State of California
California Environmental Protection Agency
Air Resources Board

SECOND TRIENNIAL REVIEW OF THE ASSESSMENT OF THE IMPACTS OF TRANSPORTED POLLUTANTS ON OZONE CONCENTRATIONS IN CALIFORNIA

(Revised)

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Staff Report: Initial Statement of Reasons

Prepared by

Technical Support Division

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OF THE ASSESSMENT AND MITIGATION OF THE IMPACTS OF TRANSPORTED POLLUTANTS ON OZONE CONCENTRATIONS IN CALIFORNIA

SUMMARY AND OVERVIEW

Under section 39610(b) of the Health and Safety Code, the California Clean Air Act of 1988 (the Act) requires the Air Resources Board (ARB or Board) to assess the relative contributions of upwind emissions to downwind state ozone standard exceedances and to update this assessment at least every three years. The first assessment was approved by the ARB in August 1990 (see Reference 4). The first triennial update occurred in August 1993 (see Reference 6). This report, which is the second triennial update of the ozone transport couples, reviews and updates the August 1993 assessment.

The ARB staff (the staff) recommends several changes to the ozone transport assessments (see Table 1): 1) eliminate the inconsequential transport classification from the Broader Sacramento Area to the Upper Sacramento Valley; 2) extend the area impacted by overwhelming transport of ozone or ozone precursors from the Broader Sacramento Area to include the central portion of the Mountain Counties Air Basin; and 3) identify the San Joaquin Valley Air Basin as an upwind contributor to ozone concentrations in the North Central Coast Air Basin.

The staff also recommends future research needs to the Board. Areas for future research identified by the staff include transport aloft, photochemical grid modeling, data analysis, and enhanced monitoring. The staff also identified several transport couples that need further research.

In May 1996 (see Reference 8), the Board created two new air basins by dividing the Southeast Desert Air Basin into the Mojave Desert Air Basin and the Salton Sea Air Basin (the Board's actions have not yet been approved by the Office of Administrative Law). These changes require the identification of four new ozone transport couples: South Coast Air Basin to Mojave Desert Air Basin, South Coast Air Basin to Salton Sea Air Basin, San Joaquin Valley Air Basin to Mojave Desert Air Basin, and Mexico to Salton Sea Air Basin. These recommended transport couple updates and changes in characterization are shown in bold in Table 1.

The ARB 1989, 1990, and 1993 transport documents on transport couple identification, assessment, and mitigation developments are included as a part of this report by reference. (See Chapter VI for References 3, 4, 5, and 6.)

Table 1 **Summary of Transport Characterization by Couples***			
Transport Couples		**Transport Characterization****	
		Previous	**Proposed**
1.	Broader Sacramento Area to Mountain Counties	O	O
2.	San Joaquin Valley to Mountain Counties	O	O
3.	San Francisco Bay Area to Mountain Counties	S	S
4a.	Mexico to Southeast Desert	O, S	---
4b.	**Mexico to Salton Sea**	---	**O, S**
5.	Mexico to San Diego	O, S, I	O, S, I
6.	San Joaquin Valley to South Central Coast	S, I	S, I
7.	San Francisco Bay Area to Broader Sacramento Area	O, S, I	O, S, I
8.	San Francisco Bay Area to San Joaquin Valley	O, S, I	O, S, I
9a.	South Coast to Southeast Desert	O, S, I	---
9b.	**South Coast to Mojave Desert**	---	**O, S**
10.	Broader Sacramento Area to Upper Sacramento Valley	O, S, I	**O, S**
11a.	San Joaquin Valley to Southeast Desert	O, I	---
11b.	**San Joaquin Valley to Mojave Desert**	---	**O**
12.	South Coast to San Diego	O, S, I	O, S, I
13.	South Coast to South Central Coast	S, I	S, I
14.	South Central Coast to South Coast	S, I	S, I
15.	San Joaquin Valley to Broader Sacramento Area	S, I	S, I
16.	San Joaquin Valley to Great Basin Valleys	O	O
17.	Broader Sacramento Area to San Joaquin Valley	S, I	S, I
18.	Broader Sacramento Area to San Francisco Bay Area	S, I	S, I
19.	California Coastal Waters to South Central Coast	S	S
20.	Bay Area to North Central Coast	O, S	O, S
21.	**San Joaquin Valley to North Central Coast**	---	**S**
22a.	South Coast to Southeast Desert	O, S, I	---
22b.	**South Coast to Salton Sea**	---	**O, S**
*Staff recommended changes shown in **Bold**			
**O=Overwhelming, S=Significant, I=Inconsequential			

CHAPTER I

BACKGROUND

A. Introduction

The California Clean Air Act of 1988 (the "Act," Stats. 1988, Chapter 1568; as amended by AB 2783, Stats. 1992, Chapter 945) requires each air pollution control and air quality management district in which a state ambient air quality standard for ozone, carbon monoxide, sulfur dioxide, or nitrogen dioxide is exceeded to develop a plan and an emission control program to attain the standard(s). The Act recognizes that ozone and ozone precursors can be carried by winds over long distances and thereby contribute to air quality problems outside the district or air basin where they originated. To address this, the Act requires upwind districts to mitigate the impacts on downwind areas of pollutants emitted in the upwind districts. (See section 39610 of the Health and Safety Code) The Act directs the Air Resources Board (ARB or Board) to assess the impacts of such transport and to establish mitigation requirements for upwind districts. This chapter provides background information related to the assessment of transport impacts and describes the public consultation process.

B. Transport Assessment

The Act directs the ARB to: 1) identify downwind areas affected by transported air pollutants and the upwind air basins or regions, which are the sources of the pollutants; 2) assess the relative contributions of upwind emissions to downwind ozone concentrations as overwhelming, significant, inconsequential, or some combination thereof, to the extent permitted by available data (Health and Safety Code section 39610(a) and (b)); and 3) update this analysis at least once every three years (Health and safety Code section 39610(d)). The staff has and will continue to report to the Board on significant findings between the triennial updates. (See Appendix A for the text of Health and Safety Code section 39610.)

Transport couple assessment depends upon the exceedance values at any given site. There are a couple of thresholds used in the assessment process that affect which exceedances will be assessed and which will not. The first threshold is the state standard. All values which exceed the state standard are considered exceedances. The next threshold is the expected peak day concentration (EPDC). This ozone concentration is one which is not expected to occur more than one time per year. Thus, ozone concentrations greater than the EPDC are, theoretically, expected to occur less than one time per year on the average. The ozone concentrations which are greater than the state standard, and less than or equal to the EPDC, are considered violations of the state standard. The values which are greater than the EPDC are considered extreme concentrations. Extreme concentrations are not weighed in the assessment process because of the nature of their occurrence. Given that these are *extreme* concentrations, the staff considers them to be beyond reasonable regulatory control and transport assessments are not performed.

More than one assessment may apply to a transport couple. These assessments rely on, but are not limited to, such parameters as wind speed and wind direction. As these parameters vary from day to day, the assessments may also vary. Therefore, while there may be a finding of inconsequential on one or more violation days, other days may be assessed as overwhelming and/or significant. Likewise, an area that is the upwind air basin on one day may be the downwind air basin on another day.

In December 1989 (see Reference 3), the ARB adopted a regulation identifying 14 transport couples, each consisting of an upwind area that is the source of transported ozone or ozone precursors and a downwind receptor area impacted by those pollutants (Title 17, California Code of Regulations, section 70500). In May 1992, the ARB approved changes to the transport identification regulation, which redefined the boundaries of the Upper Sacramento Valley and the Broader Sacramento Area.

In August 1990 (see Reference 4), the ARB approved a qualitative assessment of the relative contributions of upwind emissions to downwind ozone concentrations. In that assessment, the relative contribution was qualitatively classified as either "overwhelming," "significant," or "inconsequential."

In August 1993 (see Reference 6), the ARB approved the first required triennial update to the 1990 assessments. In that update, new transport couples were identified and assessed, the number of areas with mitigation responsibility was increased, and some previous assessments were updated.

This report is the second triennial update to the 1990 assessments. Few changes are proposed. The staff recommends modifying the assessment of one existing couple, identifying a new couple, and enlarging the downwind area of another couple. Due to the division of the Southeast Desert Air Basin into two new air basins, four new couples have been identified to conform to the new air basin names. The assessment of one of these couples has been modified.

C. Transport Impact Mitigation

Health and Safety Code section 39610(b) directs the ARB to establish mitigation requirements for upwind districts commensurate with their contributions to the air quality problems in the downwind areas. This was first done with the August 1990 transport assessment. Three parts to the mitigation requirements applicable to upwind districts were established: (1) adopt a "no-net-increase" permitting program for all new or modified stationary sources, (2) commit to adopt best available retrofit control technology

(BARCT) for some stationary sources of reactive organic gas (ROG) and oxides of nitrogen (NOx) emissions, and (3) where overwhelming transport exists, include sufficient measures in the air quality plans to ensure expeditious attainment of the ozone standard in the downwind district(s).

In March 1993 (see Reference 5), the ARB approved the deletion of the “no-net-increase” requirement from the mitigation regulation (section 70600). The effects of this deletion are that permitting requirements for all districts are those specified in the Act based on the districts’ nonattainment classification, whether or not the district is a source of transported pollutants. The remaining two mitigation requirements were not changed. The staff is not proposing to change the mitigation requirements of upwind areas at this time. The staff only recommends amendments that redefine which areas are subject to the mitigation requirements.

D. Public Consultation Process

Several transport working groups were formed in response to the Board’s 1993 direction that the staff work more directly with districts’ staffs to assess transport. These groups comprised staffs from affected districts and from the ARB. In one group, representatives of industry and affected facilities were also included. The purpose of the working groups was to identify days for analysis and then to share data, analyses, and recommendations pertinent to the chosen days. The working group members met every two to four months for approximately two years.

As part of this transport assessment update, the staff conducted a public consultation workshop on July 10, 1996, to discuss its transport assessment studies with districts and other interested parties. A copy of the workshop notice is shown in Appendix B, and the list of workshop participants is shown in Appendix C.

During the public workshop, an issue was raised regarding transport mitigation requirements of upwind districts. That issue is being further investigated through meetings with EPA, ARB, local air pollution control districts, and affected parties. This report does not propose changes in mitigation measures.

E. Definitions and Terminologies

Below are some terms used frequently in this report. See Appendix D for a glossary of many other commonly used terms:

Overwhelmed - ozone transport classification describing a condition when the emissions from the upwind area independently caused a violation of the State ozone standard in the downwind area on any single day. Significant emission sources in the downwind area were not in the pathway of the air parcel that was transported from the upwind area. The responsibility for a violation caused by overwhelming transport lies with the upwind area.

Significant - ozone transport classification describing a condition in which the emissions from the upwind area contributed measurably to a violation of the State ozone standard in the downwind area on any single day, but did not overwhelm the area. A violation is considered caused by significant transport if the emissions from sources within the downwind area combine with the transported air parcel carrying ozone or ozone precursors from the upwind area. A violation classified as significant is considered shared, with responsibility lying with both the upwind and downwind areas.

Inconsequential - ozone transport classification describing a condition when upwind emissions were not transported or did not appear to contribute significantly to a violation of the ozone standard in the downwind area. A violation not impacted by transported emissions is considered local and results when the wind flow patterns and atmospheric conditions do not strongly suggest responsibility from an upwind area. The responsibility of inconsequential transport lies with the downwind area.

Expected Peak Day Concentration - the highest concentration that is statistically expected to occur no more frequently than once every year.

Exceedance - any concentration that is greater than the ambient air quality standard.

Violation - an exceedance that is not excluded as a highly irregular or infrequent event, such as an exceptional, unusual, or extreme concentration event, and is considered beyond reasonable regulatory control.

SARMAP - stands for the **S**JVAQS (San Joaquin Valley Air Quality Study)/ **A**USPEX(Atmospheric Utility Signatures, Predictions, and Experiments) **R**egional **M**odeling **A**daptation **P**rogram.

CHAPTER II

Proposed Regulatory Changes

A. Transport Couples Identification Changes

In May 1996 (see Reference 8), the ARB adopted regulations creating two new air basins from the area that used to make up the Southeast Desert Air Basin. These new air basins were named the Mojave Desert Air Basin and the Salton Sea Air Basin. (These new basins have not yet been approved by the Office of Administrative Law.) Appropriate changes are recommended to make identified transport couples conform to these two new air basins. The staff also proposes to add a new couple, the San Joaquin Valley Air Basin transporting to the North Central Coast Air Basin. It is recommended that these changes be incorporated into the California Code of Regulations, Subchapter 1.5, Article 5, section 70500.

B. Transport Assessment Changes

The staff recommends that the Board modify the characterization of overwhelming transport impacts of pollutants from the Broader Sacramento Area on ozone concentrations in the Mountain Counties Air Basin. Under the present characterization, the northern portion of the Mountain Counties Air Basin, which includes Nevada, Sierra, and Plumas Counties, is overwhelmingly impacted by transport from the Broader Sacramento Area. The staff recommends that the Board enlarge the downwind area to include Amador and Calaveras Counties in the central portion of the Mountain Counties Air Basin. It is recommended that this change be incorporated into the California Code of regulations, Subchapter 1.5, Article 6, section 70600.

The staff also proposes that the Board modify the characterization of the transport impacts of pollutants from two transport couples which do not require changes to regulation but may have planning implications. First, the staff proposes that the Board modify the assessment of the impacts of transport from the South Coast Air Basin on ozone concentrations in San Bernardino County, which was in the Southeast Desert Air Basin but is now in the Mojave Desert Air Basin. The staff proposes that the Board include the finding of significant transport besides the 1993 finding of overwhelming and inconsequential transport. Second, the staff proposes to eliminate the finding of inconsequential transport from the Broader Sacramento Area to the Upper Sacramento Valley.

Chapter III will discuss the staff's analyses that support the proposed changes to both transport couple identification and transport assessments. The details of the analyses, including air flow charts, 850 and 500 millibar charts, ambient temperatures, profiler data, back trajectories, and other data analyses can be reviewed at the ARB offices. Discussion of a single episode in each section, gives an example of the type of transport involved. See Appendix E for the full text of the proposed amendments to the identification and mitigation regulations.

CHAPTER III

Transport Couple Assessments

A. Broader Sacramento Area to Mountain Counties Air Basin

1. Previous Assessment

In 1993 (see Reference 6), the Air Resources Board (ARB) concluded that the cause of all ozone violations in the northern portion of the Mountain Counties Air Basin (MCAB) was the overwhelming impact of transported emissions from the Broader Sacramento Area (BSA). The northern portion of the MCAB is Plumas, Sierra, and Nevada Counties.

2. Analysis for Northern Portion of the Mountain Counties Air Basin

During 1994-1995, 252 ozone exceedances of the state standard occurred in the MCAB (see Table F-1 in Appendix F). Of those, 43 were in the northern portion of the air basin (at Colfax, Grass Valley, and White Cloud Mountain). Figure 1 is a map of the area. Since the 1993 update concluded that all violations were caused by overwhelming transport of pollutants from the BSA, the focus of this update was to determine whether there was evidence to contradict the previous assessment or to demonstrate that the previous assessment is still valid. All violations were examined for possible significant or inconsequential transport.

First, the exceedances were screened by identifying and excluding those daily maximum ozone concentrations that exceeded the EPDCs (see Reference 9) and, therefore, considered extreme concentrations and not considered violations. Eight exceedances were greater than the EPDCs (see Table F-2 in Appendix F), which left 35 violations remaining for further evaluation.

The 35 violations were examined for evidence of transport. Several criteria were used to evaluate the violations. Some of these criteria were: the time of day of the violations, temporal progression of exceedances, air flow patterns (surface and aloft where available), spatial extent of the violations, and emissions from both the upwind and downwind areas. All 35 violations had meteorological and air quality data consistent with conditions of transport, such as elevated ozone concentrations in the Broader Sacramento Area and winds from the south-southwest through west.

Figure 1

[map of BSA to MCAB]

The northern MCAB precursor emission inventory trends from 1987 to 1995 remained flat. The emission inventories of precursors in the BSA continue to be much greater than those in the northern MCAB. These emission trends suggest that local precursor emissions in the MCAB are still not significant enough to cause a local exceedance. Because the emissions in the northern portion of the MCAB have not increased since the 1993 update, there still are not significant emissions in the MCAB along the pathway of the transported air parcels which carry pollutants from the BSA to contribute significantly to the violations.

A violation at Colfax is briefly discussed here to illustrate a typical case of overwhelming transport from the BSA. At 1800 PST on July 11, 1994, the daily maximum ozone concentration in Colfax was 104 parts per billion (ppb). A strong delta breeze occurred on the day before and day of the exceedance. Exceedances of the ozone standard occurred in the BSA on the day of the exceedance. In addition, the temporal progression of the daily maximum ozone concentrations from the eastern Sacramento area to Colfax is consistent with the air flow patterns of that day. These conditions indicate that Sacramento ozone and precursor emissions overwhelmingly impacted Colfax.

3. Analysis for Central Portion of the Mountain Counties Air Basin

The ARB concluded during the 1993 transport assessment that the BSA could overwhelmingly impact the northern portion of the MCAB. However, more recently available data from the San Joaquin Valley Air Quality Study show that transport from the BSA also impacts the central portion of the MCAB. Therefore, an examination of exceedances in the central portion of the MCAB was carried out to verify whether the BSA impacts the central portion of the MCAB.

During 1994-1995, 252 ozone exceedances of the state ozone standard occurred in the MCAB (see Table F-1 in Appendix F). Of those, 94 were measured in the central portion of the air basin (at Jackson and San Andreas - see Figure 1). The 58 exceedances at Placerville were not included, because Placerville is part of the BSA planning region.

The 94 exceedances were screened to reduce the number of possible exceedances for detailed analysis. First, the exceedances were screened by identifying and excluding those daily maximum ozone concentrations that exceeded the Expected Peak Day Concentrations (EPDCs) (see Reference 9) and, therefore, are considered extreme concentrations, not violations. Seven exceedances were greater than the EPDCs (see Table F-2 in Appendix F). The elimination of these 7 left 87 violations for further evaluation.

The 87 violations were examined for evidence of transport. Several criteria were used to evaluate the violations. Some of these criteria were: the time of day of the violations, temporal progression of exceedances, air flow patterns (surface and aloft where available), spatial extent of the violations, and emission sources of the upwind and downwind areas. All 87 violations had meteorological and air quality data consistent with conditions of transport from several upwind areas.

The emission inventory trends of the central portion of the MCAB from 1987 to 1995 remained flat. The upwind precursor emissions continue to be much greater than the central portion of the MCAB. These emissions suggest that local precursor emissions are still not significant enough to cause a local exceedance. There are still no significant sources of emissions in the MCAB along the pathway of the transported air parcels which carry pollutants from the upwind areas.

A violation at San Andreas is briefly described here to illustrate a typical case of overwhelming transport from the BSA into Calaveras County. (Examples of transport from the other upwind areas are discussed in Sections B and C of this report.) At 1600 PST on June 26, 1994, the daily maximum ozone concentration in San Andreas was 101 ppb. On that violation day, northwest winds blew throughout the Sacramento Valley to the delta area. A back trajectory analysis indicates that morning peak commute hour traffic and other emissions from the Sacramento urban area impacted the San Andreas area at the time of the daily maximum ozone concentration. Moreover, an increase in ozone concentrations occurred along the transport pathway from Sacramento to San Andreas. This gradient suggests that the 50-mile distance gave adequate time for the conversion of precursors to ozone. These analyses indicate that San Andreas was overwhelmingly impacted by ozone from the BSA.

4. Conclusions and Recommendations

Based on the results of the meteorological and air quality data analyses, the ARB staff concludes that the causes of all 35 violations in the northern portion of the MCAB were overwhelming transport of pollutants from the BSA. Since there are no changes to the transport findings of the 1993 report, no regulatory changes are recommended for the BSA impact on the northern MCAB.

Based upon the results of the meteorological and air quality data analyses, the ARB staff concludes that the causes of all 87 violations in the central portion of the MCAB were overwhelming transport of pollutants from several possible upwind areas. The violation on June 26, 1994, in San Andreas was shown to be caused by overwhelming transport from the BSA. The staff recommends that the Board find that on some days the central portion of the MCAB is impacted by overwhelming transport from the BSA.

As a result of these assessments, the staff recommends that the downwind area which is overwhelmed by transport from the BSA be enlarged to include all counties in the MCAB north of the Calaveras-Tuolumne County border.

B. San Joaquin Valley Air Basin to Mountain Counties Air Basin

1. Previous Assessment

In 1993 (see Reference 6), the ARB concluded that the southern portion of the MCAB was overwhelmingly impacted by transported ozone and ozone precursors from the San Joaquin Valley Air Basin (SJVAB) on some days and by both the SJVAB and the San Francisco Bay Area Air Basin (SFBAAB) on others. The southern portion of the MCAB was defined as those counties south of the Amador-El Dorado County border.

2. Analysis

The ARB concluded during the 1993 transport assessment that all violations in the southern portion of the MCAB were overwhelmed by pollutants transported from several upwind areas and that on some days the SJVAB emissions alone can overwhelm the southern portion of the MCAB. Therefore, analyses of the exceedances in the southern portion of the MCAB were carried out to determine whether if any evidence contradicts the previous assessment.

During 1994-1995, there were 252 ozone exceedances of the state ozone standard in the MCAB (see Table F-1 in Appendix F). Of those, 151 were measured in the southern portion of the MCAB; 95 in Amador and Calaveras Counties and 57 in Mariposa and Tuolumne Counties. These 57 exceedances which were measured at Sonora-Barretta, Sonora-Old Oak Ranch, Turtleback Dome, Jerseydale, Camp Mather, and Wawona were the focus of this assessment. These sites were chosen for analyses to minimize the impacts of pollutants from the BSA and the SFBAAB, since these sites are further south than those in Amador and Calaveras. See Figure 2 for a map of the area.

First, the exceedances were screened by identifying and excluding those daily maximum ozone concentrations which exceeded the Expected Peak Day Concentrations (EPDCs) (see Reference 9) and, therefore, are considered extreme concentrations but not considered violations. Eight exceedances were greater than the EPDCs (see Table F-2 in Appendix F). The elimination of these 8, left 49 violations for further evaluation.

The 49 violations were examined for evidence of transport. Several criteria were used to evaluate the violations. Some of these criteria were: the time of day of the violations, temporal progression of exceedances, air flow patterns (surface and aloft where available), spatial extent of the violations, and emission sources of the upwind and downwind areas. All 49 violations had meteorological and air quality data generally consistent with conditions of transport such as late afternoon exceedances and winds from the southwest. Additionally, violation days exhibited elevated ozone concentrations upwind in the San Joaquin Valley.

The emission inventory trends of the southern portion of the MCAB precursor from 1987 to 1995 remained flat. The emission inventories of precursors in the SJVAB continue to be considerably greater than the southern portion of the MCAB. These emission trends suggest that local precursor emissions are still not significant enough to cause a local exceedance. There are still no significant sources of emissions in the MCAB along the pathway of the transported air parcels which carry pollutants from the SJVAB.

A violation at Jerseydale is discussed here as an example of overwhelming transport from the SJVAB. At 1700 PST on August 31, the daily maximum ozone concentration in Jerseydale was 102 ppb. Light to moderate northwest winds blew throughout the SJVAB on the day before the violation.

The late morning Fresno eddy was present on both the day before and day of the violation. This eddy, a common phenomenon in the San Joaquin Valley, is a weak cyclonic, or counterclockwise, circulation which occurs when the north-northwest wind speeds are nearly equal to the drainage flow wind speeds. If the winds are too strong or too weak, the circulation does not exist. The eddy appears to have transported morning emissions and ozone from the greater Fresno area to the eastern side of the San Joaquin Valley both north and east of Fresno. These precursors and ozone then travel up into the foothills during the late morning and early afternoon to impact the higher elevations. This scenario is evident by the daytime southwest winds at both Jerseydale and Turtleback Dome, and further strengthened by the progression of the time of the daily maximum ozone concentrations along the path from Fresno (1300 PST) to Jerseydale (1700 PST) and beyond to Turtleback Dome (1800 PST).

High concentrations of ozone appear to have been confined to the central and southern portions of the SJVAB on the day before and the day of the violation. Ozone concentrations in the SFBAAB were below the state standard for both days. Ozone exceedances occurred only in the north and northeastern portions of the Broader Sacramento Area on the day of the violation. This ozone pattern suggests that the ozone violations in the central SJVAB were mainly due to local emissions which subsequently impacted the ozone concentrations at Jerseydale.

3. Conclusions and Recommendations

As found in the meteorological and air quality data analyses, the causes of all the 49 exceedances in the two most southern counties of the MCAB were overwhelming transport of ozone. The violation on the August 31, 1995, in Jerseydale was shown to be the result of overwhelming ozone transport from the SJVAB. The staff recommends that the Board find that the southern portion of the MCAB continues to be impacted by overwhelming transport from the SJVAB. This analysis agrees with the previous, 1993 transport assessment, and, therefore, requires no changes to the transport regulations.

Figure 2

[map of SJVAB to MCAB]

C. San Francisco Bay Area Air Basin to Mountain Counties Air Basin

1. Previous Assessment

In 1993 (see Reference 6), the ARB concluded that the southern portion of the Mountain Counties Air Basin (MCAB) was significantly impacted by transported pollutants from the San Francisco Bay Area Air Basin (SFBAAB). The conclusion was based on an analysis of violations at Angels Camp (Calaveras County) and Pardee Reservoir (Amador County). The Board found that emissions from the SFBAAB and the SJVAB, collectively, impacted the southern portion of the MCAB on some days. The staff was unable to separate out the individual air basin contributions. The staff analysis of other days showed that the SJVAB emissions alone can overwhelm the southern portion of the MCAB.

2. Analysis

The ARB concluded during the 1993 transport assessment that all the violations in the southern portion of the MCAB were caused by overwhelming transport of pollutants. This update to the transport assessment was done to determine whether there is evidence to contradict the previous assessment.

During 1994-1995, there were 252 ozone exceedances of the state standard in the MCAB (see Table F-1 in Appendix F). Of those, 94 were in the central portion of the air basin measured at Jackson (Amador County) and San Andreas (Calaveras County). This analysis was focused on these violations because of the close proximity to the northeastern portion of the SFBAAB, only 40 miles away. See Figure 3 for a map of the area.

The 94 exceedances were screened in order to reduce the number of possible exceedances for detailed analysis. First, the exceedances were screened by identifying and excluding the daily maximum ozone concentrations which exceeded the Expected Peak Day Concentrations (EPDCs) (see Reference 9) and, therefore, were considered extreme concentrations, not violations. Seven exceedances were greater than the EPDCs (see Table F-2 in Appendix F). The elimination of these 7 left 87 violations for further evaluation.

These 87 violations were evaluated for possible impacts from the SFBAAB. Some of the criteria used were: time of day of the violations, air flow, spatial patterns of the daily maximum ozone concentration for central California, and back trajectory analyses. The analysis identified a violation day which was significantly impacted by the SFBAAB. At 1900 PST on June 27, 1994, the daily maximum ozone concentration in San Andreas was 111 ppb. By late morning on June 27, a strong delta breeze penetrated into the Central Valley. With the delta breeze came precursor emissions and ozone from the SFBAAB. On the previous day the Sacramento Valley Air Basin and delta region were under the influence of northwest flow, while the SJVAB was under the influence of the sea breeze from the SFBAAB via the Altamont and other passes to the south.

Back trajectory analyses indicated that pollutants from the northern and northeastern SFBAAB on June 26, along with pollutants from San Joaquin County on June 27, impacted San Andreas at the time of the June 27 maximum daily ozone concentration. Back trajectory analyses were conducted for the time (1600 PST) of the maximum daily ozone concentration (91 ppb) at Jackson, which occurred three hours prior to the San Andreas daily maximum hour concentration on June 27. These analyses indicated that ozone in the Broader Sacramento Area on June 27 was transported to the MCAB and impacted Jackson and San Andreas (100 ppb) at 1600 PST on June 27. Therefore, it appears that lingering ozone from the previous day's northwest flow could also have contributed to the June 27 late afternoon ozone peak at San Andreas.

It was during the sea breeze penetration on June 27 that Bethel Island, in southern Sacramento County, and air monitoring stations in the San Joaquin County measured daily maximum ozone concentrations greater than 100 ppb. In addition, a progression of the daily maximum ozone concentrations from the SFBAAB to the downwind air basins is consistent (83 ppb at 1300 PST at Concord, 113 ppb at 1400 PST at Bethel Island, 110 and 104 ppb at 1600 PST at Stockton-Hazelton and Elk Grove respectively, 119 ppb at 1700 PST at Stockton-Mariposa, and 111 ppb at 1900 PST at San Andreas) with the air flow patterns.

