ozone episodes and ozone transport in northern and central California. The Forecast Team consisted of five members and alternates from the following organizations: California Air Resources Board, San Joaquin Valley Unified APCD, San Francisco Bay Area AQMD, Sacramento Municipal AQMD, and Desert Research Institute

The team met by conference call from 14:00 to 14:30 PDT every day, including weekends, from June 12, 2000 through September 30, 2000 (with infrequent one or two day breaks during prolonged periods of decidedly unfavorable ozone formation conditions). Forecast products were generated by the Forecast Team to be given by the team leader on the daily Management Team conference call, which followed the Forecast Team call. Each District meteorologist used both synoptic and statistical analyses to derive the 1- and 8-hour forecasts. After a synoptic and ozone forecast discussion, the ozone forecasts were consolidated, e-mailed, and placed on the web. These products included, a brief summary of synoptic conditions, a brief summary of ozone values, and the team recommendation on the go/no go decision.

The members of the CCOS Management Team consisted of one representative from the California Air Resources Board, San Joaquin Valley Unified APCD, San Francisco Bay Area AQMD, and Sacramento Municipal AQMD. After the Forecast Team reached a consensus forecast, a recommendation was made by the Forecast Team leader to the Management Team. The CCOS Field Manager provided updates on operational status of field equipment and personnel. The go/no-go decision of the management team was posted by 0300 PDT on the ARB CCOS web site and pertinent information was placed on the voicemail of a call-in line that each CCOS field study contractor checked on a daily basis.

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[1] IOP ended at 1600, PDT rather than at midnight.

[2] Collection of canister and DNPH cartridges for VOC measurements were limited to the San Joaquin Valley during this IOP.

The following criteria were used to decide whether or not to conduct IOP sampling:

- Forecasted meteorological conditions were favorable for formation and accumulation of high ozone concentrations.
- Forecasted ozone concentrations of 125 ppb or higher, including a “ramp-up” day before the high-ozone day.
- Capture ozone episodes in each of the three major air basins - Bay Area, Sacramento Valley, and San Joaquin Valley.
- Operational readiness.
- Aircraft crew safety considerations - crew require at least one day without sampling after three consecutive days of operation..

3.2 Meteorological and Ground-Based Aloft Air Quality Measurements

The existing meteorological network in central California is extensive, but uncoordinated among the different agencies. Figure 1.2-1 shows the locations of surface meteorological monitoring sites operated by the ARB, BAAQMD, SJVAPCD, SMAQMD, the National Oceanic and Atmospheric Administration (NOAA), the California Irrigation Management Information Service (CIMIS), Interagency Monitoring of PROtected Visual Environments (IMPROVE), the National Weather Service (NWS), Pacific Gas and Electric Company (PG&E), the U.S. Coast Guard, Remote Automated Weather Stations (RAWS) for fire fighting, and a few miscellaneous monitors. Wind speed and direction, temperature, and relative humidity are the most common measurements. The network of surface pressure and solar radiation measurements is also extensive. Three sites measure ultraviolet radiation in the Sacramento Valley, in the San Joaquin Valley, and along the south coast in Santa Barbara County. Figure 1.2-2 shows the surface meteorological observables measured at each monitoring location, regardless of the network from which they are derived. The specific measurements at each site and the networks they belong to are documented in Appendix C of Watson et al., (1998). Wind speed measurements are taken at heights ranging from 2 m to 10 m agl at most sites and temperatures are measured by aspirated and unaspirated thermometers.

Radar Wind Profilers (RWP) provide sequential horizontal and vertical wind components in data assimilation and model comparison on a sub-hour time scale. RWPs generally acquire measurements within 100 to 150 m thick layers between ~0.150 and 3 km AGL with a minimum vertical resolution of 60 meters. A radio-acoustic sounding system (RASS) are used to quantify virtual temperature to elevations of ~1 km AGL (up to 2 km AGL in ideal conditions), but this is insufficient altitude to characterize the daytime mixed layers of 2–3 km AGL often observed in much of the study area. Acoustic Sounders (Sodars), like RWPs, also acquire continuous measurements of winds aloft. Sodars have better vertical resolution (~30 m layers from ~50 to 600 m AGL) but less vertical range (750 m AGL maximum). Sodars were placed in locations with lower-level structure, such as that found in marine layers, in channeling through canyons and passes, and in nighttime radiation inversions.

The ARB operates two profilers (with RASS) in the San Joaquin Valley, and the San Joaquin Unified APCD and Sacramento Metropolitan AQMD operate one profiler/RASS each as part of their PAMS monitoring program. SJVAPCD also operated a profiler at Tracy during CCOS. Military facilities with operational profilers include Travis AFB, Vandenberg AFB, and the Naval Post Graduate School in Monterey. As part of CRPAQS, NOAA upgraded existing equipment, as required, at these facilities, and coordinated data collection to ensure compatibility with the CRPAQS/CCOS upper-air database. Six profiles/RASS were installed and operated during summer 2000 as part of the CRPAQS. In addition, nine profilers/RASS and 5 sodars were installed for the CCOS summer 2000 field study. Another Sodar was located in the vicinity of the Pittsburgh power plant stacks to ensure that the local 3D winds are well defined for model simulation during the early stages of plume dispersion.

Table 3.2-1 provides a summary of the aloft meteorological measurements that were made by local agencies and by the CCOS contractors, Environmental Technology Laboratory (ETL, Boulder, CO) and Air Resources Laboratory (ARL, Idaho Falls, ID) of the National Oceanic and Atmospheric Administration (NOAA), Sonoma Technology, Inc. (STI), and T&B systems. Preliminary data are available for the NPGS coastal profilers from Dick Linde at the following web site: http://www.weather.nps.navy.mil/profiler/coastprof.html. Preliminary data are available for the NOAA/ETL profilers from Bill Neff at: http://www7.etl.noaa.gov/data.

Radiosondes are required in addition to profiler and sodar measurements to determine changes in relative humidity and to quantify conditions at elevations above ~2000 m agl. They are also the only practical means of acquiring upper air measurements in cities where the noise and siting requirements of remote sensing devices make them difficult to operate. Radiosondes are routinely launched through the year at 0400 and 1600 PST from Oakland, with additional launches at Vandenberg, Edwards, and Pt. Mugu according to military mission requirements. None of these locations are within the Central Valley, so these were supplemented by launches at Sacramento and in the southern San Joaquin Valley during IOP days with six radiosondes (with ozonesonde) releases per day. NOAA's one 490 MHz RWP was placed in the Fresno area to provide higher vertical soundings in the central San Joaquin Valley. T&B Systems staff, assisted by in-kind personnel at the Sacramento site, released radiosondes/ozonesondes at two sites during IOP days. Up to six sounding release were made at Granite Bay and Parlier according to the schedule shown in Table 3.1-2.

Although ozone LIDAR was not included in the CCOS Field Study Plan, Elight Laser Systems, a German company, deployed their commercial Ozone Profiler during CCOS using in-kind resources. The profiler was installed in Dublin and made measurements for one month beginning in early August, 2000. The Ozone Profiler measures vertical ozone profiles starting at approximately 50 m up to 2000 m with a detection limit of 5µg/m³ with 200 m range resolution.

In addition to releases by T&B Systems, the Naval Air Warfare Center at Pt Mugu will released several radiosondes with ozonesonde in the Bay Area (Dublin) for comparison with the Elight ground-base ozone profiler and northern San Joaquin Valley (Tracy or Stockton) during CCOS IOPs. In addition to ozonesondes aloft air quality measurements were available from fixed platforms that are part of the routine monitoring network (e.g., Walnut Grove radio tower and Sutter Buttes). NOy and speciated hydrocarbon measurements were added during CCOS at

Sutter Buttes to provide additional information on oxidants available as carry-over to mix-down on the following day.

3.3 Solar Radiation Measurements

The photolysis rate of an air pollutant is the product of the compounds mixing ratio and its photolytic rate parameter. The photolytic rate parameter is the integral over all wavelengths of the product of the compound's absorption cross section, quantum yield and actinic flux. A compound's absorption cross section and quantum yield are available from laboratory studies. Spectrally resolved actinic flux was measured during CCOS by the Desert Research Institute at Sunol, White Cloud , and at UC, Davis using a diode array spectrometers. The ARB operates five sites and local APCDs operate 31 sites in the CCOS region with solar radiation measurements. Hourly averages are obtained by a thermopile or pyranometer. The NREL National Solar Radiation Data Base (NSRDB) includes four sites in California, Daggett, Fresno, Los Angeles, San Diego, and Santa Maria. The measurements made at these stations include global horizontal radiation in Wh/m^2 , atmospheric pressure in millibars, direct normal radiation in Wh/m^2, wind direction in increments of 10 degrees, diffuse horizontal radiation in Wh/m^2, wind speed in m/s, extraterrestrial radiation (ETR) in Wh/m^2, horizontal visibility in km, direct normal ETR in Wh/m^2. Ceiling height in decameters, total sky cover in tenths, present weather, opaque sky cover in tenths, total precipitable water in mm, dry-bulb temperature in ^oC, aerosol optical depth, dew-point temperature in ^oC, snow depth in cm, relative humidity in percent, and number of days since last snowfall.

The US Department of Agriculture's UVB Radiation Monitoring Program maintains one site, near Davis, California (Latitude: 38.529, Longitude: 121.761). The University of California at Davis operates the site. There are two existing Multifilter Rotating Shadowband Radiometers (MFRSR) at the USDA, Davis site. A shadowband radiometer has a rotating metal band that periodically blocks the direct solar beam from entering the radiometer. This feature allows a measurement of the total horizontal, diffuse and direct normal components of the irradiance. One MFRS radiometer operates in the visible region and makes filter measurements at 415, 500, 610, 665, 862 and 940 nm and for the total visible radiation. The second MFRS operates in the UV and makes measurements at 300, 305.5, 311.4, 317.6, 325.4, 332.4, 368 nm. The sampling time for the visible MFRSR is 15 seconds and the sampling time for the ultraviolet MFRSR is 20 seconds however data from both MFRSR's are stored as 3-minute averages. There are several other measurements that support the UVB radiation measurements at this site including sensors for UVA, UVB-1 and surface reflection and measurements of relative humidity, temperature and barometric pressure.

The Air Resources Laboratory (ARL), NOAA operates a national broadband solar radiation network as part of the Integrated Surface Irradiance Study (ISIS). This surface radiation monitoring program collects data in both the visible and ultraviolet (UV-B) wavebands. ISIS operates at two levels: Level 1 monitors incoming radiation only and Level 2 focuses on surface radiation balance. ISIS maintains a Level 1 site at Hanford, California in the central San Joaquin Valley. High quality data is also available from the NSF UV Monitoring Network that maintains a site at San Diego approximately three miles from the Pacific Ocean. Although not in the CCOS domain it may provide some useful information on the effect of marine clouds on UV irradiance. The facility is used for calibration and intercomparison of UV and visible radiometers. The system has been operating since October 28, 1992. The use of UVB data from two other should be considered, the EPA stratospheric UV network and the EPA Exposure network.

3.4 Surface Air Quality Measurements

The California Air Resources Board and local air pollution control districts currently operate 185 air quality monitoring stations throughout northern and central California. Of the active sites, 130 measure ozone and 76 measure NOx. Carbon monoxide and hydrocarbons are measured at 57 and 11 sites, respectively. Data from these sites are routinely acquired and archived by the ARB and Districts. ARB, in collaboration with the California air quality management districts, is establishing the $PM_{2.5}$ monitoring sites. The existing PM_{10} acquires filter samples every sixth day. Several of the PM_{10} sites have continuous monitors that measure hourly PM_{10} everyday.

3.4.1 Photochemical Assessment Monitoring Stations

States with areas classified as serious, severe, or extreme for ozone attainment are required to establish photochemical assessment monitoring stations (PAMS) as part of their State Implementation Plan. Each station measures speciated hydrocarbons and carbonyl compounds, ozone, oxides of nitrogen, and surface meteorological data. Additionally, each area must monitor upper air meteorology at one representative site.

PAMS precursor monitoring is conducted annually in California during the peak ozone season (July, August and September). Eleven PAMS sites were in operation during summer 2000 (four in Sacramento County, four in Fresno County, and three in Kern County). EPA methods TO-14 and TO-11 are specified by the EPA for sampling and analysis of speciated hydrocarbons and carbonyl compounds, respectively (EPA, 1991). Table 3.4-1 contains the minimum list of targeted hydrocarbon species. For carbonyl compounds, state and local agencies are currently required to report only formaldehyde, acetaldehyde and acetone.

Under the California Alternative Plan, four 3-hour samples (0000-0300, 0600-0900, 1300-1600, and 1700-2000, PDT) are collected every third day during the monitoring period at all PAMS sites for speciated hydrocarbons and at Type 2 (central business district) sites only for carbonyl compounds. These sampling periods were used for CCOS supplemental VOC samples. In addition to the CAP regularly scheduled measurements, samples are collected on a forecast basis during up to five high-ozone episodes of at least two consecutive days. Episodic measurements consist of four samples per day (0600-0900, 0900-1200, 1300-1600, and 1700-2000, PDT) for speciated hydrocarbons at all PAMS sites and for carbonyl compounds at Type 2 sites. Because the ARB laboratory has a limited number canisters and must recycle the them during the PAMS season, a relaxation of the regularly scheduled PAMS sampling was necessary to accommodate multi-day IOPs of three or more consecutive days. Instead of the sampling schedule in the California Alternative Plan, the U.S. Environmental Protection Agency approved a request by the ARB to modify the normal PAMS sampling schedule in order to accommodate more episodic sampling in coordination with the CCOS IOPs.

The implementation of PAMS by the local AQMDs and APCDs in central California during summer 2000 is outlined in Table 3.4-2. The new sampling plan retained only the 6-9 a.m

(PDT) sample, every third day, to preserve the analysis of long-term trend. Table 3.4-3 catalogs the trend samples collected under this plan during the summer 2000 PAMS season. Additional PAMS samples collected during IOPs are listed in Tables 3.4-4 for canister samples and 3.4-5 for cartonyl samples.

Total nonmethane hydrocarbon (NMHC) concentrations are monitored continuously on an hourly basis at all Sacramento and San Joaquin Valley PAMS sites by either automated-Preconcentration Direct Injection Flame Ionization Detection (PDFID) (e.g., Xontech 850) or TEI 55C. Recent modifications of the TEI55C (Ventura option) provide improved limit of detection (from 150 ppbC to 75 ppbC).

3.4.2 CCOS Supplemental Air Quality and Meteorological Measurements

The CCOS field measurement program consisted of four categories of supplemental measurement sites with increasing levels of chemical speciation and time resolution – Type 0, 1, and 2 "supplemental" (S) sites and "research" (R) sites as defined in Section 1. Table 3.4-6 lists the measurements (described in Appendix C of the Field Operations Plan) made at each of type of supplemental monitoring sites along with operating period and the groups that are responsible for equipment procurement and testing, installation and training, and laboratory analysis. The measurement method and specific instruments used in CCOS are given in Table 1.2-1. This table also provides nominal precision, detection limit, range, and averaging or sampling times. Tables 3.4-7a, 3.4-7b, and 3.4-7c show the instrument configuration at each of the CCOS supplemental air quality monitoring sites, using the letter designations introduced in Table 3.4-6. Figure 1.2-5 shows the locations of routine monitoring stations measuring ozone and NOx. Figure 1.2-6 shows the locations of existing monitoring stations measuring carbon monoxide and PAMS speciated hydrocarbons and carbonyl compounds in relation to proposed CCOS supplemental monitoring sites. Site descriptions and information (e.g., local contact, mail and shipping addresses, phone number), equipment installation and operational responsibilities are documented in Appendix D1. Photographs of the sites are in Appendix D2.

Continuous monitoring of ozone, NOx, CO, and optical parameters was phased in during June and early July, then phased out starting in late September into October. A complete catalog of the continuous data collected at the supplemental sites is given in Tables 3.4-8a to 3.4-8e. VOC canister samples were also collected at selected sites during IOPS. See Tables 3.4-9 and 3.4-10 for details.

3.4.3 Complementary Measurement Programs

Because a Photochemical Assessment Monitoring Station (PAMS) network does not exist in the Bay Area, the density of air quality measurements (e.g., NO/NOy and VOC) in the Bay Area is lower than is needed to reliably understand and simulate the conditions that result in days exceeding the ozone standard in the Bay Area alone. The Bay Area AQMD is sponsoring additional measurements during CCOS to obtain the information needed to develop a Bay Area specific plan. The supplemental Bay Area measurements are primarily designed to increase the understanding of high ozone in the Livermore Valley, where the Bay Area's highest ozone levels and most frequent exceedances of the standards occur. For this purpose, four types of measurements are proposed: 1) Monitoring of pollutant levels aloft on selected episode days with instrumented aircraft flights within and upwind of the Livermore Valley; 2) surface monitoring of ozone and precursor gases in the gaps through which air enters and exits the Livermore Valley; and 3) continuous aloft measurements of wind and temperature, using Doppler acoustic sounders and radar profilers, above the Livermore Valley and its entrance and exit gaps. The BAAQMD has contracted T&B Systems to implement the Bay Area component of CCOS. T&B System's effort involved the following tasks.

- Operated ozone and NOy analyzers at the BAAQMD's Lake Chabot meteorological monitoring site from 6/15/00 to 9/15/00.

- Operated surface meteorology, SODAR, and ozone in Dublin Canyon from 6/15/00 to 9/15/00.

- Installed and operated, from 6/15/00 to 9/15/00, ozone and NOy analyzers at the CCOS Livermore Valley radar profiler site (assuming that this site will be located in the undeveloped area between Livermore and Pleasanton and south of the Livermore airport). These instruments would be collocated with the Elight Ozone Profiler and radiosonde/ozonesonde measurements by the U.S. Navy.

- Operated an ozone analyzer at the BAAQMD's Kregor Peak meteorological monitoring site from 6/15/00 to 9/15/00.

- Operate a SODAR with surface meteorology in San Ramon Valley from 6/15/00 to 9/15/00.

- Operate a SODAR at the CCOS Sunol research site from 6/15/00 to 9/15/00.

- Assisted District staff with installation and operation of mobile sampling equipment (possibly including ozone, NOx, VOC canister sampler, surface met.) on up to 15 IOP days. Measurements will be taken along the 580 corridor through Dublin Canyon and east past Altamont Pass.

The CCOS field measurement program was conducted in conjunction with the California Regional $PM_{10}/PM_{2.5}$ Air Quality Study (CRPAQS). The CRPAQS field study consists of a long-term campaign from 12/1/99 through 1/31/01, a winter intensive study within the period of 11/15/00 through 1/31/01, and a fall intensive study within the period of 9/1/00 through 10/31/00. Several experiments were conducted during the summer period of 7/1/00 through 8/31/00. These include chemical characterization of $PM_{2.5}$ at the Fresno site to estimate the fraction of fine particles that is attributable to secondary organic aerosol and source contributions of directly-emitted fine particles. Other experiments examine the timing and intensity of light extinction in the San Joaquin Valley and the Mohave Desert. The baseline measurements for CRPAQS, which began in December 1999 and continue to the end of the study, are incorporated and leveraged into the CCOS field program.

3.5 In-Situ Aircraft Measurements

Specific objectives of the aircraft flights during CCOS were to collect data pertinent to the following meteorological conditions and processes.