A comparison of the precursor emission inventories was conducted for those areas that contributed to the June 27 San Andreas exceedance (based on the back trajectory analyses). This showed that the SFBAAB, BSA, and SJVAB precursor emissions that could possibly impact central MCAB were far greater than the central MCAB precursor emission inventory.

3. Conclusions and Recommendations

The above analyses establish that transport from the BSA, SFBAAB, and SJVAB collectively impacted the central portion of the MCAB on June 27, 1994. This analysis confirms that the SFBAAB can significantly impact the MCAB as was found in the 1993 transport assessment report.

Figure 3

[map of SFBAAB to MCAB]

D. San Francisco Bay Area Air Basin to North Central Coast Air Basin

1. Previous Assessment

The 1993 transport assessment (see Reference 6) classified transport from the San Francisco Bay Area Air Basin (SFBAAB) to the North Central Coast Air Basin (NCCAB) as overwhelming on some days and significant on other days. A reassessment of this transport couple was performed to take advantage of the availability of new data from a network of Radio Detection and Ranging (RADAR) wind profilers in the NCCAB and special purpose air monitoring at Pacheco Pass and Spikes Peak.

2. Transport Working Group

In 1993, the Board directed its staff to work more directly with the districts' staffs to assess transport. A result of this direction was the formation of the Bay Area to North Central Coast Transport Working Group. This group comprised staff members from the Bay Area Air Quality Management District, the Monterey Bay Unified Air Pollution Control District, and the ARB.

The purpose of the working group was to identify days to be studied and then to share data, analyses, and recommendations pertinent to those days. The working group members met periodically for the past three years.

3. Analysis

The Bay Area Air Quality Management District (Bay Area AQMD) is under contract with the Monterey Bay Unified Air Pollution Control District to analyze NCCAB ozone episodes. A detailed assessment of 1994 is included in a report by the Bay Area AQMD (see Reference 17). A follow-on report contains a summary of the transport assessments for 1995 NCCAB ozone exceedances (see Reference 18).

Fourteen ozone exceedances occurred in 1994 and 1995. Table 2 identifies where these exceedances occurred and when. Table 2 also indicates the transport assessment assigned to each day. The working group analyzed only 12 of these 14 exceedances, because the remaining two exceedances had daily maximum ozone concentrations that exceeded the Expected Peak Day Concentrations (EPDCs) (see Reference 9) and are, therefore, extreme concentrations which are not violations. Table 3 lists the EPDC values for all the sites in the NCCAB which were used to exclude extreme concentrations. See Figure 4 for a map of the area.

No inconsequential (local) days were identified in the previous assessment, and the focus of this reassessment was to determine whether that pattern has continued. The working group evaluated all 12 violations using an array of data analyses. These data analyses were used to determine the origin of ozone and the contribution of transported ozone impacting the air monitoring site when violations were measured. Each violation episode, typically the day before and day of the violation, was evaluated using some or all of the following analyses:

1. Spatial plots of the daily maximum ozone concentrations, and when they occurred, were prepared to identify the transport routes.

2. Wind speed and wind direction time series plots in the form of hourly vectors were constructed for weather monitoring stations in the SFBAAB to the NCCAB. These plots, which contained both surface and upper air winds, were used to determine ozone transport routes.

3. Spatial plots of wind and temperatures were constructed for the area encompassing the SFBAAB, northern San Joaquin Valley, and NCCAB. These plots were used to determine the extent of the inland penetration of air pollutants in the marine layer.

4. Time-height cross sections of wind and temperature were constructed based on measurements from radar wind profilers, radio acoustic sounding systems (RASS) and sonic detection and ranging systems. These plots provided information on transport routes.

5. Vertical plots of temperature were constructed based on measurements taken at Oakland by the National Weather Service. These plots were used to determine the height of existing temperature inversion bases and the temperature inversion intensity.

6. Time series plots of the temperature inversion base height were constructed based on measurements from a RASS network in the NCCAB. These plots, in connection with Oakland upper air temperature data, were used to determine whether surface precursor emissions could have transported over ridges or through mountain passes. In addition, the plots were used to determine whether aloft-transported-ozone could have fumigated to the surface.

7. Daily maximum temperature isotherm plots were constructed based on surface measurements to determine the extent of inland penetration of precursor emissions in the marine layer.

8. Gridded wind plots with overlayed wind observations were constructed for various times using an interpolation wind model. The wind plots are used to determine ozone transport routes and source areas.

9. Back trajectory plots were constructed from the violation sites in the NCCAB. These plots were used to determine transport routes.

10. Mixing heights were estimated for various upper air temperature measurement locations in the Central Valley, SFBAAB, and NCCAB. The estimates were used to determine the depth in which surface-based-precursor emissions would have been transported.

11. The synoptic weather patterns were identified by reviewing the 850 mb, 700 mb, and 500 mb constant height charts produced by the National Weather Service and Air Resources Board.

The working group found that NCCAB ozone violation episodes are typically associated with an 850 mb ridge building into the northwestern part of the country including northern California, in conjunction with a 500 mb high pressure area situated somewhere over the southwestern states. The building of the 850 mb ridge into northern California, resulted in northwest to northeast winds at the surface and aloft over the Central Valley, SFBAAB, and NCCAB. These winds acted to transport ozone and ozone precursors southward from the SFBAAB to the NCCAB; on some days southwestward from the SJVAB to the NCCAB.

4. Conclusions and Recommendations

The working group’s analyses for 1994-95 show that overwhelming and significant transport from the SFBAAB occurred on most violation days in the NCCAB. On the other NCCAB violation days, the NCCAB was impacted by transport from the SFBAAB and the SJVAB, collectively. Based on these analyses, the staff recommends no changes to the transport mitigation regulation for the SFBAAB. However, the staff recommends that transport from SJVAB to the NCCAB be identified as a new transport couple which is discussed in detail in Section E of this report.

Table 2
State Ozone Exceedance Days
NCCAB (1994-1995)

Date	Location	Max Ozone Conc. (ppb)	Max Ozone Begin Hour (PST)	Proposed Assessment*
06/09/1994	Hollister	101	1500	O - SF(1)
06/24/1994	Pinnacles	96	1700	S-SF; S-NCC
06/28/1994	Pinnacles	95	1700	S-SF; S-NCC
07/07/1994	Pinnacles	97	1700	O-SF
08/11/1994	Pinnacles	95	1700	S-SF; S-NCC
08/12/1994	Pinnacles	95	1500	O-SF
06/23/1995	Pinnacles	95	1800	O-SF(1)
07/14/1995	Scotts Valley	97	1700	O-SF
07/15/1995	Hollister	97	1100	O-SF(1)
08/01/1995	Pinnacles	138	1700	No assessment (2)
08/02/1995	Pinnacles	110	1800	No assessment (3)
08/12/1995	Pinnacles	97	1700	O-SF(1)
08/21/1995	Pinnacles	102	1800	Inconclusive
09/18/1995	Pinnacles	96	1800	S-SF; S-NCC (1)

*I=Inconsequential; S=Significant; O=Overwhelming

(1) Unknown contribution from SJVAB

(2) Ozone concentration greater than EPDC

(3) The EPDCs used in determining the need for assessments were based on 1992-94 data and was 10 ppm for Pinnacles. EPDCs based on 1993-95 data were available for this report (see Table 3) but not timely enough for performing assessment analyses. Therefore, while the most recent EPDC for Pinnalces is 11 ppm, the decision for "no assessment" was made on the previous, 10 ppm, EPDC.

Table 3
NCCAB Expected Peak Day Concentration (ppm)
1993-95

Salinas	7
Monterey	8
King City	8
Carmel Valley	10
Hollister	10
Pinnacles Nat'l Monument	11
Davenport	7
Santa Cruz	8
Watsonville	9
Scotts Valley - Scotts Valley Drive	10
Scotts Valley - Vine Hill	11

Figure 4

[map of SFBAAB to NCCAB]

E. San Joaquin Valley Air Basin to North Central Coast Air Basin

1. Previous Assessment

The transport of pollutants from the San Joaquin Valley Air Basin (SJVAB) to the North Central Coast Air Basin (NCCAB) was not evaluated in the 1993 triennial transport assessment. Likewise, these two air basins were not identified as a transport couple. However, recent analyses of the 1990-92 exceedances in the NCCAB suggested that the SJVAB emissions impacted ozone concentrations in the NCCAB (see Reference 16).

2. Geographic Setting

The geographic setting is included in this section because the SJVAB to the NCCAB is proposed as a new transport couple. The NCCAB includes Monterey, San Benito, and Santa Cruz Counties. The SFBAAB comprises Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara Counties and parts of Solano and Sonoma Counties. The SJVAB is composed of San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, and Tulare Counties and parts of Kern County. See Figure 5 for a map of the area.

The dominant topographic feature influencing air flow in the SFBAAB, SJVAB, and NCCAB is the Coast Range. The Coast Range comprises a series of parallel northwest to southeast oriented ridges and valleys. The ridges range in elevation from 2,000 feet near the coast to more than 3,000 feet inland. Between the ridges lie the San Francisco Bay, the Santa Clara Valley, the San Benito Valley, and the Salinas Valley. The Santa Clara Valley begins at the south end of the San Francisco Bay near San Jose and extends southeastward for 35 miles from San Jose until it merges with the San Benito Valley at the Santa Clara County line. The San Benito Valley extends southeastward from the Santa Clara County line for approximately 35 miles to the Pinnacles National Monument. The Santa Clara-San Benito Valley combination gently slopes upward from an elevation of 80 feet at San Jose to an elevation of 300 feet at Hollister, 45 miles southeast of San Jose. The two valleys without any physical barrier to the flow between them provide the topographic setting for transport from the SFBAAB into the NCCAB.

The Salinas Valley lies to the west of and parallel to the San Benito River Valley. The Salinas Valley extends approximately 75 miles southeastward from Salinas to San Ardo. The ridge dividing the Salinas Valley and the San Benito Valley ranges in elevation from 200 feet at the Pajaro Gap northwest of Hollister to 3,400 feet northeast of Gonzales.

The routine influxes of marine air through the Carquinez Strait, the Altamont Pass, and the Pacheco Pass are the dominant features influencing air flow between the SJVAB and the coastal areas. As a result, air flow within the SJVAB is typically northwest, along the length of the valley from north to south. However, during periods of migrating high pressure systems, surface and aloft winds can flow from the northwest through northeast over the SFBAAB, SJVAB, and into the NCCAB. During these periods of north to northeast winds, air pollutants from the SJVAB have the potential for transporting into the NCCAB.

3. Analysis

All 14 violations in the NCCAB were evaluated for transport impacts. First, the exceedances were screened by identifying and excluding those daily maximum ozone concentrations which exceeded the Expected Peak Day Concentrations (EPDCs) (see Reference 9) and, therefore, are considered extreme concentrations, not violations. Twelve of the 14 days were determined to be violations of the ozone standard, and warranted analyses.

The analyses performed for this assessment included studying spatial and chronological ozone maximums, surface wind flows, profiler and mountaintop wind data, inversion heights and strengths, surface temperatures, and air flow back trajectories. As discussed in Section D of this report, most of the violations were determined to be caused by either overwhelming or significant transport from the SFBAAB. Four of the 12 violations were suggestive of transport contributions from the SJVAB (see Table 2 in Section D).

The staff evaluated one of these four days in detail to establish the contribution of the SJVAB on the NCCAB. Appendix G-1 describes the details of the analysis of the violation which occurred on June 9, 1994. This analysis provides strong evidence that ozone and its precursors in the surface layer traveled southward from the southern SFBAAB and had an impact on Hollister. It also appears that there was flow aloft into the NCCAB from the northern SJVAB. Ozone aloft could have mixed down to the surface as the mixing layer deepened in the afternoon, thereby contributing to Hollister’s peak ozone. The transport working group concluded that the impact at Hollister is the combined transport impact from the SFBAAB and the SJVAB. However, when there are shared contributions from the SFBAAB and the northern SJVAB, it seems likely that the SFBAAB would often have the greater impact since the emissions in the SFBAAB (Santa Clara and San Mateo Counties) are far greater than the emissions from the northern SJVAB (San Joaquin and Stanislaus Counties).

4. Conclusions and Recommendations

The staff's analysis shows that overwhelming and significant transport from the SFBAAB caused most of the violations in the NCCAB. A few NCCAB violations days were caused by transport from both the SFBAAB and the SJVAB. The staff also recommends further studies for the next triennial assessment. The staff was unable to quantify the separate transport impacts from the SFBAAB and the SJVAB ozone concentrations in NCCAB. However, based on the available data, the analysis suggests that the impact is more than inconsequential. Based on this analysis, the staff recommends that SJVAB to NCCAB be identified as a new transport couple, causing significant transport impacts.

Figure 5

[map of SJVAB to NCCAB]

F. San Joaquin Valley Air Basin to Great Basin Valleys Air Basin

1. Previous Assessment

The 1993 transport assessment (see Reference 6) classified transport from the San Joaquin Valley Air Basin (SJVAB) to the Great Basin Valleys Air Basin (GBVAB) as overwhelming on all days. The assessment was based on ozone exceedances occurring at Mammoth Lakes in the GBVAB. A reassessment of this transport couple was performed because of the continued occurrence of violations in Mammoth Lakes, as well as the occurrence of exceedances at a new air monitoring site in Death Valley National Monument.

2. Analysis

During 1994-1995 there were six ozone exceedances in the GBVAB (see Table 4). Two of these exceedances occurred at the new monitor site in the Death Valley National Park. Four exceedances were reported at the Mammoth Lakes site. See Figure 6 for a map of the area.

Ozone air monitoring began at the Death Valley National Park in December 1993. The data record, which is complete for 1994, shows one exceedance in May and one in July. However, data were missing for two months in 1995. Because these two months are during the ozone season, the data are not sufficient to calculate the Expected Peak Day Concentration (EPDC). Without the EPDC, it is not possible to determine whether these two exceedances are extreme concentrations or whether they are violations. Therefore, the staff will defer making a transport assessment for the Death Valley National Park until there are sufficient data to determine the status of these exceedances.

The four exceedances at the Mammoth Lakes sites were examined for potential transport. First the exceedances were screened by identifying and excluding the daily maximum ozone concentrations which exceeded the Expected Peak Day Concentrations (EPDCs) (see Reference 9) and, therefore, were considered extreme concentrations, not violations. Two exceedances were considered extreme concentrations. The remaining two violations were examined further.

These violations occurred late in the day, between 1800 and 1900 PST. Based on the time of day that the violations occurred, the characteristics of the violations, the predominant westerly wind patterns, and the comparatively small emissions in the GBVAB, the staff considers these violations to be the result of overwhelming transport from the San Joaquin Valley.

3. Conclusions and Recommendations

The staff's analysis shows that all violation days in Mono County in the Great Basin Valleys Air Basin were overwhelmed by transport from the San Joaquin Valley Air Basin. This analysis confirms the previous assessment and, therefore, the staff recommends that no regulatory changes be made.

Table 4
State Ozone Exceedance Days
GBVAB (1994-1995)

Date	Location	Max Ozone	
		Conc. (ppb)	Begin Hour (PST)
05/22/1994	Death Valley National Monument	98	1300
07/01/1994	Mammoth Lakes	120	2000
07/09/1994	Mammoth Lakes	100	1800
07/15/1994	Death Valley National Monument	101	900
08/15/1995	Mammoth Lakes	100	1900
08/16/1995	Mammoth Lakes	110	300

Figure 6

[map of SJVAB to GBVAB]

G. South Coast Air Basin to Mojave Desert Air Basin

1. Previous Assessment

The 1993 transport assessment (see Reference 6) concluded that the transport contribution from the South Coast Air Basin (SCAB) to the San Bernardino County portion of the Southeast Desert Air Basin (SEDAB) was sometimes overwhelming and sometimes inconsequential. In May 1996, the Board divided the SEDAB into two new air basins, and now the San Bernardino County portion of the SEDAB is part of the Mojave Desert Air Basin (MDAB). The previous assessment still applies, and, the SCAB's contribution to the ozone concentrations in the MDAB was both overwhelming and inconsequential. A reassessment of this couple was done using information from a special data collection effort that was conducted during the summer of 1995.

2. Transport Working Group

In 1993, the Board directed the ARB staff to work more directly with districts' staffs to assess transport. The Mojave Desert Transport Committee was formed, made up of representatives from local industry, local air pollution districts, the military, and ARB. The committee has endeavored to:

- Foster a cooperative effort among the ARB, the districts, and the regulated community
- Clarify the legal and scientific interpretations;
- Identify and evaluate the available evidence for assessing upwind versus local contributions to the SEDAB ozone exceedances; and
- Obtain new evidence to better characterize transport into the SEDAB.

3. Analysis

The analysis consists of two parts. The report of the Mojave Desert Transport Committee, following its review of all past transport studies, is the first part. The second part consists of evaluation of data from field studies conducted by the ARB and the Mojave Desert Transport Committee in the summer of 1995 to quantify transport impacts to the desert. See Figure 7 for a map of the area.

Figure 7

[map of SCAB to MDAB]

Part 1 - Mojave Desert Transport Committee Findings

The Mojave Desert Transport Assessment Committee, based on its evaluation of past studies, prepared a report on transport into the Mojave Desert. The conclusions contained in the report "Mojave Desert Air Pollution Transport Interim Report" are the following (see Appendix H for text of the report):

- Meteorology is the predominant factor controlling changes in the air quality from one day to the next in the desert. On most exceedance days, a thermal low pressure develops over the desert due to hot rising air; cooler air moves into this low pressure area resulting in transport into the desert.

- Two types of state standard exceedance days were identified. Typical exceedance days (93% of exceedance days at Barstow) were defined as those exceedance days which were the result of overwhelming transport. Atypical exceedance days (7% of exceedance days at Barstow) are those occurring under more subtle and complex meteorological conditions for which the cause is not clearly understood. Atypical exceedance days could be caused by overwhelming transport unrecognized as coming from one or more other transport corridors, a combination of transport and local contribution, or only by local contribution.

- The available evidence from the six relevant studies is conflicting (see the report "Mojave Desert Air Pollution Transport Interim Report" in Appendix H for discussion of these studies). Shared days, where local contribution might be significant, were not studied or identified. No single study was considered sufficient to conclusively establish the presence or absence of transport on atypical exceedance days.

- All exceedances of the federal ozone standard in the SEDAB are the direct result of transport.

- According to Section 5 of the Roberts, et al., 1992 report, state standard exceedance days at Barstow, with the greatest possibility of being caused by local sources, have occurred at a rate of less than one per year over ten ozone seasons during the 1980's.

- The impact of mobile source emissions from major transportation corridors (State Highway 58 and Interstate I-40 and I-15) on atypical exceedance days is not quantified.

- Research, such as the 1995 Mojave Desert Study preliminary data, reaffirm the need to account for surface atmospheric conditions as well as atmospheric conditions at various levels aloft. Further research is needed to quantify transport and to evaluate the effectiveness of future control schemes aimed at improving the SEDAB air quality.

Part 2 - 1995 Field Studies

During the summer of 1995, a special data collection effort was conducted to evaluate transport into the Mojave Desert. The goal of this effort was to acquire data to establish whether transport of ozone aloft contributed to violations at Barstow when surface trajectories indicated no transport. (Table G-2 in Appendix G identifies the groups responsible for the data collection). The data were obtained from either U. S. EPA Aerometric Information Retrieval System (AIRS), Desert Research Institute (DRI), National Weather Service (NWS), or California Irrigation Management Information System (CIMIS).

Air quality in the desert was good in the summer of 1995. Normally, Barstow experiences 30 to 40 exceedances of the state ozone standard in a year, but only 7 exceedances were observed during the study, reducing the value of the database for analysis.

Most of the time the Mojave Desert monitoring sites (Phelan, Hesperia, Victorville, and Palmdale) are overwhelmed by ozone transport from the South Coast. However, violations of the state ozone standard at Barstow are believed to be caused either by overwhelming transport from South Coast, emissions from within the Mojave Desert, or a combination of transport from South Coast and contribution of emissions from the Hesperia, Apple Valley, and Victorville urban areas.

The seven days during which the state ozone standard was exceeded at Barstow during the 1995 study all appeared to be impacted by transport. The staff examined the data to see whether they could be used to identify the contribution of local sources to ozone the exceedances. Two approaches were used. The first approach examined days when transport from the South Coast was minimal or negligible. The days studied were days when a weak Santa Ana condition existed over the desert. The first step in the analysis was to screen the data to identify the Santa Ana days. This was done by plotting all the surface wind data in the desert and neighboring air basins for the 40 days identified in Table 5.

The ozone concentrations for these days were plotted using the EPA's AIRS Voyager software. In these plots each concentration at each site is represented by a disk of varying size depending on the concentration. Using the hourly plots, a Voyager movie was made for each of the candidate days to show the hourly progression of the ozone concentrations at each site. The Voyager movie files were helpful for watching transport scenarios unfold. Using this approach, one can see how the ozone cloud propagated through the critical passes into the Mojave Desert. The movie files were helpful in making initial assessments of particular exceedance days. After reviewing the movie files, the 40 potential days were reduced to 22 (see Table 6).

Table 5
Days With Santa Ana Conditions
Over the Desert (1995)

05/03	06/03	09/13	10/16
05/15	06/09	09/18	10/17
05/16	06/10	09/29	10/19
05/23	06/21	09/30	10/20
05/25	06/22	10/01	10/22
05/26	06/23	10/02	10/23
05/27	06/24	10/04	10/24
05/28	06/25	10/05	10/25
05/29	07/16	10/12	10/26
05/30	09/12	10/13	10/29

Table 6
Days With Santa Ana Conditions Over the Desert
With No Apparent Transport Into the Desert

05/03	10/12
05/15	10/13
05/16	10/16
05/23	10/17
05/25	10/19
09/29	10/20
09/30	10/22
10/01	10/23
10/02	10/24
10/04	10/25
10/05	10/26

To minimize the effect of carry-over (residual ozone and ozone precursors from the day prior), it is preferable to look only at periods when the Santa Ana conditions persisted for more than one day. Although all of the 22 days were analyzed, the multi-day episodes listed in Table 6 were the main focus. Upper air data were also examined to see if there was transport aloft that could impact the monitors in the desert. Unfortunately, the Radio Detection and Ranging (RADAR) wind profilers located at Apple Valley Airport and Daggett-Barstow Airport did not come on line until July, and due to equipment failure they were out of service most of August and September. Thus, upper air data for many days in Table 5 are limited to rawinsonde soundings taken three times a day at Edwards AFB and twice a day at Desert Rock (DRA) and Los Angeles (LAX). Lacking upper level data, maximum ozone concentrations from each of the Southern Mojave Desert sites (Palmdale, Hesperia, Phelan, and Victorville) were used to determine a range of values attributable to desert emissions.

By looking at days in the 1995 study period when no transport from the South Coast Air Basin occurred, this analysis indicates that the maximum ozone concentration produced in the desert is 60 ppb. Therefore, no state ozone standard violations at Barstow during the period studied were attributed strictly to local emissions.

The second approach taken consisted of evaluations of two other significant studies conducted during 1995 to try to identify the contribution of desert sources to ozone exceedances in the desert and to try to determine the amount of any contribution. The first was Air Resources Board Contract No. 94-316 entitled Monitoring in Ozone Transport Corridors by Technical and Business Systems Inc. (T&B), and the second was the Barstow Halocarbon Study by the Desert Research Institute (DRI), sponsored by members of the Mojave Desert Air Pollution Transport Committee. Neither study is completed, but data and some preliminary results are available.

During the study period June through October 1995 only six exceedances (of the seven ozone exceedances for the 1995 season) of the state ozone standard were noted by T&B at Barstow. However, several non-exceedance days with "little or no transport" into Barstow and when the "morning and early afternoon (through 14 PST)" were "considered to be relatively unaffected by transport" occurred.

T&B collected data for eight special sites during the June through October study period. Six of these sites were on mountain tops or elevated areas to try to get a measure of ozone aloft above the desert floor. Ozone concentrations from these special sites were evaluated with other available data from the MDAB. Concentrations for days that were not typical transport days were grouped by category as defined in Group 1 and Group 2.

Group 1 days: "Under the assumption that transport is manifested by a peak after 14 PST, days were identified when no concentration after 14 PST exceeded the value at 14 PST. The following morning and early afternoon (through 14 PST) were then considered to have been relatively unaffected by transport into the Barstow area. There were 24 such days in the June-October 1995 data base.

Group 2 days: "Another group of days was identified by non-exceedances [days that did not exceed the state standard] at each of the following locations: Lancaster, Palmdale, Baldy Mesa, Hesperia and Phelan. The following morning/early afternoon period was again considered to be relatively unaffected by transport. There were 20 such cases in the June-October sample.

During the period February through October 1995, DRI monitored halocarbons just east of Barstow. In a similar manner to the T&B study, a third group of days was identified from the halocarbon study data from DRI. Days with no or very little increase in levels of methylchloroform or perchloroethylene near the times of ozone peaks were considered to have been relatively unaffected by transport into the Barstow area. During the same June-October sample period there were 38 days with very little increased halocarbons, 19 of which occurred on a Saturday or Sunday. The maximum morning/early afternoon ozone concentration was 69 ppb which occurred at 13 PST on 19 June 1995.

Each of the techniques described in **Part 2** demonstrates a method to identify what ozone concentrations the MDAB area can generate in a meteorological setting where transport was not involved. The concept here is that the MDAB can make a contribution in the absence of transport. The MDAB makes the same emissions input to ozone concentrations on those days when transport is involved. The emissions input may change the time of the ozone maxima in the MDAB, and may change the location of ozone maxima, but by their presence, the emissions make a significant contribution to ozone classifications in the MDAB.

5. Conclusions and Recommendations

The staff's analysis, the ARB's contract work, the Barstow Halocarbon Study, and the work of the Mojave Desert Transport Assessment Committee work all suggest that there are days when a combination of local emissions and transported ozone and/or precursors contribute to exceedances of the state ozone standard in the MDAB. Based on the 1995 database, the staff could not find evidence of additional exceedances which were caused solely by local emissions. The staff, therefore, recommends that the Board characterize transport into the eastern and southern MDAB as overwhelming on some days and significant on others, with inconsequential transport occurring less frequently than once per year.

H. San Joaquin Valley Air Basin to Mojave Desert Air Basin

1. Previous Assessments

The 1990 and 1993 transport assessments (see References 4, 6) classified the transport contribution from the San Joaquin Valley Air Basin (SJVAB) to the Los Angeles County portion of the Southeast Desert Air Basin (SEDAB) as overwhelmed and to the San Bernardino County portion of the SEDAB as inconsequential. In May 1996, the Board divided the SEDAB into two new air basins, and now the Los Angeles County and San Bernardino County portions of the SEDAB are part of the Mojave Desert Air Basin (MDAB). The previous assessments now apply to the MDAB, and, therefore, the SJVAB contribution to the MDAB was both overwhelming and inconsequential. A reassessment of this couple was done because of the availability of data from a new monitoring site in the town of Mojave in the Kern County portion of the MDAB and because of a special data collection effort that was conducted during the summer of 1995.

2. Analysis

During the summer of 1995 a special data collection effort was conducted to study transport into the Mojave Desert. (Table G-2 in Appendix G identifies the groups responsible for the data collection). The data were obtained through either U. S. EPA Aerometric Information Retrieval System (AIRS), Desert Research Institute (DRI), National Weather Service (NWS), or California Irrigation Management Information System (CIMIS).

Ozone monitoring in the town of Mojave in Kern County began in July of 1993. In 1995 the Mojave monitoring site experienced 24 violations of the state ozone standard. On August 2, the Mojave monitoring site measured its highest ozone concentration of the year, 12 pphm. All violations were reviewed.

Transport from the San Joaquin Valley into the Mojave Desert is initially seen at the Mojave monitoring site, located on the southeast side of the Tehachapi Pass. See Figure 8 for a map of the area. Hourly surface wind plots generally show winds blowing through the Tehachapi Pass from the San Joaquin Valley to the Mojave Desert on most days. An example of the temporal progression of the maximum ozone concentration from sites in Bakersfield to the Mojave site is shown in Table 7 for August 2, 1995.

With westerly winds throughout the day and the hourly progression of the ozone maximum from one downwind site to another as the day progressed, there is clearly surface transport from the San Joaquin Valley into the Mojave Desert. Other days examined showed similar patterns. These findings are consistent with Dr. Glen Cass'

Figure 8

[map of SJVAB to MDAB]

results (see Reference 14) which found that no significant emission sources exist in eastern Kern County to generate ozone; thus all violations are caused by overwhelming transport from the Southern San Joaquin Valley.

Table 7
Progression of Maximum Ozone Concentration
August 2, 1995

Site	Ozone Max Conc. (pphm)	Time of Max Conc. (PST)
Bakersfield-California	10	1100
Bakersfield-Golden State	11	1200
Edison	14	1300
Arvin	12	1400
Tehachapi	12	1600
Mojave	12	1700

3. Conclusions and Recommendations

Based on the staff's analysis and the work done by Dr. Glen Cass, the staff recommends that the transport from the SJVAB to western MDAB be classified as overwhelming on all days. Based on the staff's analysis of transport impacts on the San Bernardino County in the MDAB (see Section G of this report), the staff recommends that the 1993 classification of overwhelming transport from SJVAB to eastern and southern MDAB remain unchanged. Staff further recommends that the inconsequential classification be discontinued, based upon the finding that local episodes in the MDAB occur less frequently than once per year (as discussed for the previous couple).

I. South Coast Air Basin to Salton Sea Air Basin

1. Previous Assessments

The 1993 transport assessment (see Reference 6) concluded that the transport contribution from the South Coast Air Basin (SCAB) to Imperial County in the Southeast Desert Air Basin (SEDAB) was significant. In May 1996, the Board divided the SEDAB into two new air basins, and now Imperial County is part of the Salton Sea Air Basin (SSAB). The previous assessment now applies to the SSAB, and, therefore, the SCAB contribution to the ozone concentrations in the SSAB was significant. A reassessment of this couple was done because of a special data collection effort that was conducted in the summer of 1995 and because there has not been an assessment done of the impacts of the SCAB on the Riverside County portion of the SSAB.

2. Analysis

During the summer of 1995 a special data collection effort was conducted to study transport into the Mojave Desert. (Table G-2 in Appendix G identifies the groups responsible for the data collected during the Summer of 1995). The data were obtained through either U. S. EPA Aerometric Information Retrieval System (AIRS), Desert Research Institute (DRI), National Weather Service (NWS), or California Irrigation Management Information System (CIMIS).

A similar analysis to that done for the San Joaquin Valley was also applied to identify transport from the South Coast to the Salton Sea Air Basin. In 1995 the Palm Springs monitoring site measured 43 exceedances of the state ozone standard, and nine exceedances of the federal ozone standard. See Figure 9 for a map of the area. July 23 began a period of transport that lasted ten days. On July 24, the Palm Springs monitoring site measured its maximum ozone concentration of 16 pphm for the May through October ozone season. Hourly plots of the surface winds in the area show that winds were generally through the San Gorgornio Pass and into the Salton Sea Air Basin. Table 8 shows the temporal progression of the ozone maximum.

As indicated, progression of the maximum ozone concentrations starts out in the basin early in the afternoon and follows the westerly winds toward Banning as the afternoon progresses. Also, peak ozone increases as the plume picks up fresh emissions, until it reaches the Salton Sea Air Basin at Palm Springs where the plume is cut off from fresh emissions and the concentrations begin to dilute and drop.

Figure 9

[map of SCAB to SSAB]

Table 8
Progression of Maximum Ozone Concentrations
July 24, 1995

Site	Ozone Max Conc. (pphm)	Time of Max Conc. (PST)
Norco	12	1300
Rubidoux	15	1400
Perris	17	1500
Banning	18	1700
Palm Springs	16	1800
Indio	14	2000

3. Conclusions and Recommendations

Based on this analysis, the staff recommends that the transport from the SCAB to the SSAB be classified as overwhelming on some days. Based on the previous 1993 assessment, the staff recommends maintaining the finding of significant transport on other days.

J. San Francisco Bay Area Air Basin to San Joaquin Valley Air Basin

1. Previous Assessment

The ARB assessed ozone and ozone precursor transport to the San Joaquin Valley Air Basin (SJVAB) in two previous reports (see Reference 4, 6). The 1990 assessment concluded that in July and August of 1983 through 1986, 43 percent of the exceedance days were impacted by transport, 11 percent were nontransport, and the remainder could not be identified as either. It was concluded that the transport days were a mixture of significant and inconsequential transport. A case study, August 7-8, 1984, was simulated by a photochemical model. While these results of the model run were not reliable, they provide qualitative insight. The 1990 assessment was based on two exceedance days which were screened from routine data collected from 1986 through 1988. It was concluded that the ozone exceedance on June 2, 1994, was not impacted by transport (inconsequential) and that June 3, 1987, was significantly impacted by transport from the SFBAAB.

The second report focused on a case study done during the 1990 San Joaquin Valley Air Quality Study, specifically August 6. It was concluded from detailed surface and upper air data that overwhelming transport occurred, with the high levels of ozone recorded at Tracy and Crow's Landing directly related to emissions originating in the SFBAAB. That report also reviewed data obtained from the August 3 tracer release experiment conducted during the San Joaquin Valley Air Quality Study. It was concluded that pollutants emitted from the tracer release sites, Pittsburg and San Jose, were transported into the SJVAB but the degree of impact could not be quantified. The Board identified transport to the western portion of Stanislaus County from the SFBAAB as overwhelming.

2. Geographical Features

The California coastal mountain range separates the San Joaquin and Sacramento Valleys from the coastal regions. A significant break in that range occurs at the Carquinez Strait where the San Joaquin River flows into the San Francisco Bay. There exists a 30 km gap at 500 meters msl. This is important because the offshore marine layer is typically 400 to 700 meters thick. In most cases, the coastal range acts as a barrier. See Figure 10 for a map of the area. Another important feature is the Livermore Valley with various passes to the east. The Livermore Valley, which is oriented east-west, is a branch of the San Ramon Valley. The effective barrier height to the east of Livermore is approximately 300 meters above sea level (msl) with Altamont Pass as the principal gap at 243 msl.

The Santa Clara Valley is another pathway from the San Francisco Bay Area Air Basin (SFBAAB) to the San Joaquin Valley Air Basin (SJVAB). To the east of the head

Figure 10

[map of SFBAAB to SJVAB]

of the Santa Clara Valley is an effective barrier of 450 - 500 msl. The principal gap is Pacheco Pass at 410 msl.

3. General Meteorological Summer Conditions

Often during the summer a pressure difference exists between the Sacramento-San Joaquin Valleys and the coast due to a daytime thermal low. A temperature inversion above the offshore marine layer prevents flow from moving directly over the coastal ranges. The Carquinez Strait and the Altamont and Pacheco Passes can, however, experience westerly flows.

The magnitude of the gap and pass flows are dependent on the location and strength of the Pacific surface high pressure system, Gulf of Alaska 500mb low pressure system, the Central Valley thermal low pressure system, and to a lesser extent, the southwest desert thermal low pressure system. The Carquinez Strait and Altamont Pass wind flows usually split upon entering the Central Valley, with a northwesterly flow then moving into the San Joaquin Valley. The Carquinez Strait and Altamont Pass flows have been divided into four different San Francisco Bay Area categories; weak northwesterly, moderate-to-strong northwesterly, southerly, and bay outflow. Both northwesterly conditions account for 87% of all cataloged summer flows. Of that, about 69% of summer flows were from the San Francisco Bay Area and were diverted into the San Joaquin Valley (see Reference 1).

4. Analysis

This assessment of transport from the SFBAAB into the SJVAB is based on surface ozone and wind data from 1994 and 1995 for both basins. Initial review suggested overwhelming impact on four different days. However, a more detailed analysis revealed only two days in 1995 where SFBAAB caused overwhelming impact.

The routine data for the 1994-1995 period for the area of interest was sparse and limited to surface observations. Consequently, no conceptual model could be created for transport above the surface.

The first level of screening for possible transport during the 1994-1995 period is the selection of those days that had hourly ozone concentrations which exceeded the State standard for stations nearest the border between the two air basins. For the SJVAB, that is Stockton, Tracy and Crow's Landing; for the SFBAAB, that is Bethel Island, Livermore and Gilroy. That last station unfortunately does not have a counterpart in the western area of the SJVAB, so it will not be used. Table 9 shows the exceedance days in 1994 and 1995.

The second step was the review of the ARB's objective surface flows at 1600 PST. Days with significant flow from the southern portion of the Sacramento Valley and/or the Stockton area to the Crow's Landing and Tracy area were eliminated from further consideration as possible transport impact days. The other days show surface flow either through the Carquinez Strait or Altamont Pass and extending to the Tracy and Crow's Landing site.

Table 9

OZONE (pphm)				
	Bethel Island	**Crows Landing**	**Tracy**	**Livermore**
08-17-94	10.2	10.8	N/A	8.7
09-05-94	8.3	10.1	N/A	10.8
09-16-94	10.3	8.2	10.7	10.5
06-26-95	6.1	11.9	11.1	9.8
07-15-95	8.4	9.7	8.8	9.8
07-16-95	8.8	6.9	12.4	12.1
07-27-95	12.4	11.0	9.9	15.5
08-01-95	8.1	9.6	8.7	11.4
08-09-95	8.5	9.9	10.9	9.5
08-14-95	10.7	8.7	10.0	13.4
08-20-95	7.3	8.9	11.5	13.0
09-07-95	12.8	9.3	10.3	7.8
09-19-95	11.4	3.7	10.0	11.8

The third step was to eliminate from further consideration those days where the peak ozone concentration exceeded the Expected Peak Day Concentrations (EPDCs) (see Reference 9) and were therefore considered extreme concentrations rather than violations. Three of the four remaining episodes had wind data from the Tracy site. In all three cases, the wind shifted from a northerly flow to a westerly flow during the afternoon within a span of an hour. In two of those cases, this shift fell between two ozone concentration peaks recorded at Tracy. This suggests that before the wind shift, polluted air had come through the Carquinez Strait and afterwards, polluted air had come through the Livermore Valley.

In all four cases, the increase of ozone concentrations during the morning at both Tracy and Crow's Landing was rapid enough to suggest two other possible sources of ozone besides direct transport from either through the Livermore Valley or the Carquinez Strait. One mechanism could have been the downward fumigation of ozone from aloft. The other could have been that ozone precursors were in the area or just upwind. As the morning temperatures increased and there was more sunlight, more ozone was formed.

Unfortunately there are no data for wind or ozone aloft to establish ozone fumigation and its origin. However, aircraft ozone data collected from August 3 through 6, 1990 during the San Joaquin Valley Air Quality Study (SJVAQS) does show morning ozone concentrations between 6 and 10 pphm in the layer from 200 msl through 1500 msl. Morning fumigation did appear to have been important during that field study at Tracy and Crow's Landing.

A detailed discussion of the analysis of the four episodes can be found in Appendix G-3.

5. Additional Study Methods

The SARMAP modeling system is used to investigate transport of ozone and its precursors from the SFBAAB and Sacramento to San Joaquin Valleys. To investigate this transport, emissions were set to zero first in the Bay Area and Sacramento to evaluate their transport impact on the San Joaquin Valley. Next the San Joaquin Valley's emissions were set to zero to evaluate its own contribution to ozone concentrations. Effects of ozone concentrations were assessed by examining model results for geographical areas in which the ambient ozone standard would be exceeded under these scenarios.

The SARMAP modeling system consists of the SARMAP Meteorological Model (SMM), the Emissions Modeling System (EMS), and the SARMAP Air Quality Model (SAQM). The modeling domain covers central California which includes the San Joaquin Valley, the Bay Area, and the Sacramento area. The modeling system is applied to simulate the August 3-6, 1990, ozone episode in the study domain. An extensive model performance evaluation is performed using the rich database of the 1990 San Joaquin Valley Air Quality Study. The modeling system met the model evaluation criteria of both the US-EPA's and the ARB. Details of the SARMAP Modeling System can be found in References 15, 19, and 20.

The model simulations for August 3-6, 1990, indicated that high ozone concentrations in the SJVAB were due to varying combinations of local and transported emissions. The greatest transport impact was seen in the northern Valley where peak ozone concentrations were reduced by about one-third when Bay Area and Sacramento emissions were zeroed. Peak ozone concentrations in the central and southern San Joaquin Valley were primarily attributable to emissions from within the SJVAB (see Reference 2).

6. Conclusions and Recommendations

The August 1, 1995, and August 9, 1995, ozone exceedances at Tracy and Crow's Landing can be attributed solely to transport from the SFBAAB. The peak ozone value at Crow's Landing on August 1 can be attributed to emission sources near the Carquinez Strait and the peak ozone value at Crow's Landing on August 9 can be attributed to flow from the Livermore Valley.

Based on the defined criteria and analyses, the staff concludes that transport of ozone and ozone precursors from the SFBAAB overwhelmingly impacted Crow's Landing on August 1 and August 9, 1995. Since this agrees with the previous assessment, the staff recommends no change to the transport assessment of this transport couple.

K. San Francisco Bay Area to Broader Sacramento Area

1. Previous Assessments

In 1993 (see Reference 6), the ARB concluded that transport from the San Francisco Bay Area Air Basin (SFBAAB) to the Broader Sacramento Area (BSA) be characterized as inconsequential on some days and significant on other days. Additionally, the Board concluded that San Francisco Bay Area Air Basin causes overwhelming transport to the most westerly portions of the BSA.

2. Transport Working Group

At the June 1993 Hearing, the Board directed the ARB staff to work more directly with districts' staffs to assess transport. A result of this direction was the formation of the San Francisco Bay Area to Broader Sacramento Area Transport Working Group. This group comprised staff from the Bay Area, Sacramento Metropolitan, and Yolo/Solano Air Quality Management Districts and the ARB.

The purpose of the working group was to identify days to analyze and then to share data, analyses, and recommendations pertinent to the chosen days. The working group members met every two to four months for approximately two years.

3. Analysis

All 1994 and 1995 exceedance days were first screened to determine which were violations and which were extreme concentrations using the Expected Peak Day Concentration (EPDC) (see Reference 9). The violation days (Tables F-3 and F-4 in Appendix F) were then screened for worst case scenarios, or those which would depict overwhelming transport and inconsequential transport. Of these days, an in-depth analysis was performed by the ARB and the Bay Area staffs and was reviewed by the transport working group. Eight days were examined to represent inconsequential transport. These days are: June 10, July 7 and 12-14, and August 5, 1994, and June 24 and July 27, 1995 (see Table 10). June 24, 1995 is a unique day because it clearly depicts inconsequential transport at Folsom and overwhelming Bay Area transport at Vacaville. See Figure 11 for a map of the area.

The Bay Area and the ARB staffs' analyses were used for these assessments. The Bay Area's ozone concentration animation was used for June 24, 1995. The animation is a two dimensional motion picture depicting aerial coverage of ozone concentrations. In this animation, a model incorporated wind speeds and directions and interpolations of ozone concentrations. The presentation was a very effective way to represent the movement of an ozone plume. The ARB analyses included: CalTech Winds2D backward and forward trajectories, time series showing ozone trends of significant SFBAAB and

BSA sites, spatial distributions of daily maximum ozone values, and spatial distributions of the hour of maximum ozone concentration. Other considerations for each of the analyzed days included data analyses such as the surface wind flow patterns (incorporated in the trajectories), wind flow patterns aloft, ozone concentrations aloft (when available), the character of the exceedance (abrupt, gradual, early, or late), and the duration of the exceedance. Overall, the analyses combined to provide a 24-hour history along the transport route.

Most violation days had similar characteristics. Typically, ozone concentration peaks rose simultaneously in the Bay Area and the Broader Sacramento Area. Also, rural areas between the Bay Area and Sacramento metropolitan area had lower ozone concentrations that were closer to or below the state ozone standard. In some cases, the hour of maximum ozone was earlier in the BSA than in the SFBAAB. This is more typical of a local episode than of a transport episode. These characteristics, combined with results of more detailed analyses mentioned in the previous paragraph, are indicators of a locally generated violation.

In the case of June 24, 1995, it was apparent that there were two separate wind flow regimes affecting different parts of the BSA simultaneously. That portion located more closely to the center of the valley underwent near stagnant atmospheric conditions with light/variable or light/northerly wind flow. The western portion of the BSA was undergoing stagnant conditions with light/variable or light/southwesterly wind flow. Atmospheric conditions in the Bay Area had also been stagnant with unusually high ozone concentrations. As the marine air began to displace the stagnant, polluted air mass and move it toward the east-northeast, an ozone front, effectively, passed over Vacaville and caused ozone exceedances. This phenomenon shows up well in the Bay Area’s ozone concentration animation.

4. Conclusions and Recommendation

The staff recommends that the previous transport classifications remain unchanged. The analyses which were used on the 1994 and 1995 data do not conclude different results than those already established for this couple. Therefore, SFBAAB to BSA ozone transport should be classified as overwhelming (Solano County only), significant, and inconsequential.

Table 10
Broader Sacramento Area
Ozone Violation Days
Assessed as "Inconsequential"

DATE	OZONE CONC. (ppb)	SITE
06-10-94	136	Folsom
07-07-94	126	Folsom
07-12-94	142	Folsom
07-13-94	140	Folsom
07-14-94	133	Folsom
08-5-94	143	Folsom
06-24-95	100	Folsom
06-27-95	125	Folsom

Figure 11

[map of SFBAAB to BSA]

L. Broader Sacramento Area to Upper Sacramento Valley

1. Previous Assessment

In 1993 (see Reference 6), the ARB concluded that Upper Sacramento Valley (USV) transport from the Broader Sacramento Area (BSA) was characterized as overwhelming, significant, and inconsequential. Transport from the BSA was found to be overwhelming to the sites in Willows (Glenn County), Yuba City (Sutter County), and Arbuckle (Colusa County). Transport was found to be inconsequential to the sites in Redding and Anderson in Shasta County. Significant transport occurred at Colusa (Colusa County), Willows, Red Bluff (Tehama County), and Yuba City.

2. Transport Working Group

In 1993, the Board directed the ARB staff to work more directly with the districts' staffs to assess transport. A result of this direction was the formation of the Bay Area/Broader Sacramento Area to Upper Sacramento Valley Transport Working Group. This group comprised staff from the Bay Area, Sacramento Metropolitan, Shasta, Feather River, and Yolo/Solano Air Quality Management Districts, the Butte, Colusa, Tehama, and Glenn County Air Pollution Control Districts, Sacramento Valley Basinwide Control Council, Sonora Technology, Inc. (STI - under contract with Shasta County) and ARB.

The purpose of the working group was to identify days to analyze and then to share data, analyses, suggestions, and recommendations pertinent to the chosen days. The working group members met every two to four months for approximately two years.

3. Analysis

All 1994 and 1995 exceedance days were first screened to determine which were violations and which were extreme concentrations using the Expected Peak Day Concentration (EPDC) (see Reference 9). The working group looked at all of these violation days (see Table 11) with the focus on analyzing for an inconsequential transport episode because significant and overwhelming transport episodes are already well documented. The working group did not identify any days in which the preponderance of data indicated inconsequential transport. The working group also reviewed data for overwhelming and significant transport. The assessment classification of all violation days can be found in Table 11. See Figure 12 for a map of the area.

The ARB staff and STI analyses were used for these assessments. Data collected by STI for their contract with Shasta County filled most of the data voids normally present due to lack of upper air data. The ARB staff analyses included: CalTech Winds2D backward and forward trajectories, time series (ozone concentrations plotted on a graph chronologically by hour) showing ozone trends of significant Bay Area, Broader

Sacramento Area, and Upper Sacramento Valley sites, spatial distributions of daily maximum ozone values, and spatial distributions of the hour of maximum ozone concentration. Other considerations for each of the analyzed days included data analyses such as the surface wind flow patterns (incorporated in the trajectories), wind flow patterns aloft, ozone concentrations aloft (when available), the nature of the exceedance (abrupt, gradual, early, or late), the duration of the exceedance, recent agricultural burning practices, and the emission inventory comparisons. Each analysis was a reconstruction of the 24- to 48-hour atmospheric and pollutant history along the transport route.

Most violation days in which surface analyses showed the slightest possibility of an inconsequential episode were preceded, approximately 4 to 18 hours earlier, by elevated ozone concentrations at Sutter Buttes or Tuscan Buttes. The transport mechanisms in the USV are complex, but it is evident that there is transport taking place at the surface and aloft. The transport aloft normally affects the northern USV sites, while surface transport normally affects the southern USV sites closer to the metropolitan Sacramento area.

It has been determined that there is not any notable transport contribution from the Bay Area to the USV. When air flow comes from the Bay Area, through the Carquinez Strait, and then through the BSA, the associated pollutants are found to be diluted and aged greatly. Additionally, they are then masked by the pollutants from the metropolitan area of Sacramento. Therefore, the only upwind area identified as impacting ozone concentrations in the USV is the BSA.

4. Conclusions and Recommendation

Based on the recent analyses, the staff recommends that the USV transport classification of inconsequential be discontinued and that the classification be changed to overwhelming and significant only. The staff determined that ozone violations are classified as significant transport at Redding, Willows, Yuba City, and Red Bluff on some days; on other days, ozone violations were determined to be classified as overwhelming transport at Yuba City, Willows, Colusa, Redding, Chico, and Red Bluff.

Figure 12

[map of BSA to USV]

Table 11
1994-95 Ozone Violations
Upper Sacramento Valley

Basin	Site	Date	Max Ozone (ppb)	Hour Max Ozone	Assessments*
SV	Redding-Health Dept Roof	06/20/94	98	14	S
SV	Redding-Health Dept Roof	06/21/94	101	12	
SV	Redding-Health Dept Roof	06/22/94	97	11	
SV	Yuba City-Almond Street	06/27/94	98	11	O
SV	Willows-E Laurel Street	06/30/94	96	15	S/O
SV	Yuba City-Almond Street	07/08/94	111	16	O
SV	Colusa-Fairgrounds	07/08/94	100	16	
SV	Redding-Health Dept Roof	07/08/94	95	11	
SV	Yuba City-Almond Street	07/12/94	96	14	O
SV	Yuba City-Almond Street	07/13/94	98	16	
SV	Chico-Manzanita Avenue	07/14/94	95	13	
SV	Yuba City-Almond Street	07/15/94	98	13	
SV	Yuba City-Almond Street	07/28/94	103	15	S/O
SV	Red Bluff-Walnut Street	07/28/94	100	13	
SV	Redding-Health Dept Roof	07/29/94	101	11	
SV	Yuba City-Almond Street	07/29/94	98	16	
SV	Yuba City-Almond Street	08/17/94	107	16	O
SV	Colusa-Fairgrounds	08/17/94	101	17	
SV	Red Bluff-Walnut Street	08/18/94	100	12	
SV	Colusa-Fairgrounds	08/20/94	100	15	O
SV	Yuba City-Almond Street	09/17/94	99	15	S
SV	Yuba City-Almond Street	09/18/94	106	17	
SV	Yuba City-Almond Street	09/19/94	104	16	
SV	Yuba City-Almond Street	09/22/94	97	14	S
SV	Redding-Health Dept Roof	06/30/95	99	15	S/O

Table 11 (con't)
1994-95 Ozone Violations
Upper Sacramento Valley

Basin	Site	Date	Max Ozone (ppb)	Hour Max Ozone	Assessments*
SV	Yuba City-Almond Street	07/28/95	101	12	S/O
SV	Yuba City-Almond Street	08/01/95	102	15	O
SV	Colusa-Fairgrounds	08/01/95	95	14	O
SV	Red Bluff-Walnut Street	08/02/95	100	10	O
SV	Yuba City-Almond Street	08/03/95	99	12	O
SV	Red Bluff-Walnut Street	08/04/95	100	11	O
SV	Red Bluff-Walnut Street	08/22/95	100	14	S
SV	Tuscan Butte	09/01/95	100	14	S/O
SV	Yuba City-Almond Street	09/08/95	95	14	S/O
SV	Red Bluff-Walnut Street	09/09/95	100	14	S/O
SV	Red Bluff-Walnut Street	09/10/95	100	15	S/O
SV	Colusa-Fairgrounds	09/11/95	95	16	S/O
SV	Red Bluff-Walnut Street	09/13/95	100	13	O
SV	Yuba City-Almond Street	09/13/95	96	16	O
SV	Tuscan Butte	09/13/95	96	17	O
SV	Colusa-Fairgrounds	09/13/95	95	15	O
SV	Yuba City-Almond Street	09/14/95	101	16	O
SV	Red Bluff-Walnut Street	09/14/95	100	14	O
SV	Red Bluff-Walnut Street	09/15/95	100	14	O
SV	Yuba City-Almond Street	09/19/95	98	15	S
SV	Colusa-Fairgrounds	09/19/95	96	13	S
SV	Yuba City-Almond Street	09/20/95	109	13	S

*O=Overwhelming, S=Significant, I=Inconsequential

M. South Coast Air Basin to San Diego Air Basin

1. Previous Assessment

The 1993 transport assessment (see Reference 6) classified the transport impacts from the South Coast Air Basin (SCAB) on the San Diego Air Basin (SDAB) as overwhelming on some days, significant on others, and inconsequential on still others.

2. Analysis

The analysis for this couple continues to be a joint ARB/District staff effort (see References 10, 11, 12, 13). Daily, the San Diego County Air Pollution Control District (SDCAPCD) staff reviews meteorology and air quality data to determine the contribution of transport from the SCAB. The ARB staff reviewed the SDCAPCD staff's procedures and analyses on days of special interest. The studies continue to show that transport from the SCAB to be overwhelming, significant, and inconsequential to state ozone standard violations in the SDAB, depending on the meteorology of a specific day and location. See Figure 13 for a map of the area. Table 12 identifies the number of days in each classification during the last three years.

Table 12
State Ozone Exceedance Days by Transport Classification
San Diego Air Basin
1993-95

Classification	1993	1994	1995
Inconsequential	39	43	43
Significant	31	29	48
Overwhelming	20	7	5
Total Ozone Exceedance Days	**90**	**79**	**96**

3. Conclusions and Recommendations

The staff is not aware of any information that would change the 1993 ARB findings. Therefore, the staff recommends the previous classifications remain unchanged. Transport from the SCAB to the SDAB should continue to be classified as overwhelming on some days, significant on some other days and inconsequential on others.

Figure 13

[map of SCAB to SDAB]

N. South Coast Air Basin to South Central Coast Air Basin

1. Previous Assessment

The 1990 transport assessment (Reference 4) classifies transport from South Coast to South Central Coast as significant on certain days, and inconsequential on other days. A reassessment was necessary because the previous assessment was based on photochemical modeling simulations using the Carbon Bond II chemical mechanism which is now outdated. In addition, there have been nine episodes with high concentrations (exceeding the national ozone standard) between 1994 and 1996, several of which were recorded at a new monitoring site at Las Flores Canyon. See Figure 14 for a map of the area.

2. Analysis

Recent observations indicate nine high ozone episode days in Santa Barbara County in the last three years, 1994-1996. The peak ozone concentrations during these episodes ranged from 125 to 143 ppb. Table 13 identifies these high ozone episodes by location and time of daily maximum concentration.

On these days, the vertical structure of the atmosphere was characterized by a surface marine layer of 200-300 m and an inversion layer extending up to 1000 m. Wind regimes in the marine layer are often different than in the inversion layer aloft. There are at least two possible transport mechanisms, one at the surface in the marine layer and a second aloft in the inversion layer.

Transport within the marine layer would be indicated if, in the South Coast Air Basin, elevated ozone concentrations are observed along the coastal regions coupled with offshore flow in the afternoon or evening preceding the episode. On the episode day, winds from the south or southeast would be observed in Santa Barbara County.

Conditions indicative of transport within the marine layer were observed during the May 1, 1996 episode. In the South Coast monitoring sites along the coast reported elevated ozone concentrations of 100 ppb at Costa Mesa and 110 ppb at West L.A. and Hawthorne. Late afternoon and evening winds in the South Coast were offshore on the previous day. Meanwhile, winds at San Nicolas Island and along the Santa Barbara coast were south to southeasterly on the episode day.

Sometimes a widespread pattern of elevated ozone concentrations is seen with transport within the surface marine layer. Often a Catalina Eddy is indicative of surface transport from the South Coast to Santa Barbara. An example is the October 4, 1995 episode where the 0400 PST and 1000 PST surface winds indicated the presence of a

Catalina Eddy. Peak ozone concentrations were observed at El Capitan Beach with 135 ppb and at Las Flores Canyon with 143 ppb.