1. Boundary conditions along western edge of the modeling domain.

2. Intra-valley transport within the San Joaquin Valley by eddies and slope-flows.

3. Boundary condition along northern edge of the modeling domain.

Four instrumented aircraft were used to measure the vertical and horizontal gradients of temperature and humidity in the study region during CCOS IOPs. These aircraft included two Cessna 172RG and Cessna 182 operated by University of California, Davis (UCD), and a Cessna 182 and Piper Aztec operated by Sonoma Technology, Inc. (STI). In addition, the U.S. Department of Energy Gulfstream 159 (G-1) participated in CCOS during a two-week period from 6/28/00 to 7/12/00 through the Atmospheric Chemistry Program (ACP).One additional aircraft (Twin Otter), flown by the Tennessee Valley Authority (TVA), made measurements in power plant plumes. These data will be used to evaluate the plume-in-grid (PiG) parameterizations used in air quality models. The plume study is described in Addendix D of the CCOS Field Study Plan.

3.5.1 Overview of Flight Plans

Alternate flight plans were developed for the two UCD and two STI aircraft corresponding to the type of ozone episode that is forecast for the IOP day. The three types of ozone episodes are described in Section 3 and are summarized here.

Type 1 - The San Francisco Bay Area (SFBA) has its highest basin-wide ozone values, though still less in absolute magnitude than San Joaquin Valley. This scenario is characterized by the weakest sea breeze (lowest west-to-east component through Carquinez Strait), and the lowest Oakland inversion base heights.

Type 2 - The San Joaquin Valley (SJV) has its highest basin-wide values while the Bay Area and Sacramento Valley are relatively cleaner. A stronger sea breeze, relatively to Type 1, keeps the pollutants moving through the Bay Area and the Sacramento Valley, but may increase transport into the SJV. Mountain Counties have lower ozone levels during this scenario.

Type 3 – Sacramento Valley (SV) has its highest basin-wide ozone values, as does the Mountain Counties Air Basin. As with Type 2, a stronger sea breeze is present, relative to Type 1, but the daily maximum surface temperatures in Sacramento Valley are significantly higher, indicating less and/or later intrusion of the sea breeze, allowing more time for photochemistry before evening transport to the Mountain Counties.

Figures 3.5-1, 3.5-2, and 3.5-3 show diagrams of the flight paths for the two UCD Cessna, STI Aztec, STI Cessna, and PNNL G-1 (western boundary flights only). One UCD Cessna captured the flow through the Carquinez Strait, through the delta and into the northern

SJV, and the flow approaching and leaving Sacramento. The second UCD Cessna documented the conditions in the Bay Area in the morning and in locations east of the Berkeley Hills in the afternoon. It captured the flow in and around the Livermore Valley and the flow through Altamont Pass to Tracy. The STI Piper Aztec documemented conditions along the western and northern boundaries and the STI Cessna covered the San Joaquin Valley. Boundary measurements were made during both non-episode and episode days. When the Aztec was not flying along the boundaries, it participated in flux plane measurements.

3.5.2 University of California, Davis

The aircraft are both single engine Cessnas, 172RG and 182, based in Davis. They carry instrumentation to measure position (Garmin GPS); humidity, temperature, wind speed, and wind direction (Aventech AIMMS-10); ozone (Dasibi 1008); NO, NOy (TEI 42S); hydrocarbons (3 canisters per flight, analyzed by BRC); carbonyl compounds (3 DNPH cartridges from 40 liter Tedlar bags, analyzed by AtmAA). UCD#1 also carries an instrument to measure particle concentration (Climet). Performance audits of O_3 and NOy analyzers were performed by ARB quality assurance section.

The area of coverage was the delta, Sacramento, and downwind of Sacramento plus some flights in Sacramento Valley. Objectives of flights during IOPs were to:

1. Capture the flow through the Carquinez Strait
2. Capture the flow through the delta and into the Northern SJV
3. Capture flow approaching and leaving Sacramento.
4. Define conditions in the bay area in the AM and behind the Berkeley hills in the PM.
5. Capture conditions in and around Livermore AM and PM
6. Capture flow through Altamont pass and to Tracy
7. Have daily camparisions between both aircraft and the Elk Grove RASS (Franklin field)

Both UCD aircraft flew during each IOP with all instruments operating. Figures 3.5-1. 3.5-2, and 3.5-3 show the flight path for all IOPS for both aircraft during morning IOPs, afternoon IOPs and afternoon on post IOPs, respectively. Morning flights were scheduled to depart at 0600, returning by 0930 PDT, and afternoon flights to depart 1300 and return 1630 PDT. Basic flight patterns were to spiral climb over Davis followed by vertical saw tooth patterns: ascents along the straight lines shown in the figures and descending spirals (actually squares) at the rectangles shown. Note these boxes are approximately to scale or a little larger than the actual expected pattern. Altitude variation was to be from (near) the surface to about 4500' AGL. While the aircraft paths sometimes cross or spiral near the same locations they were displaced in time by 45 to 75 minutes. After 7/31/00, the Concord spiral on UCD #2 PM flights were switched to San Pablo Bay for the remainder of the study due to traffic problems. On two mornings, low clouds/showers forced them to skip most of the Bay Area part of the route. UCD aircraft planned to depart within 5 minutes of each other, to afford daily cross-comparisons on climb out, and coordinate parallel flight with STI aircraft and fly by radar wind profilers. Tables 3.5-1 and 3.5-2 document schedules and details of completed flights.

3.5.3 Sonoma Technology Inc.

The aircraft used were a twin engine Piper Aztec and a single engine Cessna 182. They each carried instrumentation to measure position (Garmin 250); humidity, temperature, wind speed, and wind direction (Aventech AIMMS-10); dew point (Cambridge Systems 137-C); Temperature (YSI/MRI); Temperature backup (Rosemont 102); ozone (Monitor Labs 8410E); NO, NOy (TEI 42S); b_{scat} (MRI 1560 modified by Waggoner); particle concentration (Climet); hydrocarbons (3-4 canisters per flight, analyzed by BRC); carbonyl compounds (3-4 DNPH cartridges from Tedlar bags, analyzed by AtmAA), and collect VOC samples. Performance audits of O_3 and NOy analyzers by ARB quality assurance section.

The Aztec was based in Santa Rosa to cover the western and northern boundaries of the study area, and the Cessna in Bakersfield to cover the San Joaquin Valley. See the Field Operations Plan for details of the proposed flight plans. Tables 3.5-3 and 3.5-4 document schedules and details of completed flights.

3.5.4 Pacific Northwest National Laboratory Gulfstream 159 (G-1)

The G-1 twin-engine turboprop aircraft was based at the Fresno Air Terminal. Onboard measurements included position (Trimble GSP/Loran C), temperature (Rosemount), pressure (Rosemount), wind (differential pressure gust probe and GPS), humidity (General Eastern chilled mirror; AIR Lyman-α), SO_2 (TEI 43S), O_3 (TEI 49-100), CO (TEI 48), particle size spectrum (PMS FSSP & PCASP-100X), particle concentration (TSI 3010), particle optical properties (TSI 3563 nephelometer, Radiance PSAP), PAN/NO_2 (ANL), formaldehyde (BNL), up/down total UV (Eppley TUV), HC canisters (ANL). ARB provided a TEI 42CY NO/NO_y instrument for use during CCOS. Quality assurance audits were conducted by the ARB quality assurance section on 7/6/00 in Fresno.

There were two sets of basic flight plans for the G-1 in CCOS: 1) Fresno and central San Joaquin Valley and 2) Western In-Flow Boundary. Within each there were separate morning and afternoon flight patterns. Timing of the morning and afternoon flights took into account the length of the duty day for the pilots (<12 hours) as well as the scientific objectives for each flight. Even with activation of our FAA Low-Level Waiver, operations below 1000 ft AGL over populated areas could only be done over an airport. Portions of the ferry flights between Pasco, WA and Fresno, CA, were used for sampling within the Central Valley. The following activity report was submitted by PNNL.

Wednesday 6/28/00. The G-1 arrived in Fresno at ~3 PM after a 4:15 flight. Research measurements were made on the track from Redding to Fresno with a loop around the Bakersfield area.

Wednesday 7/5/00 All instruments were turned on at 5 AM and appeared to be functioning at time of the morning Fresno area flight. Morning flight was 2:30 from engine start to engine shut down. This was shorter than planned because less time was spent in and after each low level pass at the way points.

The afternoon flight pattern included spirals southeast of Fresno in which the STI Aztec flew tight spirals while the G-1 flew larger radius spirals. Following the spirals a constant level transect was flown to a point north Fresno and then west to Chowchilla where another set of spirals were flown. Return to Fresno followed same path without spirals. Test flight duration was 1:45. All instruments appeared to function.

Saturday 7/8/00 The western in-flow boundary flight plan was altered to return to Fresno instead of Monterey at the end of the morning flight because of the presence of low level stratus clouds cover along coast and fog at Monterey. The two flights totaled 8:20. Because of the cloud cover only one descent to ~300' MSL could be done on the morning flight; two such descents were made during the afternoon flight and one descent to cloud top at ~1000' MSL. Conditions were very clean in the free troposphere above the marine layer. Only an increase in particle concentrations was noted at low altitudes within the marine layer. All instruments except CO gave reasonable readings; CO output was very noisy.

Sunday 7/9/00 A morning and afternoon flight were made with all instruments operational; CO output is questionable. Low level passes instead of spirals at the airport waypoints reduced flight time of the morning flight to slightly more than 2 hours; a spiral was flown at the Angiola tower. Morning mixed layer depths were very shallow; high concentrations were seen only near the low point of low level passes at airport waypoints. High O3 and NOy values seen in layer aloft at ~6000' MSL in the morning flight. Afternoon mixed layer depths were lower over the central valley than along the foothills. Higher concentrations generally were seen downwind of Fresno. The two flights totaled 5:45.

Monday 7/10/00 Morning and afternoon flights in the Fresno area were made with all instruments except CO operating satisfactorily. A spiral over Turlock Lake was added to the morning flight. Ramp profiles to 7,500' MSL were added to the afternoon flight on departure from Fresno, from Harris Ranch to Angiola, and from Harris River to Mariposa. Near the end of the afternoon flight, a smoke plume from a stubble field fire in the Tulare area was sampled aloft at ~5,200' MSL. High concentrations of NOy and HCHO were detected in the plume; VOC canister samples were collected outside and within plume. The two flights totaled 6:45.

Tuesday 7/11/00 Morning and afternoon flights were made in the Fresno area; instrumentation as on prior flights. This day provided the highest O3 (~130 ppb), and NOy (~12 ppb) readings aloft in the Fresno plume in the late afternoon, especially on the eastern end of the cross-valley track between Harris River and Harris Ranch. Upslope flows along the foothills appear to draw the Fresno plume towards the western slope of the Sierras in the afternoon. Several field fires were seen in the area but none were sampled. The afternoon flight concluded the G-1 research flight activity in CCOS. This day was also the only day with significant cirrus cloud development over the valley. The two flights totaled 6:20.

Wednesday 7/12/00 Ferry flight from Fresno CA to Pasco WA.

About 35 flight hours were flown by the G-1 in CCOS; ~31 hours of which provided research data. Processing of that data is in progress and will continue over the next several weeks.

3.5.5 Tennessee Valley Authority

A package designed by Tennessee Valley Authority (TVA) Atmospheric Sciences staff was installed in a twin engine de Havilland Twin Otter Aircraft. It consisted of 6 TEI instruments, 4 for the measurement of various nitrogen oxides, one for "fast" ozone measurements, and one for ambient CO measurements. A LiCor instrument for CO_2 was on board, along with a TSI 3-wavelength nephelometer, a solar radiation device, and probes for temperature, relative humidity, (GPS) position, and (pressure) altitude. Samples of hydrocarbons were taken in canisters at selected intervals beginning with the 31 July mission, and for a subset of the canister-filling locations, bags were filled for post-flight collection on DNPH cartridges and analysis for carbonyls, beginning with the 1 August mission. Collection of hydrocarbon and carbonyl samples was controlled by the datalogger program and initiated by keystroke from the on-board display computer. Real-time position was displayed using the flight-mapping program running on a second on-board computer. Performance audits of gaseous analyzers by ARB quality assurance section. Coordinate parallel flight with other aircraft as desired. TVA onboard calibrator can be used to intercompare with other aircraft when at the same airport.

The objectives of the TVA program were to map detailed ozone, precursor, and products in power plant plumes and in regional airmasses during ferries and supplemental add-ons. 40 hours of flight time were planned, with additional hours possible if time and budget permit. Flights were targeted at Moss Landing and Pittsburg natural gas generating stations._Flight air speed was near 125 kts for ferries and near 95 kts for plume traversing. Ferries were also to provide detailed gaseous speciation. TVA submitted the following activity report.

Flight plans were as follows: At 1100 PDT ferry to target power plant (Pittsburg or Moss Landing) at mid boundary layer. Spiral from minimum safe altitude to 5000' 5 km upwind of plant for upwind vertical profile. Circle plant at 5 km to establish actual plume centerline direction and for first traverse. Continue a series of plume traverses at mid boundary level at 5 km spacing out to distance where ozone chemistry has finished or plume is indistinguishable from background. Spacing of lagrangian plume traverses will be fixed for a given flight and set based on profiler mid boundary layer wind at flight time. Length of traverses will be adjusted in flight depending on horizontal mixing observed in real time. Downwind spiral to 5000' will be performed when last traverse completed. Ferry back to base at completion.

The missions, shown in Table 3.5-5, were conducted during the period of July 24-August 11, 2000, using a base at the Monterey Peninsula Airport, Monterey, CA. Each full-day mission comprised approximately 6-h of flight time plus ferry time to the vicinity of the power plant. Ferry time from base to the Moss Landing plant was less than 15 min, but was about 40 min to the Pittsburg plant. Airborne zeroing using an on-board zero air source was conducted during each flight. An altitude test of the zero and span gas system was conducted during ferry times on flight 9, with zero air and span gas readings stabilized at low altitude (ca. 1000 ft MSL) and high altitude (ca. 6500 ft MSL) constant-altitude legs, then readings recorded during ascent and descent at 500 ft/min.

General observations as to data quality are as follows. All of the nitrogen oxide instruments, the fast ozone instrument, and the SO_2 instrument performed well throughout the study. Nephelometer data were reliably obtained throughout the study, although the nephelometer output could not usually be used as a plume detector because of the nature of the power plant emissions. The CO instrument, although refurbished and calibrated on the ground, performed erratically during the PM missions due to the high and variable temperatures in the cabin between morning and afternoon portions of missions. Although the LiCor CO_2 instrument was refurbished and re-calibrated at the factory just prior to the study, its output was somewhat erratic and did not serve as a reliable real-time indicator of the presence of the power plant plumes.

As noted above, hydrocarbon canisters and bag samples for carbonyls were collected on missions conducted on (and after) 31 July and 1 August, respectively. A summary of collected samples and locations are given in Table 3.4-6. Data processing is well under way and we can provide sample plots of data from the flights upon request.

3.5.6 VOC Sample Collection Methods and Protocols

Hydrocarbon samples are collected in stainless steel canisters and will be analyzed for C_1 to C_{11} hydrocarbons, CO and CO_2 at Biospheric Research Corporation (Beaverton, OR) by gas chromatography with flame ionization detection. The aircraft samplers were supplied by BRC. They operate manually off 24-48 volts and were configured to collect 3.2 liters canisters over averaging times of several minutes to near instantaneous.

Carbonyl samples were collected in Tedlar bags and transferred to dinitrophenyl hydrazine impregnated cartridges on the ground at the conclusion of the flight. Samples were collected by ramming air through a Telfon inlet tube into pre-cleaned 40-liter Tedlar bags that had been doped with excess NO to react with any O_3 in the air sample. Sampling times are approximately 2-5 minutes. The stainless steel valves attached to the Teflon bags were specially modified to permit rapid filling and all rubber seals have been replaced with inert Viton parts. Because the sample sizes for the aloft carbonyl samples (nominally 30 liters) are substantially less than for a typical surface sample, additional efforts were necessary to reduce blank variability in order to achieve the required detection level. The samples will be analyzed for C_1-C_7 carbonyl compounds by HPLC with UV detection at AtmAA (Calabasas, CA).

The budget allowed for collection and analysis of three or four sets of hydrocarbon and carbonyl samples per flight.

3.5.7 Intercomparison Flights

Intercomparison flights were performed between (1) the STI Aztec, STI Cessna 182, and one UCD Cessna, (2) the two UCD Cessnas, (4) the STI Aztec and the DOE G-1, and (5) one UCD Cessna and the TVA Twin Otter.

Table 3.2-1
Upper Air Meteorological Measurements for CCOS

Site ID	Name	Purpose	Justification	Operator[a]	Contractor	Radar[b]	RASS[b]	Sodar[b,c]	Sonde[b,d]	Nexrad
ABK	Arbuckle	Intrabasin transport	Location provides coverage of predominant summer flow through Sacramento Valley.	CCOS	NOAA-ETL	SC	SC			
ABU	N. of Auburn, S. of Grass Valley	Upslope/downslope flow, downwind of major area source	Site to monitor possible summer eddy flow, vertical temperature structure evolution, model input and evaluation data. Downwind of Sacramento area source.	CCOS	NOAA-ETL	SC	SC			
ACP	Angel's Camp	Upslope/downslope flow, complex terrain for challenging model evaluation	Served as site to capture eddy flow, mixing, vertical temperature structure, model input and evaluation data during SJVAQS/AUSPEX	CCOS	NOAA-ETL			SC		
ANGI	Angiola	Intrabasin transport, vertical mixing, micrometeorology	Positioned to monitor transport up the valley, low level nocturnal jet flow, and Fresno eddy flow patterns. Collocated with tall tower.	CRPAQS-rwp, CCOS-sodar	NOAA-ETL	AC	AC	SC		
BBX	Beale AFB-Oro Dam Blvd West	Northern boundary transport, synoptic conditions	Fulfill needs of National Weather Service and Beale AFB flight operations; existing long-term site.	BAFB						AC
BHX	Humboldt County	Onshore/offshore transport	Fulfill needs of National Weather Service; existing long-term site	NWS						AC
CAR	Carizo Plain	Interbasin tranport.	Monitor tranport between San Joaquin Valley and South Central Coast Air Basins.	CCOS	NOAA-ARL	SC	SC	SC		
CRG	Corning	Nothern Valley barrier, characterize Northern SV convergence zone.	To observe southerly barrier winds along the Sierra Nevada which may be a transport mechanism. May characterize extent of northerly flow into SV for some scenarios.	CCOS	NOAA-ETL	SC	SC			
DAX	Sacramento	Intrabasin transport	Fulfill needs of National Weather Service; existing long-term site	NWS						AC
EDI	Edison	Interbasin transport through Tehachapi Pass. Downwind of major source.	Site to observe possible divergence flow at southern end of the valley, low level jet flow, and eddy flows. Data from SJVAQS/AUSPEX taken at Oildale supports these observations. Downwind of Bakersfield area source.	ARB		AC	AC			
EDW	Edwards AFB	Intrabasin transport	Existing long term site. Transport through Tehachapi Pass, desert mixed layer, synoptic conditions.	EAFB					AS SE	