Transport aloft can be determined by upper-level wind data and large scale meteorological phenomena. Frequently the position of high and low pressure systems at 1500 m (850 mb) can be indicative of wind patterns. Winds circulate clockwise around high pressure and counter clockwise around low pressure. If high pressure is east of the area, winds aloft would have a southerly component that could draw ozone layers aloft into the region. This pattern characterizes the episodes of August 13, 1994, September 6, 1995, and May 11, 1996.

Ozone can remain aloft longer than at the surface because the ozone plume is often trapped into a very stable inversion layer, which limits dispersion. Also, there are no sources of nitric oxides aloft to transform ozone into other chemical species. The ozone layer aloft acts as a reservoir that is only detrimental if there is a mechanism to bring ozone down to the surface. One mechanism is surface heating that can induce sufficient vertical mixing to extend into the inversion layer. Often an isolated exceedance at a monitoring station that is at higher elevation than surrounding stations is indicative of a situation of ozone transported aloft.

Ozone exceedances on eight of the nine episode days occurred at Las Flores Canyon, inland from El Capitan Beach. The Las Flores Canyon monitor is located at 160 m above sea level which typically puts it near the base of a very strong inversion. On June 23, 1994, August 12, 1994, October 3, 1995, and May 12, 1996, exceedances were observed at Las Flores Canyon, but not at El Capitan. Transport aloft was indicated by southeasterly winds above the surface marine layer and sufficient surface heating on these days, and elevated concentrations in the South Coast on the previous day.

Due to the limitation of available data, it is difficult to quantify how much of the observed concentrations are due to local sources and how much is due to transport. Certainly ozone transported into Santa Barbara county passes over sources in Ventura County, onshore sources in Santa Barbara County, and offshore sources. All these sources interact to produce the local component of the observed concentrations. However, the elevated ozone concentrations in upwind source regions suggest a significant contribution of transport on these days.

3. Conclusions

All ozone exceedances greater than 124 ppb, from 1994-1996 inclusively, seemed to be related to transport of ozone from outside Santa Barbara County. Some episodes were tied to transport at the surface, while others tapped into a reservoir of ozone that was transported within the inversion layer. A lot of inferences were made from the Vandenberg soundings, surface wind patterns, air quality data, and temperature data.

However, the preponderance of available data did indicate that all nine episode days listed in Table 13 can be classified as shared transport days.

Table 13
Peak Ozone Concentrations
Santa Barbara County
1994 - 1996

Date	**Location**	**Max. O3 (ppb)**	**Peak Hour (PST)**
6/23/94	Las Flores Canyon	125	1700
8/12/94	Gaviota West	127	1500
	Gaviota East	133	1500
	Gaviota GTC Site C	134	1500
	Las Flores Canyon	142	1600
8/13/94	Goleta	127	1300
	Carpenteria	129	1300
9/6/95	Gaviota GTC Site C	125	1400
	Las Flores Canyon	127	1200
	El Capitan Beach	130	1400
10/3/95	Las Flores Canyon	126	1300
10/4/95	El Capitan Beach	135	1400
	Las Flores Canyon	143	1500
5/1/96	Carpenteria	128	1400
	Goleta	128	1300
	Las Flores Canyon	133	1500
5/11/96	Las Flores Canyon	125	1500
	Gaviota GTC C	130	1400
5/12/96	Las Flores Canyon	134	1700

Figure 14

[map of SCAB to SCCAB]

CHAPTER IV

IMPACT ANALYSIS

A. Public Health, Welfare, And Environmental Impacts

The adoption of the proposed amendments to ozone transport identification and mitigation is not expected to result in any adverse impacts on public health, welfare, and environment. The proposed amendments would omit the inconsequential ozone transport classification from the Broader Sacramento Area to Upper Sacramento Valley couple. This amendment is not expected to cause adverse impacts because it does not excuse either the upwind or the downwind area from mitigation of state ozone exceedances.

Also in the proposed amendments are several transport couple redefinitions due to the Board's May 1996 decision to divide the Southeast Desert Air Basin into the Mojave Desert Air Basin and the Salton Sea Air Basin (although as of the date of publication of this report, these air basin changes have not been approved by the Office of Administrative Law). The South Coast to Southeast Desert ozone transport couple is now South Coast to Mojave Desert and South Coast to Salton Sea; San Joaquin Valley to Southeast Desert is now San Joaquin Valley to Mojave Desert; and Mexico to Southeast Desert is now Mexico to Salton Sea. Since these couple redefinitions do not change the mitigation responsibilities, it is not expected to cause adverse impacts.

The proposed amendments also identify a new transport couple, the San Joaquin Valley Air Basin to the North Central Coast Air Basin. Additionally, the proposed amendments enlarge the downwind areas of the Broader Sacramento Area to include Amador and Calaveras counties. These amendments are not expected to cause adverse impacts since the identification of upwind/downwind areas does not exclude exceedances from mitigation, but rather assigns the mitigation to the responsible area or areas for effective control strategies. The requirement on the upwind areas to provide for attainment in downwind areas overwhelmed by transported pollutants may result in adoption of additional controls in the affected upwind areas. The environmental impacts of such control measures will be addressed in the formal planning and rule making process in the upwind areas.

The staff expects that the implementation of the required measures in upwind areas will have positive environmental impacts in the downwind and in most upwind areas. The mitigation requirements will provide for more expeditious attainment of the ozone standard in downwind areas by reducing emissions of ozone precursors that contribute to the poor air quality in downwind areas.

B. Economic Impacts

The Board's Executive Officer has determined that the proposed transport assessments and transport couple redefinitions will not create costs or savings (as defined in Government Code section 11346.5(a)(6)) to any state agency or in federal funding to the state, costs or mandate to any local agency or school district whether or not reimbursable by the state pursuant to part 7 (commencing with section 17500) Division 4, Title 2 of the government code, or result in other nondiscretionary costs or savings to local agencies.

The proposed transport assessments and transport couple redefinitions require the assignment of mitigation responsibility of exceedances impacted by transported pollutants. The transport assessments more effectively assign mitigation responsibilities to the area which will have the best probability of successfully reducing the ozone concentrations in the downwind areas. The Executive Officer does not anticipate that the amendments will result in additional controls statewide, but merely change the distribution of emission controls from the downwind areas to the upwind areas. Ozone exceedances are already occurring and the California Clean Air Act requires that districts adopt emission control measures to attain the standard. If an upwind area has to do more because of the impacts of transported pollutants to a downwind area, then the downwind area may have to do less, perhaps much less because the downwind controls would be ineffective in some transport situations.

The expanded responsibility of the Broader Sacramento Area (BSA) for attainment in the central portion of the Mountain Counties may create costs to, and impose a mandate upon, the Broader Sacramento Area, as the upwind area, to continue to mitigate the impact of their emissions on downwind areas. The districts in the Broader Sacramento Area may need to adopt additional control measures in order to mitigate the impact of their emissions on the new downwind area. However, the staff does not believe the districts will need to adopt more measures than have already been scheduled. The Broader Sacramento Area is already responsible for the attainment of other downwind areas and has scheduled control measures accordingly. These control measures and strategies which are designed to mitigate the BSA's impacts on already identified downwind areas (the northern portion of the Mountain Counties and the Upper Sacramento Valley) should be sufficient to mitigate the impacts on the central portion of the Mountain Counties. Such control measures would be proposed as part of districts' air quality attainment plans for ozone under the California Clean Air Act, and would be adopted by the districts pursuant to their normal regulatory adoption procedures which include the consideration of economic and environmental impacts resulting from the implementation of new control measures. (See Health and Safety Code sections 40725-40728.5)

The identification of the San Joaquin Valley Air Basin as an upwind contributor to ozone exceedances in the North Central Coast Air Basin and amendments to the mitigation regulation requires the San Joaquin Valley Air Basin to adopt best available retrofit control technology. This is not expected to create additional costs or mandates because the San Joaquin Valley Air Basin is already required to adopt these measures since the air basin was previously identified as an upwind contributor.

The Executive Officer also has determined, in accordance with Government Code section 11346.5(a)(8), that adoption of the proposed amendments will not have a significant adverse economic impact on businesses, including the ability of California businesses to compete with businesses in other States. Finally, the Executive Officer has determined that there will be no potential cost impact, as defined in Government Code section 11346.5(a)(9), on private persons or businesses directly affected as a result of adopting the proposed amendments.

In accordance with Government Code section 11346.3, the Executive Officer has determined that adoption of the proposed amendments will not affect the creation or elimination of jobs within the State of California, the creation of new businesses or the elimination of existing businesses within California, or the expansion of businesses currently doing business within California.

Before taking final action on the proposed amendments to the regulations, the Board must determine that no alternative considered by the agency would be more effective in carrying out the purpose for which the action is proposed or would be as effective or less burdensome to affected private persons than the proposed action (Government Code section 11346.14(b)).

C. Alternatives to the Staff's Proposed Amendments

State law explicitly requires the ARB to assess the contribution of upwind emissions to downwind ozone concentrations based on the preponderance of evidence, and to establish transport mitigation requirements that are commensurate with those contributions (Health and Safety Code section 39610(b)). This mandate precludes consideration of the "no action" alternative. The identification process leaves little room for alternatives. Each transport couple is accompanied by discussion of the basis for the identification. Implicit in these discussions is the consideration of possible alternative transport assessment classifications. Various alternatives to the mitigation requirements were considered by the staff when the regulation was revised in March 1993. This proposal does not change the requirements; it only amends the regulation to assign additional responsibilities to previously identified upwind areas based on new findings of overwhelming and significant transport.

CHAPTER V

Recommendations for Further Research

Not all the questions about transport of ozone and ozone precursors have been answered with this transport assessment. Through the process of putting this update together, the staff has identified areas that need further research. This includes data collection to understand and assess transport aloft, assessment of potential new couples, photochemical modeling to quantify upwind contributions, data collection along transport routes, analyses of existing data from field studies, and enhancing the monitoring network.

A. Transport Aloft

Ozone formed during summer daytime hours disperses throughout the mixed layer which can be several thousand feet deep. Most of this ozone becomes separated from the mixed layer when nighttime inversions form. The presence of these ozone “reservoirs” aloft has been revealed by aircraft measurements made during intensive field studies in the South Coast, Southeast Desert, North Central Coast, San Francisco Bay Area, San Joaquin Valley, and Sacramento Valley Air Basins. There has been some discussion presented in this report concerning analysis of upper-level winds and air quality, but most of the transport analyses are based on surface transport because of the lack of data aloft. It is likely that upper-level transport may influence the overall transport of ozone and precursors throughout California. While there is considerable upper-level wind and air quality data available for use in transport studies in some areas of the state for limited time periods, the lack of upper air data is a major problem in assessing ozone transport for most areas of the state.

Photochemical grid models use three-dimensional wind fields and, therefore, are able to use all available upper-level wind and air quality data for the episodes modeled. When models are not available, techniques for analyzing upper-level wind and air pollutant data need to be reviewed and if needed, new techniques developed. Past studies of air quality aloft have been done by outfitting aircraft with instrumentation or placing monitors on towers. Siting monitors in high terrain also offers a way to measure upper-level air quality when the site is not affected by upslope winds.

Remote sensing studies may offer several advantages over currently used methods such as aircraft and tower monitoring and the use of high terrain sites. Remote sensing uses equipment which may be left unattended and which has the capability to provide continuous measurements. Aircraft can cover large upper-level volumes but the measurements only represent a snapshot picture. Towers are ideal for longer measuring times of the vertical picture of the atmosphere above a point. High terrain sites are also single point measurements but can also record air quality over long time periods. Remote sensing may be able to define upper-level air quality for a large volume as well as for longer time periods.

Specifically, and for example, data aloft measurements have been emphasized in all phases of transport assessment from the South Coast to the Mojave Desert and from the San Joaquin Valley to the Mojave Desert. Using the preponderance of data as suggested in the California Clean Air Act does not always give complete understanding when there is a void of critically necessary data. The staff recommends allotting resources to help fill this void for better, more scientific future transport assessments statewide.

B. Specific Couples for Transport Research

The staff recommends exploring the potential for transport from the San Diego Air Basin to the Salton Sea Air Basin. Additionally, further research is warranted for ozone transport from the South Coast Air Basin to the Great Basin Valleys Air Basin. In the latter couple, emphasis should be placed on the Death Valley National Park monitoring site because ozone transport assessments have already been established for the Mammoth monitoring site. The ARB staff also recommends more research be conducted for the San Joaquin Valley to North Central Coast transport couple.

C. Photochemical Grid Modeling

The staff was not able to quantify the upwind transport contribution to the downwind areas in the 1990 or in the 1993 assessments because the modeling tools and data sets were not available. Likewise, the staff was not able to quantify contributions in this current assessment. However, the staff believes that quantification is ultimately needed to equitably divide the mitigation responsibilities between the upwind and downwind areas.

Future studies are planned to study ozone-producing mechanisms. These studies will include the five air basins in southern California: South Coast, Mojave Desert, Salton Sea, San Diego, and South Central Coast. A benefit from these studies will be a wealth of meteorological and air quality data which will be used for transport assessment.

D. Data Analysis

Innovative analytical techniques may be added to the data analysis techniques currently used for transport assessment. The staff recommends that any new methods be further evaluated in order to be incorporated, where appropriate, into future transport studies.

Additionally, even though there are some trajectory models available now, they need refining to incorporate wind flows in complex terrain, such as in the foothills of the

Sierra Nevada and the Mountain Counties Air Basin. These tools would meet many other ARB needs, as well.

Data analysis techniques also need to be expanded to include more parameters than just meteorology and ozone. Understanding the complexity of ozone production and ozone transport requires more detailed analyses of such parameters including, but not limited to, volatile organic compound speciation and the impact of NOx on downwind transport receptor areas.

Researching nonstandard methods of data analysis may also be helpful. For instance, exploring the daily minimum ozone values may provide some insight in understanding carryover from the previous day. This phenomenon is also very complex as the principle of NOx scavenging is taken into consideration along with emission inventories of local areas.

E. Enhanced Monitoring

The staff recommends increased monitoring of meteorology and ozone concentrations to improve the data available for analyses. Increased monitoring is needed for studying spatial variability of ozone along transport routes. The staff and research contractors have identified transport corridors from one area to another. Some of these corridors lack sufficient meteorological and air quality data for a complete transport assessment. The staff recommends that more meteorology and air quality monitors be sited in these transport corridors particularly on ridges that sometimes act as barriers to the transport of pollutants. Monitors could be placed in areas such as, but not limited to, Grapevine between the San Joaquin Valley and South Coast Air Basins, Santa Catalina Island between the South Coast and San Diego Air Basins, Channel Islands between the South Coast and South Central Coast Air Basins, and in the Fairfield/Vacaville hills between the San Francisco Bay Area Air Basin and the Broader Sacramento Area.

In addition to increased monitoring sites, the staff recommends increasing monitoring parameters in some locations. Specifically, staff recommends measuring temperature, dew point, and wind at both Tracy and Crows Landing.

Staff also recommends the installation of additional wind profilers in Santa Barbara County, perhaps at El Capitan and an inland site. These profilers provide a three-dimensional cross section of winds and temperatures which is helpful for characterizing an ozone plume.

CHAPTER VI

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APPENDIX A

TEXT OF HEALTH AND SAFETY CODE SECTION 39610

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Section 39610

(a) Not later than December 31, 1989, the state board shall identify each air basin, or subregion thereof, in which transported air pollutants from upwind areas outside the air basin, or subregion thereof, cause or contribute to a violation of the state ambient air quality standard for ozone, and shall identify the district of origin of the transported air pollutants based upon the preponderance of available evidence. The state board shall identify and determine the priorities of information and studies needed to make a more accurate determination, including, but not limited to, emission inventories, pollutant characterization, ambient air monitoring, and air quality models.

(b) The state board shall, in cooperation with the districts, assess the relative contribution of upwind emissions to downwind ozone ambient air pollutant levels to the extent permitted by available data, and shall establish mitigation requirements commensurate with the level of contribution. In assessing the relative contribution of upwind emissions to downwind ozone ambient air pollutant levels, the state board shall determine if the contribution level of transported air pollutants is overwhelming, significant, inconsequential, or some combination thereof. Any determination by the state board shall be based upon a preponderance of available evidence.

(c) The state board shall make every reasonable effort to supply air pollutant transport information to heavily impacted districts prior to the development of plans to attain the state ambient air quality standards, shall consult with affected upwind and downwind districts, and shall adopt its findings at a public hearing.

(d) The state board shall review and update its transport analysis at least once every three years.

(e) The state board shall conduct appropriate studies to carry out its responsibilities under this section.

APPENDIX B

PUBLIC WORKSHOP NOTICE

APPENDIX C

July 10, 1996 Transport Workshop Participants

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July 10, 1996 Transport Workshop Participants

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APPENDIX D

GLOSSARY

Appendix D

Transport-Meteorology Glossary

Adiabat/Adiabatic - see Lapse rate.

APOB - acronym for Airplane observation.

air basin - an area wherein there are similar meteorological and geographic conditions; also defined by political boundaries; an area in which the air mass is homogeneous; an area usually bounded by topographical feature.

aircraft soundings - temperature and/or pollutant measurements aloft obtained by aircraft either at multiple levels over one location (referred to as a spiral) or one level over several locations (referred to as a traverse).

air flow charts - the Air Resources Aboard meteorology section prepares charts which include wind speed and wind direction for many sites. The winds are analyzed with lines showing air flow patterns; a modified streamline chart produced by the Air Resources Board meteorology section.

air-flow type/pattern - the Air Resources Board meteorology section first plots wind speed and direction at various locations statewide, then they analyze the plots using a modified streamline method, then they categorize, or type, air flow patterns in the larger, predominant regions of the state.

aloft - above the earth's surface, generally 50 feet elevation and higher; as opposed to the surface is not exactly at the surface but usually anywhere from 2 to 30 feet above the ground.

ambient - surrounding, on all sides; in situ; for use in air pollution, ambient refers to free moving air as opposed to, possibly, in a laboratory setting.

anti-cyclonic - clockwise; wind flow around an area of high pressure.

AUSPEX - San Joaquin Valley Air Quality Study/Atmospheric Utility Signatures, Predictions, and Experiments (SJVAQS/AUSPEX); a field program conducted in 1990.

background - for ozone studies, background refers to an area's normal minimum ozone concentration, or that concentration normally experienced by an area without influence or transport from an upwind area. For instance, clean air, such as the air mass over the Pacific Ocean has a normal background concentration of 4 pphm. Areas in the mountains may have background concentrations of 5 or 6 pphm because there is not a presence of Nox for ozone scavenging as there is in the urban areas. Urban areas often have background ozone concentration levels of 0 or 1 pphm.

backward trajectory - a pictorial technique which estimates the path an air parcel took over a specified period of time. This path is estimated using wind speed and wind direction at various sites in the domain which have been analyzed into successive hours of wind fields. Terrain and meteorology are also considered in this analysis. In the case of backward trajectory, the site of the ozone concentration in question is used as the start point and then a figurative air parcel is "backed up" to determine the approximate source area of the polluted air mass.

bimodal - an analysis in which there are two areas where a certain value, number, or concentration occurs with high frequency.

biogenic - hydrocarbon emissions from plant species including alcohols, acetates, aldehydes, ketones, ethers, esters, alkanes, alkenes, aromatics, and, most prevalently, isoprene and alpha pinene (a monoterpene).

boundary conditions - for use in photochemical modeling, a boundary condition refers to those pollutant concentrations in air entering the domain being modeled.

boundary sites - for use in transport assessments, a boundary site is a site close to the air basin boundary line.

break (inversion) - The temperature at the top of the inversion is an indicator of when the inversion might cease to exist, or *break*. This break temperature is the temperature at which the top of the inversion would be if lowered dry adiabatically. In other words, as a parcel of air changes altitude, it will warm if lowered or cool if raised, approximately 5F° per 1000 feet. When the surface temperature equals or exceeds that of the inversion top temperature lowered adiabatically, vertical mixing is possible and the inversion is said to have broken or eroded. Vertical mixing is contained only in layers of the atmosphere where the temperature decreases with height.

Clean Air Act - The *California* Clean Air Act was AB 2595, Sher (Chapter 1568, Statutes of 1988). Referring only to transport, this Act established time frames by which districts should improve air quality or meet attainment of the ambient air quality standard for ozone. This Act also established requirements for transport assessments to be made as well as triennial updates of these assessments. The *Federal* Clean Air Act was passed in 1977 and amendments were made in 1990. The state's transport research is primarily aligned with the California Clean Air Act.

corridor - a common path of air flow, usually unobstructed and long and usually transects two air basins.

convection/convective (heating) - upward vertical motion in the atmosphere; free convection is a result of surface heating or vertical motion caused by density differences within the airmass; forced convection is a mechanical lifting caused by such things as weather fronts or terrain.

couple - a pair of geographic areas, one considered upwind and one considered downwind.

decoupled - occurs when the air mass below the inversion is distinctly different than the air mass above the inversion.

CDEC - acronym for California Data Exchange Center.

character of exceedance - an ozone concentration trend will indicate whether the ozone exceedance occurred abruptly or if the ozone concentrations gradually built up to exceed the state standard. The ozone concentration trend also indicates whether the exceedance was brief or if it spanned many hours. The ozone concentration trend for the downwind site, compared with trends for upwind sites, will help support an assessment of transport or no transport.

CIMIS - acronym for California Irrigation Management Information System.

contours - on constant pressure charts, ie 500 millibar chart, a contour is a line of uniform pressure heights.

confluence - the rate at which adjacent flow is converging, or coming together, along an axis oriented normal to the flow at the point in question; the opposite of diffluence; referring to direction.

convergence - flowing or running together to form one mass.

conversions -

from this▾ to this▸	m/sec	mph	knots
m/sec	x1	x2.2369	x1.9425
mph	x.44707	x1	x.86839
knots	x.51479	x1.1516	x1

from this▾ to this▸	lbs/day	tons/day	°F	°C
lbs/day	x1	x.0005	--	--
tons/day	x2000	x1	--	--
°F	--	--	x1	.5555(°F-32)
°C	--	--	(1.8x°C)+32	x1

cyclonic - counter-clockwise; wind flow around an area of low pressure.

differential heating/cooling - when the *rate* of heating/cooling differs spatially.

difluence - the rate at which adjacent flow is diverging, or moving apart, along an axis oriented normal to the flow at the point in question; opposite of confluence; referring to direction.

disperse - to break up and scatter in all directions; in transport, this term refers to the scattering of air pollutants by wind or by convection.

diurnal - daily; especially pertaining to actions which are completed within twenty-four hours and which recur every twenty-four hours.

divergence - flowing or moving apart from one common mass; opposite of convergence; referring to the velocity field.

domain - a field or sphere of activity or influence; in transport, the domain is the area of which data is input for modeling purposes.

downwind - The direction toward which the wind is blowing; with the wind.

drainage flow - general term for gravity-induced, down slope flow of relatively cold air.

duration - normally referring to the duration of the ozone exceedance at a particular site; the number of hours of ozone exceedance can be determined by reviewing the ozone concentration trend.

eddy - current of air moving against the main current and with a circular motion; limited in importance or effect.

emission inventory - usually expressed in tons per day; the emission inventory is used in photochemical modeling and in area comparisons.

exceedances - any ozone concentration greater than the ambient air quality standard for ozone.

extreme concentration - a concentration that is statistically expected to occur less frequently than once every year.

forward trajectory - a pictorial technique which estimates the path an air parcel took over a specified period of time. This path is estimated using wind speed and wind direction at various sites in the domain which have been analyzed into successive hours of wind fields. Terrain and meteorology are also considered in this analysis. In the case of forward trajectory, an upwind area or site is used at the start point and then a figurative "air parcel" is then moved forward to determine the possible impacted area.

fumigate - this occurs as the air mass carrying a smoke plume becomes unstable and the airmass mixes vertically causing the smoke to come in contact with the earth's surface.

GMT - acronym for Greenwich Mean Time, the time in Greenwich, England which is eight hours later than Pacific Standard Time; also referred to as Zulu or Z time.

gradient - usually refers to temperature or pressure change over a given distance (usually horizontal); the ratio of change to distance. A 'tight' or 'strong' gradient refers to a high ratio or a lot of change per given distance. A 'loose' or 'weak' gradient, therefore, is less change over the same given distance.

high pressure - a dominating atmospheric feature; a large area where surface pressures are higher than the surrounding area; an area of anticyclonic circulation.

hydrocarbons - used generally and interchangeably with reactive hydrocarbons and reactive organic gases to mean all organic compounds which may participate in the ozone formation process.

intrusion - see Stratospheric Intrusion.

inversion - that portion of the vertically measured atmosphere in which the temperature increases, rather than decreases, with height.

inverted (thermal) trough - a low pressure area induced by surface heating in which the general flow is from east to west instead of west to east; a meteorological feature commonly found in California from the Imperial Valley northward through the Sacramento Valley.

isopleth - a line of equal or constant value of a given quantity with respect to either space or time.

isotherm - a line connecting points of equal temperature.

isobar - a line connecting points of equal pressure.

jet stream - a channel of increased wind speeds. Some low level jets are mechanically induced such as jets near the inversion or jets funneled by terrain; upper level jet streams (25,000 to 50,000 feet) are induced by the temperature differences between two air masses. Jet streams are usually considered as such when they are a relatively narrow band of greater wind speeds than the surrounding winds and are greater than 50 knots.

knot - a rate of speed equal to one nautical mile per hour (therefore, no such term as knots per hour); equal to 1.1508 statute miles per hour or .5144 meters per second.

lapse rate - this is the rate at which a particular column of air cools. A negative lapse rate indicates warming with height rather than cooling (see inversion). A lapse rate that equals the standard atmospheric lapse rate is referred to as the adiabatic lapse rate. A super-adiabatic lapse rate occurs as a layer of air cools with height quicker than the adiabatic lapse.

latitude - angular distance, measured in degrees (0-90), north or south from the equator.

lidar - a system which uses laser technology to measure atmospheric parameters.

local - a transport assessment also referred to as inconsequential; a transport assessment given to an exceedance day in which the emission impact from an upwind district was either non-existent or so little as to have inconsequential impact on the exceedance; a transport assessment in which it has been determined that nearly all the emissions causing the exceedance were locally generated.

longitude - distance east or west, measured in degrees (0-180), from the prime meridian (or longitude) which passes through Greenwich, England.

low pressure/heights - on the surface, an area of low pressure is surrounded by an higher pressures; aloft, an area of low heights is an area where a constant pressure is lower than the same pressure is in surrounding areas.

magnitude - one dimensional; a number given to a quantity for purposes of comparison with other quantities of the same class.

marine air - air whose characteristics are developed over an extensive water surface and which, therefore, has the basic maritime quality of high moisture content in at least its lower levels; below the inversion, moist, thermally modified air intrudes as far inland as 100 miles or more into most of California.

marine layer - the layer from surface to the base of the inversion.

Marta - a system for retrieving and managing various types of meteorological data including hourly observations and satellite imagery.

microclimate - the fine climatic structure of the air space which extends from the very surface of the earth to a height where the effects of the immediate character of the underlying surface no longer can be distinguished from the general local climate; generally, four times the height of surface growth or structures defines the level where micro climatic tones disappear.

millibar (MB) - a unit measure of atmospheric pressure. The worldwide average sea level pressure is 1013.2 MB; 850 MB is approximately 5000 ft; 700 MB is approximately 10,000 ft; 500 MB is approximately 18,000 ft.

mitigation - in air pollution control, mitigation refers to those measures that are taken to prevent or reduce emissions in the atmosphere.

mixing depth - the layer of atmosphere, usually surface-based, where vertical circulation can occur; this depth usually defined by the inversion.

model - a computer derived situation of which variables can be altered to determine an outcome.

moderate - regarding the California Clean Air Act, an area classified as moderate for ozone 1) is expected to reach attainment by December 31, 1997, and 2) has a once in one year recurrence rate of 12 pphm or less.

nautical mile - 1852 meters, 6076.103 feet, or 1.1508 statute miles; the length of one minute of arc along any great circle on the earth's surface. This distance varies slightly with latitude and therefore the distance of a nautical mile has been reached by international agreement.

nephanalysis - the analysis of a synoptic chart in terms of the types and amount of clouds and precipitation.

nitric oxides (NO) - a colorless, poisonous gas found in variable trace quantities in the atmosphere, especially near industrial areas.

nocturnal jet - a low-level jet that exists at night due to the strength of the inversion at that time.

nocturnal - of, done, or happening in the night.

NOx - nitrogen oxides (NO and/or NO2).