Table 3.2-1 (continued)
Upper Air Meteorological Measurements for CCOS

Site ID	Name	Purpose	Justification	Operator[a]	Contractor	Radar[b]	RASS[b]	Sodar[b,c]	Sonde[b,d]	Nexrad
EYX	Edwards AFB	Intrabasin transport	Fulfill needs of National Weather Service and Edwards AFB flight operations; existing long-term site.	EAFB						AC
FAT	Fresno Air Terminal	Intrabasin transport	Capture the Fresno eddy, characterize urban mixing heights, transport from major Fresno area source.	CCOS	NOAA_ETL	SC-449	SC	SC		
FSF	Fresno-First Street	Urban Heat Island, Intrabasin Transport, Synoptic Conditons. Characterize	Site to monitor possible summer eddy flow, vertical temperature structure evolution, model input and evaluation data. Flow out of Fresno.	CCOS	T&B				SE	
HNX	Hanford-edge of town between fairgrounds and municipal	Intrabasin Transport	Fulfill needs of National Weather Service; existing long-term site.	NWS						AC
HUR	Huron	Intrabasin transport	This is to monitor daily transport from north to south with average surface winds during afternoons and early evening and the low level nocturnal jet on the western side of the SJV; models should do well with topographic	CRPAQS or ARB	NOAA-ETL or ARB	AC	AC			
LGR	Lagrange	Upslope/downslope flow	This site represents valley/Sierra interactiion in northern SJV. Monitor possible upslope flow transport of pollutants during day and possible recirculation via Mariposa River Valley exit jet by night. Also completes the west to east transect across SJV from SNA to LIV sites.	CCOS	NOAA_ETL	SC	SC			
LHL	Lost Hills	Intra&interbasin transport across Carizo Plain	Situated east of the coastal range and represents uniform flow aloft at 1000m as opposed to a site on the Tremblor Range. Good position to detect the direction of flow between the Carrizo Plain and the SJV	ARB or NOAA		AC	AC			
LIV	Livingston	Intrabasin transport	Representative of mid SJV flow since variation in flow is small along the valley's central axis.	CRPAQS-rwp, CCOS-	NOAA_ETL	AC	AC	SC		
LVR	Livermore	Intrabasin transport	Monitor flow through Castro Valley between San Leandro/Oakland and Livermore.	CCOS	STI	SC	SC			

Table 3.2-1 (continued)
Upper Air Meteorological Measurements for CCOS

Site ID	Name	Purpose	Justification	Operator[a]	Contractor	Radar[b]	RASS[b]	Sodar[b,c]	Sonde[b,d]	Nexrad
MJD	Mojave Desert	Interbasin transport	Chosen to monitor interbasin flow out of the San Joaquin Valley to the desert via Tehachapi Pass. Previous monitoring studies have shown a clear exit jet out of the SJV in this region. The exact site is to be determined.	CRPAQS	NOAA_ETL	AC	AC			
MKR	Mouth Kings River	Upslope/downslope flow	The current suspicion is that the mountain exit jets flow along the axis of the valley over Trimmer. A site between Academy and Humphrey's Station is more likely to observe the flow than a site at Piedra.	CRPAQS	NOAA_ETL	AC	AC			
MON	Monterey	Onshore/offshore transport	Existing long term site. Transport through Tehachapi Pass, desert mixed layer, synoptic conditions.	USNPGS		AC	AC			
MUX	Santa Clara	Interbasin transport	Fulfill needs of National Weather Service; existing long-term site.	NWS						AC
NTD	Point Mugu USN	Onshore/offshore transport, synoptic conditions.	Existing long term site	USN					AS SE	
OAK	Oakland airport	Onshore/offshore transport, synoptic conditions.	Fulfill needs of National Weather Service; existing long-term site.	NWS					AS SE	
PLE	Plesant Grove	Intra- and interbasin tranport.	Monitor transport between Sacramento and Upper Sacramento Valley and North Mountain	CCOS	NOAA-ETL	SC	SC			
POR	Pt. Reyes	On-shore flow, along coast flow	Coastal meteorology impacts air quality not only in coastal regions but by modulating the strength, and intrusion extent of the sea breeze.	CCOS	STI	SC	SC			
REV	Reno National Weather Service Office	Northern boundary transport, synoptic conditions	Fulfill needs of National Weather Service; existing long-term site.	NWS					AS	
RGX	Washoe County-Virginia Peak	Northern boundary transport, synoptic conditions	Fulfill needs of National Weather Service; existing long-term site	NWS						AC
RIC	Richmond	Onshore/offshore transport.	Monitor possible deeper mixed layer.	CCOS-p, CCOS-sodar	NOAA-ETL	SC	SC	AC		

Table 3.2-1 (continued)
Upper Air Meteorological Measurements for CCOS

Site ID	Name	Purpose	Justification	Operator[a]	Contractor	Radar[b]	RASS[b]	Sodar[b,c]	Sonde[b,d]	Nexrad
SAC	Sacramento	Intra and interbasin transport	Monitor N-S flow within Sacramento Valley, afternoon sea breeze intrusion, and flow from San Francisco Bay Area; help resolve northern boundary of SV/SJV divergence zone.	SMUAPCD/ARB		AC	AC		SE	
SHA	Shasta	Intrabasin transport	Monitor flow at the northern end of the Sacramento Valley. Eddy flows.	CCOS	NOAA-ETL	SC	SC			
SNA	Santa Nella, E of I-5 toward Los Banos	Interbasin transport from Pacheco Pass, model QA.	May represents flow through Pacheco pass during some coastal valley intrusions; represents along-valley flow on western side at other times. Models should handle channeled, along-valley flow well at this point.	CRPAQS or ARB	NOAA-ETL or ARB	AC	AC			
SNM	San Martin	Intra- and interbasin transport, flow through Santa	Monitor transport from SFBA to NCC via Santa Clara Valley south of San Jose.	CCOS	STI	SC	SC			
SOX	Orange County	Onshore/offshore transport.	Fulfill needs of National Weather Service; existing long-term site	NWS						AC
TRA	Travis AFB	Interbasin transport between San Joaquin Valley and Bay	Existing long term site	TAFB		AC		WC		
TRC	Tracy, W of Tracy, S of I-205, W of I-580	Interbasin transport through Altamont Pass.	Monitor flow through Altamont Pass for San Francisco Bay Area to SJV transport in p.m.; also help monitor less frequent off-shore flow.	CCOS	STI	SC	SC			
VBG	Vandenberg AFB	Onshore/offshore transport, synoptic conditions.	Existing long term site	VAFB		AC			AS SE	
VBX	Orcutt Oil field-Vandenberg	Onshore/offshore transport.	Fulfill needs of National Weather Service and Vandenberg operations; existing long-term site.	VAFB						AC
VIS	Visalia	Intrabasin transport.	Existing long term site	SJVUAPCD		AC	AC			
VTX	Ventura County	Intrabasin transport-onshore/offshore transport.	Fulfill needs of National Weather Service; existing long-term site.	NWS						AC
	Pittsburg	Plume Study		PG&E	PG&E	SC	SC			
	Moss Landing	Plume Study		PG&E	PG&E	SC	SC			

Table 3.2-1 (continued)
Upper Air Meteorological Measurements for CCOS

	Operator[a]	Contractor	Radar[b]	RASS[b]	Sodar[b,c]	Sonde[b,d]	Nexrad
Totals by Operator:	CCOS		13	13	5	2	
	CRPAQS		6	6			
	ARB/Districts		4	4	1		
	Military/U.S.		3	1		4	10
	TOTALS		26	24	6	6	10

Footnotes

[a]CCOS=Central California Ozone Study (this study)' ARB=Air Resoures Board, BAAQMD=Bay Area Air Quality Management District; USNPGS=U.S. Navy Post Graduate School; SJVUAPCD=SJV Unified Air Pollution Control District, NWS=National Weather Service; SMAQMD=Sacramento Metropolitan Air Quality Management District, CRPAQS=California Regional PM10/PM2.5 Air Quality Study; VAF=Vandenberg Air Force Base, TAF=Travis Air Force Base, EAF=Edwards Air Force Base, USN=U.S. Navy.

[b]AC=Annual continuous measurements; AS=Annual sporadic measurements, SC=Summer continuous, 6/1/2000-9/30/2000; SE=Summer episodic measurements on forecasted days.

[c]Summer campaign sodars added at some sites as part of CRPAQS/CCOS except at RIC.

[d]Balloon launch on episode days. Frequency should be 4-8 times per day but include 0700 and 1900 PST.

Table 3.2-2
Radiosonde/Ozonesonde releases at Parlier and Granite Bay

Parlier

Date	0500 PDT	0800 PDT	1100 PDT	1400 PDT	1700 PDT	2200 PDT
7/23	500 mb	NS	500 mb	NS	500 mb	500 mb
7/24	500 mb	NS	500 mb	NS	810 mb	NS
7/30	500 mb	NS	500 mb	NS	500 mb	500 mb
7/31	500 mb	NS	500 mb	NS	500 mb	500 mb
8/1	6221/6037	NS	6215/5998	NS	6276/6044	NS
8/2	NS	4822/4809	NS	6176/5998	NS	NS
8/14	6263/6120	NS	6251/5940	6132/5974	6144/6001	NS
9/14	NS	6152/5952	-	6085/5875	NS	NS
9/17	6026/5849	NS	6064/5907	6171/6015	5992/5863	6036/5867
9/18	3567/3558	NS	6187/6077	6219/6047	6186/6019	6209/6007
9/19	6183/6018	NS	6206/6005	6186/6022	6140/5919	6140/5919
9/20	6084/5879	NS	6087/5933	6112/5932	6084/5884	0/0
9/21	6056/5882	NS	6008/5826	6021/5869	5945/5762	NS
9/30	5955/5797	NS	6128/5924	6124/5955	5931/5701	NS
10/1	5943/5748	NS	3025/2827	5918/5757	5915/5771	NS
10/2	5873/5710	NS	6032/5814	5871/5690	5848/5642	NS

Granite Bay

Date	0500 PDT	0800 PDT	1100 PDT	1400 PDT	1700 PDT	2200 PDT
7/23	500 mb	NS	500 mb	NS	500 mb	500 mb
7/24	500 mb	NS	500 mb	NS	500 mb	500 mb
7/30	500 mb	NS	500 mb	NS	500 mb	500 mb
7/31	500 mb	500 mb	500 mb	500 mb	500 mb	500 mb
8/1	6449/6171	NS	6341/6201	6354/6223	6370/6103	NS
8/2	NS	6631/6575	NS	6422/6276	NS	NS
8/14	6285/6110	NS	6440/6265	6563/6426	6299/6122	NS
9/14	NS	6270/6117	6291/6143	6307/6112	NS	NS
9/17	6300/6164	NS	632/6180	6321/6173	2561/6134	6303/6140
9/18	6300/6146	NS	6347/6173	6347/6181	6322/6173	6351/6144
9/19	6511/6319	NS	6350/6175	6371/6217	6342/6177	6322/6159
9/20	6388/6236	NS	5240/6598	6272/6127	6291/6113	6233/6063
9/21	6235/6232	NS	6186/6020	6185/6008	6206/6048	NS
9/30	NS	NS	NS	NS	NS	NS
10/1	NS	NS	NS	NS	NS	NS
10/2	NS	NS	NS	NS	NS	NS

Table entries are maximum height of soundings -PTU03/winds in meters (or mb where noted).
NS = none scheduled
On 9/14 scheduled sounding times were actually 0800, 1200, and 1500 PDT

Table 3.4-1
PAMS Target Species

1	Ethylene	29	2,3-Dimethylpentane
2	Acetylene	30	3-Methylhexane
3	Ethane	31	2,2,4-Trimethylpentane
4	Propene	32	n-Heptane
5	Propane	33	Methylcyclohexane
6	Isobutane	34	2,3,4-Trimethylpentane
7	1-Butene	35	Toluene
8	n-Butane	36	2-Methylheptane
9	trans-2-Butene	37	3-Methylheptane
10	cis-2-Butene	38	n-Octane
11	Isopentane	39	Ethylbenzene
12	1-Pentene	40	m&p-Xylene
13	n-Pentane	41	Styrene
14	Isoprene	42	o-Xylene
15	trans-2-Pentene	43	n-Nonane
16	cis-2-Pentene	44	Isopropylbenzene
17	2,2-Dimethylbutane	45	n-Propylbenzene
18	Cyclopentane	46	1-ethyl 3-methylbenzene
19	2,3-Dimethylbutane	47	1-ethyl 4-methylbenzene
20	2-Methylpentane	48	1,3,5-Trimethylbenzene
21	3-Methylpentane	49	1-ethyl 2-methylbenzene
22	2-Methyl-1-Pentene	50	1,2,4-Trimethylbenzene
23	n-Hexane	51	n-decane
24	Methylcyclopentane	52	1,2,3-Trimethylbenzene
25	2,4-Dimethylpentane	53	m-diethylbenzene
26	Benzene	54	p-diethylbenzene
27	Cyclohexane	55	n-undecane
28	2-Methylhexane		Total NMOC

Table 3.4-2
PAMS Sites in the CCOS Area

Site	Type of Site	Sampling Schedule for 2000 (CCOS)					
		HC [a]	Carb [b]	00	06	13	17
Sacramento							
Elk Grove-Bruceville	PAMS - 1	x		1	1	0	0
Sacramento-Airport Rd.	PAMS - 2	x	x	0	1	0	1
Sacramento-Del Paso	PAMS - 2A	x	x	1	1	0	1
Folsom-50 Natoma Street	PAMS - 3	x		0	1	0	1
Fresno							
Madera	PAMS - 3/1	x		0	0	0	0
Clovis Villa	PAMS - 2	x	x	1	1	0	1
Fresno-1st Street	PAMS - 2	x	x	1	1	0	1
Parlier	PAMS - 3	x		0	1	0	0
Bakersfield							
Bakersfield-Golden State	PAMS - 2	x	x	1	1	0	1
Arvin	PAMS - 3/1	x		1	1	0	1
Shafter	PAMS - 1	x		1	1	0	0
				7	10	0	7

Type 1 - Upwind background.
Type 2 - Maximum precursor emissions (typically located immediately downwind of the central business district).
Type 3 - Maximum ozone concentration.
Type 4 - Extreme downwind transported ozone area that may contribute to overwhelming transport in other areas.
a - Canisters collected every third day (one 3-hr sample beginning at 0600 PDT) plus CCOS IOPs as indicated.
b - DNPH cartridges collected every third day (one 3-hr sample beginning at 0600 PDT) plus CCOS IOPs as indicated.

Table 3.4-3
PAMS trends NMOC sampling record

DATE	Bakersfield - California Ave	Bakersfield - Golden St Hwy	Shafter	Clovis	Parlier	Madera	Sacramento - Airport	Sacramento - Bruceville Rd	Sacramento - Del Paso	Sacramento - Folsom	Fresno - First St	Fresno - First St Collocated
07/02/00	X	X	X	INV #1	X	X	X	INV #1	NR	X	X	X
07/05/00	X	X	NR	X	X	INV #1	X	X	NR	X	X	X
07/08/00	X	X	X	X	X	INV #1	INV #1	INV #1	INV #1	X	X	X
07/11/00	X	X	X	X	X	INV #1	X	INV #1	INV #2	X	INV #2	X
07/14/00	X	X	INV #1	X	X	X	X	INV #1	INV #2	X	X	X
07/17/00	X	X	X	X	X	X	X	INV #1	INV #2	X	X	X
07/20/00	X	X	X	INV #1	X	INV #3	X	INV #1	INV #2	X	X	X
07/23/00	X	X	X	INV #1	X	X	X	NR	INV #2	X	X	NR
07/26/00	X	X	X	NR	X	X	X	INV #1	X	X	X	X
07/29/00	X	X	NR	X	X	X	X	INV #1	X	NR	X	X
08/01/00	X	X	NR	INV #1	X	X	X	INV #1	X	X	X	X
08/04/00	INV #1	X	X	X	X	X	X	INV #1	X	X	X	X
08/07/00	INV #4	X	X	X	X	X	X	NR	X	NR	X	X
08/10/00	X	X	X	X	X	X	X	NR	X	X	X	X
08/13/00	X	X	X	X	X	X	X	NR	X	X	X	X
08/16/00	X	X	X	X	X	X	X	X	X	X	X	X
08/19/00	X	X	X	X	NR	X	X	INV #1	X	X	X	X
08/22/00	X	X	X	NR	X	X	X	X	X	X	X	X
08/25/00	X	X	X	X	X	X	NR	NR	NR	NR	X	X
08/28/00	X	X	NR	X	X	X	NR	NR	NR	NR	X	X
08/31/00	X	X	X	X	X	X	NR	NR	NR	NR	X	X

Table 3.4-3 (continued)
PAMS trends NMOC sampling record

	Bakersfield - California Ave	Bakersfield - Golden St Hwy	Shafter	Clovis	Parlier	Madera	Sacramento - Airport	Sacramento - Bruceville Rd	Sacramento - Del Paso	Sacramento - Folsom	Fresno - First St	Fresno - First St Collocated
09/03/00	**NR**	**X**	**X**	**X**	**X**	**X**	**NR**	**NR**	**NR**	**NR**	**X**	**X**
09/06/00	X	X	X	X	NR	X	NR	NR	NR	NR	X	X
09/09/00	X	X	X	X	NR	X	NR	NR	NR	NR	NR	X
09/12/00	INV #4	X	X	X	X	X	NR	NR	NR	NR	X	X
09/15/00	X	NR	X	INV #1	INV #1	X	NR	NR	NR	NR	X	X
09/18/00	X	X	NR	X	X	X	NR	NR	NR	NR	X	X
09/21/00	X	X	X	X	X	X	NR	NR	NR	NR	X	X
09/24/00	NR	NR	X	NR	X	X	NR	NR	NR	NR	X	X
09/27/00	NR	NR	X	X	X	X	NR	NR	NR	NR	X	X
09/30/00				X	X	X					X	X
Total Expected	30	30	30	30	30	30	30	30	30	30	30	30
Total Valid Received	24	27	24	22	26	26	17	3	10	16	28	29
Total Invalidated	3	0	1	5	1	4	1	11	6	0	1	0
Total Not Received	3	3	5	3	3	0	12	16	14	14	1	1
% Efficiency	80%	90%	80%	73%	87%	87%	57%	10%	33%	53%	93%	97%

	Indicates that a sample is both PAMS and CCOS
NR	Not received as of 10/4/00
X	Sample received and is not invalid
INV #1	Invalid due to received with pressure less than 5.0 psi
INV #2	Invalid due to sampling equipment being inoperative
INV #3	Invalid due to sampling duration out of range
INV #4	Invalid due to sampler malfunction
INV #5	Invalid due to sample leak in transit
**	Samples were received for 9/30/00 although the last official PAMS sampling date was 9/27/00
NOTE:	As of 8/25/00 we no longer supported the Sacramento sites due to their switching to 3L canisters

Table 3.4-4
PAMS/CCOS NMOC SAMPLING RECORD

DATE	TIME	Bakersfield - California Ave	Bakersfield - Golden St Hwy	Shafter	Sacramento - Airport	Sacramento - Bruceville Rd	Sacramento - Del Paso	Sacramento - Folsom	Fresno - First St
07/22/00	23:00	X	X	X	N/A	NR	NR	N/A	X
07/23/00	5:00	X	X	X	X	INV #1	INV #2	X	X
07/23/00	16:00	X	X	N/A	X	N/A	NR	X	X
07/23/00	23:00	X	X	X	N/A	NR	NR	N/A	NR
07/24/00	5:00	X	X	X	X	INV #1	NR	X	X
07/24/00	16:00	X	X	N/A	INV #4	N/A	NR	X	X
07/29/00	5:00							X	
07/29/00	23:00	X	X	X	N/A	INV #1	X	N/A	X
07/30/00	5:00	X	X	X	X	INV #1	X	X	X
07/30/00	16:00	X	X	N/A	X	N/A	X	X	X
07/30/00	23:00	X	X	X	N/A	INV #1	X	N/A	X
07/31/00	5:00	X	X	X	X	INV #1	X	X	X
07/31/00	16:00	X	X	N/A	X	N/A	X	X	X
07/31/00	23:00	X	X	NR	N/A	NR	NR	N/A	X
08/01/00	5:00	X	X	NR	NR	NR	NR	NR	X
08/01/00	16:00	X	X	N/A	NR	N/A	NR	NR	X
08/13/00	23:00	X	X	X	X		X	X	
08/14/00	5:00	X	X	X	X		X	X	
08/14/00	12:00	X	X	X	X		X	X	
08/14/00	16:00	X	X	X	X		X	X	
09/12/00	23:00			X					
09/13/00	23:00	X	X	NR					
09/14/00	5:00	X	X	X					
09/14/00	12:00	X	X	X					
09/14/00	16:00	X	X	X					
09/16/00	23:00	X	X	NR					
09/17/00	5:00	X	X	NR					
09/17/00	12:00	X	X	NR					
09/17/00	16:00	X	X	NR					

Table 3.4-4 (continued)
PAMS/CCOS NMOC SAMPLING RECORD

DATE	TIME	Bakersfield - California Ave	Bakersfield - Golden St Hwy	Shafter	Sacramento - Airport	Sacramento - Bruceville Rd	Sacramento - Del Paso	Sacramento - Folsom	Fresno - First St
09/17/00	23:00	X	X	NR					
09/18/00	5:00	X	X	NR					
09/18/00	12:00	X	X	X					
09/18/00	16:00	X	X	INV #1					
09/18/00	23:00	X	X	X					
09/19/00	5:00	X	X	X					
09/19/00	12:00	X	X	X					
09/19/00	16:00	X	X	X					
09/19/00	23:00	X	X	X					
09/20/00	5:00	X	X	X					
09/20/00	12:00	X	X	X					
09/20/00	16:00	X	X	X					
09/20/00	23:00	X	X	X	X	INV #1	X	X	
09/21/00	5:00	X	X	X	X	INV #1	X	X	
09/21/00	12:00	X	X	X	X	INV #1	X	X	
09/21/00	16:00	X	X	X	X	INV #1	X	X	
09/23/00	23:00			X					
09/24/00	5:00			X					
09/24/00	12:00			X					
09/24/00	16:00			X					
TOTAL VALID SAMPLES		**43**	**43**	**33**	**15**	**0**	**14**	**17**	**14**

(shaded) Indicates that a sample is both PAMS and CCOS

N/A Indicates that there is no sample scheduled for this sampling time

NR Not received as of 10/4/00

X Sample received and is not invalid

INV #1 Invalid due to received with pressure less than 5.0 psi

INV #2 Invalid due to sampling equipment being inoperative

INV #3 Invalid due to sampling duration out of range

INV #4 Invalid due to sampler malfunction

INV #5 Invalid due to sample leak in transit

Table 3.4-5
PAMS/CCOS carbonyl sample collection

DATE	TIME	Fresno – 1st St.	Sac - Airport	Sac – Del Paso
7/22	23:00	X	N/A	X
7/23	5:00	X	X	X
7/23	16:00	X	X	X
7/23	23:00	X	N/A	X
7/24	5:00	X	X	X
7/24	16:00	X	X	X
7/29	23:00	X	N/A	X
7/30	5:00	X	X	X
7/30	16:00	X	X	X
7/30	23:00	X	N/A	X
7/31	5:00	X	X	X
7/31	16:00	X	X	X
7/31	23:00	X	NR	NR
8/1	5:00	X	NR	NR
8/1	16:00	X	NR	NR
8/13	23:00	NR	N/A	X
8/14	5:00	NR	X	X
8/14	16:00	NR	X	X
9/16	23:00	NR	N/A	X
9/17	5:00	NR	X	X
9/17	16:00	NR	X	X
9/17	23:00	NR	N/A	X
9/18	5:00	NR	X	X
9/18	16:00	NR	X	X
9/18	23:00	NR	N/A	X
9/19	5:00	NR	X	X
9/19	16:00	NR	X	X
9/19	23:00	NR	N/A	X
9/20	5:00	NR	X	X
9/20	16:00	NR	X	X
Total Valid Samples By Site		**15**	**18**	**27**
Total Valid Samples:		**60**		

N/A Sampling is not scheduled for this interval.
NR Sample was not received for this interval.
X Sample was received for this interval and is valid.

Table 3.4-6
CCOS Supplemental Surface Measurements

Code	Observable and Method	Period	Site Types	Equipment Procurement & Testing	Equipment Installation and Training	Laboratory Analysis
A	Surface Meteorology (WS,WD, T and RH) at 10 m	Study Period	S0, S1, S2, R	NOAA	NOAA	--
B	Ozone (ultraviolet absorption monitor)	Study Period	S0, S1, S2, R	DRI	DRI	--
C	Trace level NO, NOx (chemiluminescent monitor)	Study Period	R	CE-CERT	CE-CERT/DRI	--
D	NO, NOy (high sensitivity chemiluminescent monitor with external converter)	Study Period	S0, S1, S2	CE-CERT	CE-CERT/DRI	--
E	NOy, NOy-HNO_3 (high sensitivity chemiluminescent monitor with dual converters w/ & w/o NaCl impregnated fiber denuder)	Study Period	R	CE-CERT	CE-CERT	--
F	NO_2, PAcNs (GC - Luminol)	Study Period	S2, R	CE-CERT	CE-CERT	--
G	NO_3^- (flash vaporization)	Study Period	R	CRPAQS/AD	AD/DRI	--
H	CO (nondispersive infrared)	Study Period	R	DRI	DRI	--
I	CO_2 (nondispersive infrared)	Study Period	R	DRI	DRI	--
J; J'	CO, CO2, CH4, C_2-C_{12} hydrocarbons (canister/GC-FID); 55 target HC and NMOC for PAMS	IOP	S1, S2; PAMS	DRI/BRC	DRI/BRC	DRI/BRC & ARB for PAMS
K	C_8-C_{20} hydrocarbons (Tenax GC-FID, MSD)	IOP	R	DRI	DRI	DRI
L	VOC (Automated-GC/ion trap mass spectrometer)	Study Period	R	DRI	DRI	DRI
N; N'	C_1-C_7 carbonyls(DNPH-HPLC/UV); C_1-C_2 for PAMS	IOP	S1, S2; PAMS	AtmAA	AtmAA	AtmAA & ARB for PAMS
P	NO_2, HNO_3 (TDLAS)	IOP	R (Parlier)	CE-CERT	CE-CERT	--
Q	H_2O_2, HCHO (TDLAS)	IOP	R (Parlier)	CE-CERT	CE-CERT	--
R	PM2.5 light absorption (aethalometer)	Study Period	R	CRPAQS/DRI	DRI	--
S	PM2.5 light scattering (nephelometer)	Study Period	R	CRPAQS/DRI	DRI	--
T	Scanning Radiometers	Study Period	R	DRI	DRI	--
U	PM2.5 mass (beta attenuation)	12/1/99 to 1/31/01	CRPAQS Anchor	CRPAQS	CRPAQS	--
V	PM10 mass (beta attenuation)	12/1/99 to 1/31/02	CRPAQS Anchor	CRPAQS	CRPAQS	--
W	PM2.5 Organic and Elemental Carbon	12/1/99 to 1/31/03	CRPAQS Anchor	CRPAQS	CRPAQS	--

Table 3.4-7a
CCOS Supplemental Surface Air Quality Monitoring Sites and Measurements in the Sacramento Valley and Northern Sierra Nevada Foothills

				Measurements				Operation			
Site	**Site Code**	**County**	**Type**	**Existing or Special**	**CRPAQS**	**CCOS**	**Facilites Installation**	**Met**	**Continuous Analyzers**	**VOC Sampling (4)**	**VOC Analysis**
Shasta Lake	SHL	Shasta	ozone only	B (ARB)		A	ENSR	NOAA	Shasta APCD		
Bella Vista	BEV	Shasta	S0	--	--	ABD	ENSR	NOAA	Shasta APCD		
Sutter Buttes	SUT	Sutter	S1	AB	--	DJN	ENSR	ARB	ARB	DRI	DRI, AtmAA
Lambie Road	LAR	Solano	S0	--	--	ABD	ENSR	NOAA	BAAQMD		
Walnut Grove Tower	WAG	Sacramento	ozone only	AB	--	--	Parsons	Parsons	Parsons		
Elk Grove	ELK	Sacramento	S1'	ABC'J'N'	--	D	SMAQMD	SMAQMD	SMAQMD	SMAQMD	ARB, ARB
Sloughhouse	SLU	Sacramento	S0	AB	--	D	SMAQMD	SMAQMD	SMAQMD		
Granite Bay	GRB	Placer	R	--	--	ABCEFGHI JKLMNORST	ENSR	NOAA	DRI	DRI (5,6)	DRI, AtmAA
White Cloud	WHC	Nevada	S1	AB	--	DJN	ARB	ARB	DRI	DRI	DRI, AtmAA

See footnotes at end of Table 2.4-3c.

Table 3.4-7b
CCOS Supplemental Surface Air Quality Monitoring Sites and Measurements in the San Francisco Bay Area

Site	Site Code	County	Type	Measurements			Facilites Installation	Operation			
				Existing or Special	CRPAQS	CCOS		Met	Continuous Analyzers	VOC Sampling [4]	VOC Analysis
Bodega Bay	BODB	Sonoma	S1	--	RSJ[1]	ABDJN	ENSR	CRPAQS	T&B	T&B	BRC, AtmAA
Pt Reyes	POR	Marin	Met only	--	--	A		NOAA			
Bethel Island	BTI	Contra Costa	S2	ABC'H'	S	DFJMN	BAAQMD/ ENSR	BAAQMD	BAAQMD	BAAQMD	DRI, AtmAA
San Leandro	SLE	Alameda	S1	ABC	--	JN	BAAQMD	BAAQMD	BAAQMD	BAAQMD	DRI, AtmAA
Lake Chabot	LAC	Alameda	S0	A		BD	BAAQMD	BAAQMD	T&B		
Livermore	LIV	Alameda	S0	ABC'H'		D	BAAQMD	BAAQMD	T&B		
Camp Parks	CAP	Alameda	ozone only	A		B	BAAQMD	BAAQMD	T&B		
Mobile Van	MOV	Livermore area	S1			ABDJ	BAAQMD	BAAQMD	BAAQMD	BAAQMD	BAAQMD
San Jose 4th Street	SJO	Santa Clara	S1	ABCH	S	J[2]N[2]	BAAQMD	BAAQMD	BAAQMD	BAAQMD	BA, AtmAA
Sunol	SUN	Alameda	R	--	S	ABCEFGHI JKLMNRT	ENSR	BAAQMD	UCB	DRI [5,6]	DRI, AtmAA
Patterson Pass	PAP	Alameda	S2	--	ASU	BDFJMN	ENSR	NONE	UCB	UCB	DRI, AtmAA
San Martin	SNM	Santa Clara	S0	AB	--	D	BAAQMD	BAAQMD	BAAQMD		
Pacheco Pass	PAP	Merced	S2	--	AS	BDJNMN	CRPAQS/ ENSR	CRPAQS	T&B	T&B	BRC, AtmAA

See footnotes at end of Table 2.4-3c.

Table 3.4-7c
CCOS Supplemental Surface Air Quality Monitoring Sites and Measurements in the San Joaquin Valley , Central Sierra Nevada Foothills, and South Central Coast

Site	Site Code	County	Type	Measurements			Facilites Installation	Operation			
				Existing	CRPAQS	CCOS		Met	Continuous Analyzers	VOC Sampling [4]	VOC Analysis
Turlock	TSM	Stanislaus	S1	ABCH	--	DJN	SJVUAPCD	SJVUAPCD	T&B	T&B	BRC, AtmAA
San Andreas	SGS	Calaveras	S1	ABH	--	DJN	ARB	ARB	ARB	ARB	BRC, AtmAA
Kettleman City	KCH	Kings	S0	--	S	ABD	ENSR	NOAA	SJVUAPCD		
Angiola	ANGI	Tulare	S1+	--	ABDJ[1]S RUVW	JN	CRPAQS	CRPAQS	CRPAQS	SJVUAPCD	BRC, AtmAA
Trimmer	TRIM	Fresno	S2	--	A[3]S	BDFJMN	CRPAQS/ ENSR	CRPAQS	ARB	ARB	DRI, AtmAA
Parlier	PLR	Fresno	R'	ABC'J'N'	--	EFGHI KLMPQRST	SJVUAPCD/ ENSR	SJVUAPCD	SJVUAPCD	SJVAPCD [5,6] SJVAPCD	DRI, AtmAA ARB, ARB
Arvin	ARV	Kern	S2'	ABCJ'	--	DFM	ARB	ARB	ARB	ARB	ARB
McKittrick	MCK	Kern	S0	--	--	ABD	ENSR	NOAA	SJVUAPCD		
Red Hills	RDH	San Luis Obispo	S0	AB	S	D	SLOAPCD	SLOAPCD	SLOAPCD		
Camp Roberts	CRO	San Luis Obispo	S1	AB			SLOAPCD	SLOAPCD	SLOAPCD		
Piedras Blancas	PIB	San Luis Obispo	S1	--	--	ABDJN	ENSR	NOAA	SLOAPCD	SLOAPCD	BRC, AtmAA

(1) CRPAQS Annual Site, 24-hour canister sample every 6th day.
(2) Bay Area component of CCOS, samples collected and analyzed by BAAQMD.
(3) 10-m meteorological tower located nearby.
(4) Four canister and DNPH samples daily on 15 IOP days (0000-0300, 0600-0900, 1300-1600, 1700-2000, PDT).
(5) Two canister samples per day on 5 IOP days (0600-0900, 1300-1600, PDT) and daily auto-GC/MS from 7/2/00 to 9/2/00 (23 hourly on IOP days and seven 3-hr on non IOP days).
(6) Four Tenax and DNPH samples daily on 15 IOP days (0000-0300, 0600-0900, 1300-1600, 1700-2000, PDT).

Table 3.4-8a
Percent Data Recovery for CCOS Supplemental Monitoring Sites - June

			June																												
	Site	Instrument / Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
S0	BEV	O_3																														
		NO_Y																														
	KCH	O_3					**27**	76	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	94	100	100	100	100	100	100
		NO_Y																														**88**
	LAR	O_3													**59**	65	95	95	95	95	95	95	95	95	95	95	95	95	95	95	93	95
		NO_Y																														
	MCK	O_3				**33**	95	95	95	95	95	95	95	95	95	95	95	95	95	100	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y																														**86**
	SNM	NO_Y																														
	SLU	NO_Y																							**56**	96	96	96	96	96	96	96
S1	BODB	O_3																														
		NO_Y																														
	ELK	NO_Y																														
	PIB	O_3																														
		NO_Y																														
	SGS	NO_Y																														
	SUT	NO_Y																														
	TSM	NO_Y																														
	WHC	NO_Y																														
S2	ARV	NO_Y																														**99**
	BTI	NO_Y																								**30**	95	95	95	95	95	95
	PAP	O_3																														
		NO_Y																														
	PCP	O_3																										**79**	94	94	94	94
		NO_Y																										**94**	94	94	94	94
	TRIM	O_3											**22**	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y																														
R	GRB	O_3																						38	92	97	97	96	97	97	96	97
		NO_X																						38	94	94	94	94	94	94	94	94
		NO_Y (NA)																														
		CO																						38	92	97	97	97	97	97	97	97
		CO_2																						38	96	97	97	97	97	97	97	97
		Aethalometer																							**33**	97	97	98	98	99	99	99
		Nephelometer																														
		NO_3																														
	PLR	NO_Y (NA)																														
		CO																														**0**
		CO_2																														**0**
		Aethalometer																													**68**	98
		NO_3																														
	SUN	O_3																														
		NO_X																														
		NO_Y (NA)																														
		CO																														
		CO_2																														
		Aethalometer																														
		NO_3																														

Table 3.4-8b
Percent Data Recovery for CCOS Supplemental Monitoring Sites- July

	Site	Instrument	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
S0	BEV	O_3																											89	95	95	95	95
		NO_Y																													70	95	95
	KCH	O_3	100	100	100	100	100	53	69	75	100	95	95	95	95	95	10	86	95	94	95	95	55	95	95	95	95	95	95	95	95	95	95
		NO_Y	100	100	100	100	100	53	69	75	100	95	95	95	94	95	10	86	95	94	95	95	55	95	95	95	95	95	95	95	95	95	95
	LAR	O_3	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y	84	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	MCK	O_3	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	SNM	NO_Y	84	96	96	96	96	96	96	96	96	96	96	95	95	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	20
	SLU	NO_Y	96	96	96	96	96	96	96	96	96	96	96	96	95	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	14
S1	BODB	O_3												36	94	94	94	94	94	94	94	94	94	29	0	0	0	0	0	0	0	0	0
		NO_Y												35	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
	ELK	NO_Y		0	0	0	0	0	0	0	65	95	94	95	95	95	95	95	100	95	95	95	94	95	95	95	94	95	95	95	95	95	95
	PIB	O_3											35	92	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
		NO_Y												60	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	SGS	NO_Y							23	94	16	57	33	94	90	73	73	73	73	18	0	0	35	73	73	73	73	73	73	73	73	73	73
	SUT	NO_Y																										86	94	94	94	94	94
	TSM	NO_Y	84	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	15
	WHC	NO_Y											49	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
S2	ARV	NO_Y	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
	BTI	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	95	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	PAP	O_3									60	95	95	95	15	94	95	95	95	14	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y									60	95	95	95	15	94	95	95	95	14	95	95	95	95	95	95	95	95	95	95	95	95	95
	PCP	O_3	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
		NO_Y	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	TRIM	O_3	83	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95	14
		NO_Y	83	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95	14
R	GRB	O_3	97	96	97	90	97	96	97	97	97	97	97	96	97	97	96	97	97	97	96	97	96	97	96	97	96	97	97	96	97	97	96
		NO_X	94	94	94	94	90	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
		NO_Y (NA)																															
		CO	97	97	97	97	95	96	97	97	97	97	97	97	97	97	97	97	97	97	97	97	96	97	96	97	97	97	96	97	97	97	97
		CO_2	97	97	97	97	95	96	97	97	97	97	97	97	97	97	97	97	97	97	97	97	96	97	96	97	97	97	97	97	97	97	97
		Aethalometer	98	93	99	99	98	99	100	99	99	99	99	99	99	100	99	100	99	99	98	98	99	99	99	99	99	99	95	98	98	98	98
		Nephelometer																															
		NO_3																															
	PLR	NO_Y (NA)																															
		CO	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
		CO_2	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
		Aethalometer	99	99	98	99	99	99	98	99	99	98	98	98	98	98	98	99	98	97	97	97	97	98	98	97	97	98	98	97	97	98	97
		NO_3																															
	SUN	O_3			21	97	97	97	97	97	97	97	97	97	96	97	97	97	96	97	97	97	96	97	97	97	96	97	97	97	96	97	97
		NO_X			21	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	94	94	94	94
		NO_Y (NA)																															
		CO			21	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
		CO_2			21	99	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	0
		Aethalometer				15	99	99	99	99	99	99	99	99	99	99	99	100	99	98	99	99	100	100	99	99	99	100	99	99	99	99	98
		NO_3																															38

Table 3.4-8c
Percent Data Recovery for CCOS Supplemental Monitoring Sites - August