NOx scavenging - method by which ozone is removed from the ambient air. When ozone reacts with nitric oxide, the resulting concentration of ozone is lower.

ozone - a secondary ambient air pollutant generated by photochemical reaction involving hydrocarbons and nitric oxides.

ozone concentrations - produced by the chemical reaction of nitrogen oxides and hydrocarbons in the presence of sunlight ozone reservoir.

Pacific High - a semi-permanent synoptic condition dominating the eastern Pacific.

parcel - a theoretical 'box' of air that may be physically tracked to show movement from an upwind area to a downwind area; a theoretical 'box' of air that contains certain masses of atmospheric gases.

PGM - Photochemical Grid Model; mathematical representation of the three-dimensional atmosphere to simulate the dispersion and chemical transformation of pollutant emissions that produce ozone.

photochemical - the effect of light or other radiant energy in producing chemical action; a chemical reaction which involves either the absorption or emission of radiation.

pibal - contraction for pilot-balloon observation; this type of observation measures winds aloft by tracking a balloon with a theodolite.

plume - on a point-source scale, a plume is the airborne discharge from an industrial stack, an agricultural burn location, or any other single source; on a regional scale, a plume is considered to be the polluted air mass which may travel away from the source region.

ppb - parts per billion; pphm x 10.

pphm - parts per hundred million; ppm x 100.

ppm - parts per million.

precursors - primary air pollutants; air pollutants which haven't undergone chemical processes in the ambient air.

preponderance - term used in California Clean Air Act to describe the types and amount of data used to make transport assessments; greater in amount, weight, power, influence, importance; predominant.

profiler - equipment which provides continuous winds aloft measurements using the doppler shift principle and radar waves.

PST - Pacific Standard Time.

qualification - making a transport assessment using general, relative terms.

quantification - making a transport assessment using specific numbers.

radiosonde - a balloon-borne instrument for the simultaneous measurement and transmission of meteorological data - specifically pressure, temperature, and humidity.

RAOB - contraction for radiosonde observation.

rawinsonde - a radiosonde observation combined with a rawin (winds-aloft) observation; rawin is a method of winds-aloft observation; use of radiosonde to determine pressure, temperature, dewpoint, wind speed, and wind direction aloft.

reactive hydrocarbons - used generally and interchangeably with hydrocarbons and reactive organic gases to mean all organic compounds which may participate in the ozone formation process.

reactive organic gases - used generally and interchangeably with hydrocarbons and reactive hydrocarbons to mean all organic compounds which may participate in the ozone formation process.

receptor - a downwind area; downwind from the emission source area.

ridge - as a terrain feature, a ridge is the crest line, or the line which joins the highest peaks of a mountain range, often the air basin boundary; as a meteorological feature, a ridge is most commonly referred to as a large area of high pressure such as the 'ridging' over the California coastline or a 'ridge' of high pressure.

Schultz Eddy - counter-clockwise circulation found in the southwestern portion of the Sacramento Valley. This phenomena is dependent upon wind speed and direction from the delta area. Very strong southwest windflow will erode the eddy, very light windflow will not support the eddy.

sea breeze - air flowing from the ocean to land; usually occurs in late afternoon through mid evening and the land has become hotter causing air to rise, cooler marine air will flow landward to replace the air which has risen; see also marine air.

serious - an area which has a once in one year recurrence rate greater than or equal to 12 pphm but less than 16 pphm.

severe - an area which has a once in one year recurrence rate greater than or equal to 16 pphm.

sloshing - a theory that polluted air flows up a mountain with the valley breeze in the afternoon and down the mountain with drainage flow in the late night and early morning hours leaving behind some of the polluted air near the inversion. The theory is that this phenomena may accumulate over several days thereby causing ozone exceedances.

sounding - this term is used for any type of vertical atmospheric measurement. These measurement methods include pibals, APOBs, lidar, rawinsonde, and profilers

source area - upwind area; the area from where emissions originate.

spatial - horizontal, geographic relationship.

spirals - vertical aircraft patterns whereby aircraft can measure air pollutants aloft.

stable - when a warm strata of air overlies a cooler strata of air, the condition is considered stable. Stability is determined by the lapse rate. When a lapse rate is less than the adiabatic lapse rate (slower cooling with height), the air mass tends to be more stable. When a lapse rate is more than the adiabatic lapse rate (more cooling with height), or super-adiabatic, the air mass tends to be less stable. A stable air mass will have little vertical motion associated with it and will therefore be absent of vertically developed clouds and weather. An unstable air mass will have greater vertical motion and may have many vertically developed clouds, depending on the availability of moisture in the air mass.

Stability is very important in assessing air pollution transport and in real-time air pollution matters such as agricultural burning. Even if there is not enough moisture for clouds, vertical motion still occurs and will assist in dispersing and diluting the air pollutants into the atmosphere.

statute mile - the 'common' mile; 5,280 feet.

stratosphere - the atmosphere immediately above the tropopause usually beginning somewhere between 35,000 and 65,000 feet, depending on the latitude and the season.

stratospheric intrusion - air which is downward vertically mixed from the stratosphere into the troposphere. This is usually caused by a synoptic disturbance.

streamline analysis - normally, an analysis produced for areas with nearly laminar flow such as the ocean surface and constant pressure charts (layers aloft); in this type of analysis, wind vectors are plotted and lines drawn parallel to the vectors; airflow charts used in transport analyses are sometimes referred to as streamline charts but are not true streamline charts as such.

subsidence - descending air, usually associated with a high pressure area.

surface - the boundary between the earth and the atmosphere.

surface deposition - method by which ozone is removed from the ambient air. Deposition occurs on vegetation or other surfaces.

synoptic - presenting or involving data on weather and atmospheric conditions over a wide area at a given time.

theodolite - a piece of survey-type equipment used for tracking weather balloons; equipment with azimuth (direction) and elevation readings.

thermal low - an area of low atmospheric pressure due to high temperatures caused by intensive heating at the earth's surface; non-frontal.

thermal trough - see thermal low.

time-series - a graph with hour on the x-axis, ozone concentration on the y-axis; graph indicates ozone trend for a given period of time.

trajectory - the path an air parcel takes in movement from one area to another dependent upon wind speed, wind direction, terrain, and meteorology; a pictorial analysis technique which estimates the path an air parcel took over a specified period of time. This path is estimated using wind speed and wind direction at various sites in the domain which have been analyzed into successive hours of wind fields. Terrain and meteorology are also considered in this analysis. See also forward and backward trajectory.

transport - horizontal movement of air pollution or air pollution precursors at the earth's surface or aloft. Vertical movement of air pollution is referred to as mixing.

traverses - horizontal aircraft patterns whereby aircraft can measure air pollutants spatially.

tropopause - the boundary between the troposphere and the stratosphere.

troposphere - the atmosphere beginning at the earth's surface and extending to the tropopause.

trough - an area of low pressure (surface) or low heights (aloft); wind flow around a trough is cyclonic or counter-clockwise.

trof - same as trough.

turbulence - vertical air motion; random motion in layers of a fluid (atmosphere)

UAM - Urban Airshed Model.

upwind - in the direction *from* which the wind is blowing; against the wind.

UV intensity - solar radiation.

valley breeze - wind flow up a mountain from valley during the day.

vector - wind speed and wind direction combined.

violation - an exceedance of the ambient air quality standard for ozone greater than the ambient air quality standard for ozone but less than the once in one year expected peak day concentration.

Winds2D - a two-dimensional air flow model used for generating parcel trajectories.

wind - Air in motion relative to surface of the earth; horizontal movement of air generated and modified by pressure differences, earth's rotation, terrain, synoptic conditions, latitude; measured or named as direction *from* which the wind is blowing such as northerly, southeasterly, valley breeze, sea breeze.

wind run - analysis method of algebraically adding wind velocity at a given location; unreliable analysis method due to inherent assumption of regionally uniform, unobstructed windflow patterns.

WNI - Weather Network, Inc., a Butte County company providing weather data, historic and real-time, to contracted users. (Company name recently changed).

Z - Zulu time.

Zulu - see GMT.

References

Air Resources Board, 1989: *Proposed Identification of Districts Affected by Transported Air Pollutants which Contribute to Violations of the State Ambient Air Quality Standard for Ozone.*

Air Resources Board, 1990: *Assessment and Mitigation of the Impacts of Transported Pollutants on Ozone Concentrations within California*.

Air Resources Board, 1993: *Assessment and Mitigation of the Impacts of Transported Pollutants on Ozone Concentrations within California*

Huschke, Ralph E., editor, *Glossary of Meteorology*, 1959

APPENDIX E

PROPOSED TEXT OF REGULATION

IDENTIFYING AREAS WHICH ARE IMPACTED

BY TRANSPORTED AIR POLLUTANTS

APPENDIX E
PROPOSED TEXT OF REGULATION
IDENTIFYING AREAS WHICH ARE IMPACTED
BY TRANSPORTED AIR POLLUTANTS

Amend Subchapter 1.5, Article 5, Section 70500, Title 17, California Code of Regulations to read as follows (items which have been added in previous rulemaking procedures but subsequently omitted from the California Code of Regulations are in italics) (proposed additions are underlined and in italics, proposed deletions are struck out)[1]:

Article 5. Transported Air Pollutants

70500 Transport Identification

(a) Purpose: This regulation identifies the areas in which transported air pollutants from upwind areas cause or contribute to a violation of the state ambient air quality standard for ozone and the areas of origin of the transported pollutants. All areas identified in the table are the air basins except as otherwise specifically described and defined.

(b) Definitions:

(1) "California Coastal Waters" includes the area between the California coastline and a line starting at the California-Oregon border at the Pacifica Ocean; thence to 42.0 degrees North, 125.5 degrees West; thence to 41.0 degrees North, 125.5 degrees West; thence to 40.0 degrees North, 125.5 degrees West; thence 39.0 degrees North, 125.0 degrees West; thence to 38.0 degrees North, 124.5 degrees West; thence to 37.0 degrees North, 123.5 degrees West; thence to 36.0 degrees North, 122.5 degrees West; thence to 35.0 degrees North, 121.5 degrees West; thence to 34.0 degrees North, 120.5 degrees West; thence to 33.0 degrees North, 119.5 degrees West; thence to 32.5 degrees North, 118.5 degrees West; and ending at the California-Mexican border at the Pacific Ocean.

(2) "Upper Sacramento Valley" includes the Colusa, Butte, Glenn, Tehama, and Shasta County Air Pollution Control Districts, and that area of the Feather River Air Quality Management District, which is north of a line connecting the northern border of Yolo County to the southwestern tip of Yuba County, and continuing along the southern Yuba County border to Placer County.

(3) "Broader Sacramento Area" includes the Sacramento Metropolitan Air Quality Management District; Yolo-Solano Air Pollution Control District; the portions of the El Dorado County Air Pollution Control District included in 1990 U.S. Census Tracts 306.01, 307, 308.01, 308.02, 308.03, 308.04, 309.01, 309.02, 310, 311, 312, 315.01, and 315.02; and the portions of the Placer County Air Pollution Control District included in 1990 U.S. Census Tracts 203, 204, 205, 206.01, *206.02*, *206.03*, *207.01*, *207.02*, *207.03*, *208*, *209*, *210.01*, *210.02*, 211.01, 211.02, 212, 213.01, 213.02, 214, 215.01, 215.02, 216, 218.01, and 218.02; and that area of the Feather River Air Quality Management District which is south of a line connecting the northern border of Yolo County to the southwestern tip of Yuba County, and continuing along the southern Yuba County border to Placer County.

(c) Transport Identification Table

OZONE IMPACTED BY TRANSPORT:	AREAS OF ORIGIN OF TRANSPORT:
1. North Central Coast	San Francisco Bay Area *<u>San Joaquin Valley</u>*
2. South Central Coast	South Coast California Coastal Waters San Joaquin Valley
3. South Coast	South Central Coast
4. San Diego	South Coast Mexico
5. Upper Sacramento Valley	Broader Sacramento Area
6. Broader Sacramento Area	San Francisco Bay Area San Joaquin Valley
7. San Joaquin Valley	San Francisco Bay Area Broader Sacramento Area
8. Great Basin Valleys	San Joaquin Valley
9. ~~Southeast~~ *<u>Mojave</u>* Desert	South Coast San Joaquin Valley Mexico
10. San Francisco Bay Area	Broader Sacramento Area
11. Mountain Counties	Broader Sacramento Area San Joaquin Valley San Francisco Bay Area
12. *<u>Salton Sea</u>*	*<u>South Coast</u>* *<u>Mexico</u>*

Note: Authority cited: Sections 39600, 39601, 39610(a), Health and Safety Code.
Reference: Section 39610(a), Health and Safety Code.

1. At the May 30, 1996 public hearing, the Air Resources Board approved amendments to sections 60104 and 60109, and added a new Section 60114, Title 17, California Code of Regulations which divided the Southeast Desert Air Basin into two new air basins; the Mojave Desert Air Basin and the Salton Sea Air Basin. These amendments have not yet been formally approved by the Office of Administrative Law. However, the transport identification regulation above has been amended to reflect the changes in the Southeast Desert Air Basin.

PROPOSED TEXT OF REGULATION
FOR MITIGATING THE UPWIND EMISSIONS
ON DOWNWIND OZONE CONCENTRATIONS

Amend Subchapter 1.5, Article 6, Section 70600, Title 17, California Code of Regulations, to read as follows (proposed additions are underlined and in italics, proposed deletions are struck out)[1]:

ARTICLE 6. Transport Mitigation

70600. Emission Control Requirements

Districts within the areas of origin of transported air pollutants, as identified in section 70500(c), shall include sufficient emission control measures in their attainment plans for ozone adopted pursuant to chapter 10 of the Health and Safety Code, Part 3, Division 26, beginning with section 40910, to mitigate the impact of pollution sources within their jurisdictions on ozone concentrations in downwind areas. At a minimum, the attainment plans for districts within the air basins or areas specified below shall conform to the following requirements:

(a) Broader Sacramento Area (as defined in section 70500(b)(3)) shall:

(1) require the adoption and implementation of best available retrofit control technology, as defined in Health and Safety Code section 40406, on all existing stationary sources of ozone precursor emissions as expeditiously as practicable. At a minimum, the plan shall provide for the adoption of rules that represent best available retrofit control technology for source categories that collectively amount to 75 percent of the 1987 actual reactive hydrocarbon emissions inventory for permitted stationary sources, and 75 percent of the 1987 actual nitrogen oxides emissions inventory for permitted stationary sources, no later than January 1, 1994.

(2) include measures sufficient to attain the state ambient air quality standard for ozone by the earliest practicable date within the Upper Sacramento Valley and that portion of the Mountain Counties Air Basin north of the ~~Amador-El Dorado~~ *<u>Calaveras-Tuolumne</u>* County border and south of the Sierra-Plumas County border, except as provided in Health and Safety Code section 41503(d), during air pollution episodes which the state board has determined meet the following conditions:

(A) are likely to produce a violation of the state ozone standard in the Upper Sacramento Valley or that portion of the Mountain Counties Air Basin north of the ~~Amador-El Dorado~~ *Calaveras-Tuolumne* County border and south of the Sierra-Plumas County border; and

(B) are dominated by overwhelming pollutant transport from the Broader Sacramento Area; and

(C) are not measurably affected by emissions of ozone precursors from sources located within the Upper Sacramento Valley or that portion of the Mountain Counties Air Basin north of the ~~Amador-El Dorado~~ *Calaveras-Tuolumne* County border and south of the Sierra-Plumas County border.

(b) San Francisco Bay Air Basin shall:

(1) require the adoption and implementation of best available retrofit control technology, as defined in Health and Safety Code section 40406, on all existing stationary sources of ozone precursor emissions as expeditiously as practicable. At a minimum, the plan shall provide for the adoption of rules that represent best available retrofit control technology for source categories that collectively amount to 75 percent of the 1987 actual reactive hydrocarbon emissions inventory for permitted stationary sources, and 75 percent of the 1987 actual nitrogen oxides emissions inventory for permitted stationary sources, no later than January 1, 1994.

(2) include measures sufficient to attain the state ambient air quality standard for ozone by the earliest practicable date within the North Central Coast Air Basin, that portion of Solano County within the Broader Sacramento Area, and that portion of Stanislaus County west of Highway 33, except as provided in the Health and Safety Code section 41503(d), during air pollution episodes which the state board has determined meet the following conditions:

(A) are likely to produce a violation of the state ozone standard in the North Central Coast Air Basin, or that portion of Solano County within the Broader Sacramento Area, or that portion of Stanislaus County west of Highway 33; and

(B) are dominated by overwhelming pollutant transport from the San Francisco Bay Air Basin; and

(C) are not measurably affected by emissions of ozone precursors from sources located within the North Central Coast Air Basin, or that portion of Solano County within the Broader Sacramento Area, or that portion of Stanislaus County west of Highway 33.

(c) San Joaquin Valley Air Basin shall:

(1) require the adoption and implementation of best available retrofit control technology, as defined in Health and Safety Code section 40406, on all existing stationary sources of ozone precursor emissions as expeditiously as practicable. At a minimum, the plan shall provide for the adoption of rules that represent best available retrofit control technology for source categories that collectively amount to 75 percent of the 1987 actual reactive hydrocarbon emissions inventory for permitted stationary sources, and 75 percent of the 1987 actual nitrogen oxides emissions inventory for permitted stationary sources, no later than January 1, 1994.

(2) include measures sufficient to attain the state ambient air quality standard for ozone by the earliest practicable date within the ~~Southeast~~ *Mojave* Desert Air Basin, the Great Basin Valleys Air Basin, and that portion of the Mountain Counties Air Basin south of the Amador-El Dorado County border, except as provided in Health and Safety Code section 41503(d), during air pollution episodes which the state board has determined meet the following conditions:

(A) are likely to produce a violation of the state ozone standard in the ~~Southeast~~ *Mojave* Desert Air Basin, or the Great Basin Valleys Air Basin, or that portion of the Mountain Counties Air Basin south of the Amador-El Dorado County border; and

(B) are dominated by overwhelming pollutant transport from the San Joaquin Valley Air Basin; and

(C) are not measurably affected by emissions of ozone precursors from sources located within the ~~Southeast~~ *Mojave* Desert Air Basin or the Great Basin Valleys Air Basin, or that portion of the Mountain Counties Air Basin south of the Amador-El Dorado County border.

(d) South Central Coast Air Basin south of the Santa Barbara-San Luis Obispo County border shall, for sources located in that portion of the Basin:

(1) require the adoption and implementation of best available retrofit control technology, as defined in Health and Safety Code section 40406, on all existing stationary sources of ozone precursor emissions as expeditiously as practicable. At a minimum, the plan shall provide for the adoption of rules that represent best available retrofit control technology for source categories that collectively amount to 75 percent of the 1987 actual reactive hydrocarbon emissions inventory for permitted stationary sources, and 75 percent of the 1987 actual nitrogen oxides emissions inventory for permitted stationary sources, no later than January 1, 1994.

(e) South Coast Air Basin shall

(1) require the adoption and implementation of best available retrofit control technology, as defined in Health and Safety Code section 40406, on all existing stationary sources of ozone precursor emissions as expeditiously as practicable. At a minimum, the plan shall provide for the adoption of rules that represent best available retrofit control technology for source categories that collectively amount to 75 percent of the 1987 actual reactive hydrocarbon emission inventory of permitted stationary sources, and 75 percent of the 1987 actual nitrogen oxides emissions inventory for permitted stationary sources, no later than January 1, 1994.

(2) include measures sufficient to attain the state ambient air quality standard for ozone by the earliest practicable date within the South Central Coast Air Basin south of the Santa Barbara-San Luis Obispo County border, the San Diego Air Basin, ~~and~~ the ~~Southeast~~ <u>*Mojave*</u> Desert Air Basin, <u>*and the Salton Sea Air Basin*</u>, except as provided in Health and Safety Code section 41503(d), during air pollution episodes which the state board has determined meet the following conditions:

(A) are likely to produce a violation of the state ozone standard in the South Central Coast Air Basin south of the Santa Barbara-San Luis Obispo County border, or in the San Diego Air Basin, or in the ~~Southeast~~ <u>*Mojave*</u> Desert Air Basin, <u>*or in the Salton Sea Air Basin*</u>; and

(B) are dominated by overwhelming pollutant transport from the South Coast Air Basin; and

(C) are not measurably affected by emissions of ozone precursors from sources located within the South Central Coast Air Basin south of the Santa Barbara-San Luis Obispo County border, or the San Diego Air Basin, or the ~~Southeast~~ *Mojave* Desert Air Basin*, or the Salton Sea Air Basin*~~, as applicable~~.

Note: Authority cited: Sections 39601 and 39610(b), Health and Safety Code. Reference: Sections 39610, 40912, 40913, 40921 and 41503, Health and Safety Code.

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1. At the May 30, 1996 public hearing, the Air Resources Board approved amendments to sections 60104 and 60109, and added a new Section 60114, Title 17, California Code of Regulations which divided the Southeast Desert Air Basin into two new air basins; the Mojave Desert Air Basin and the Salton Sea Air Basin. These amendments have not yet been formally approved by the Office of Administrative Law. However, the transport mitigation regulation above has been amended to reflect the changes in the Southeast Desert Air Basin.

APPENDIX F

DATA TABLES

Table F-1
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
08/03/95	Colfax-City Hall	130	17
07/08/94	Colfax-City Hall	122	17
07/28/94	Colfax-City Hall	119	17
09/21/95	Colfax-City Hall	117	16
07/15/94	Colfax-City Hall	112	18
08/18/94	Colfax-City Hall	111	17
07/28/95	Colfax-City Hall	110	17
08/17/94	Colfax-City Hall	109	15
07/05/95	Colfax-City Hall	109	17
09/14/95	Colfax-City Hall	108	14
08/04/95	Colfax-City Hall	105	18
07/11/94	**Colfax-City Hall**	**104**	**18**
07/29/94	Colfax-City Hall	104	11
09/19/95	Colfax-City Hall	104	16
09/12/95	Colfax-City Hall	103	17
10/10/95	Colfax-City Hall	102	16
09/09/95	Colfax-City Hall	102	17
09/15/95	Colfax-City Hall	101	17
08/05/95	Colfax-City Hall	101	18
09/11/95	Colfax-City Hall	101	14
08/04/94	Colfax-City Hall	100	18
07/18/94	Colfax-City Hall	98	17
09/13/95	Colfax-City Hall	98	16
09/20/95	Colfax-City Hall	98	12
08/19/94	Colfax-City Hall	98	17
08/16/94	Colfax-City Hall	98	12
05/20/95	Colfax-City Hall	96	17
08/01/94	Colfax-City Hall	96	18
08/30/94	Colfax-City Hall	96	17
07/16/94	Colfax-City Hall	96	18

Table F-1 (con't)
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
05/25/94	Colfax-City Hall	95	16
07/29/94	Grass Valley-Litton Building	110	0
07/28/94	Grass Valley-Litton Building	110	18
07/08/94	Grass Valley-Litton Building	110	20
07/15/94	Grass Valley-Litton Building	100	18
07/11/94	Grass Valley-Litton Building	100	21
07/13/94	Grass Valley-Litton Building	100	21
06/20/94	Grass Valley-Litton Building	100	17
08/17/94	Grass Valley-Litton Building	100	15
08/01/95	Jackson-Clinton Road	146	16
09/20/94	Jackson-Clinton Road	123	16
08/20/95	Jackson-Clinton Road	123	17
07/17/94	Jackson-Clinton Road	119	14
08/19/95	Jackson-Clinton Road	117	18
07/26/94	Jackson-Clinton Road	115	17
08/17/94	Jackson-Clinton Road	112	18
09/13/95	Jackson-Clinton Road	111	17
07/15/94	Jackson-Clinton Road	110	16
08/15/94	Jackson-Clinton Road	109	16
05/24/94	Jackson-Clinton Road	106	17
08/02/95	Jackson-Clinton Road	106	17
06/10/94	Jackson-Clinton Road	106	16
08/15/95	Jackson-Clinton Road	105	13
07/15/95	Jackson-Clinton Road	103	17
09/18/94	Jackson-Clinton Road	103	17
09/26/94	Jackson-Clinton Road	102	14
08/16/94	Jackson-Clinton Road	101	17
09/20/95	Jackson-Clinton Road	101	13
09/12/95	Jackson-Clinton Road	99	16
08/18/94	Jackson-Clinton Road	99	17

Table F-1 (con't)
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
09/19/95	Jackson-Clinton Road	99	16
09/07/95	Jackson-Clinton Road	99	17
07/14/94	Jackson-Clinton Road	99	15
08/03/95	Jackson-Clinton Road	98	13
09/21/95	Jackson-Clinton Road	98	15
07/28/95	Jackson-Clinton Road	98	16
07/12/94	Jackson-Clinton Road	98	18
07/27/95	Jackson-Clinton Road	97	15
08/31/94	Jackson-Clinton Road	97	17
08/14/95	Jackson-Clinton Road	96	16
08/31/95	Jackson-Clinton Road	96	16
07/31/95	Jackson-Clinton Road	96	15
08/18/95	Jackson-Clinton Road	96	17
07/14/95	Jackson-Clinton Road	95	16
06/24/95	Jackson-Clinton Road	95	15
08/15/95	Jerseydale - 6440 Jerseydale	110	17
08/03/95	Jerseydale - 6440 Jerseydale	108	14
09/09/95	Jerseydale - 6440 Jerseydale	106	16
09/20/95	Jerseydale - 6440 Jerseydale	103	18
08/31/95	**Jerseydale - 6440 Jerseydale**	**102**	**17**
09/15/95	Jerseydale - 6440 Jerseydale	102	14
08/02/95	Jerseydale - 6440 Jerseydale	101	15
09/14/95	Jerseydale - 6440 Jerseydale	99	17
10/10/95	Jerseydale - 6440 Jerseydale	99	19
08/04/95	Jerseydale - 6440 Jerseydale	98	15
09/08/95	Jerseydale - 6440 Jerseydale	97	20
09/01/95	Jerseydale - 6440 Jerseydale	97	15
08/16/95	Jerseydale - 6440 Jerseydale	97	1
09/21/95	Jerseydale - 6440 Jerseydale	95	14
08/22/95	Jerseydale - 6440 Jerseydale	95	14

Table F-1 (con't)
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
09/03/95	Jerseydale - 6440 Jerseydale	95	5
07/12/94	Placerville-Gold Nugget Way	130	18
06/26/95	Placerville-Gold Nugget Way	126	16
06/10/94	Placerville-Gold Nugget Way	126	19
06/27/94	Placerville-Gold Nugget Way	124	17
08/16/94	Placerville-Gold Nugget Way	124	16
08/21/95	Placerville-Gold Nugget Way	121	17
09/19/95	Placerville-Gold Nugget Way	120	16
08/03/95	Placerville-Gold Nugget Way	119	17
08/14/95	Placerville-Gold Nugget Way	119	17
08/31/95	Placerville-Gold Nugget Way	117	18
08/02/95	Placerville-Gold Nugget Way	116	16
08/12/94	Placerville-Gold Nugget Way	116	16
09/12/95	Placerville-Gold Nugget Way	114	15
07/13/94	Placerville-Gold Nugget Way	113	16
07/27/95	Placerville-Gold Nugget Way	113	15
05/24/94	Placerville-Gold Nugget Way	112	17
09/13/95	Placerville-Gold Nugget Way	111	14
06/24/94	Placerville-Gold Nugget Way	111	17
09/14/95	Placerville-Gold Nugget Way	111	16
07/31/95	Placerville-Gold Nugget Way	110	17
07/14/94	Placerville-Gold Nugget Way	109	17
09/06/94	Placerville-Gold Nugget Way	109	16
07/07/94	Placerville-Gold Nugget Way	109	19
08/30/95	Placerville-Gold Nugget Way	108	17
07/06/94	Placerville-Gold Nugget Way	108	14
06/28/94	Placerville-Gold Nugget Way	107	17
07/27/94	Placerville-Gold Nugget Way	107	16
08/02/94	Placerville-Gold Nugget Way	107	18
06/23/95	Placerville-Gold Nugget Way	106	17