	Site	Instrument	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
S0	BEV	O_3	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	94	95	95	95	95	95	93	95	95	95	95	94	95	95	95	95
		NO_Y	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	94	94	95	95	95	95	94	95	95	95	95	94	95	95	95	95
	KCH	O_3	95	95	95	95	95	95	95	95	95	95	95	82	95	95	95	95	95	95	95	95	95	95	95	95	95	95	61	95	95	95	95
		NO_Y	95	94	95	95	95	95	95	95	95	95	95	84	95	95	95	95	10	0	0	0	0	0	0	33	95	95	61	95	95	95	94
	LAR	O_3	95	95	95	91	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y	95	50	0	12	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	MCK	O_3	94	95	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y	93	95	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	SNM	NO_Y	96	96	96	96	96	96	96	96	10	0	0	0	0	0	0	0	0	23	94	95	95	95	95	95	95	95	95	95	95	95	95
	SLU	NO_Y	96	96	96	96	96	96	96	87	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	87
S1	BODB	O_3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y	100	100	100	100	95	95	95	95	95	95	95	95	95	95	95	92	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	ELK	NO_Y	95	95	95	95	95	95	95	94	95	95	94	95	95	95	95	95	95	95	100	95	95	95	95	95	95	95	95	95	94	95	95
	PIB	O_3	100	100	100	100	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y	100	100	100	100	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	SGS	NO_Y	73	73	73	73	73	73	73	73	73	73	71	63	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	61	94	94	94
	SUT	NO_Y	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
	TSM	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	89	80
	WHC	NO_Y	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
S2	ARV	NO_Y	94	94	94	94	94	94	94	94	94	94	94	35	94	94	94	94	10	0	0	0	0	0	0	0	0	0	0	50	94	94	94
	BTI	NO_Y	95	95	95	95	95	94	95	95	95	95	95	35	95	95	95	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95
	PAP	O_3	95	95	95	94	94	95	95	95	95	95	95	87	95	95	95	93	95	95	95	95	95	95	94	94	95	95	95	95	95	85	94
		NO_Y	95	95	95	94	94	95	95	95	95	95	95	87	95	95	95	94	95	95	95	95	95	95	94	94	95	95	95	95	95	95	94
	PCP	O_3	100	79	95	95	94	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	94	95	95	95	95	94	100	100	100
		NO_Y	100	79	95	95	94	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	94	95	95	95	95	94	100	100	100
	TRIM	O_3	95	95	95	94	95	95	95	95	93	95	95	38	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
		NO_Y	95	95	93	94	95	95	95	95	93	95	95	38	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
R	GRB	O_3	94	97	84	94	93	96	93	94	94	94	94	94	94	93	94	94	97	96	97	97	96	97	97	97	97	97	97	97	97	96	97
		NO_X	94	94	84	94	89	94	94	94	94	94	94	94	94	92	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
		NO_Y (NA)					47	94	94	94	94	94	94	94	94	91	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
		CO	97	97	86	97	93	96	94	97	97	97	97	97	97	94	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
		CO_2	97	97	86	97	93	97	94	97	97	95	97	97	97	94	97	97	97	97	97	97	97	97	97	96	97	97	97	97	97	97	97
		Aethalometer	98	98	99	99	99	100	99	93	99	99	98	99	99	94	98	98	98	99	99	99	98	98	99	98	98	99	98	98	99	99	99
		Nephelometer																	0	0	0	35	100	100	100	100	100	100	100	100	100	95	100
		NO_3															35	85	3	91	100	93	100	100	99	100	100	100	42	0	0	33	99
	PLR	NO_Y (NA)			48	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
		CO	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	96	97	97
		CO_2	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	96	97	97
		Aethalometer	98	96	98	97	98	99	98	98	96	97	96	97	98	98	97	97	97	97	98	99	97	96	97	97	97	97	98	97	97	96	99
		NO_3										17	98	99	100	100	100	99	100	100	100	33	52	99	100	99	100	100	100	99	100	100	100
	SUN	O_3	97	97	96	97	93	97	96	97	97	97	96	97	97	97	97	96	97	97	97	96	97	97	97	97	97	96	97	97	97	96	97
		NO_X	94	94	94	94	94	94	94	94	94	94	95	94	94	94	94	95	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
		NO_Y (NA)																		57	94	94	94	94	94	94	94	94	94	94	94	94	94
		CO	97	97	97	97	94	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
		CO_2	97	97	97	97	94	97	97	97	97	97	97	97	97	97	96	97	97	96	96	97	97	97	97	97	97	97	97	97	97	97	97
		Aethalometer	97	97	98	97	99	99	100	99	99	99	97	98	99	98	97	97	98	99	99	99	97	98	99	99	96	99	99	98	98	98	99
		NO_3	97	100	100	100	100	100	100	100	100	100	100	100	100	100	98	100	100	95	100	100	100	99	99	100	100	100	100	100	100	100	100

Table 3.4-8d
Percent Data Recovery for CCOS Supplemental Monitoring Sites- September

	Date	September																													
Site	Instrument	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
BEV	O_3	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
KCH	O_3	87	95	100	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	NO_Y	87	95	100	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	95
LAR	O_3	95	95	95	95	95	95	95	95	95	95	93	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	NO_Y	95	95	95	95	95	95	95	95	95	95	93	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
MCK	O_3	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	95	95	95	95
	NO_Y	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	95	95	95	95
SNM	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
SLU	NO_Y	95	95	95	95	95	95	95	95	95	95	95	94	95	95	95	95	95	95	94	95	95	95	**50**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
BODB	O_3	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
ELK	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
PIB	O_3	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
SGS	NO_Y	94	94	94	94	94	94	94	94	94	57	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
SUT	NO_Y	94	94	94	94	94	94	94	94	94	58	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
TSM	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
WHC	NO_Y	94	94	94	94	94	93	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
ARV	NO_Y	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	61	94	94	94	94	94	94	94	94
BTI	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	94	95	95
PAP	O_3	95	**32**	**0**	**0**	**0**	**0**	**0**	**39**	95	95	95	95	95	95	95	95	95	95	**51**	**0**	**9**	95	95	95	95	95	95	95	95	95
	NO_Y	95	95	95	95	95	95	95	94	95	95	95	95	95	95	95	95	95	95	**51**	**0**	**9**	95	95	95	95	95	95	95	95	95
PCP	O_3	100	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	NO_Y	100	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
TRIM	O_3	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
GRB	O_3	97	97	96	97	97	96	97	97	96	97	97	96	97	97	97	96	97	97	96	97	97	96	97	97	97	96	97	97	96	97
	NO_X	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
	NO_Y (NA)	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
	CO	97	97	97	97	97	97	97	96	96	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
	CO_2	97	97	97	97	97	97	97	97	96	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
	Aethalometer	99	99	100	99	99	98	98	99	98	98	98	97	97	99	99	99	98	98	98	98	**84**									
	Nephelometer	100	100	100	100	100	100	100	100	98	100	100	100	100	100	100	96	100	100	100	100	100	100	100	100	98	100	100	100	100	100
	NO_3	100	99	100	100	100	99	100	100	100	99	**38**	**0**	**0**	**0**	**40**	100	99	99	100	100	**53**									
PLR	NO_Y (NA)	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	**64**						
	CO	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	**56**						
	CO_2	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	**35**						
	Aethalometer	98	99	99	100	98	97	97	94	97	98	97	95	95	97	98	97	97	96	97	97	97	98	97	**32**						
	NO_3	99	96	100	100	99	100	100	100	99	100	100	100	99	100	100	100	99	100	100	100	94	100	**64**							
SUN	O_3	97	97	97	96	97	97	97	96	97	97	96	96	97	97	97	96	97	97	97	97	96	97	97	97	96	97	97	97	97	96
	NO_X	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
	NO_Y (NA)	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
	CO	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
	CO_2	97	97	97	97	97	97	97	97	97	97	97	95	91	97	97	97	97	97	96	97	97	97	97	97	97	97	97	97	97	97
	Aethalometer	99	99	100	100	98	98	98	98	99	99	97	97	98	99	99	99	99	98	97	98	99	**57**								
	NO_3	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	97	100	100	44								

Table 3.4-8e
Percent Data Recovery for CCOS Supplemental Monitoring Sites - October

Site	Instrument	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
BEV	O_3	95	95	95	95	95	95	95	95	95	95	95	95	9	0	95	95	95	95	95	9	0	0	0	0	0						
	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	9	0	95	95	95	95	95	9	0	0	0	0	0						
KCH	O_3	95	95	95	95	95	95	95	95	95	95	95	95	11																		
	NO_Y	95	94	94	95	93	94	94	95	95	95	95	95	11																		
LAR	O_3	95	95	95	95	95	26																									
	NO_Y	95	95	95	95	95	26																									
MCK	O_3	95	95	95	95	95	95	95	95	95	95	95	95	11	0																	
	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	11	0																	
SNM	NO_Y	95	95	95	95	95	95	95	95	95	95	40																				
SLU	NO_Y	0	12	93	95	95	95	95	95	95	95	95	95	18	0	95	95	95	13													
BODB	O_3	95	94	95	95	9																										
	NO_Y	95	94	95	95	9																										
ELK	NO_Y	95	95	95	95	95	95	95	95	95	95	95	89	10	0	95	95	95	10													
PIB	O_3	95	95	95	95	95	95	95	95	95	95	95	95	12	0	0	0	0														
	NO_Y	95	95	95	95	95	95	95	95	95	95	95	95	12	0	0	0	0														
SGS	NO_Y	94	94	94	94	94	94	94	94	94	94	94	94	13																		
SUT	NO_Y	94	94	94	94	94	94	94	94	94	94	94	65	0	0	0	26	94	94	15												
TSM	NO_Y	95	95	95	95	95	95	95	95	94	94	94	15	0	0	67	94	95	15													
WHC	NO_Y	94	94	94	94	94	94	94	94	94	94	50																				
ARV	NO_Y	94	94	94	94	94	94	94	94	8	94	94	94	8	0	0																
BTI	NO_Y	95	95	95	95	95	95	95	95	9																						
PAP	O_3	95	95	95	95	95	95	95	95	94	12																					
	NO_Y	95	95	95	95	95	95	95	95	94	12																					
PCP	O_3	95	95	95	95	95	95	95	95	95	95	88	50																			
	NO_Y	95	95	95	95	10	0	0	0	0	0	63	50																			
TRIM	O_3	95	95	95	94	95	95	95	95	95	95	95	64	0																		
	NO_Y	95	95	95	94	95	95	95	95	95	95	95	64	0																		
GRB	O_3	97	97	44																												
	NO_X	94	94	94	94	94	50																									
	NO_Y (NA)	94	94	70																												
	CO	97	97	97	97	97	60																									
	CO_2	97	97	97	97	97	66																									
	Aethalometer																															
	Nephelometer	22																														
	NO_3																															
PLR	NO_Y (NA)																															
	CO																															
	CO_2																															
	Aethalometer																															
	NO_3																															
SUN	O_3	96	96	96	50																											
	NO_X	94	94	94	70																											
	NO_Y (NA)	94	94	94	64																											
	CO	97	97	97	75																											
	CO_2	97	97	97	75																											
	Aethalometer																															
	NO_3																															

Table 3.4-9
CCOS VOC Sample Collection Log – DRI Canisters

Date	Start Time PDT	Sutter Buttes	White Cloud	Bethel Island	Patterson Pass	Trimmer	San Leandro	Sunol	Granite Bay	Parlier
7/23/00	12a	V	V	V	V	V	V			
	06a	I	V	V	V	V	V			
	13p	V	V	V	V	V	V			
	17p	V	V	V	V	V	V			
7/24/00	12a	V	V	V	V	V	V			
	06a	I	V	V	V	V	V	V	V	V
	13p	V	V	V	V	V	V	V	V	V
	17p	V	V	V	V	V	V			
7/30/00	12a	I	V	V	V	V	V			
	06a	I	V	V	V	V	V			
	13p	I	V	V	V	V	I			
	17p	V	V	V	V	V	I			
7/31/00	12a	V	V	V	V	V	V			
	06a	V	V	V	V	V	V	V	V	V
	13p	V	V	V	V	V	V	V	V	V
	17p	V	V	V	V	V	V			
8/1/00	12a	V	V	V	V	V	V			
	06a	V	V	V	V	V	V			
	13p	V	V	V	V	V	V			
	17p	V	V	V	V	V	V			
8/14/00	12a	V	V	V	V	V	V			
	06a	V	V	V	V	V	V			
	13p	V	V	V	V	V	V			
	17p	V	V	I	V	V	V			
9/17/00	12a	V	V	V	V	V	V			
	06a	I	V	V	V	V	V	V	V	V
	13p	V	V	V	V	V	V	V	V	V
	17p	V	V	V	V	V	V			
9/18/00	12a	V	V	V	V	V	V			
	06a	I	V	V	V	V	V	V	V	I
	13p	V	V	V	V	V	V	V	V	V
	17p	I	V	V	V	V	V			
9/19/00	12a	I	V	V	V	V	V			
	06a	V	V	V	V	V	V			
	13p	V	V	V	V	V	V			
	17p	V	V	V	V	V	V			
9/20/00	12a	V	V	V	V	V	V			
	06a	V	V	V	V	V	V			
	13p	V	V	V	V	V	V			
	17p	V	V	V	V	V	V			
9/21/00	12a	V	V	V	V	V	V			
	06a	I	V	V	I	V	V			
	13p	V	V	V	I	V	I			
	17p	V	V	V	I	V	I			

V = Valid sample
I = Invalid sample

Table 3.4-10
CCOS VOC Sample Collection Log – DRI Canisters
Comments

Site	Date	Time	Comments
Sutter Buttes	9/18/00	06A	
Sutter Buttes	9/18/00	13P	(-22)"Hg leak to (-10)"Hg; no pump
Sutter Buttes	9/19/00	06A	non integrated sample - pump on @ 0820a
Sutter Buttes	9/20/00	06a	no valve open, possible leak
Sutter Buttes	9/21/00	12a	questionable when sample ran
White Cloud	9/17/00	06a	field data sheet reported twice
White Cloud	9/18/00	06a	no field data sheet - is one reported 9/17/00 06a
White Cloud	9/18/00	13p	159 min
White Cloud	9/18/00	17p	backpressure = final pressure
White Cloud	9/19/00	17p	backpressure < final pressure
Bethel Island	7/31/00	12a	possible leak
Patt Pass	7/23/00	06a	slight leak; solenoid valve problem
Patt Pass	7/24/00	13p	line lost pressure; noticable after closing valve - slow loss
Trimmer	8/1/00	12a	backpressure = final pressure
Trimmer	8/14/00	12a	backpressure = final pressure
Trimmer	9/17/00	12a	backpressure < final pressure
Trimmer	9/17/00	06a	backpressure = final pressure
Trimmer	9/20/00	12a	backpressure = final pressure
Trimmer	9/21/00	12a	backpressure = final pressure
San Leandro	7/23/00	06a	backpressure < final pressure
San Leandro	7/24/00	12a	backpressure < final pressure
San Leandro	7/24/00	06a	backpressure < final pressure
San Leandro	8/1/00	13p	backpressure = final pressure
San Leandro	8/14/00	06a	backpressure < final pressure
San Leandro	9/18/00	06a	backpressure = final pressure
San Leandro	9/19/00	12a	backpressure = final pressure
San Leandro	9/19/00	06a	backpressure < final pressure
San Leandro	9/21/00	06a	backpressure = final pressure
Sunol	9/17/00	06a	backpressure = final pressure
Sunol	9/18/00	13p	backpressure < final pressure
Granite Bay	7/31/00	06a	possible slight soleniod valve leak
Granite Bay	7/31/00	13p	(-26)"Hg leak to (-16)"Hg before sampling started

Table 3.5-1
UCD Cessna 172 RG

Date	Departure Time (PST)	Arrival Time (PST)	Flight Time	Route	Route Code	Comments
7/6/00						
7/8/00	5:09	7:57	2:48	Davis-Antioch-Lincoln-Davis	UC1-A	No ROG or carbonyl samples. Over-flew, but skipped spirals at some sites due to low clouds.
7/8/00	12:03	15:21	3:18	Davis-Antioch-Lincoln-Davis	UC1-P	No ROG or carbonyl samples.
7/23/00	5:13	8:33	3:20	Davis-Antioch-Lincoln-Davis	UC1-A	
7/23/00	12:36	15:54	3:18	Davis-Antioch-Lincoln-Davis	UC1-P	
7/24/00	5:02	8:20	3:18	Davis-Antioch-Lincoln-Davis	UC1-A	
7/24/00	12:40	15:58	3:18	Davis-Antioch-Lincoln-Davis	UC1-P	
7/25/00	12:51	16:06	3:15	Davis-Auburn-Arbuckle-Davis	UC1-PIOP	Post IOP flight.
7/30/00	4:59	8:22	3:23	Davis-Antioch-Lincoln-Davis	UC1-A	
7/30/00	12:28	16:25	3:57	Davis-Antioch-Lincoln-Davis	UC1-P	Ozone analyzer problems.
7/31/00	5:02	8:22	3:20	Davis-Antioch-Lincoln-Davis	UC1-A	ROG can filling problems.
7/31/00	12:28	15:57	3:29	Davis-Antioch-Lincoln-Davis	UC1-P	
8/1/00	4:59	8:22	3:23	Davis-Antioch-Lincoln-Davis	UC1-A	
8/1/00	12:39	16:03	3:24	Davis-Antioch-Lincoln-Davis	UC1-P	
8/14/00	5:02	8:17	3:15	Davis-Antioch-Lincoln-Davis	UC1-A	
8/14/00	12:28	15:50	3:22	Davis-Antioch-Lincoln-Davis	UC1-P	Lost about 30 minutes of data from AIMMS instrument.
9/14/00	5:06	8:23	3:17	Davis-Antioch-Lincoln-Davis	UC1-A	
9/14/00	11:28	14:34	3:06	Davis-Antioch-Lincoln-Davis	UC1-P	Flight conducted one hour early than usual.
9/17/00	4:58	8:14	3:16	Davis-Antioch-Lincoln-Davis	UC1-A	
9/17/00	12:33	15:48	3:15	Davis-Antioch-Lincoln-Davis	UC1-P	
9/18/00	5:02	8:13	3:11	Davis-Antioch-Lincoln-Davis	UC1-A	
9/18/00	12:36	15:50	3:14	Davis-Antioch-Lincoln-Davis	UC1-P	
9/19/00	5:11	8:18	3:07	Davis-Antioch-Lincoln-Davis	UC1-A	Lost about 1 hour of ozone data due to analyzer problems.
9/19/00	12:32	15:42	3:10	Davis-Antioch-Lincoln-Davis	UC1-P	Missing almost all ozone data due to analyzer problems
9/20/00	5:07	8:17	3:10	Davis-Bay-NSJV-Foothills-Davis	UC2-A	Flying UCD #2 route.
9/20/00	12:27	15:53	3:26	Davis-Bay-NSJV-Foothills-Davis	UC2-P2	Flying UCD #2 route.
9/21/00	4:57	8:01	3:04	Davis-Bay-NSJV-Foothills-Davis	UC2-A	Skipped San Pablo Bay and modified Hayward spiral due to low clouds.

Table 3.5-2
UCD Cessna 182

Date	Departure Time (PST)	Arrival Time (PST)	Flight Time	Route	Route Code	Comments
7/6/00	13:25	15:02	1:37			STI Intercomparison
7/8/00	5:22	7:38	2:16	Davis-Bay-NSJV-Foothills-Davis	UC2-A	Missing first 45 min. of data. No ROG or carbonyl samples. Skipped spirals in Bay Area due to clouds.
7/8/00	12:06	15:26	3:20	Davis-Bay-NSJV-Foothills-Davis	UC2-P1	No ROG or carbonyl samples.
7/23/00	5:10	8:27	3:17	Davis-Bay-NSJV-Foothills-Davis	UC2-A	
7/23/00	12:33	15:59	3:26	Davis-Bay-NSJV-Foothills-Davis	UC2-P1	
7/24/00	5:06	8:17	3:11	Davis-Bay-NSJV-Foothills-Davis	UC2-A	Missing first 45 min. of data.
7/24/00	12:30	16:09	3:39	Davis-Bay-NSJV-Foothills-Davis	UC2-P1	
7/25/00	13:13	16:44	3:31	Davis – Redding – Davis	UC2-PIOP	Post IOP flight.
7/30/00	5:00	8:24	3:24	Davis-Bay-NSJV-Foothills-Davis	UC2-A	Missing first 55 min of data.
7/30/00	12:27	15:48	3:21	Davis-Bay-NSJV-Foothills-Davis	UC2-P1	
7/31/00	5:24	8:22	2:58	Davis-Bay-NSJV-Foothills-Davis	UC2-A	
7/31/00	12:27	15:55	3:28	Davis-Bay-NSJV-Foothills-Davis	UC2-P1	
8/1/00	5:02	8:11	3:09	Davis-Bay-NSJV-Foothills-Davis	UC2-A	
8/1/00	12:41	16:16	3:35	Davis-Bay-NSJV-Foothills-Davis	UC2-P2	Switched flight route from Concord to San Pablo Bay.
8/7/00	8:16	9:22	1:06			Intercomparison
8/14/00	5:05	8:10	3:05	Davis-Bay-NSJV-Foothills-Davis	UC2-A	
8/14/00	12:30	15:58	3:28	Davis-Bay-NSJV-Foothills-Davis	UC2-P2	
9/14/00	5:12	8:33	3:21	Davis-Bay-NSJV-Foothills-Davis	UC2-A	
9/14/00	12:42	15:42	3:00	Davis-Bay-NSJV-Foothills-Davis	UC2-P2	Skipped Hayward due to clouds.
9/17/00	5:01	8:12	3:11	Davis-Bay-NSJV-Foothills-Davis	UC2-A	
9/17/00	12:45	16:11	3:26	Davis-Bay-NSJV-Foothills-Davis	UC2-P2	
9/18/00	5:04	8:20	3:16	Davis-Bay-NSJV-Foothills-Davis	UC2-A	
9/18/00	12:38	15:49	3:11	Davis-Bay-NSJV-Foothills-Davis	UC2-P2	
9/19/00	5:13	8:13	3:00	Davis-Bay-NSJV-Foothills-Davis	UC2-A	
9/19/00	12:35	15:53	3:18	Davis-Bay-NSJV-Foothills-Davis	UC2-P2	
9/20/00	6:58	8:14	1:16	Davis – Franklin – Folsom – Davis	UC1-Partial	Partial IOP in Sacramento Valley flying UCD #1 route. Short flight due to required aircraft maintenance schedule.
9/21/00	12:48	15:51	3:03	Davis-Delta-Folsom-Lincoln-Davis	UC1-P	SAC Valley IOP PM. Flying UCD #1 route.
30-Sep	5:27	7:56	2:29	Davis-Auburn-San Andreas-Davis	UC-foothill	AM flight only due to mechanical problems.
2-Oct	13:25	15:48	2:23	Davis-Auburn-San Andreas-Davis	UC-foothill	PM flight only due to mechanical problems.

Table 3.5-3
STI Cessna flights

Date	Departure Time (PDT)	Landing Time (PDT)	Flight Time	Route	Route Code	Comments
7/6/00	14:00	16:20	2:20			Intercomparison between Aztec, STI Cessna, and UCD Cessna
7/23/00	5:32	9:56	4:24	Bakersfield - Modesto	C-1	
7/23/00	13:21	17:31	4:10	Modesto - Bakersfield	C-2	
7/24/00	8:59	11:47	2:48	Bakersfield –Paso Robles	C-4	Flight abbreviated. Instrument problems causing late takeoff.
7/24/00	13:20	17:47	4:27	Paso Robles - Bakersfield	C-5	
7/30/00	5:39	9:38	3:59	Bakersfield - Modesto	C-1	
7/30/00	13:30	17:30	4:00	Modesto - Bakersfield	C-2	Lost ten minutes of data, data acquisition problems.
7/31/00	5:38	9:18	3:40	Bakersfield –Paso Robles	C-4	
7/31/00	13:35	15:55	2:20	Paso Robles - Bakersfield	C-5	Aborted flight due to ozone instrumentation problems.
8/1/00	13:52	17:46	3:54	Modesto - Bakersfield	C-2	late departure
8/14/00	6:25	10:22	3:57	Bakersfield - Modesto	C-1	
8/14/00	13:45	17:50	4:05	Modesto - Bakersfield	C-2	
9/14/00	5:50	10:10	4:20	Bakersfield - Modesto	C-1	
9/14/00	13:39	17:55	4:16	Modesto - Bakersfield	C-2	Minor data acquisition problems
9/17/00	5:49	8:42	2:53	Bakersfield - Mendota	C-1	NO/NOy instrument questions
9/17/00	8:59	*10:00*	1:01	Mendota - Modesto	C-1	Aborted flight after Mariposa. some question about NO data.
9/17/00	13:42	17:50	4:08	Modesto - Bakersfield	C-2	
9/18/00	5:45	9:50	4:05	Bakersfield - Modesto	C-1	
9/18/00	13:34	17:50	4:16	Modesto - Bakersfield	C-2	
9/19/00	5:36	9:55	4:19	Bakersfield - Modesto	C-1	
9/19/00	13:40	17:55	4:15	Modesto - Bakersfield	C-2	
9/20/00	5:34	9:44	4:10	Bakersfield - Modesto	C-1	
9/20/00	13:32	17:42	4:10	Modesto - Bakersfield	C-2	

Table 3.5-4
STI Aztec flights

Date	Departure Time (PDT)	Landing Time (PDT)	Flight Time	Route	Route Code	Comments
7/5/00	10:21	11:43	1:22			Ferry to Fresno
7/5/00	14:51	16:29	1:38			Intercomparison between Aztec and DOE G1
7/6/00	14:00	16:20	2:20			Intercomparison: Aztec, STI Cessna, and UCD Cessna
7/8/00	8:56	12:58	4:02	Santa Rosa - Paso Robles	A-1 (Far offshore)	Minor DAS problems.
7/8/00	16:29	20:03	3:34	Paso Robles - Santa Rosa	A-2 (Coastline)	No ozone measurements last half of flight. Minor DAS problems.
7/23/00	7:46	11:57	4:11	Santa Rosa - Paso Robles	A-1 (Far offshore)	
7/23/00	14:17	18:11	3:54	Paso Robles - Santa Rosa	A-2 (Coastline)	
7/24/00	5:37	9:49	4:12	Santa Rosa - Modesto	A-4 (SJV)	
7/24/00	13:11	17:33	4:22	Modesto - Santa Rosa	A-5 (SJV)	Had to abort final spiral at STS, low on fuel.
7/30/00	6:06	9:59	3:53	Santa Rosa - Paso Robles	A-1 (Far offshore)	
7/30/00	13:13	16:53	3:40	Paso Robles - Santa Rosa	A-2 (Coastline)	
7/31/00	5:32	9:14	3:42	Santa Rosa - Modesto	A-4 (SJV)	
7/31/00	13:08	17:25	4:17	Modesto - Santa Rosa	A-5 (SJV)	Lost 10 min of nephelometer data.
8/1/00	10:31	11:34	1:03			Ferry to Modesto. No pilot for morning flight.
8/1/00	12:55	17:26	4:31	Modesto - Santa Rosa	A-5 (SJV)	
8/14/00	6:16	7:03	0:47	Santa Rosa - Paso Robles	A-1 (Far offshore)	Aborted flight due to engine failure.
9/17/00	5:55	10:10	4:15	Santa Rosa - Paso Robles	A-1 (Far offshore)	
9/17/00	13:26	17:19	3:53	Paso Robles - Santa Rosa	A-2 (Coastline)	Lost two carbonyl samples bags exploded in-flight.
9/18/00	5:55	10:19	4:24	Santa Rosa - Modesto	A-3 (N. Sac Valley)	
9/18/00	13:28	17:54	4:26	Modesto - Santa Rosa	A-5 (SJV)	Ozone data questionable for last hour of flight, should be retrievable.
9/19/00	11:00	11:40	0:40	Santa Rosa - Modesto		Ferry from Santa Rosa to Modesto to replace ozone monitor.
9/19/00	13:22	17:51	4:29	Modesto - Santa Rosa	A-5 (SJV)	Ozone data are questionable for first spiral at Modesto. Ozone monitoring problem diagnosed.

Table 3.5-5.
TVA Mission Summary

Flight No.	Date	Power Plant	Time of Day	IOP Day (Y/N)
0 (Test)	26-Jul-00	Moss Landing	PM	No
1	29-Jul-00	Moss Landing	PM	?
2	30-Jul-00	Pittsburg	AM	Yes
3	31-Jul-00	Pittsburg	AM+PM	Yes
4	1-Aug-00	Moss Landing	AM+PM	Yes
5	3-Aug-00	Moss Landing	PM	?
6	5-Aug-00	Pittsburg	AM+PM	No
7	7-Aug-00	Intercomparison	AM	No
8	9-Aug-00	Pittsburg	AM+PM	No
9	11-Aug-00	Pittsburg	AM+PM	No

Table 3.5-6
Summary of collected samples and locations for TVA flights

Flight No.	Date	No. of HC Canisters	No. of Carbonyl Bags	Sampling Location (1 nm = about 1.15 mi = about 1.9 km)
1	29-July	0	0	No Samples
2	30-July	0	0	No Samples
3	31-July	6	0	2-34 nm downwind from Pittsburg PP
4	1-Aug	12	4	2-24 nm downwind from Moss Landing PP
5	3-Aug	8	4	5-20 nm downwind from Moss Landing PP
6	5-Aug	12	8	upwind and 2-26 nm downwind from Pittsburgh PP
7	7-Aug	1	1	4500 ft over Tracy during Intercomparison flight
8	9-Aug	10	8	2-28 nm downwind from Pittsburgh PP
9	11-Aug	9	8	upwind and 2-25 nm downwind from Pittsburgh PP

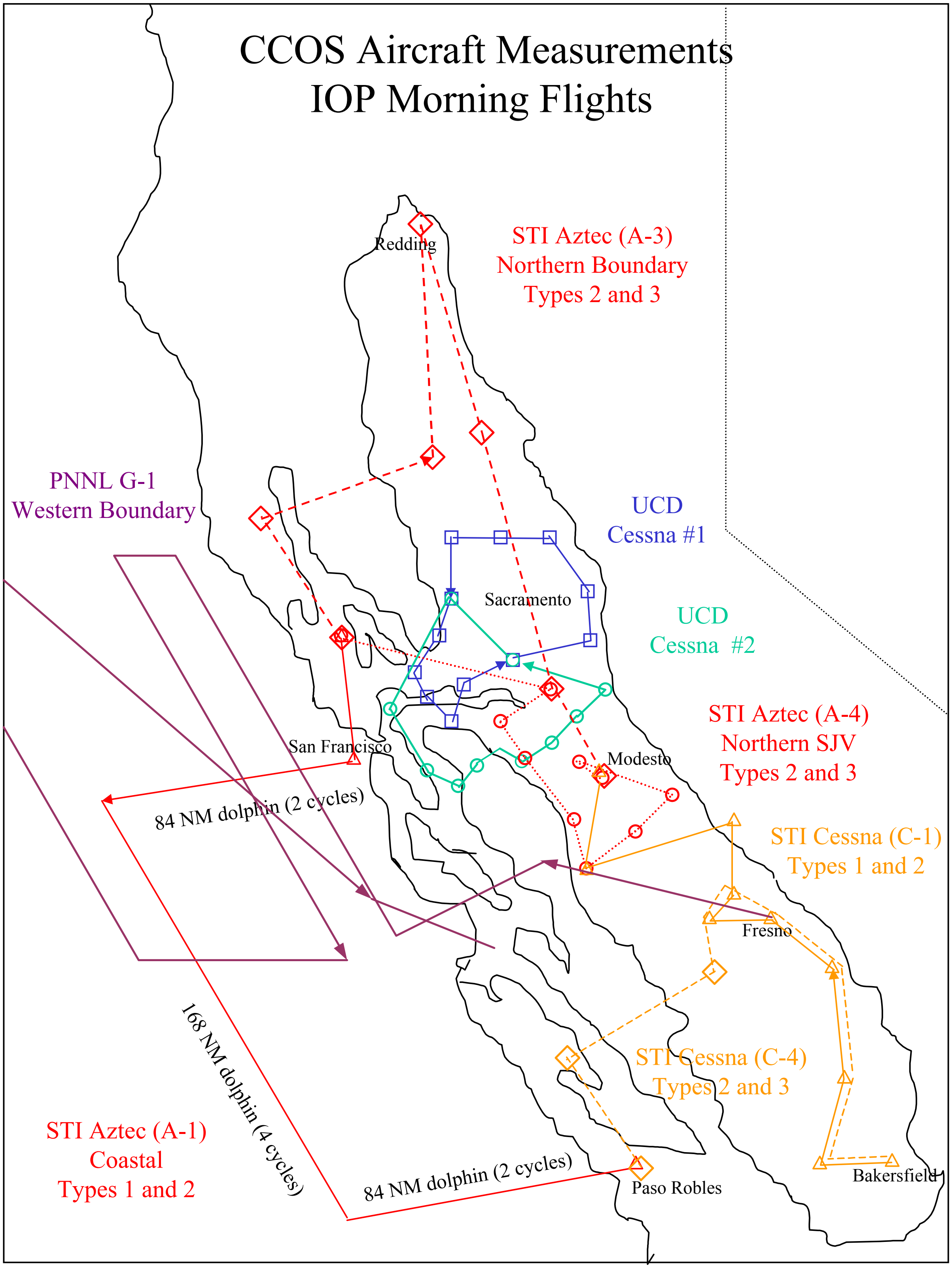

Figure 3.5-1. Morning flight paths for CCOS IOPS.

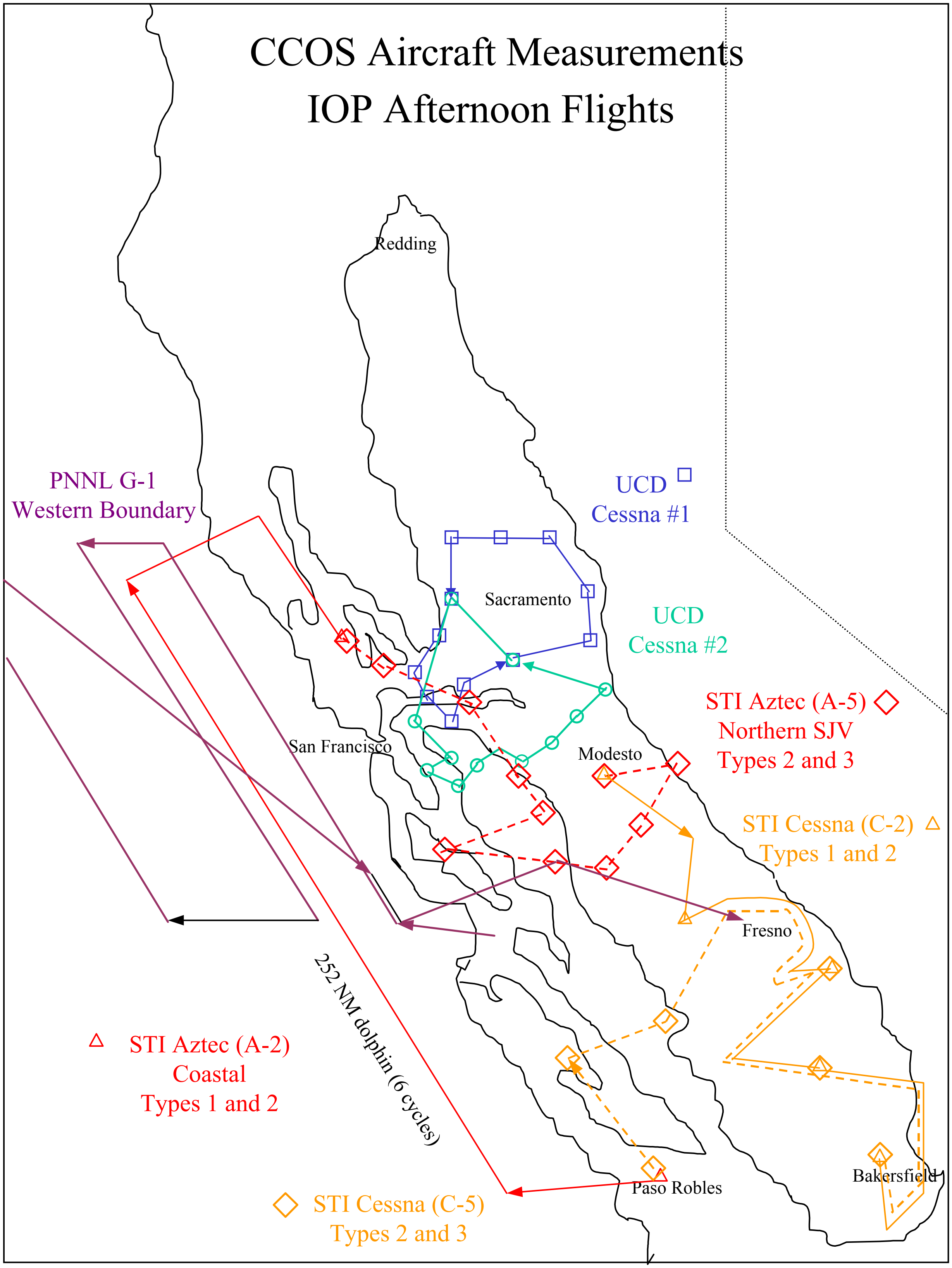

Figure 3.5-2. Afternoon flight path for CCOS IOPs.