Table F-1 (con't)
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
09/07/95	Placerville-Gold Nugget Way	106	16
08/01/95	Placerville-Gold Nugget Way	106	10
06/01/95	Placerville-Gold Nugget Way	106	14
06/19/94	Placerville-Gold Nugget Way	106	18
08/19/95	Placerville-Gold Nugget Way	105	16
08/17/94	Placerville-Gold Nugget Way	105	19
09/01/95	Placerville-Gold Nugget Way	104	16
09/08/95	Placerville-Gold Nugget Way	103	16
07/15/94	Placerville-Gold Nugget Way	103	17
08/20/95	Placerville-Gold Nugget Way	103	14
08/05/94	Placerville-Gold Nugget Way	103	19
09/20/94	Placerville-Gold Nugget Way	103	20
06/25/95	Placerville-Gold Nugget Way	102	17
09/11/95	Placerville-Gold Nugget Way	101	16
07/28/95	Placerville-Gold Nugget Way	100	16
08/15/95	Placerville-Gold Nugget Way	99	16
07/15/95	Placerville-Gold Nugget Way	98	17
07/28/94	Placerville-Gold Nugget Way	98	18
08/20/94	Placerville-Gold Nugget Way	97	18
07/14/95	Placerville-Gold Nugget Way	97	16
09/20/95	Placerville-Gold Nugget Way	97	18
09/16/94	Placerville-Gold Nugget Way	96	15
09/10/95	Placerville-Gold Nugget Way	96	20
08/13/94	Placerville-Gold Nugget Way	96	16
09/17/94	Placerville-Gold Nugget Way	95	14
08/22/95	Placerville-Gold Nugget Way	95	11
07/18/95	Placerville-Gold Nugget Way	95	17
07/26/95	Placerville-Gold Nugget Way	95	14
08/24/94	Placerville-Gold Nugget Way	95	16
06/12/95	Quincy-N Church Street	105	15

Table F-1 (con't)
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
08/01/95	San Andreas-Gold Strike Road	146	16
08/17/94	San Andreas-Gold Strike Road	121	19
07/15/94	San Andreas-Gold Strike Road	120	17
09/18/94	San Andreas-Gold Strike Road	117	17
08/15/94	San Andreas-Gold Strike Road	114	16
07/17/94	San Andreas-Gold Strike Road	114	15
08/20/95	San Andreas-Gold Strike Road	113	17
08/31/94	San Andreas-Gold Strike Road	112	17
06/27/94	**San Andreas-Gold Strike Road**	**111**	**19**
09/20/94	San Andreas-Gold Strike Road	111	16
06/10/94	San Andreas-Gold Strike Road	110	17
08/16/94	San Andreas-Gold Strike Road	108	17
09/16/94	San Andreas-Gold Strike Road	107	17
09/20/95	San Andreas-Gold Strike Road	107	13
07/06/94	San Andreas-Gold Strike Road	105	15
08/15/95	San Andreas-Gold Strike Road	105	13
08/03/95	San Andreas-Gold Strike Road	105	13
08/07/94	San Andreas-Gold Strike Road	104	16
08/18/94	San Andreas-Gold Strike Road	103	17
09/19/95	San Andreas-Gold Strike Road	103	16
07/25/94	San Andreas-Gold Strike Road	103	15
07/31/95	San Andreas-Gold Strike Road	102	15
09/18/95	San Andreas-Gold Strike Road	102	17
09/15/94	San Andreas-Gold Strike Road	102	15
09/14/94	San Andreas-Gold Strike Road	101	15
08/02/95	San Andreas-Gold Strike Road	101	17
07/28/95	San Andreas-Gold Strike Road	101	16
07/27/95	San Andreas-Gold Strike Road	101	14
07/08/94	San Andreas-Gold Strike Road	101	19
06/26/94	**San Andreas-Gold Strike Road**	**101**	**16**

Table F-1 (con't)
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
08/31/95	San Andreas-Gold Strike Road	101	15
07/13/94	San Andreas-Gold Strike Road	100	16
07/14/94	San Andreas-Gold Strike Road	100	17
07/12/94	San Andreas-Gold Strike Road	100	18
07/14/95	San Andreas-Gold Strike Road	99	17
09/13/95	San Andreas-Gold Strike Road	99	17
06/24/95	San Andreas-Gold Strike Road	99	16
07/30/94	San Andreas-Gold Strike Road	99	17
07/15/95	San Andreas-Gold Strike Road	98	18
06/09/94	San Andreas-Gold Strike Road	97	14
09/06/94	San Andreas-Gold Strike Road	97	17
09/08/95	San Andreas-Gold Strike Road	97	14
07/28/94	San Andreas-Gold Strike Road	97	18
06/26/95	San Andreas-Gold Strike Road	96	12
09/22/94	San Andreas-Gold Strike Road	96	13
08/14/95	San Andreas-Gold Strike Road	96	16
09/26/94	San Andreas-Gold Strike Road	96	14
05/25/94	San Andreas-Gold Strike Road	96	17
05/24/94	San Andreas-Gold Strike Road	96	17
05/23/94	San Andreas-Gold Strike Road	96	17
07/11/94	San Andreas-Gold Strike Road	96	16
09/03/94	San Andreas-Gold Strike Road	96	16
09/07/95	San Andreas-Gold Strike Road	96	13
09/12/95	San Andreas-Gold Strike Road	95	17
09/21/95	San Andreas-Gold Strike Road	95	16
06/19/94	San Andreas-Gold Strike Road	95	18
07/29/94	San Andreas-Gold Strike Road	95	18
08/18/95	San Andreas-Gold Strike Road	95	17
08/01/95	Sonora-Barretta Street	135	18
07/15/94	Sonora-Barretta Street	107	18

Table F-1 (con't)
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
08/15/95	Sonora-Barretta Street	103	17
06/29/94	Sonora-Barretta Street	102	16
07/17/94	Sonora-Barretta Street	101	16
07/06/94	Sonora-Barretta Street	101	17
08/02/95	Sonora-Barretta Street	100	14
08/03/95	Sonora-Barretta Street	99	15
09/08/95	Sonora-Barretta Street	97	15
08/04/95	Sonora-Barretta Street	96	13
09/15/95	Sonora-Barretta Street	95	12
07/14/94	Sonora-Barretta Street	95	18
09/20/95	Sonora-Barretta Street	95	14
07/16/94	Sonora-Barretta Street	95	12
07/08/94	Sonora-Barretta Street	95	16
09/15/95	Sonora-Old Oak Ranch Road	103	23
09/16/95	Sonora-Old Oak Ranch Road	98	0
08/17/94	Wawona	95	16
08/09/95	White Cloud Mountain	99	20
09/07/95	White Cloud Mountain	99	18
08/15/95	White Cloud Mountain	96	14
07/15/94	Yosemite NP-Camp Mather	97	14
08/17/94	Yosemite NP-Camp Mather	95	17
08/15/95	Yosemite NP-Turtleback Dome	114	17
07/15/94	Yosemite NP-Turtleback Dome	113	15
08/17/94	Yosemite NP-Turtleback Dome	111	19
07/08/94	Yosemite NP-Turtleback Dome	109	17
09/09/95	Yosemite NP-Turtleback Dome	104	18
08/25/94	Yosemite NP-Turtleback Dome	101	17
09/07/94	Yosemite NP-Turtleback Dome	100	16
09/17/94	Yosemite NP-Turtleback Dome	100	15
07/16/95	Yosemite NP-Turtleback Dome	100	18

Table F-1 (con't)
MCAB State Ozone Exceedances
(1994-1995)

Date	Location	Max Ozone (ppb)	Hour of Max Ozone (PST)
08/09/95	Yosemite NP-Turtleback Dome	100	17
09/20/94	Yosemite NP-Turtleback Dome	100	17
08/03/95	Yosemite NP-Turtleback Dome	99	19
07/16/94	Yosemite NP-Turtleback Dome	98	16
08/31/95	Yosemite NP-Turtleback Dome	97	18
07/27/95	Yosemite NP-Turtleback Dome	97	18
06/10/94	Yosemite NP-Turtleback Dome	97	17
08/18/94	Yosemite NP-Turtleback Dome	96	11
09/08/95	Yosemite NP-Turtleback Dome	96	18
08/21/95	Yosemite NP-Turtleback Dome	95	18
08/04/95	Yosemite NP-Turtleback Dome	95	16
08/16/95	Yosemite NP-Turtleback Dome	95	0

F-2

**Expected Peak Day Concentrations
for Sites in the Mountain Counties Air Basin
1993-1995**

District	Monitor Site Name	Concentration in ppm
Amador	Jackson-Clinton Road	0.12
Calaveras	San Andreas-Gold Strike Road	0.12
El Dorado	Placerville-Gold Nugget Way	0.13
Mariposa	Yosemite Village-Park Headquarters	0.09
Mariposa	Yosemite Village-Visitor Center	0.09
Mariposa	Wawona	0.11
Mariposa	Jerseydale-6440 Jerseydale	0.11
Mariposa	Yosemite NP-Turtleback Dome	0.12
Northern Sierra	Truckee-Fire Station	0.08
Northern Sierra	Nevada City-Willow Valley	0.07
Northern Sierra	White Cloud Mountain	0.10
Northern Sierra	Grass Valley-Litton Building	0.11
Northern Sierra	Quincy-N. Church Street	0.09
Placer	Colfax-City Hall	0.12
Tuolumne	Yosemite NP-Camp Mather	0.10
Tuolumne	Sonora-5 Mile Learning Center	0.10
Tuolumne	Sonora-Barretta Street	0.11

Table F-3
1994 Ozone Violations
Broader Sacramento Area

Basin	Site	Date	Max Ozone (ppb)	Hour Max Ozone
SV	Auburn-Dewitt-C Avenue	05/10/94	107	17
SV	Rocklin-Rocklin Road	05/10/94	103	16
SV	Folsom-City Corporation Yard	05/10/94	99	16
SV	Roseville-N Sunrise Blvd	05/10/94	98	16
MC	Placerville-Gold Nugget Way	05/24/94	112	17
SV	Folsom-City Corporation Yard	05/24/94	110	14
SV	Rocklin-Rocklin Road	05/24/94	100	14
SV	Sacramento-Del Paso Manor	06/10/94	145	12
SV	Folsom-City Corporation Yard	06/10/94	136	16
MC	Placerville-Gold Nugget Way	06/10/94	126	19
SV	Sacramento-T Street	06/10/94	108	12
SV	Elk Grove-Bruceville Road	06/10/94	106	12
SV	Roseville-N Sunrise Blvd	06/10/94	98	15
SV	North Highlands-Blackfoot Way	06/10/94	97	13
SV	Rocklin-Rocklin Road	06/10/94	95	11
SV	Auburn-Dewitt-C Avenue	06/10/94	95	13
SV	Folsom-City Corporation Yard	06/19/94	107	16
MC	Placerville-Gold Nugget Way	06/19/94	106	18
SV	Rocklin-Rocklin Road	06/19/94	98	16
SV	North Highlands-Blackfoot Way	06/19/94	95	16
MC	Placerville-Gold Nugget Way	06/24/94	111	17
SV	Folsom-City Corporation Yard	06/24/94	108	15
MC	Placerville-Gold Nugget Way	06/27/94	124	17
SV	Folsom-City Corporation Yard	06/27/94	119	15
SV	Auburn-Dewitt-C Avenue	06/27/94	104	14
SV	Elk Grove-Bruceville Road	06/27/94	104	16
SV	Sacramento-T Street	06/27/94	102	17
SV	Davis-UCD Campus	06/27/94	98	15
SV	Rocklin-Rocklin Road	06/27/94	96	14
SV	North Highlands-Blackfoot Way	06/27/94	96	17
SV	Folsom-City Corporation Yard	06/28/94	117	15
SV	Rocklin-Rocklin Road	06/28/94	117	17
SV	Roseville-N Sunrise Blvd	06/28/94	109	16

Table F-3 (con't)
1994 Ozone Violations
Broader Sacramento Area

Basin	Site	Date	Max Ozone (ppb)	Hour Max Ozone
MC	Placerville-Gold Nugget Way	06/28/94	107	17
SV	Auburn-Dewitt-C Avenue	06/28/94	105	15
SV	North Highlands-Blackfoot Way	06/28/94	98	15
SV	Auburn-Dewitt-C Avenue	06/29/94	121	15
SV	Folsom-City Corporation Yard	06/29/94	116	14
SV	Rocklin-Rocklin Road	06/29/94	111	14
SV	Roseville-N Sunrise Blvd	06/29/94	105	14
SV	Auburn-Dewitt-C Avenue	07/01/94	96	16
MC	Placerville-Gold Nugget Way	07/06/94	108	14
SV	Folsom-City Corporation Yard	07/07/94	126	17
SV	Rocklin-Rocklin Road	07/07/94	120	15
SV	Auburn-Dewitt-C Avenue	07/07/94	118	16
MC	Placerville-Gold Nugget Way	07/07/94	109	19
SV	Roseville-N Sunrise Blvd	07/07/94	107	14
SV	North Highlands-Blackfoot Way	07/07/94	98	16
SV	Auburn-Dewitt-C Avenue	07/08/94	133	15
SV	Rocklin-Rocklin Road	07/08/94	116	14
SV	Roseville-N Sunrise Blvd	07/08/94	107	15
SV	Folsom-City Corporation Yard	07/08/94	105	15
SV	North Highlands-Blackfoot Way	07/08/94	102	14
SV	Auburn-Dewitt-C Avenue	07/09/94	103	14
SV	Rocklin-Rocklin Road	07/09/94	97	13
SV	Roseville-N Sunrise Blvd	07/09/94	95	13
SV	Folsom-City Corporation Yard	07/09/94	95	14
SV	North Highlands-Blackfoot Way	07/11/94	118	15
SV	Auburn-Dewitt-C Avenue	07/11/94	117	17
SV	Roseville-N Sunrise Blvd	07/11/94	111	16
SV	Rocklin-Rocklin Road	07/11/94	111	17
SV	Folsom-City Corporation Yard	07/11/94	110	15
SV	Sacramento-Del Paso Manor	07/11/94	99	14
SV	Sacramento-T Street	07/11/94	96	13
SV	Folsom-City Corporation Yard	07/12/94	142	16
MC	Placerville-Gold Nugget Way	07/12/94	130	18

Table F-3 (con't)
1994 Ozone Violations
Broader Sacramento Area

Basin	Site	Date	Max Ozone (ppb)	Hour Max Ozone
SV	Rocklin-Rocklin Road	07/12/94	128	17
SV	Roseville-N Sunrise Blvd	07/12/94	119	14
SV	North Highlands-Blackfoot Way	07/12/94	104	14
SV	Sacramento-Del Paso Manor	07/12/94	103	14
SV	Auburn-Dewitt-C Avenue	07/12/94	97	12
SV	Folsom-City Corporation Yard	07/13/94	140	13
SV	Auburn-Dewitt-C Avenue	07/13/94	130	17
SV	Rocklin-Rocklin Road	07/13/94	119	13
SV	Roseville-N Sunrise Blvd	07/13/94	113	14
MC	Placerville-Gold Nugget Way	07/13/94	113	16
SV	North Highlands-Blackfoot Way	07/13/94	98	14
SV	Sacramento-Del Paso Manor	07/13/94	95	14
SV	Folsom-City Corporation Yard	07/14/94	133	14
MC	Placerville-Gold Nugget Way	07/14/94	109	17
SV	Roseville-N Sunrise Blvd	07/14/94	106	14
SV	Rocklin-Rocklin Road	07/14/94	105	15
SV	North Highlands-Blackfoot Way	07/14/94	95	14
SV	Auburn-Dewitt-C Avenue	07/15/94	113	16
SV	Rocklin-Rocklin Road	07/15/94	111	15
MC	Placerville-Gold Nugget Way	07/15/94	103	17
SV	Roseville-N Sunrise Blvd	07/15/94	102	15
SV	Folsom-City Corporation Yard	07/15/94	101	15
SV	Auburn-Dewitt-C Avenue	07/16/94	114	16
SV	Rocklin-Rocklin Road	07/16/94	103	14
SV	Roseville-N Sunrise Blvd	07/16/94	98	14
SV	Folsom-City Corporation Yard	07/17/94	98	11
SV	Rocklin-Rocklin Road	07/22/94	95	17
SV	Davis-UCD Campus	07/26/94	95	13
SV	Roseville-N Sunrise Blvd	07/27/94	124	16
SV	Rocklin-Rocklin Road	07/27/94	124	16
SV	Auburn-Dewitt-C Avenue	07/27/94	121	18
SV	Folsom-City Corporation Yard	07/27/94	113	16
MC	Placerville-Gold Nugget Way	07/27/94	107	16

Table F-3 (con't)
1994 Ozone Violations
Broader Sacramento Area

Basin	Site	Date	Max Ozone (ppb)	Hour Max Ozone
SV	North Highlands-Blackfoot Way	07/27/4	105	17
SV	Auburn-Dewitt-C Avenue	07/28/94	119	16
SV	Rocklin-Rocklin Road	07/28/94	106	15
SV	Roseville-N Sunrise Blvd	07/28/94	100	14
MC	Placerville-Gold Nugget Way	07/28/94	98	18
SV	North Highlands-Blackfoot Way	07/28/94	97	14
SV	Rocklin-Rocklin Road	07/29/94	103	16
SV	Auburn-Dewitt-C Avenue	07/29/94	99	17
SV	Auburn-Dewitt-C Avenue	08/01/94	98	16
SV	Folsom-City Corporation Yard	08/02/94	115	15
MC	Placerville-Gold Nugget Way	08/02/94	107	18
SV	Auburn-Dewitt-C Avenue	08/02/94	97	15
SV	Rocklin-Rocklin Road	08/02/94	96	15
SV	Folsom-City Corporation Yard	08/03/94	98	14
SV	Auburn-Dewitt-C Avenue	08/04/94	99	17
SV	Folsom-City Corporation Yard	08/05/94	143	17
MC	Placerville-Gold Nugget Way	08/05/94	103	19
SV	Rocklin-Rocklin Road	08/05/94	100	17
SV	Elk Grove-Bruceville Road	08/06/94	102	11
SV	Folsom-City Corporation Yard	08/06/94	96	17
MC	Placerville-Gold Nugget Way	08/12/94	116	16
SV	Auburn-Dewitt-C Avenue	08/12/94	97	13
SV	Folsom-City Corporation Yard	08/12/94	95	16
MC	Placerville-Gold Nugget Way	08/13/94	96	16
SV	Folsom-City Corporation Yard	08/14/94	103	14
SV	Rocklin-Rocklin Road	08/14/94	100	17
SV	Roseville-N Sunrise Blvd	08/14/94	96	17
SV	Davis-UCD Campus	08/15/94	97	15
MC	Placerville-Gold Nugget Way	08/16/94	124	16
SV	Auburn-Dewitt-C Avenue	08/16/94	99	14
SV	Folsom-City Corporation Yard	08/16/94	98	14
SV	Sacramento-Del Paso Manor	08/16/94	96	14
SV	Elk Grove-Bruceville Road	08/16/94	95	16

Table F-3 (con't)
1994 Ozone Violations
Broader Sacramento Area

Basin	Site	Date	Max Ozone (ppb)	Hour Max Ozone
SV	Auburn-Dewitt-C Avenue	08/17/94	131	15
SV	Rocklin-Rocklin Road	08/17/94	111	14
SV	Elk Grove-Bruceville Road	08/17/94	110	15
SV	Sacramento-Del Paso Manor	08/17/94	107	13
SV	Roseville-N Sunrise Blvd	08/17/94	105	12
MC	Placerville-Gold Nugget Way	08/17/94	105	19
SV	North Highlands-Blackfoot Way	08/17/94	101	14
SV	Folsom-City Corporation Yard	08/17/94	101	17
SV	Woodland-Sutter Street	08/17/94	100	13
SV	Pleasant Grove-4 miles SW	08/17/94	97	13
SV	Davis-UCD Campus	08/17/94	95	13
SV	Auburn-Dewitt-C Avenue	08/18/94	130	15
SV	Rocklin-Rocklin Road	08/18/94	105	14
SV	Auburn-Dewitt-C Avenue	08/19/94	105	15
SV	Rocklin-Rocklin Road	08/19/94	99	16
SV	Folsom-City Corporation Yard	08/20/94	107	15
SV	Sacramento-Del Paso Manor	08/20/94	106	13
MC	Placerville-Gold Nugget Way	08/20/94	97	18
MC	Placerville-Gold Nugget Way	08/24/94	95	16
SV	Auburn-Dewitt-C Avenue	08/30/94	103	17
SV	Auburn-Dewitt-C Avenue	08/31/94	99	16
SV	Rocklin-Rocklin Road	08/31/94	95	15
SV	Sacramento-Del Paso Manor	09/05/94	99	15
MC	Placerville-Gold Nugget Way	09/06/94	109	16
SV	Folsom-City Corporation Yard	09/06/94	106	13
SV	Sacramento-Del Paso Manor	09/06/94	99	13
SV	Folsom-City Corporation Yard	09/15/94	115	15
SV	Sacramento-Del Paso Manor	09/15/94	105	16
SV	Elk Grove-Bruceville Road	09/16/94	99	13
MC	Placerville-Gold Nugget Way	09/16/94	96	15
MC	Placerville-Gold Nugget Way	09/17/94	95	14
SV	Sacramento-Del Paso Manor	09/18/94	108	15
SV	Roseville-N Sunrise Blvd	09/18/94	105	15

Table F-3 (con't)
1994 Ozone Violations
Broader Sacramento Area

Basin	Site	Date	Max Ozone (ppb)	Hour Max Ozone
SV	Rocklin-Rocklin Road	09/18/94	102	15
SV	North Highlands-Blackfoot Way	09/18/94	102	16
SV	Folsom-City Corporation Yard	09/18/94	99	16
SV	Sacramento-Del Paso Manor	09/19/94	101	15
SV	Elk Grove-Bruceville Road	09/19/94	96	15
SV	North Highlands-Blackfoot Way	09/19/94	95	16
SV	Elk Grove-Bruceville Road	09/20/94	108	14
MC	Placerville-Gold Nugget Way	09/20/94	103	20
SV	Sacramento-Meadowview Road	09/20/94	100	16
SV	Rocklin-Rocklin Road	10/02/94	114	16
SV	Roseville-N Sunrise Blvd	10/02/94	107	15
SV	Auburn-Dewitt-C Avenue	10/02/94	102	17
SV	North Highlands-Blackfoot Way	10/02/94	99	14
SV	Sacramento-Del Paso Manor	10/02/94	95	13
SV	Folsom-City Corporation Yard	10/02/94	95	15

Table F-4
1995 Ozone Violations
Broader Sacramento Area

BASIN	SITE	DATE	MAX OZONE (ppb)	HOUR MAX OZONE
SV	North Highlands-Blackfoot Way	04/23/95	98	15
SV	Auburn-Dewitt-C Avenue	05/20/95	100	16
SV	Sacramento-Del Paso Manor	05/29/95	104	13
SV	Roseville-N Sunrise Blvd	05/29/95	101	15
SV	North Highlands-Blackfoot Way	05/29/95	100	14
SV	Rocklin-Rocklin Road	05/29/95	99	16
SV	North Highlands-Blackfoot Way	05/30/95	103	15
SV	Auburn-Dewitt-C Avenue	05/30/95	97	17
SV	Sacramento-Del Paso Manor	05/30/95	95	15
MC	Placerville-Gold Nugget Way	06/01/95	106	14
SV	Folsom-City Corporation Yard	06/03/95	100	14
SV	Rocklin-Rocklin Road	06/03/95	96	16
SV	Folsom-City Corporation Yard	06/23/95	116	13
MC	Placerville-Gold Nugget Way	06/23/95	106	17
SV	Sacramento-Del Paso Manor	06/23/95	100	12
SV	Rocklin-Rocklin Road	06/23/95	95	13
SV	Vacaville-Allison Drive	06/24/95	106	15
SV	Folsom-City Corporation Yard	06/24/95	100	14
SV	Sacramento-Del Paso Manor	06/25/95	125	13
SV	Folsom-City Corporation Yard	06/25/95	124	15
SV	Vacaville-Allison Drive	06/25/95	115	16
SV	Davis-UCD Campus	06/25/95	103	18
MC	Placerville-Gold Nugget Way	06/25/95	102	17
SV	Rocklin-Rocklin Road	06/25/95	99	17
SV	Auburn-Dewitt-C Avenue	06/26/95	148	15
SV	Rocklin-Rocklin Road	06/26/95	146	14
SV	Folsom-City Corporation Yard	06/26/95	136	13
SV	Roseville-N Sunrise Blvd	06/26/95	135	14
SV	Sacramento-Del Paso Manor	06/26/95	132	13
MC	Placerville-Gold Nugget Way	06/26/95	126	16
SV	North Highlands-Blackfoot Way	06/26/95	124	13

Table F-4 (con't)
1995 Ozone Violations
Broader Sacramento Area

BASIN	SITE	DATE	MAX OZONE (ppb)	HOUR MAX OZONE
SV	Pleasant Grove-4 miles SW	06/26/95	112	14
SV	Sacramento-Earhart Drive	06/26/95	104	14
SV	Folsom-City Corporation Yard	06/28/95	120	15
SV	Sacramento-Del Paso Manor	06/28/95	113	14
SV	Sacramento-Earhart Drive	06/28/95	98	15
SV	Auburn-Dewitt-C Avenue	07/05/95	96	16
SV	Elk Grove-Bruceville Road	07/14/95	111	13
SV	Sacramento-Del Paso Manor	07/14/95	110	12
SV	Folsom-City Corporation Yard	07/14/95	106	13
MC	Placerville-Gold Nugget Way	07/14/95	97	16
SV	Sacramento-Del Paso Manor	07/15/95	117	12
SV	Folsom-City Corporation Yard	07/15/95	114	13
SV	Rocklin-Rocklin Road	07/15/95	102	12
SV	Elk Grove-Bruceville Road	07/15/95	101	11
MC	Placerville-Gold Nugget Way	07/15/95	98	17
SV	Folsom-City Corporation Yard	07/18/95	114	14
SV	Auburn-Dewitt-C Avenue	07/18/95	104	16
SV	Sacramento-Del Paso Manor	07/18/95	103	12
SV	Rocklin-Rocklin Road	07/18/95	100	15
SV	Sacramento-Earhart Drive	07/18/95	98	15
MC	Placerville-Gold Nugget Way	07/18/95	95	17
MC	Placerville-Gold Nugget Way	07/26/95	95	14
SV	Sacramento-Del Paso Manor	07/27/95	131	16
SV	Folsom-City Corporation Yard	07/27/95	125	17
MC	Placerville-Gold Nugget Way	07/27/95	113	15
SV	Elk Grove-Bruceville Road	07/27/95	107	12
SV	Vacaville-Allison Drive	07/27/95	105	16
SV	Roseville-N Sunrise Blvd	07/27/95	104	17
SV	North Highlands-Blackfoot Way	07/27/95	98	17
SV	Sacramento-Earhart Drive	07/27/95	97	17
SV	Auburn-Dewitt-C Avenue	07/27/95	95	15
SV	Davis-UCD Campus	07/27/95	95	17
SV	Sacramento-Del Paso Manor	07/28/95	133	13

Table F-4 (con't)
1995 Ozone Violations
Broader Sacramento Area

BASIN	SITE	DATE	MAX OZONE (ppb)	HOUR MAX OZONE
SV	Folsom-City Corporation Yard	07/28/95	124	14
SV	Auburn-Dewitt-C Avenue	07/28/95	123	12
SV	Rocklin-Rocklin Road	07/28/95	122	14
SV	Roseville-N Sunrise Blvd	07/28/95	117	13
SV	North Highlands-Blackfoot Way	07/28/95	115	13
MC	Placerville-Gold Nugget Way	07/28/95	100	16
SV	Sacramento-Earhart Drive	07/28/95	98	13
SV	Sacramento-Del Paso Manor	07/31/95	154	12
SV	Folsom-City Corporation Yard	07/31/95	127	15
MC	Placerville-Gold Nugget Way	07/31/95	110	17
SV	Roseville-N Sunrise Blvd	07/31/95	108	12
SV	Auburn-Dewitt-C Avenue	07/31/95	104	13
SV	Rocklin-Rocklin Road	07/31/95	103	13
SV	Sacramento-T Street	07/31/95	100	12
SV	North Highlands-Blackfoot Way	07/31/95	99	11
SV	Sacramento-Del Paso Manor	08/01/95	125	15
SV	Folsom-City Corporation Yard	08/01/95	124	11
SV	Sacramento-T Street	08/01/95	114	15
SV	Sacramento-Earhart Drive	08/01/95	112	16
SV	Davis-UCD Campus	08/01/95	111	14
SV	Elk Grove-Bruceville Road	08/01/95	109	14
SV	North Highlands-Blackfoot Way	08/01/95	108	16
MC	Placerville-Gold Nugget Way	08/01/95	106	10
SV	Auburn-Dewitt-C Avenue	08/01/95	104	11
SV	Pleasant Grove-4 miles SW	08/01/95	102	15
SV	Woodland-Sutter Street	08/01/95	100	13
SV	Roseville-N Sunrise Blvd	08/01/95	100	17
SV	Rocklin-Rocklin Road	08/01/95	99	11
SV	Folsom-City Corporation Yard	08/02/95	147	14
SV	Rocklin-Rocklin Road	08/02/95	117	12
MC	Placerville-Gold Nugget Way	08/02/95	116	16
SV	Sacramento-Del Paso Manor	08/02/95	115	12
SV	Roseville-N Sunrise Blvd	08/02/95	109	12