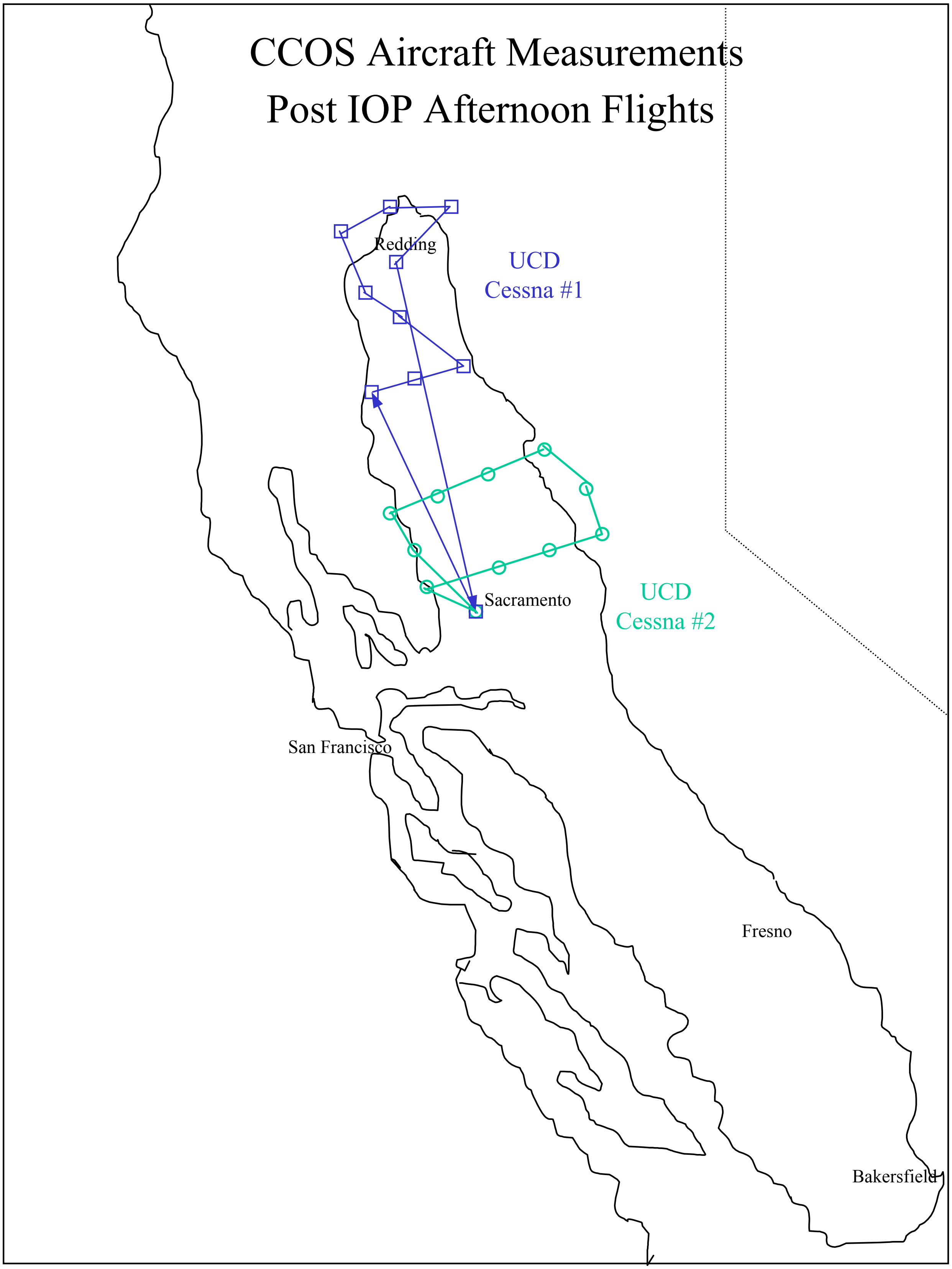

Figure 3.5-3. Afternoon flight path for post CCOS IOPs.

4.0 REFERENCES

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APPENDIX A

Central California Ozone Study
Field Study Contact List

CCOS Field Study Contact List

Responsibility	Call In [a]	Contact	Organization	Address	Phone	Email
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Bay Area AQMD Monitoring Program		Avi Okin	Bay Area AQMD	939 Ellis Street San Francisco, CA 94109	(510) 749-4616	aokin@baaqmd.gov
Bay Area AQMD Monitoring Sites - Area Supervisor (San Leandro, San Jose, and San Martin)	(c) (d)	Stan Yamaichi	Bay Area AQMD	939 Ellis Street San Francisco, CA 94109	(510) 656-5243	syamaichi@baaqmd.gov
Bay Area AQMD Monitoring Sites - Area Supervisor (Bethel Island, Lambie Road,)	(c) (e)	Tom Conwell	Bay Area AQMD	939 Ellis Street San Francisco, CA 94109	(707) 552-3515 (415) 998-9412 Page	tconwell@baaqmd.gov
San Luis Obispo County		Paul Allen	San Luis Obispo County APCD	3433 Roberto Court San Luis Obispo, CA 93401-7126	(805) 781-5919	pallen_apcd@co.slo.ca.us
Supplemental Site Operations - Site Operators						
Shasta Lake (SHL) - O3		Rita Cirulus	Shasta County APCD	1855 Placer St., Suite 101 Redding, CA 96001	(530) 225-5156 or (530) 225-5674 (530) 225-5237 Fax	aqmd@co.shasta.ca.us
Bella Vista (BEV) - O3, NO/NOy		Rita Cirulus	Shasta County APCD	1855 Placer St., Suite 101 Redding, CA 96001	(530) 225-5156 or (530) 225-5674 (530) 225-5237 Fax	aqmd@co.shasta.ca.us
Sutter Buttes (SUT) - NO/NOy, canister, DNPH	X	Rich Hackney	Air Resources Board	2020 L Street or Mail: P.O. Box 2815 Sacramento, CA 95812	(916) 322-6161 (530) 755-2588 Home	rhackney@arb.ca.gov
Lambie Road (LAR) - O3, NO/NOy		Dan Borst	Bay Area AQMD	939 Ellis St. San Francisco, CA 94109-7799	(707) 252-0870 (707) 252-0870 Fax (415) 201-6679 Cell	danborst@baaqmd.gov

CCOS Field Study Contact List

Responsibility	Call In [a]	Contact	Organization	Address	Phone	Email
Elk Grove (ELK) - NO/NOy, PAMS canister	(b)	Gordon Sill	Sacramento Metropolitan AQMD	777 12th Street, 3rd Floor Sacramento, CA 95814-1908	(916) 874-4841 (916) 874-4890 Fax	gsill@airquality.org
Sloughhouse (SLU) - NO/NOy		Donald Petron	Sacramento Metropolitan AQMD	777 12th Street, 3rd Floor Sacramento, CA 95814-1908	(916) 874-4836 (916) 874-4899 Fax	dpetron@airquality.org
Sacramento-Airport Rd. PAMS canister and DNPH	(b)	Mike Poole	Sacramento Metropolitan AQMD	777 12th Street, 3rd Floor Sacramento, CA 95814-1908	(916) 874-4842	mpoole@airquality.org
Sacramento-Del Paso - PAMS canister and DNPH	(b)	Mike Poole	Sacramento Metropolitan AQMD	777 12th Street, 3rd Floor Sacramento, CA 95814-1908	(916) 874-4843	mpoole@airquality.org
Folsom-50 Natoma Street - PAMS canister	(b)	Donald Petron	Sacramento Metropolitan AQMD	777 12th Street, 3rd Floor Sacramento, CA 95814-1908	(916) 874-4836 (916) 874-4899 Fax	dpetron@airquality.org
Granite Bay (GRB) - GC/MS, canister, DNPH, Tenax	X	Barbara Zielinska	Desert Research Institute	2215 Raggio Parkway Reno, NV 89512	(775) 674-7066 (775) 674-7008 Fax (775) 843-6881 Cell	barbz@dri.edu
Granite Bay (GRB) - O3, NO/NOx, NOy/NOy*, NO2/PAN, HCHO, CO, CO2, Aeth, Neph		John Bowen	Desert Research Institute	2215 Raggio Parkway Reno, NV 89512	(775) 674-7044 (775) 674-7009 Fax (775) 560-9246 Cell	johnb@dri.edu
White Cloud (WHC) - NO/NOy		John Bowen	Desert Research Institute	2215 Raggio Parkway Reno, NV 89512	(775) 674-7044 (775) 674-7009 Fax (775) 560-9246 Cell	johnb@dri.edu
White Cloud (WHC) - VOC	X	Kelly Fitch	Desert Research Institute	2216 Raggio Parkway Reno, NV 89512	(775) 674-7037 (775) 674-7008 Fax (775) 530-4340 Cell	kfitch@dri.edu
White Cloud (WHC) - Radiometer		Bill Stockwell	Desert Research Institute	2216 Raggio Parkway Reno, NV 89512	(775) 674-7058 (775) 674-7008 Fax	wstock@dri.edu
Bodega Bay (BODB) - O3, NO/NOy, canister, DNPH	(a)	Sue Hynek	T&B Systems	859 2nd Street Santa Rosa, CA 95404	(707) 526-2775 (707) 579-5954 Fax	sue@tbsys.com
Bethel Island (BTI) - NO/NOy, NO2/PAN, HCHO, canister, DNPH	(e)	Graham Scovell	Bay Area AQMD	939 Ellis St. San Francisco, CA 94109-7799	(925) 439-1303 (925) 439-1305 Fax (415) 740-6864 Cell	gscovell@baaqmd.gov
San Leandro (SLE) NOy (T&B), canister, DNPH	(d)	Bob Schusteritsch	Bay Area AQMD	939 Ellis St. San Francisco, CA 94109-7799	(415) 749-4632 (415) 621-0565	rschusteritsch@aqmd.gov
San Jose 4th St. (SJ4) canister (BAAQMD), DNPH	(d)	Tony Larsen	Bay Area AQMD	120B No. Fourth Street San Jose, CA 95122	(408) 295-0692 (510) 656-8970 Fax	alarsen@baaqmd.gov
Sunol (SUN) - GC/MS, canister, DNPH, Tenax	X	John Sagebiel	Desert Research Institute	2216 Raggio Parkway Reno, NV 89512	(775) 674-7064 (775) 674-7008 Fax (775) 722-2108 Cell	johns@dri.edu
Sunol (SUN) - O3, NO/NOx, NOy/NOy*, NO2/PAN, HCHO, CO, CO2, Aeth, Neph, Radiometer	X	Andrew Kean	University of California Berkeley	631 Davis Hall #1710 Dept. of Civil & Environmental Engr. Davis Hall, Room 631 Berkeley, CA 94720	(510) 642-6582 (510) 642-7483 Fax (415) 760-7723 Cell	kean@newton.berkeley.edu
Patterson Pass (PTP) - O3, NO/NOy, NO2/PAN, HCHO, canister, DNPH	X	Andrew Kean	University of California Berkeley	631 Davis Hall #1710 Dept. of Civil & Environmental Engr. Davis Hall, Room 631 Berkeley, CA 94720	(510) 642-6582 (510) 642-7483 Fax (415) 760-7723 Cell	kean@newton.berkeley.edu
Sunol and Patterson Pass		Phil Martien	Bay Area AQMD	939 Ellis St. San Francisco, CA 94109-7799	(510) 642-6582 (510) 642-7483 Fax (415) 760-7722 Cell	PTMartien@baaqmd.gov

CCOS Field Study Contact List

Responsibility	Call In [a]	Contact	Organization	Address	Phone	Email
San Martin (SMN) - NO/NOy		Tony Larsen	Bay Area AQMD	120B No. Fourth Street San Jose, CA 95122	(408) 295-0692 (510) 656-8970 Fax	tlarsen@baaqmd.gov
Pacheco Pass (PCP) - O3, NO/NOy, NO2/PAN, HCHO, canister, DNPH	(a)	Bill Keifer	T&B Systems	859 2nd Street Santa Rosa, CA 95404	(707) 526-2775 (707) 693-6949 Fax (707) 975-4590 Cell	
Turlock (TSM) - NO/NOy, canister, DNPH	(a)	Bill Keifer	T&B Systems	859 2nd Street Santa Rosa, CA 95404	(707) 526-2775 (707) 693-6949 Fax (707) 975-4590 Cell	
San Andreas (SGS) - NO/NOy		James Frasche	Air Resources Board - Monitoring and Laboratory Division		(916) 445-1036 (916) 799-9707 Cell	jfrasche@arb.ca.gov
San Andreas (SGS) - canister, DNPH	X	Greg O'Brien	Air Resources Board - Planning and Technical Support Division	2020 L Street or Mail: P.O. Box 2815 Sacramento, CA 95812	(916) 322-7063	gobrien@arb.ca.gov
Kettleman City (KCW) - O3, NO/NOy		Carl Camp	San Joaquin Unified APCD	1990 East Gettysburg Ave. Fresno, CA 93726-0244	(559) 230-5864 (559) 230-6064 Fax (775) 530-4350 Cell	carl.camp@valleyair.org
Angiola (ANGI) - canister, DNPH	X (f)	Carl Camp Mike Smith (backup)	San Joaquin Unified APCD	1990 East Gettysburg Ave. Fresno, CA 93726-0244	(559) 230-5864 (559) 230-6064 Fax (775) 530-4350 Cell (559) 230-5866 Smith	carl.camp@valleyair.org michael.smith@valleyair.org
Trimmer (TRIM) - O3, NO/NOy, NO2/PAN, HCHO, canister, DNPH	X	George Jung	Air Resources Board - Monitoring and Laboratory Division		(559) 734-0659	gjung@arb.ca.gov
Parlier (PLR) - GC/MS, canister, Tenax	X	Mark McDaniel	Desert Research Institute	2216 Raggio Parkway Reno, NV 89512	(775) 674-7180 (775) 674-7008 Fax (775) 750-1570 Cell	mmcdan@dri.edu
Parlier (PLR) - PAMS canister, CCOS DNPH	(f)	Carl Camp Mike Smith (backup)	San Joaquin Unified APCD	1990 East Gettysburg Ave. Fresno, CA 93726-0244	(559) 230-5864 (559) 230-6064 Fax (775) 530-4350 Cell (559) 230-5866 Smith	carl.camp@valleyair.org michael.smith@valleyair.org
Parlier (PLR) O3, NO/NOx, NOy/NOy*, NO2/PAN, HCHO, CO, CO2, Aeth, N2(l) for GC/MS		Carl Camp Mike Smith (backup)	San Joaquin Unified APCD	1990 East Gettysburg Ave. Fresno, CA 93726-0244	(559) 230-5864 (559) 230-6064 Fax (775) 530-4350 Cell (559) 230-5866 Smith	carl.camp@valleyair.org michael.smith@valleyair.org
Madera - PAMS canister	(f)	Dick Nelson (will call in when Carl Camp cannot) Gary Stanford (backup)	San Joaquin Unified APCD	1991 East Gettysburg Ave. Fresno, CA 93726-0244	(559) 230-5863 (559) 230-6064 Fax	dick.nelson@valleyair.org
Clovis Villa - PAMS canister and DNPH	(f)	Dick Nelson	San Joaquin Unified APCD	1992 East Gettysburg Ave. Fresno, CA 93726-0244	(559) 230-5863 (559) 230-6064 Fax	dick.nelson@valleyair.org
Fresno-1st Street - PAMS canister	X	Dave Wilkerson	Air Resources Board - Monitoring and Laboratory Division		(559) 228-1825	

CCOS Field Study Contact List

Responsibility	Call In [a]	Contact	Organization	Address	Phone	Email
Arvin (ARV) - NO/NOy, NO2/PAN, HCHO, PAMS canister	X	Alvin Danque	Air Resources Board - Monitoring and Laboratory Division	5558 California Ave., Suite 460 Bakersfield, CA 93309	(661) 334-3994 (661) 334-3999 Fax (661) 331-5621 Cell (661) 854-2560 Site	adanque@arb.ca.gov
Shafter PAMS Site canister	X	Ralph Robles	Air Resources Board - Monitoring and Laboratory Division	5559 California Ave., Suite 460 Bakersfield, CA 93309	(661) 334-3993	rrobles@arb.ca.gov
Bakersfield-Golden State Highway - PAMS canister and DNPH	X	Alvin Danque	Air Resources Board - Monitoring and Laboratory Division	5558 California Ave., Suite 460 Bakersfield, CA 93309	(661) 334-3994 (661) 334-3999 Fax (661) 331-5621 Cell (661) 854-2560 Site	adanque@arb.ca.gov
McKittrick (MCK) - O3, NO/NOy		Ralph Robles	Air Resources Board - Monitoring and Laboratory Division	5559 California Ave., Suite 460 Bakersfield, CA 93309	(661) 334-3993	rrobles@arb.ca.gov
Red Hills (RDH) - O3, NO/NOy		Jay Courtney	San Luis Obispo County APCD	3433 Roberto Court San Luis Obispo, CA 93401-7126	(805) 781-4656	jcourtney_apcd@co.slo.ca.us
Piedras Blancas (PIB) - O3, NO/NOy, canister, DNPH	X	Barry LaJoie	San Luis Obispo County APCD	3433 Roberto Court San Luis Obispo, CA 93401-7126	(805) 781-5743 (805) 781-1002 Fax	blajoie_apcd@co.slo.ca.us
Aircraft Operations						
Aircraft Measurements		Don Blumenthal	Sonoma Technology	1360 Redwood Way, Suite C Petaluma, CA 94954-1169	(707) 665-9900 (707) 665-9800 Fax	don@sonomatech.com
Aircraft Measurements	X	Siana Alcorn	Sonoma Technology	1360 Redwood Way, Suite C Petaluma, CA 94954-1169	(707) 665-9900 (707) 665-9800 Fax	siana@sonomatech.com
Aircraft Measurements	X	John Carroll	University of California, Davis	Dept. of Land, Air and Water Resources University of California Davis, CA 95616	(916) 752-3245 (916) 752-1552 Fax	jjcarroll@ucdavis.edu
Aircraft Measurements		Alan Dixon	University of California, Davis	Dept. of Land, Air and Water Resources University of California Davis, CA 95617	(916) 752-1459 (916) 752-1552 Fax	ajdixon@ucdavis.edu
Aircraft Measurements		Rich Barchet	Pacific Northwest National Laboratory	902 Battelle Blvd. or P.O. Box 999 Richland, VA 99352	(509) 372-6158	rich.barchet@pnl.gov
Aircraft Measurements	X	Roger Tanner	Tennessee Valley Authority		(256) 386-2958 (831) 601-5457 Cell	rltanner@tva.gov
Aircraft Measurements		Raph Valente	Tennessee Valley Authority		(256) 386-3649 (831) 601-5453 Cell	rjvalente@tva.gov
QA and Data Management						
Quality Assurance Manager		Dave Bush	AVES	50 East Foothill Blvd. Third Floor Arcadia, CA 91006	(530) 642-2312 (530) 642-2398 Fax	david.bush@parsons.com
Air Quality Audits		Mike Miguel	Monitoring & Laboratory Division, ARB	P.O. Box 2815 Sacramento, CA 95812	(916) 324-6191	mmiguel@arb.ca.gov
Air Quality Audits		Don Fitzell	Monitoring & Laboratory Division, ARB	P.O. Box 2815 Sacramento, CA 95813	(916) 322-3892	dfitzell@arb.ca.gov
Air Quality Audits		Fred Burriel	Monitoring & Laboratory Division, ARB	P.O. Box 2815 Sacramento, CA 95814	(916) 327-0886	fburriel@arb.ca.gov

CCOS Field Study Contact List

Responsibility	Call In [a]	Contact	Organization	Address	Phone	Email
Database Manager		Greg O'Brien	Planning & Technical Support Division, ARB	P.O. Box 2815 Sacramento, CA 95814	(916) 322-7063 (916) 327-8524 Fax	gbrien@arb.ca.gov

[a] **X (a)** Will acknowledge IOP GO decision at (916) 324-1953 and letter associates operators to be contacted by this individual.
[1]

APPENDIX B

AIR QUALITY MONITORING SITES IN CENTRAL AND NORTHERN CALIFORNIA

APPENDIX B
Air Quality Monitoring Site in Northern and Central California

							Parameters Measured						
Site ID	Air Basin	City	Site Address	Land Use	Location Type	EL_MSL	CO	NMHC	Carb	HC	NO2	O3	PM10
CCY	NC	Crescent City	9th & H St Crescent City - Ch Annex	Residential	Urban / Center City	0							1
CCY2	NC	Crescent City	880 Northcrest Drive	Residential	Urban / Center City								1
EU6	NC	Eureka	Health Dept-6th & I St	Commercial	Urban / Center City	18							1
WEV	NC	Weaverville	Main Street	Residential	Urban / Center City	600							1
FTB	NC	Fort Bragg	416 N. Franklin St.	Commercial	Urban / Center City	14							1
WLF	NC	Willits	Fire Stn-Commercial & Humboldt	Not Available	Not Available	955							1
WLM	NC	Willits	899 So Main Street	Mobile	Suburban	1377	1				1	1	
UKC	NC	Ukiah	Library-105 N Main St.	Commercial	Suburban	192							1
UKG	NC	Ukiah	306 E. Gobbi Street	Mobile	Suburban	194	1				1	1	
YRE	NEP	Yreka	528 Foothill Dr.	Commercial	Suburban	800						1	1
LVB	NEP	Lava Beds	P.O. Box 867 Lava Beds	Agricultural	Rural	1451							1
ALW	NEP	Alturas	202 W. Fourth Street	Commercial	Urban / Center City	1334							1
MSO	NEP	Mount Shasta	3 North Old Stage Road	Residential	Suburban	0							1
RDH	SV	Redding	Hlth Ctr-2630 Hospital Ln	Commercial	Suburban	143						1	1
LNP	SV	Lassen Volcanic Nat Pa	Manzanita Lake Rs	Forest	Rural	1788						1	
ADN	SV	Anderson	2220 North Street	Industrial	Suburban	498						1	1
RBL	SV	Red Bluff	Messer Drive	Industrial	Suburban	98							1
RBO	SV	Red Bluff	502 Oak Street	Mobile	Urban / Center City	98						1	
CHM	SV	Chico	468 Manzanita Ave	Commercial	Suburban	61	1				1	1	2
CHL	SV	Chico	101 Salem St.	Mobile	Urban / Center City	61	1						
WLW	SV	Willows	420 E. Laurel St.	Mobile	Suburban	41						1	2
CSS	SV	Colusa	100 Sunrise Blvd.	Commercial	Rural	17						1	2
YAS	SV	Yuba City	773 Almond St.	Commercial	Suburban	20	1				1	1	2
PGV	SV	Pleasant Grove	4sw-7310 Pacific Ave	Agricultural	Rural	50						1	
SNH	SV	North Highlands	7823 Blackfoot Way	Residential	Suburban	27	1				1	1	1
FLN	SV	Folsom	50 Natoma Street	Residential	Suburban	0		1		1	1	1	
WSS	SV	Woodland	40 Sutter Street	Agricultural	Urban / Center City	17							1
	SV	Woodland	41929 E. Gibson Road	Residential	Suburban							1	
	SV	Sacramento	3801 Airport Road	Commercial	Suburban		1	1	1	1	1	1	2
SDP	SV	Sacramento	Del Paso-2701 Avalon Dr	Residential	Suburban	25	1	1	1	1	1	1	3
SEW	SV	Sacramento	3535 El Camino & Watt	Commercial	Suburban	18	1						
WSA	SV	West Sacramento	132 15th St.	Industrial	Urban / Center City	13							1
S13	SV	Sacramento	1309 T St.	Residential	Urban / Center City	7	1				1	1	3
SST	SV	Sacramento	Hlth Ctr-2221 Stockton Blvd	Commercial	Urban / Center City	8							2
SBR	SV	Sacramento	3711 Branch Center Rd.	Residential	Suburban	20							1
DVS	SV	Davis	Uc Davis-Campus	Agricultural	Rural	16	1				1	1	
SLU	SV	Sloughhouse	7520 Sloughouse Road	Agricultural	Rural	58						1	
VEL	SV	Vacaville	1001 Allison Drive	Residential	Suburban	55						1	
ELK	SV	Elk Grove	12490 Bruceville Rd	Agricultural	Rural	6		1		1	1	1	

APPENDIX B (continued)
Air Quality Monitoring Site in Northern and Central California

Site ID	Air Basin	City	Site Address	Land Use	Location Type	EL_MSL	Parameters Measured						
							CO	NMHC	Carb	HC	NO2	O3	PM10
FFD	SV	Fairfield	Baapcd-401 Gregory St	Residential	Urban / Center City	3						1	
LKL	LC	Lakeport	905 Lakeport Blvd.	Mobile	Suburban	405						1	1
CHE	MtC	Chester	222 First Avenue	Residential	Urban / Center City	1403							1
QUC	MtC	Quincy-East Quincy	267 N. Church St.	Commercial	Urban / Center City	1067						1	2
POL	MtC	Portola	220 Commercial St	Residential	Urban / Center City	1480							1
LOY	MtC	Loyalton	309 W. Third Street	Residential	Rural	1505							1
GFS	MtC	Truckee	Glenshire Fs-10900 Manchester	Residential	Suburban	1811							1
TRU	MtC	Truckee	Fs-10049 Donner Pass Rd	Residential	Urban / Center City	1676						1	2
WCM	MtC	Nevada City	26533 State Hwy 20-White Cloud Mtn	Forest	Rural	0						1	
GVL	MtC	Grass Valley	200 Litton Dr.	Residential	Suburban	853						1	1
GVH	MtC	Grass Valley	420 Henderson St	Residential	Urban / Center City	735							1
LTY	MtC	South Lake Tahoe	3337 Sandy Way	Commercial	Urban / Center City	0	1				1	1	1
LTS	MtC	South Lake Tahoe	Stateline-4045 Hwy 50	Commercial	Urban / Center City	1911	1						
CUS	MtC	Cool	1400 American River Trail	Agricultural	Rural	0						1	
ROC	MtC	Rocklin	5000 Rocklin Road	Residential	Rural	100						1	2
ROS	MtC	Roseville	151 No Sunrise Blvd	Mobile	Suburban	161	1				1	1	1
PGN	MtC	Placerville	3111 Gold Nugget Way	Residential	Suburban	0	1					1	1
JAC	MtC	Jackson	201 Clinton Road	Commercial	Suburban	377	1					1	
SGS	MtC	San Andreas	501 Gold Strike Road	Agricultural	Rural	0	1					1	1
FML	MtC	Sonora	15700 Old Oak Ranch Road	Forest	Rural	0						1	
SNB	MtC	Sonora	251 S Barretta	Residential	Urban / Center City	0	1					1	
YOY	MtC	Yosemite Nat Park	Visitor Ctr-Yosemite Village	Not Available	Not Available	1216							1
YOT	MtC	Yosemite Nat Park	Turtleback Dome	Forest	Rural	1605						1	
JSD	MtC	Jerseydale	6440 Jerseydale Road	Forest	Rural	0						1	
CLV	SFBA	Cloverdale	100 Washington St.	Commercial	Urban / Center City	91							1
HDM	SFBA	Healdsburg	Airport-200a Heidelberg Way	Commercial	Rural	30						1	
HDB	SFBA	Healdsburg	133 Matheson St.	Commercial	Urban / Center City	31							1
GUE	SFBA	Guerneville	Church And First Streets	Mobile	Urban / Center City	17							1
SRF	SFBA	Santa Rosa	837 5th St.	Commercial	Urban / Center City	49	1				1	1	1
VAC	SFBA	Vacaville	650 Merchant St.	Commercial	Urban / Center City	59							1
NJS	SFBA	Napa	2552 Jefferson Ave.	Commercial	Urban / Center City	12	1				1	1	1
VJO	SFBA	Vallejo	304 Tuolumne St.	Commercial	Urban / Center City	23	1				1	1	1
CKT	SFBA	Crockett	Kendall Ave.	Industrial	Suburban	63							
PBG	SFBA	Pittsburg	583 W. 10th St.	Residential	Urban / Center City	2	1				1	1	
MTZ	SFBA	Martinez	521 Jones St.	Residential	Urban / Center City	8							
BTI	SFBA	Bethel Island	5551 Bethel Island Rd	Agricultural	Rural	0	1				1	1	1
SRL	SFBA	San Rafael	534 4th Street	Commercial	Urban / Center City	1	1				1	1	1
SPE	SFBA	San Pablo	Unit 759 El Portal Shopping Center	Commercial	Urban / Center City	15	1				1	1	1

APPENDIX B (continued)
Air Quality Monitoring Site in Northern and Central California

Site ID	Air Basin	City	Site Address	Land Use	Location Type	EL_MSL	Parameters Measured						
							CO	NMHC	Carb	HC	NO2	O3	PM10
RMD	SFBA	Richmond	1065 7th St.	Industrial	Suburban	6							
CCD	SFBA	Concord	2975 Treat Blvd	Residential	Suburban	26	1				1	1	1
OKA	SFBA	Oakland	822 Alice St.	Commercial	Urban / Center City	7	1					1	
SFE	SFBA	San Francisco	939 Ellis St.	Commercial	Urban / Center City	38	1						
SFA	SFBA	San Francisco	10 Arkansas St.	Industrial	Urban / Center City	5	1				1	1	1
SEH	SFBA	San Leandro	Hospital-15400 Foothill Blvd	Residential	Suburban	36						1	1
LVF	SFBA	Livermore	2614 Old 1st St.	Commercial	Urban / Center City	146	1				1	1	2
HLM	SFBA	Hayward	3466 La Mesa Dr.	Residential	Rural	287						1	
FCW	SFBA	Fremont	40733 Chapel Way.	Residential	Suburban	18	1				1	1	1
RED	SFBA	Redwood City	897 Barron Ave.	Industrial	Suburban	5	1				1	1	1
SJD	SFBA	San Jose	935 Piedmont Road	Residential	Rural	0						1	1
MVC	SFBA	Mountain View	160 Cuesta Dr.	Residential	Suburban	24						1	
SJ4	SFBA	San Jose	120b N 4th St	Residential	Urban / Center City	24	2				1	1	3
SJK	SFBA	San Jose	Hlth Ctr-2220 Moorpark Ave	Residential	Suburban	360							1
SJT	SFBA	San Jose	528 Tully Rd.	Industrial	Suburban	38							1
LGS	SFBA	Los Gatos	306 University Ave.	Residential	Urban / Center City	183						1	
SMM	SFBA	San Martin	13030 Murphy Ave.	Residential	Rural	87						1	
GRY	SFBA	Gilroy	9th & Princeville	Residential	Suburban	55						1	
SOW	SJV	Stockton	8778 Brattle Place Stockton-Wagner Holt	Residential	Suburban	7							1
SOC	SJV	Stockton	4310 Claremont	Commercial	Suburban	13	1						
SOH	SJV	Stockton	Hazelton-Hd	Residential	Urban / Center City	13	1				1	1	3
SOM	SJV	Stockton	13521 E. Mariposa	Not Available	Not Available	17						1	
TPP	SJV	Tracy	24371 Patterson Pass Road	Agricultural	Rural	31					1	1	
MIS	SJV	Modesto	1100 I St	Other Unknown Resid	Urban / Center City	27							2
	SJV	Modesto	814 14th St-Modesto Rover	Commercial	Urban / Center City		1				1	1	
M14	SJV	Modesto	814 14th St.	Commercial	Urban / Center City	27	1				1	1	2
TSM	SJV	Turlock	900 S Minaret Street	Residential	Suburban	56	1				1	1	1
MRA	SJV	Merced	385 S. Coffee Avenue	Agricultural	Rural	86					1	1	
FNP	SJV	Shaver Lake	North Perimeter Road	Forest	Rural	0						1	
M29	SJV	Madera	Rd. 29 1/2 No. Of Ave 8	Agricultural	Rural	0		1		1	1	1	
FSS	SJV	Fresno	Sierra Skypark#2-Blythe & Chnnlt	Residential	Suburban	98	1				1	1	
CLO	SJV	Clovis	908 N Villa Ave	Residential	Urban / Center City	86	1	1	1	1	1	1	1
FIS	SJV	Fresno	1145 Fisher Street	Commercial	Urban / Center City	90	1						
FSF	SJV	Fresno	3425 N First St	Residential	Suburban	96	1	1	1	1	1	1	3
FSD	SJV	Fresno	4706 E. Drummond St.	Commercial	Suburban	162	1				1	1	1
PLR	SJV	Parlier	9240 S. Riverbend	Not Available	Not Available	166		1		1	1	1	
SLK	SJV	Sequoia Nat Park	Lower Kaweah-Sequoia NP	Forest	Rural	1890						1	
LMK	SJV		Lookout Point-Mineral King Road	Forest	Rural	0						1	

APPENDIX B (continued)
Air Quality Monitoring Site in Northern and Central California

Site ID	Air Basin	City	Site Address	Land Use	Location Type	EL_MSL	Parameters Measured						
							CO	NMHC	Carb	HC	NO2	O3	PM10
VCS	SJV	Visalia	310 N Church St	Commercial	Urban / Center City	92	1				1	1	3
HIR	SJV	Hanford	807 South Irwin Street	Residential	Suburban	99					1	1	1
COP	SJV	Corcoran	1520 Patterson Ave.	Residential	Suburban	0							2
COV	SJV	Corcoran	Van Dorsten Ave.	Not Available	Not Available	61							3
SHA	SJV	Shafter	548 Walker Street	Commercial	Suburban	126		1		1	1	1	
OLD	SJV	Oildale	3311 Manor St.	Industrial	Suburban	180					1	1	1
BGS	SJV	Bakersfield	1128 Golden State Highway	Commercial	Urban / Center City	123		1	1	1	1	1	1
BKA	SJV	Bakersfield	5558 California Ave	Mobile	Urban / Center City	120	1				1	1	5
EDS	SJV	Edison	Johnson Farm	Agricultural	Rural	128					1	1	
ARV	SJV	Arvin	20401 Bear Mtn Blvd	Agricultural	Rural	145		1		1	1	1	
TAC	SJV	Taft	College-29 Emmons Park Dr.	Commercial	Suburban	292							3
MCS	SJV	Maricopa	School-755 Stanislaus St.	Residential	Suburban	289						1	
MLK	GBV	Mono Lake	Simus Res-Hiwy 167	Not Available	Rural	1948							1
LEE	GBV	Lee Vining	Sms-Hwy 395	Not Available	Not Available	2071							1
MAG	GBV	Mammoth Lakes	Gateway Hc.	Commercial	Urban / Center City	2396	1					1	1
LPE	GBV	Lone Pine	501 E. Locust St.	Residential	Suburban	1128							2
DVL	GBV	Death Valley	Death Valley NP	Desert	Rural	125						1	
KCG	GBV	Keeler	190 Cerro Gordo Road	Residential	Rural	1097							4
OLW	GBV	Olancha	131 Walker Creek Rd.	Desert	Rural	1100							2
COS	GBV	Coso Junction	Rest Area On Hiwy 395	Not Available	Not Available	1010							2
CJN	GBV	Coso Junction	10 Mi E Of Coso Junction	Desert	Rural	1315							1
SVD	NCC	Scotts Valley	4859 Scotts Valley Dr #E	Commercial	Rural	122						1	
DVP	NCC	Davenport	Fire Dept.	Residential	Rural	0	1				1	1	1
SCQ	NCC	Santa Cruz	2544 Soquel Avenue	Commercial	Suburban	78						1	1
WAA	NCC	Watsonville	444 Airport Blvd	Commercial	Suburban	67						1	1
HST	NCC	Hollister	1979 Fairview Rd.	Residential	Rural	126						1	1
MLS	NCC	Moss Landing	7539 Sandholt Road	Commercial	Rural	10							1
SL2	NCC	Salinas	Ii-1270 Natividad Rd	Residential	Suburban	13	1				1	1	1
MON	NCC	Monterey	24580 Silver Cloud Ct.	Commercial	Rural	0						1	
CMV	NCC	Carmel Valley	35 Ford Rd-Tularcito Sch	Residential	Suburban	131						1	1
PIN	NCC	Pinnacles National Mon	Ne Entrance	Forest	Rural	335						1	
KCM	NCC	King City	750 Metz Road	Industrial	Rural	116						1	1
PRF	SCC	Paso Robles	235 Santa Fe Avenue	Residential	Suburban	100						1	1
ATL	SCC	Atascadero	6005 Lewis Avenue	Commercial	Suburban	262					1	1	2
MBP	SCC	Morro Bay	Morro Bay Blvd & Kern Ave	Commercial	Urban / Center City	18						1	1
SLM	SCC	San Luis Obispo	1160 Marsh St.	Commercial	Urban / Center City	66	1				1	1	1
GCL	SCC	Grover City	9 Le Sage Dr.	Residential	Suburban	4					1	1	
ARR	SCC	Arroyo Grande	000 Ralcoa Way	Commercial	Rural	300							1

APPENDIX B (continued)
Air Quality Monitoring Site in Northern and Central California

Site ID	Air Basin	City	Site Address	Land Use	Location Type	EL_MSL	Parameters Measured						
							CO	NMHC	Carb	HC	NO2	O3	PM10
NGR	SCC	Nipomo	1300 Guadalupe Rd.	Industrial	Rural	60						1	2
STL	SCC	Santa Maria	Library-420 S Broadway	Commercial	Urban / Center City	152							1
SMY	SCC	Santa Maria	500 S Broadway	Commercial	Suburban	76					1	1	1
LHS	SCC	Lompoc	Hs & P Facility-500 M Sw	Agricultural	Rural	244					1	1	
LOM	SCC	Lompoc	128 S H St.	Commercial	Urban / Center City	24	1				1	1	1
SYN	SCC	Santa Ynez	Airport Rd.	Agricultural	Rural	204						1	
VBS	SCC	Vandenberg Afb	Sts Power Plant	Agricultural	Rural	100	1				1	1	2
LPD	SCC	Los Padres National Fo	Paradise Rd	Agricultural	Rural	547					1	1	
GVB	SCC	Gaviota	Gtc B-Hwy 101-Near Nojoqui Pass	Agricultural	Rural	305					1	1	
CA1	SCC	Capitan	Lfc #1-Las Flores Canyon	Agricultural	Rural	0	1				1	1	1
CA2	SCC	Capitan	Lfc #2-Las Flores Canyon	Agricultural	Rural	0					1		2
GVW	SCC	Gaviota	Gaviota West-Nw Of Chevron Plant	Agricultural	Rural	91					1	1	1
GVE	SCC	Gaviota	Gaviota East-N Of Chevron Plant	Agricultural	Rural	94					1	1	1
GVC	SCC	Gaviota	Gtc C-1 Mi E Of Plant	Agricultural	Rural	70					1	1	2
CA3	SCC	Capitan	Lfc #3-Las Flores Canyon	Agricultural	Rural	0					1		
ECP	SCC	Capitan	El Capitan St Prk Hwy 101	Not Available	Rural	30					1	1	2
PCN	SCC	Concepcion	Point Conception Lighthouse	Agricultural	Rural	40					1	1	2
GNF	SCC	Goleta	380 N Fairview Avenue	Residential	Suburban	50	1				1	1	
SBC	SCC	Santa Barbara	3 W. Carrillo St.	Mobile	Urban / Center City	16	1				1	1	1
OJO	SCC	Ojai	1201 Ojai Avenue	Agricultural	Suburban	262					1	1	1
SBU	SCC	Isla Vista	Ucsb West Campus-Arco Tank	Agricultural	Rural	9					1	1	2
CRP	SCC	Carpinteria	Gobernador Rd	Agricultural	Rural	152					1	1	
PIR	SCC	Piru	2sw 2815 Telegraph Rd	Agricultural	Rural	182						1	1
VTA	SCC	Oak View	5500 Casitas Pass Rd-Near Oak View	Agricultural	Rural	319					1	1	
VTE	SCC	Ventura	Emma Wood State Beach	Mobile	Suburban	3		1			1	1	
SIM	SCC	Simi Valley	5400 Cochran Street	Residential	Suburban	310	1	1			1	1	2
ELM	SCC	El Rio	Rio Mesa School	Agricultural	Rural	34	1	1	1		1	1	1
THM	SCC	Thousand Oaks	9 2323 Moorpark Road	Residential	Suburban	232					1	1	1
SRI	SCC	Channel Islands Nationa	Santa Rosa Island-Becher's Bay	Forest	Rural	0						1	
CLK	MD	China Lake	Powerline Rd.	Not Available	Rural	697							1
MOP	MD	Mojave	923 Poole Street	Mobile	Rural	853					1	1	1