Table F-4 (con't)
1995 Ozone Violations
Broader Sacramento Area

BASIN	SITE	DATE	MAX OZONE (ppb)	HOUR MAX OZONE
SV	Sacramento-Earhart Drive	08/02/95	104	15
SV	North Highlands-Blackfoot Way	08/02/95	99	12
SV	Woodland-Sutter Street	08/02/95	97	15
SV	Elk Grove-Bruceville Road	08/02/95	96	13
SV	Auburn-Dewitt-C Avenue	08/03/95	145	17
SV	Roseville-N Sunrise Blvd	08/03/95	134	15
SV	Rocklin-Rocklin Road	08/03/95	133	16
SV	Sacramento-Del Paso Manor	08/03/95	122	13
SV	North Highlands-Blackfoot Way	08/03/95	121	13
MC	Placerville-Gold Nugget Way	08/03/95	119	17
SV	Folsom-City Corporation Yard	08/03/95	105	15
SV	Pleasant Grove-4 miles SW	08/03/95	104	13
SV	Sacramento-Earhart Drive	08/03/95	101	13
SV	Auburn-Dewitt-C Avenue	08/04/95	99	16
SV	Auburn-Dewitt-C Avenue	08/09/95	120	15
SV	North Highlands-Blackfoot Way	08/09/95	102	13
SV	Rocklin-Rocklin Road	08/09/95	97	14
SV	Folsom-City Corporation Yard	08/09/95	96	16
MC	Placerville-Gold Nugget Way	08/14/95	119	17
SV	Folsom-City Corporation Yard	08/14/95	109	11
SV	Sacramento-Del Paso Manor	08/14/95	102	14
SV	Elk Grove-Bruceville Road	08/14/95	100	16
SV	Vacaville-Allison Drive	08/14/95	98	17
SV	Davis-UCD Campus	08/14/95	96	13
SV	Auburn-Dewitt-C Avenue	08/15/95	110	13
MC	Placerville-Gold Nugget Way	08/15/95	99	16
SV	Folsom-City Corporation Yard	08/19/95	123	13
SV	Sacramento-Del Paso Manor	08/19/95	120	14
MC	Placerville-Gold Nugget Way	08/19/95	105	16
SV	North Highlands-Blackfoot Way	08/19/95	96	12
SV	Sacramento-T Street	08/19/95	95	13
SV	Sacramento-Earhart Drive	08/20/95	116	15
SV	Sacramento-Del Paso Manor	08/20/95	109	16

Table F-4 (con't)
1995 Ozone Violations
Broader Sacramento Area

BASIN	SITE	DATE	MAX OZONE (ppb)	HOUR MAX OZONE
SV	Elk Grove-Bruceville Road	08/20/95	104	13
SV	Pleasant Grove-4 miles SW	08/20/95	104	17
MC	Placerville-Gold Nugget Way	08/20/95	103	14
SV	Sacramento-T Street	08/20/95	103	15
SV	Folsom-City Corporation Yard	08/20/95	100	10
SV	North Highlands-Blackfoot Way	08/20/95	100	17
SV	Davis-UCD Campus	08/20/95	99	13
SV	Woodland-Sutter Street	08/20/95	98	13
SV	Vacaville-Allison Drive	08/20/95	98	13
MC	Placerville-Gold Nugget Way	08/21/95	121	17
SV	Auburn-Dewitt-C Avenue	08/21/95	100	14
SV	Sacramento-Earhart Drive	08/21/95	95	15
SV	Sacramento-Del Paso Manor	08/22/95	124	15
SV	Sacramento-Earhart Drive	08/22/95	106	14
SV	Folsom-City Corporation Yard	08/22/95	104	15
SV	Elk Grove-Bruceville Road	08/22/95	100	16
SV	Sacramento-T Street	08/22/95	97	15
MC	Placerville-Gold Nugget Way	08/22/95	95	11
SV	Pleasant Grove-4 miles SW	08/22/95	95	14
SV	Woodland-Sutter Street	08/22/95	95	15
SV	Folsom-City Corporation Yard	08/26/95	96	17
MC	Placerville-Gold Nugget Way	08/30/95	108	17
SV	Roseville-N Sunrise Blvd	08/31/95	120	15
SV	Rocklin-Rocklin Road	08/31/95	117	15
MC	Placerville-Gold Nugget Way	08/31/95	117	18
SV	North Highlands-Blackfoot Way	08/31/95	115	13
SV	Sacramento-Del Paso Manor	08/31/95	115	14
SV	Auburn-Dewitt-C Avenue	08/31/95	110	15
SV	Pleasant Grove-4 miles SW	08/31/95	96	15
SV	Sacramento-Earhart Drive	08/31/95	95	15
MC	Placerville-Gold Nugget Way	09/01/95	104	16
SV	Rocklin-Rocklin Road	09/01/95	97	16
SV	Folsom-City Corporation Yard	09/06/95	118	13

Table F-4 (con't)
1995 Ozone Violations
Broader Sacramento Area

BASIN	SITE	DATE	MAX OZONE (ppb)	HOUR MAX OZONE
SV	Elk Grove-Bruceville Road	09/07/95	114	16
SV	Auburn-Dewitt-C Avenue	09/07/95	112	15
SV	Folsom-City Corporation Yard	09/07/95	106	13
MC	Placerville-Gold Nugget Way	09/07/95	106	16
SV	Rocklin-Rocklin Road	09/07/95	102	13
SV	Pleasant Grove-4 miles SW	09/07/95	96	15
SV	Roseville-N Sunrise Blvd	09/07/95	95	13
SV	Sacramento-Del Paso Manor	09/07/95	95	14
SV	Folsom-City Corporation Yard	09/08/95	133	14
SV	Sacramento-Del Paso Manor	09/08/95	111	12
SV	North Highlands-Blackfoot Way	09/08/95	106	13
SV	Roseville-N Sunrise Blvd	09/08/95	104	14
SV	Pleasant Grove-4 miles SW	09/08/95	104	15
SV	Rocklin-Rocklin Road	09/08/95	103	14
SV	Auburn-Dewitt-C Avenue	09/08/95	103	14
MC	Placerville-Gold Nugget Way	09/08/95	103	16
SV	Sacramento-Earhart Drive	09/08/95	95	13
SV	Auburn-Dewitt-C Avenue	09/09/95	102	16
SV	Folsom-City Corporation Yard	09/10/95	110	16
MC	Placerville-Gold Nugget Way	09/10/95	96	20
SV	Roseville-N Sunrise Blvd	09/10/95	95	15
SV	Auburn-Dewitt-C Avenue	09/11/95	114	17
SV	Folsom-City Corporation Yard	09/11/95	108	15
SV	Rocklin-Rocklin Road	09/11/95	108	15
MC	Placerville-Gold Nugget Way	09/11/95	101	16
SV	North Highlands-Blackfoot Way	09/11/95	98	14
SV	Sacramento-Del Paso Manor	09/11/95	98	14
SV	Roseville-N Sunrise Blvd	09/11/95	98	16
MC	Placerville-Gold Nugget Way	09/12/95	114	15
SV	Sacramento-Del Paso Manor	09/12/95	110	13
SV	Auburn-Dewitt-C Avenue	09/12/95	110	15
SV	Folsom-City Corporation Yard	09/12/95	110	16
SV	Elk Grove-Bruceville Road	09/12/95	109	15

Table F-4 (con't)
1995 Ozone Violations
Broader Sacramento Area

BASIN	SITE	DATE	MAX OZONE (ppb)	HOUR MAX OZONE
SV	Sacramento-T Street	09/12/95	103	14
SV	Pleasant Grove-4 miles SW	09/12/95	99	14
SV	Sacramento-Earhart Drive	09/12/95	99	15
SV	North Highlands-Blackfoot Way	09/12/95	98	16
SV	Rocklin-Rocklin Road	09/12/95	97	13
SV	Folsom-City Corporation Yard	09/13/95	120	15
MC	Placerville-Gold Nugget Way	09/13/95	111	14
SV	Sacramento-Del Paso Manor	09/13/95	105	14
SV	North Highlands-Blackfoot Way	09/13/95	100	14
SV	Elk Grove-Bruceville Road	09/13/95	98	13
SV	Rocklin-Rocklin Road	09/13/95	98	15
SV	Sacramento-Earhart Drive	09/13/95	97	15
SV	Auburn-Dewitt-C Avenue	09/13/95	97	15
SV	Roseville-N Sunrise Blvd	09/13/95	95	14
SV	Folsom-City Corporation Yard	09/14/95	116	15
MC	Placerville-Gold Nugget Way	09/14/95	111	16
SV	Sacramento-Del Paso Manor	09/14/95	97	15
SV	Rocklin-Rocklin Road	09/14/95	95	14
SV	North Highlands-Blackfoot Way	09/14/95	95	15
SV	Auburn-Dewitt-C Avenue	09/15/95	99	16
SV	Sacramento-Del Paso Manor	09/18/95	116	15
SV	Folsom-City Corporation Yard	09/18/95	114	17
SV	Auburn-Dewitt-C Avenue	09/18/5	112	16
SV	Rocklin-Rocklin Road	09/18/95	107	15
SV	Roseville-N Sunrise Blvd	09/18/95	103	16
SV	North Highlands-Blackfoot Way	09/18/95	99	15
SV	Elk Grove-Bruceville Road	09/18/95	96	15
SV	Folsom-City Corporation Yard	09/19/95	156	16
SV	Sacramento-Del Paso Manor	09/19/95	154	15
SV	Sacramento-T Street	09/19/95	128	14
SV	North Highlands-Blackfoot Way	09/19/95	127	14
SV	Elk Grove-Bruceville Road	09/19/95	120	13
SV	Rocklin-Rocklin Road	09/19/95	120	14

Table F-4 (con't)
1995 Ozone Violations
Broader Sacramento Area

BASIN	SITE	DATE	MAX OZONE (ppb)	HOUR MAX OZONE
SV	Roseville-N Sunrise Blvd	09/19/95	120	15
MC	Placerville-Gold Nugget Way	09/19/95	120	16
SV	Sacramento-Earhart Drive	09/19/95	119	15
SV	Auburn-Dewitt-C Avenue	09/19/95	114	14
SV	Pleasant Grove-4 miles SW	09/19/95	112	15
SV	Woodland-Sutter Street	09/19/95	108	14
SV	Vacaville-Allison Drive	09/19/95	102	16
SV	Davis-UCD Campus	09/19/95	101	14
SV	Folsom-City Corporation Yard	09/20/95	130	16
SV	Rocklin-Rocklin Road	09/20/95	129	15
SV	Pleasant Grove-4 miles SW	09/20/95	126	13
SV	North Highlands-Blackfoot Way	09/20/95	125	14
SV	Auburn-Dewitt-C Avenue	09/20/95	124	13
SV	Roseville-N Sunrise Blvd	09/20/95	122	15
SV	Woodland-Sutter Street	09/20/95	114	14
SV	Sacramento-Del Paso Manor	09/20/95	113	14
SV	Sacramento-Earhart Drive	09/20/95	111	13
SV	Davis-UCD Campus	09/20/95	108	13
SV	Elk Grove-Bruceville Road	09/20/95	99	11
MC	Placerville-Gold Nugget Way	09/20/95	97	18
SV	Auburn-Dewitt-C Avenue	09/21/95	111	16
SV	Rocklin-Rocklin Road	09/21/95	103	16
SV	Roseville-N Sunrise Blvd	09/21/95	101	16
SV	Elk Grove-Bruceville Road	10/06/95	97	15
SV	Folsom-City Corporation Yard	10/29/95	102	14

APPENDIX G

SUPPLEMENTAL INFORMATION

G-1

Staff Analysis of Transport from the San Joaquin Valley Air Basin to the North Central Coast Air Basin

A transport working group composed of staff from the Monterey Bay Unified Air Pollution Control District (MBUAPCD), Bay Area Air Quality Management District, and ARB was formed to collectively analyze 1994-1995 NCCAB ozone exceedances. As found during previous SFBAAB to NCCAB transport assessments, some days were overwhelming and on others significant. However, on one NCCAB exceedance day (June 9, 1994) both SFBAAB and SJVAB, collectively, overwhelmed the NCCAB. On this day at 1500 PST Hollister's daily maximum ozone concentration reached 101 ppb. The working group's analysis is described below.

The working group reviewed the geographical distributions of the ozone maxima and their times of occurrence for June 9, the day of the State exceedance. In the NCCAB Scotts Valley, Carmel Valley, and the Pinnacles recorded 9 pphm. The peaks observed in those areas occurred later than the Hollister peak. In the SFBAAB San Martin recorded a peak ozone concentration of 11 pphm; and Gilroy, San Jose, and Fremont, 10 pphm. In the northern SJVAB Merced had 10 pphm and Modesto and Turlock had 9 pphm. The Broader Sacramento Area (BSA) had a maximum of only 7 pphm. The spatial ozone pattern points to the southern SFBAAB and the northern SJVAB as possible sources of ozone that could have had an impact on Hollister.

The group then reviewed wind data from San Jose, San Martin, Gilroy, Granite Rock #3 and Hollister to evaluate surface flow in the Santa Clara Valley and within the NCCAB through the Pajaro Gap. They also reviewed wind data from PG&E's Los Banos site for evidence of possible flow from the SJVAB through the Pacheco Pass. The persistent northwest winds at San Jose, San Martin, and Gilroy from around 0900 PST to the evening hours suggest probable transport from the SFBAAB toward Hollister. The wind direction at the MBUAPCD's Hollister station varied between west and northwest from 0600 PST to 2000 PST. The winds at the Granite Rock #3 site changed from northwest at 1300 to west at 1500 PST, suggesting possible transport within the NCCAB through the Pajaro Gap. The north to northeast winds at Los Banos suggest possible flow from the northern SJVAB toward the NCCAB. However, for this day there wasn’t any available wind data from the Pacheco Pass area to verify that the flow continued on into the NCCAB. The airflow patterns based on the surface wind data suggest that ozone and its precursors were transported from the southern SFBAAB to Hollister. In addition, westerly winds at Granite Rock #3 suggests that sources within the NCCAB impacted Hollister.

Further, the group examined mountain-top wind data at several locations to identify the possible transport directions at elevated levels. They also reviewed the radar profiler data collected at Hollister, Fort Ord, and UCSC Long Marine Laboratory; Doppler acoustic sounder data collected by PG&E at Moss Landing; and Oakland rawinsonde data. On this day Mt. Pise (elevation 621 m) experienced continuous offshore flow until 1300 PST. Weak onshore flow occurred between 1400 and 1900 PST, followed by a return to offshore flow after 1900 PST. Monitors at Kregor Peak (elevation 577 m) also reported offshore flow in the morning. Moss Landing experienced offshore flow in the lowest 500 m (the upper limit of the Doppler sounder measurements) above mean sea level (msl) in the morning. The sea breeze started at 0900 PST at the surface and deepened to 500 m by 1100 PST. At 1700 PST a land breeze began at the surface. The land-breeze layer deepened to 500 m by 2000 PST. The coastal profilers (Fort Ord and UCSC) showed diurnal flow patterns similar to those at Moss Landing. At around 1000 m msl the winds were northeast throughout the day. The Hollister profiler showed variable winds below 500 m in the morning. Between 500 m and 1000 m winds were predominantly from the east to north-northwest. Above 1000 m northeast winds prevailed. The Hollister profiler did not record winds after 1200 PST. The 0400 PST Oakland sounding showed north-northwest winds below 150 m and north-northeast winds above 800 m in the morning. In the afternoon Oakland recorded west-northwest winds near the surface and northeast winds at 85 mb. The wind pattern aloft at Hollister and Oakland suggests that transport aloft from the SFBAAB and from the northern SJVAB could have had an impact on Hollister.

Inversion heights at Oakland, Hollister, and Fort Or were derived from the temperature profiles. All locations observed ground-based inversions in the early morning and late evening. The 0400 PST Oakland inversion top and strength was 500 m and 16 Celsius degrees of potential temperature, respectively, indicating that nighttime emissions were concentrated in a shallow layer by a strong inversion cap. As a result of surface heating, the inversion base had begun to rise by 0900 PST. The inversion base height increased to 250 m at Fort Or and 500 m at Hollister by 1000 PST and decreased somewhat thereafter. The maximum height of the inversion base in the afternoon was 150 m at Fort Or, and is unknown at Hollister, however, due to missing data. The inversion base and top at 1600 PST at Oakland were 400 m and 520 m, respectively, with a strength of 2.7 Celsius degrees. Daily maximum surface temperatures at Salinas and Sacramento and temperature soundings at Oakland and Vandenberg were used to estimate mixing heights at Hollister. The analysis suggests that the afternoon mixing height in the Hollister area could have exceeded 1000 m and allowed ozone aloft to mix down to the surface.

Hollister's maximum surface temperature of 95 degrees Fahrenheit on June 9, 1994 is similar to the maximum temperatures in the southern SFBAAB (San Martin and Gilroy) and in the northern SJVAB. Thus, it appears that the marine layer had not penetrated as far inland as Hollister at the time of the ozone peak.

Back trajectories were calculated for five elevations (10 m, 100 m, 300 m, 500 m, and 1000 m above ground level (age)) using hourly gridded wind fields. The WOCSS diagnostic wind model used observations to calculate interpolated winds for each grid cell. Then the hourly gridded winds were used to calculate backward trajectories from Hollister at 1500 PST, the time of the ozone peak. Air parcels that arrived at Hollister in the surface layer were traced backward to the Gilroy and San Jose area in the early morning. Air trajectories aloft suggest that the morning commute-time emissions near Stockton could have traveled southwestward through the Pacheco Pass to contribute to Hollister's 1500 PST peak ozone concentration of 101 ppb. The trajectory analyses suggest that ozone and precursor gases from the southern SFBAAB within the lowest 100 m, and from the northern SJVAB aloft, impacted Hollister at the time of the exceedance.

The above analyses, when taken as a whole, provide strong evidence that ozone and its precursors in the surface layer traveled southward from the southern SFBAAB and had an impact on Hollister. It also appears that there was flow aloft into the NCCAB from the northern SJVAB. Ozone aloft could have mixed down to the surface as the mixing layer deepened in the afternoon, thereby contributing to Hollister's peak ozone. The transport working group concluded that the impact at Hollister is the combined transport impact from the SFBAAB and the SJVAB. However, when there are shared contributions from the SFBAAB and the northern SJVAB, it seems likely that the SFBAAB would often have the greater impact since the emissions ratio between SFBAAB (Santa Clara and San Mateo Counties) and NCCAB (San Benito County) is 25 to 1 and the emissions ratio between the northern SJVAB (San Joaquin and Stanislaus Counties) and NCCAB (San Benito County) is 16 to 1, respectively. To help the group estimate the possible SJVAB transport contribution, we reviewed the SARMAP model transport results for the August 5, 1990, ozone exceedance at Hollister. Unfortunately, the August 5, 1990, model results proved of little benefit for June 9, 1994, because local wind patterns were dissimilar. Therefore, the group was unable to estimate the contribution of ozone transported aloft from the SJVAB to the Hollister area.

G-2
Data Sources

Source	Responsible Entity
AIRS	Arizona Department of Environmental Quality
DRI	Bureau of Land Management
AIRS	California Air Resources Board
CIMIS	California Irrigation Management Information System
AIRS	Clark County Health Department
AIRS	Chevron Oil
AIRS	Environmental Monitoring Company
AIRS	Exxon
AIRS	Fresno County APCD
AIRS	Great Basin Unified APCD
AIRS	Imperial County APCD
AIRS	Los Angeles County APCD
AIRS	Mariposa County Health Department
AIRS	Mojave Desert AQMD
DRI	National Parks Service
NWS	National Weather Service
AIRS	POPCO
AIRS	Riverside County APCD
AIRS	Santa Barbara APCD
AIRS	South Coast AQMD
AIRS	San Diego County APCD
AIRS	Joaquin Valley Unified APCD
AIRS	San Luis Obispo County APCD
AIRS	Texaco
DRI	US Forest Service
AIRS	UNOCAL
AIRS	US EPA
AIRS	Ventura County APCD
AIRS	Xontec Inc.

G-3

Staff Analysis of the Four Selected Exceedance Days at Crow's Landing and Tracy

1. August 17, 1994

The 1600 PST surface analysis for August 17, 1994, seems to imply a convergence zone in the area of Tracy. There are no ozone data from Tracy for that day but Crow's Landing to the south had a peak that day of 10.8 pphm. The surface flow path to Crow's Landing seems to have been through Livermore; however, the peak ozone concentration recorded at Livermore was 8.7 pphm. The peak ozone value recorded at Bethel Island of 10.2 pphm implies that higher ozone concentrations aloft had been mixed downwards just upwind of Crow's Landing. It may have been that the flow that had passed over Bethel Island had been forced over an underlying flow from Livermore and then eventually mixed further south.

That same 1600 PST surface analysis does show a significant flow through the area between the Santa Clara and Hollister Valleys and over the Pacheco Pass. In fact, an IR satellite photograph for that same hour, strongly suggests that same flow into that part of the San Joaquin Valley. The nearest wind data site to Crow's Landing was Turlock, 23 km (14 miles) to the west-northwest. There was northerly flow at Turlock during the morning up to 10 am, southwesterly flow from 11 am - 2 pm, westerly flow from 3 pm - 5 pm, and southwesterly flow again during the rest of the afternoon and evening. Ozone values at Crow's Landing above 9.5 pphm occurred between 1 and 6 pm. This suggests polluted air from Pacheco Pass made it to Crow's Landing. At this point it is not possible to determine the source of the original emission sources. They could have been from the SFBAAB or the North Central Coast Air Basin.

2. September 5, 1994

The 1600 PST surface analysis for September 5, 1994, shows flows from Livermore and the Carquinez Strait to Tracy. Flow to Crow's Landing is less certain. On that day the peak ozone values for Livermore, Bethel Island and Crow's Landing were 10.8 pphm, 8.3 pphm and 10.1 pphm respectively. Ozone data from both Tracy and Crow's Landing show two peaks, one in the mid-afternoon and the other in the evening. Ozone concentrations at Tracy and Crow's Landing began to increase early in the morning from values below 1 pphm to 8 pphm by noon. Tracy's ozone values increased at 6 am whereas the increase at Crow's Landing began earlier at 4 am. The light winds (< 1 m/s) prior to noon at both sites, suggests that the early increase of ozone was due more to fumigation from levels just above the surface.

By the time ozone peaked at Tracy and Crow's Landing, the flow was northerly at both sites. Even though this points to the Carquinez Strait, the wind speeds in the Tracy area at the time of its ozone peak (2 - 4 m/s) and at Bethel Island prior to noon (< 3 m/s) suggest a travel time of 6 or more hours between Tracy and the Carquinez Strait. Bethel Island and the area near Tracy prior to 9 am experienced wind speeds 1 m/s or less. This implies the air that passed over Tracy at 2 pm did not come through the Carquinez Strait that day.

On the other hand, the second ozone peak at Tracy can be attributed to transport from Livermore based on the wind directions at Tracy. Given the wind speeds at Livermore and Tracy (5 - 6 m/s), travel time from one to the other is about 2 hours. The time difference between the wind direction shift at Tracy and the rapid wind speed increase at Livermore was 3 or 4 hours. When considering the effect of the air flow spreading horizontally after passing over Altamont Pass, the wind shift time difference and time travel support each other.

3. August 1, 1995

The 1600 PST surface analysis for August 1, 1995, is similar to that of August 17, 1994, with an implied convergence zone in the Tracy area. The peak surface ozone concentrations for Bethel Island, Livermore, Tracy and Crow's Landing were 8.1 pphm, 11.4 pphm, 8.7 pphm and 9.6 pphm, respectively. Ozone data from Tracy shows two main peaks, at 1 pm and 7 pm. Ozone concentrations at Tracy began to increase early in the morning from values below 1 pphm to 8 pphm by noon. There is no ozone data from Crow's Landing prior to 2 pm. Because of the light winds prior to 10 am at Tracy (1 - 2 m/s), it is suspected that the early increase of ozone was due more to fumigation.

When ozone values peaked at Tracy, the flow was from the north-northeast. Even though this direction points to the east of Bethel Island, the wind directions at Bethel Island and Stockton were in alignment from the northwest, suggesting that flow from the Bethel Island area eventually passed over Tracy. The wind speeds (3 m/s) in the Tracy area at the time of its ozone peak and at Bethel Island prior to noon (4 - 5 m/s) suggest a travel time of 4 - 5 hours from the Carquinez Strait to Tracy. This would indicate that the first ozone peak recorded at Tracy is attributable to emissions from the Carquinez Strait area.

The source of the second ozone peak at Tracy is harder to trace. The wind direction at Tracy then was from the west-northwest. This may imply flow from the Carquinez Strait that had passed well south of Bethel Island and followed the terrain orientation.

The ozone peak recorded at Crow's Landing can be attributed to air having passed near Tracy 3 hours earlier at the time the first peak was experienced at Tracy. The 3 hour travel time is based on the 3 m/s wind speeds at Turlock and Tracy and the wind direction from the north-northwest at Crow's Landing. Because the two ozone peaks are linked, the argument can be made that the Crow's Landing peak is attributable to the emissions from the Bay Area.

A diagnostic computer model was used to calculate the surface trajectory of a parcel of air that passed over Crow's Landing at the time of the maximum ozone concentration, 4 pm, starting at midnight. These computations were based on spatial interpolations of hourly observed data. Such analyses should be treated carefully and flow features that are smaller than the distances between observation sites reflect the interpolation algorithms more than actual physical processes. However, the trajectory supports the previous subjective analysis. The trajectory path being south of Bethel Island could explain why peak ozone at Crow's Landing (9.6 pphm) was larger than at Bethel Island (8.1 pphm). One could expect an increasing gradient south of Bethel Island because of the higher peak at Livermore (11.4 pphm).

4. August 9, 1995

The 1600 PST surface analysis for August 9, 1995, shows a surface flow from Bethel Island to Tracy and Livermore to Crow's Landing. However, hourly wind data recorded at Tracy shows a shift from the north to the west occurring between 2 - 3 pm. The Tracy data was not used in the 1600 PST surface analysis which would have created a streamline analysis linking flow from Livermore to Tracy. Prior to 1 pm and after 8 am, data from the Mariposa site just southeast of Stockton shows wind direction between the north and the northeast. When considering the peak surface values from Bethel Island (8.5 pphm), Tracy (10.9 pphm), and Stockton-Mariposa (10.4 pphm), ozone levels recorded at Tracy prior to the wind shift would then be attributable to surface air passing over Stockton emission sources. After the wind shift, surface flow came from the Livermore direction which had lower levels of ozone as indicated in the decline recorded at Tracy.

The situation at Crow's Landing was different. The nearest wind data site, Turlock, between 8 am and 5 pm had wind directions on the average from the west-northwest. By 5 pm ozone levels increased to 9.9 pphm. Until 1 pm, surface flow at Livermore was from the west with speeds of 4 to 5 m/s. Afterwards Livermore winds were from the west-northwest at 9.3 m/s. Livermore recorded an ozone peak of 9.6 pphm at noon. Assuming a flow speed of 4 m/s and the distance between Crow's Landing and Livermore of about 65 km, a surface travel time of 4.5 hours results. This compares well with the time difference of 5 hours between the Livermore and Crow's Landing ozone peaks.

A surface trajectory was calculated starting at midnight and ending at the time of the recorded ozone peak at Crow's Landing, 5 pm. The path supports the previous subjective analysis that the high ozone at Crow’s Landing was due to transport of polluted air from the SFBAAB that had passed through the Livermore Valley.

APPENDIX H

MOJAVE DESERT AIR POLLUTION TRANSPORT INTERIM REPORT

MOJAVE DESERT AIR POLLUTION TRANSPORT

INTERIM REPORT

Submitted to:

THE STATE OF CALIFORNIA AIR RESOURCES BOARD

Prepared by:

Mojave Desert Air Pollution Transport Committee

February 2, 1996

and

as Revised, July 22, 1996*

INTERIM REPORT:
EXECUTIVE SUMMARY

The purpose of this interim report is to present the California Air Resources Board (CARB) with the background, and current conclusions and recommendations of the Mojave Desert Air Pollution Transport Committee (Committee).

The Committee was established in 1993 by CARB to resolve differences which various groups had regarding the impacts of transported and local emissions on the ozone air quality in the Mojave Desert portion of the Southeast Desert Air Basin (SEDAB) and particularly in the Barstow area. The Committee is comprised of representatives from the regulated community (including military), CARB, the Mojave Desert Air Quality Management District (MDAQMD), and Kern County Air Pollution Control District.

Throughout 1994, the Committee evaluated the applicabilities of a total of 33 individual studies and databases relative to transport into the SEDAB. The studies were screened for data which could be used to support or refute a conclusion of locally generated ozone exceedances. However, of the 33 individual studies and databases, only six were found to address the types of exceedances observed during the CARB identified study days of April 29 and September 15, 1989. Air monitoring data from two remote sites presented during an early Committee session in Needles provided new information indicating possible regional and carry-over transport on the two design days identified by CARB. A summary of these studies is contained in Appendix A of this report.

In addition to evaluating historical data, the Committee has and is being included in planning for transport studies. The Committee is also tracking the results of several recent studies. These studies include:

- The 1995 Mojave Desert Transport Study;

- The 1994-95 Barstow Halocarbon Study, an analysis of halocarbon "tracers of opportunity";

- The 1992 Project MOHAVE, an investigation of long range transport from urban to pristine areas of Colorado;

- Mobile source traffic counts on SEDAB transportation corridors, and

- The 1992 Radar Wind Profile Data Analysis (ARB Contract 94-2).

After careful consideration of the available studies, the committee agreed upon the following conclusions:

- Meteorology is the dominant factor controlling the change in air quality from one day to the next in the desert. On most ozone exceedance days, a thermal low pressure develops over the desert due to hot rising air; cooler air moves into this low pressure area resulting in transport into the desert.

- Two types of state exceedance days were identified. **Typical exceedance days** (93% of exceedance days at Barstow) were defined as those exceedance days which were the result of overwhelming transport. **Atypical exceedance days** (7% of exceedance days at Barstow) are those occurring under more subtle and complex meteorological conditions and for which the cause is not clearly understood. <u>Atypical</u> exceedance days could be caused by overwhelming transport unrecognized as coming from one or more other transport corridors, a combination of transport and local contribution, or only by local contribution.

- The available evidence from the six relevant studies is conflicting. Shared days, where local contribution might be significant, were not studied or identified. No single study was considered sufficient to conclusively establish the presence or absence of transport on <u>atypical</u> exceedance days.

- All exceedances of the Federal ozone standard in SEDAB are the direct result of transport.

- According to Section 5 of the Roberts, et al, 1992 Report, state exceedance days at Barstow, with the greatest possibility of local effects, have occurred at a rate of less than one per year over 10 ozone seasons during the 1980's.

- The impact of mobile source emissions from major transportation corridors (State Highway 58 and Interstates I-40 and I-15) on atypical exceedance days is not quantified.

- Research, such as the 1995 Mojave Desert Study preliminary data, reaffirmed the need to account for three dimensional atmospheric structure. Further research (such as the 1997 SCOS Study) is needed to quantify transport and to evaluate the effectiveness of future control schemes aimed at improving SEDAB air quality.

As a result of these findings, the Committee formulated the following recommendations:

- In light of AB 421 (Olberg-1995), also know as the Mojave Desert Air Basin Bill, the committee's conclusions should be considered in the redesignation of the new basin created by the legislation.

- The impact of transport from outside the SEDAB and from out-of-area mobile sources is not sufficiently defined to determine the effectiveness of such a control scheme in improving air quality in SEDAB. Recognizing this uncertainty, control strategies to achieve attainment and their effectiveness need to be re-evaluated.*

- CARB staff should continue development of a quantitative characterization of transport, such as a transport index. This index would define the contribution of transport.

- The impact of South Coast Air Basin (SoCAB) vehicles traveling on major transportation corridors to/from Nevada and/or Colorado River recreational and gaming areas should be considered by Cal Trans or the Southern California Association of Governments (SCAG). CARB staff should promote CalTrans or SCAG involvement with improving the mobile source inventory.

- Resources should be dedicated to further improve UAM modeling for transport impacted areas. Efforts should be directed at upgrading meteorological and transportation corridor inputs.

- Continue Transport Committee meetings to more accurately define meteorological events of influence and to further improve the understanding of air quality in the Mojave Desert. The committee inputs to the regulatory and planning process should be utilized to avoid the potential cost to society of rulemaking for Mojave stationary sources, without any subsequent, significant improvement in air quality and the accompanying public health benefit.

The main body of the Interim Report provides information and documentation which support the Committee's conclusions and recommendations.

MDAPTC INTERIM REPORT

SEDAB (Mojave Desert) Air Pollution Transport

1.0 INTRODUCTION

The Mojave Desert Air Pollution Transport Committee (MDAPTC or "Committee") is comprised of representatives of the California Air Resources Board (CARB or "Board"), the Mojave Desert Air Quality Management District (MDAQMD or "District"), the regulated community in the Mojave Desert including military bases, and interested scientific groups (e.g., Jet Propulsion Lab and Desert Research Institute). The MDAPTC was created to resolve differences which various groups had regarding the impacts of transport and local emissions on the ozone air quality in the South East Desert Air Basin (SEDAB)[1] and, particularly, the Barstow area. Different opinions, in large part, arose from different interpretations based on limited (spatially and temporally) air quality and meteorological data in the Mojave Desert.

This report provides background information on the current situation and summarizes the interim findings, conclusions, and recommendations of the Committee. This report is the product of a review of available information (based on previous and current field studies) and discussions on the impacts of transport and local emissions on ozone air quality in the SEDAB and, in particular, the Mojave Desert. The purpose of this paper is to present the Committee's conclusions and recommendations for consideration when the Board addresses issues relevant to the SEDAB (e.g., air quality designations, apportionment between upwind and local areas of the controls necessary to achieve healthful air quality, allocation of resources for further research on air quality in southern California and the Mojave Desert in particular).

1.1 Background

The California Clean Air Act of 1988 requires the CARB to assess the relative contributions of upwind pollutants to violations of the state ozone standard (9 pphm, 1-hour average) in downwind areas. The California Health and Safety Code (H&SC), Section 39610(a) states that CARB shall identify the origin of the transported pollutants, "based upon a preponderance of available evidence." Prior to 1994, Section 39610(b)

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[1]This area is defined by AB421 (Olberg) Mojave Desert Air Basin (Chaptered #113).

stated: "The state board shall, in cooperation with the districts, assess the relative contribution of upwind emissions to downwind ozone ambient pollutant levels to the extent permitted by available data, and shall establish mitigation requirements commensurate with the level of contribution" (CARB, 1992, pg. 14). However, after Assembly Bill 2757 was adopted in 1994, two sentences were added to Section 39610(b) of the H&SC requiring that CARB "determine if the contribution . . . of transported air pollutants is overwhelming, significant, inconsequential, or some combination thereof" and that any determination by CARB "shall be based upon the preponderance of the *available*[2] evidence."

Since exceedances of the state ozone standard frequently occur within the SEDAB, staff in CARB's Technical Support Division were required to perform this upwind-downwind assessment based on available data, with new assessments scheduled every three years beginning in 1990. The CARB analysis for the SEDAB focused on ozone standard exceedances at Barstow, CA, where Interstate Highways I-15 and I-40 meet. The reason for this focus is that Barstow "is close enough to data sources to allow reliable analyses and far enough away from basin boundaries to show inconsequential transport" (CARB, 1990).

In their 1990 assessment, CARB staff believed that the contribution of local sources can be important and identified what they considered to be a case study day: a Barstow ozone exceedance which occurred on April 29, 1989. At the August 23, 1991 Workshop on Alternative Ozone Policy Issues sponsored by CARB in Sacramento, a difference of opinion about this local contribution developed. Members of the District and representatives of the regulated community believed that the local contribution was negligible in general and presented evidence that transport from outside the SEDAB contributed to the April 29, 1989 exceedance (Tilden et al., 1991). CARB staff believed that local conditions caused the exceedances near mid-day and that overwhelming transport caused the exceedances after 4 p.m.

Throughout the next two years at workshops and technical working group meetings, discussions continued about the impact of local emissions on exceedances of

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[2]The italicized emphasis on "available" is in the Code text.

the ozone standard in the SEDAB and the non-attainment classification for ozone. In their 1993 assessment, CARB staff identified a second case study day (September 15, 1989) for which they concluded that local emissions made an important contribution to an ozone exceedance at Barstow. Thus, CARB staff had provided two examples of ozone exceedance days at Barstow for which they concluded that little or no transport was involved:

- April 29, 1989 (CARB, 1990), and
- September 15, 1989 (CARB, 1993).

The CARB analyses of these two days included preparation of surface-wind back trajectories and consideration of available upper air data[3]. Furthermore, California surface wind climatological data indicated that meteorological conditions which are not consistent with typical transport exceedance, may exist up to 35% of the time (Hayes et al, 1984). Based on this analysis, CARB proposed the lowest level of planning requirements for SEDAB stationary sources in this area by assigning a "moderate" nonattainment classification. Initial dates for compliance were also set.

However, controversy surrounded the CARB analysis and actions, because there was not general agreement among the regulating, regulated, and scientific communities. There were also economic impact concerns regarding the addition of new emisions controls on SEDAB stationary sources and would these controls noticeably improve SEDAB air quality and provide the corresponding public health benefit. Opposition to the CARB conclusion that locally generated ozone concentrations can, and do, exceed the state standard centered on four general points: 1) the preponderance of evidence documenting routine transport of pollutants into the SEDAB, 2) possible shortcomings in the CARB methodology to assess transport, 3) the possibility of transport from out-of-state urban areas, and 4) the relative ozone-precursor contributions of local mobile sources versus local stationary sources. Each of these four points is addressed in a following sub-section, respectively.

[3] For a complete list of CARB methods of analysis, see CARB, 1993, Chapter III.D.

1.1.1 Preponderance of Evidence

Representatives of the District and the regulated community cited the "preponderance of available evidence" clause in Section 39610(a) of H&SC. The scientific literature abounds with studies documenting transport into the SEDAB (e.g., the comprehensive CARB bibliography of Raudy, 1990), primarily because transport has been the focus of many field studies. There were only a handful of studies supporting possible local generation, and half of these alluded to other possible explanations for the SEDAB exceedances (e.g. Roberts et al. 1992). Only two known studies directly assert the existence of locally-generated SEDAB ozone exceedances: CARB (1990) for Barstow on April 29, 1989; and CARB (1993) for Barstow on September 15, 1989. Also, a comprehensive classification of Barstow exceedance days from the decade of the 1980's showed that locally generated exceedances of the ozone standard are infrequent and, at most, could account for only 7% of Barstow ozone exceedances (Roberts et al. 1992).

The Committee believes that this original point of opposition may be a point of misunderstanding. "Preponderance" has been used by some in a sense similar to "frequency". CARB staff readily acknowledges that the vast majority of exceedances of the ozone standard in the SEDAB are the consequence of "overwhelming" transport. The true issue is not the most frequent cause of ozone exceedances but rather the weight of evidence supporting the occurrence of locally generated exceedances in a frequency greater than what is termed a "highly irregular or infrequent event". CARB staff has interpreted this as "more than once per year, on average".

1.1.2 Uncertainties of CARB Methodology

After a study of the April 29, 1989 exceedance by Tilden et al. (1991), questions were raised by representatives of the regulated community and the MDAQMD about CARB's interpretation of their back trajectory for April 28-29, 1989. Industry and District representatives considered the available wind data to be too spatially and temporally sparse to reliably support the CARB conclusion. The surface wind back trajectories prepared by CARB involve essentially two horizontal dimensions and may not account for the real three-dimensional nature of the atmosphere. Transport in layers aloft has been observed in previous SoCAB/SEDAB field studies (e.g., Smith et al., 1983). Such elevated layers could exist on a spatial scale which is an order of magnitude smaller than the upper-air network of the National Weather Service. These elevated layers could transport pollutants above any surface air quality or meteorological monitoring site, leading to an underestimation of transport by the CARB methodology.

The Committee believes that this original point of opposition is, in fact, a point of interpretation. CARB staff readily acknowledges the limitations of two-dimensional trajectories in an area with widely separated data sources and complex terrain. The fact that two private contractors also constructed trajectories and came to two totally different conclusions about the origin of the high ozone concentrations indicates the limitations of the database and the subjectivity of the analyses. Once again, the issue boils down to whether the weight of the available evidence supports the occurrence of locally generated ozone exceedances.

1.1.3 Possibility of Transport from Outside of California

The back trajectory prepared by CARB for September 15, 1989 shows air originating from near the southern California/Nevada border in the eastern Mojave Desert. District and industry representatives expressed concern that emission sources in the Las Vegas metropolitan area or the rapidly growing Laughlin, NV and Bullhead City, AZ areas were not considered in the CARB analysis. Similarly, the impact of pollutants from Mexico is not well documented.

The Committee acknowledges that the current data base and modeling/analytical tools are not adequate to quantify the impact of "out-of-state" emissions on ozone air quality in Barstow.

1.1.4 Relative Contribution of Local Mobile versus Stationery Sources

Industry and district representatives argued that mitigation requirements within the SEDAB must address the most significant emissions sources. Even if a few SEDAB exceedances are locally generated, local mobile sources, rather than local stationary sources, may make the largest contribution to ozone precursors.[4] In this case, new controls on stationary sources would not be cost effective for society as a whole; SEDAB air quality might not noticeably improve, even after incurring these costs.

1.2 The Mojave Desert Air Pollution Transport Committee

At the Board meeting in August 1993, Board member Barbara Riordan suggested the creation of a committee to work out problem areas among the Board, the District and the regulated community. A public hearing, entitled "Joint Workshop on Pollutant Transport and Other Related Air Quality Planning Issues," was held on December 1, 1993 in Victorville, CA at the District facilities. Citizens living in the SEDAB, representatives of industry, government agencies, and scientific organizations with interests in SEDAB air quality were in attendance.

After that hearing, the Mojave Desert Air Pollution Transport Committee was established. The committee has endeavored to accomplish the following:

- to foster a cooperative effort among the CARB, the District, and the regulated community;
- to clarify the legal and scientific interpretations;
- to identify and evaluate the available evidence from previous studies and existing data bases for assessing upwind versus local contributions to SEDAB ozone exceedances;
- to obtain new evidence to better characterize transport into the SEDAB; and
- to present its recommendations to CARB for the optimal regulatory policy addressing SEDAB air quality concerns.

The Committee is chaired by Don McNerny, Branch Chief of Modeling and Meteorology within the Technical Support Division of CARB. Participating organizations and members are listed in Table 1. Minutes for the twelve-plus Committee meetings were

[4] Recent studies (e.g., NRC, 1991) have shown that mobile emissions may have been grossly underestimated in the commonly available emissions inventories (e.g., CARB, 1994).

Table 1
Participating Organizations and Current Members of the Mojave Desert Air Pollution Transport Committee

Organization	Name
Allied signal (Goldstone)	Jon Turnipseed
ARB	Don McNerny, Chairman* Paul Buttner Leon Dolislager Arndt Lorenzen Bill Wilson
Calaveras Cement Company	Stuart Tomlinson
California Portland Cement Co.	John Bennett
Cement Industry Environmental Consortium (CIEC)	Frank Sheets
Desert Research Institute	Robert Keislar* Doug Lawson
Edwards Air Force Base	Phil Brady
JPL	Ezra Abrahamy* Dr. Minoo Dastoor Dr. Stanley Sander Dr. Ian McDermid
Kern County APCD	Thomas Paxton
Mitsubishi Cement	Doug Shumway
Mojave Desert AQMD	Eldon Heaston* Robert Ramirez Fred Wohosky
National Cement Co.	Jerry Stefanik
NAWS, China Lake	Brenda Mohn
NTC, Fort Irwin	Walt Perry
Riverside Cement Company	Gene Kulesza, Secretary
SCAQMD	Henry Hogo
Southern California Edison	Stan Marsh
Southwestern Portland Cement	John Blythe

* Lead Person

prepared by Riverside Cement Company, and copies are available from Beverly Saverance at (909) 683-6458 in Riverside, California.

1.3 Definition of Terms

The Committee found that existing terms used to characterize transport were confusing. The Committee members attempted to redefine terms such as "carry-over" and "typical" and "atypical" exceedance days. The Committee agreed upon the definitions discussed in the following subsections.

1.3.1 Transport Characterization

Given the intractable numerical problem of turbulence and diffusion in complex terrain, and given society's limited resources for collection of meteorological and air quality data, CARB staff has assigned qualitative characterizations[5] of transport contributions to downwind exceedances. This is in lieu of a more desirable but currently unattainable quantitative apportionment of upwind and downwind source contributions. Table 2 cross-references the definitions of transport characterization offered by CARB (1990), the operational definitions generally agreed to by Committee members, and other common terms used by the air quality community.

Table 2
Transport Characterizations

Legal Term (CARB, 1990 and 1993)	CARB Definition (CARB, 1990)	MDAPTC Operational Definition	Other Commonly-Used Terms
Overwhelming	**Ozone exceedance in the downwind area occurred with little or no emissions contribution from the downwind area.**	**Transport alone caused the exceedance.**	**Transport Day**
Significant	**Both upwind and downwind emissions contributed to exceedance in the downwind area.**	**Both the transported and local contributions are necessary to cause the exceedance.**	**Shared Day**
Inconsequential	**Upwind emissions did not contribute significantly to exceedance in the downwind area.**	**Local contribution alone caused the exceedance.**	**Local Day**

[5] CARB (1990) describes these characterizations as semi-quantitative.

1.3.2 Pollutant Carry-Over

Air quality is frequently dependent upon the air quality on the previous day. In assessing whether a transported air mass could have contributed significantly or overwhelmingly to a SEDAB exceedance, the question of carry-over of pollutants must be considered. The Committee's definition of "carry-over" is pollutants from previous day(s) that could exist in elevated layers or unmonitored surface air masses within the SEDAB which cause or contribute to an exceedance. Thus, local and transported pollutants can be carried over from one day to the next. Existing evidence and analysis supports the concept of carry-over of ozone from the day immediately preceding a SEDAB exceedance (e.g., Smith et al., 1983; Roberts et al., 1992). In contrast with the carry-over of ozone, evidence for the carry-over of ozone precursors is not definitive. The Committee believes that impacts of a transported pollutant is greater than impacts of carry-over by local pollutants. However, the Committee pondered but could not answer the question of how many previous days of carry-over could significantly impact local air quality. In particular, the Committee could not recommend a specific time-limit to be placed on back trajectory analysis, regardless of the increasing uncertainty in such analysis due to computational error alone. In general uncertainty in the trajectory increases with the number of hours modeled and with the decreasing density of the meteorological network.

1.3.3 Typical Versus Atypical Barstow Ozone Exceedance Days

As discussed in Section 1.1, Barstow was selected by CARB staff as the area in the interior of the SEDAB most likely to represent the maximum ozone concentrations resulting from emissions within the desert. Federal exceedances at all other current monitoring sites are presumed to be overwhelmingly impacted by transport. Barstow ozone exceedance days can be classified into typical and atypical groups. The meteorological basis for this classification is given in Section 1.3.1 of this paper and is further addressed in Section 2.1 describing the Roberts et al. (1992) study. A definition, based on air quality monitoring data alone, of an overwhelming transport impact (SoCAB-to-SEDAB) on air quality in Barstow, is presented here and leads to the definition of a "typical" Barstow ozone exceedance day. An overwhelming transport impact in Barstow air quality (henceforth called "overwhelming" transport day at Barstow) is assumed when the day exhibits the following characteristics:

A. A Barstow ozone exceedance of the state standard begins after 4 p.m. PST.

B. An exceedance of the state standard occurs earlier in the day at either Lancaster or Victorville (or both).

C. The lag time in peak ozone concentrations is at least 2 hours between Lancaster and Barstow and at least 1 hour between Victorville and Barstow.

A "typical" Barstow ozone exceedance day (henceforth called "typical day") is characterized (defined) by overwhelming transport either on the same or preceding day.

An "atypical" Barstow ozone exceedance day (henceforth called "atypical day") is then defined as a day which does not exhibit all three traits and is not preceded by a day exhibiting all three traits. An atypical day generally has a forenoon or early afternoon exceedance at Barstow without any exceedances in the Mojave Desert on the previous day. However, the Committee concluded that an atypical exceedance does not necessarily indicate local generation of the exceedance. It just means that transport processes were less evident and that emissions from within the desert may have contributed to the exceedance. Additional analyses are necessary to ascertain better the cause of the exceedance.

1.4 Scope of This Paper

Aside from the background references cited in this introduction, the scope of this paper is limited to the findings, conclusions, and recommendations reached by the Mojave Desert Air Pollution Transport Committee as of July 31, 1995. The Committee's focus was to determine the potential impacts of emissions within and outside the SEDAB on air quality within the SEDAB. The Committee evaluated the evidence from 33 past studies and data bases as described in Section 2 of this paper and discussed the Barstow exceedance days considered atypical of the otherwise predominant, overwhelming transport pattern (SoCAB-to-SEDAB). Where Committee consensus was not reached in interpreting these past studies, dissenting opinions and rebuttals are also discussed.

Current studies are briefly discussed in Section 3, but no preliminary findings from these efforts are incorporated herein. Committee conclusions are detailed in Section 4, and recommendations to the CARB management are presented in Section 5.

1.5 Definition of Transport Couples

Section 39606 of the California Health and Safety Code requires the CARB to divide the state into air basins based on similar meteorological and geographic conditions (and giving consideration to political boundaries whenever practicable). Neighboring air basins tend to have different air masses because of the differing meteorological and geographic influences. However, ozone concentrations in neighboring basins often are not independent of each other because air can and does flow from one basin to another. Air basins between which ozone and ozone precursors can be transported are called "transport couples". The contribution of transported pollutants to violations of the state ozone standard must be considered so that pollution controls in the upwind and downwind areas will be commensurate with their level of contribution to the ozone air quality problem. The CARB has identified the most significant transport couples (CARB, 1990; CARB, 1993).

The predominant transport couple of interest for SEDAB ozone exceedances related to these studies is the SoCAB/SEDAB couple. However, CARB has also identified the San Joaquin Valley Air Basin (SJVAB) and Mexico as source regions which may impact the SEDAB. Transport across state borders could potentially contribute to SEDAB ozone exceedances, but it has not been formally addressed for California state regulatory purposes. Figure 1 shows the SEDAB and surrounding basins and important topographic features.

Table 3 lists the areas, populations, emissions and densities of the ozone precursors of reactive organic gases (ROG, primarily from mobile sources and refineries) and oxides of nitrogen (NO_X, from both mobile and stationary combustion sources) for the SEDAB, the San Joaquin Valley, and the South Coast Air Basins. Also shown are estimates for Las Vegas, Nevada and the combined suburban area of Laughlin, Nevada

FIGURE 1

Location of Data Sources within the SEDAB and Surrounding Areas

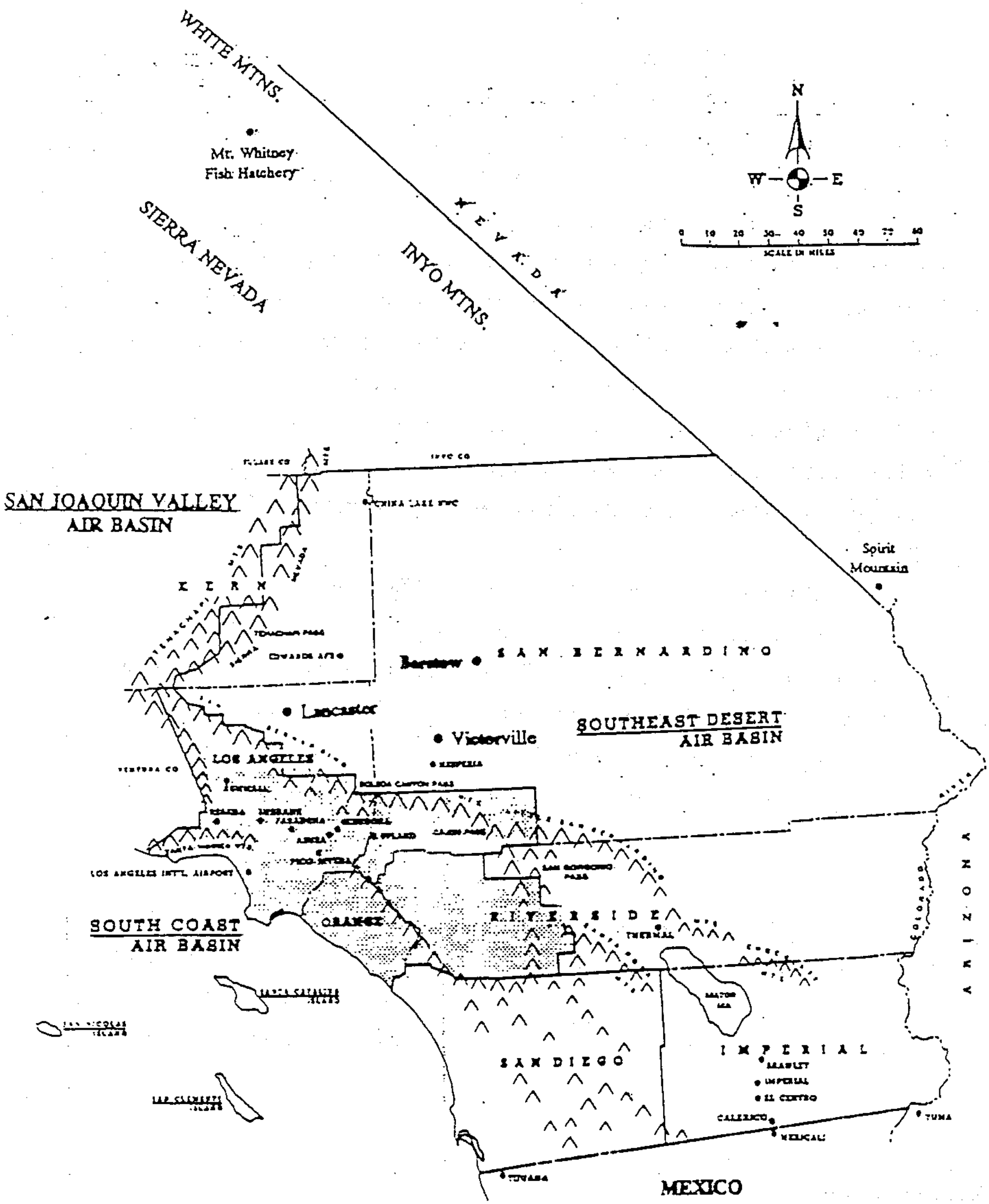

Table 3

Air Basin Comparison

	POPULATION (millions)	AREA (mi²)	ROG EMISSIONS (tons/day)	ROG DENSITY (lbs/day)/mi²	NO_x EMISSIONS (tons/day)	NO_x DENSITY (lbs/day)/mi²
SEDAB[1]	1.08	32,400	180	11.1	260	16.0
SoCAB[1]	13.54	6,530	1,400	428.8	1,300	398.2
SJVAB[2]	2.74	24,850	570	45.9	540	43.5
Las Vegas[3]	0.80	1,564	150[4]	191.8[4]	56	71.6
Laughlin/Bullhead Area[5]	.03	47	6	243	71	3017

Notes:
1. 1991 Emissions Inventory, CARB (1994)
2. 1990 Emissions Inventory, CARB (1993a)
3. Clark County District Health Department, APCD
4. Before implementation of Stage 2 Vapor Recovery
5. Bullhead City (1990)- Arizona Dept of Env. Quality, Laughlin (1995)- Clark County APCD
   Mojave Power Station (1995)- Nevada State Natural Resource Dept.

and Bullhead City, Arizona.[6] Mexico is another source area of potential interest, but definitive basin boundaries and emissions inventories are not available.

1.5.1 The SoCAB/SEDAB Transport Couple

There is no question that transport of pollutants from the South Coast Air Basin (SoCAB) severely affects ozone concentrations in the SEDAB, which lies to the north and east of the SoCAB. Previous studies have identified a typical summertime SoCAB-to-SEDAB transport pattern (e.g., Smith et al., 1983; Green, 1990). Over 90% of Barstow exceedances can be directly attributed to transport of polluted SoCAB air that left the SoCAB less than 24 hours prior to the first hour of the Barstow exceedance (Roberts et al., 1992).

1.5.1.1 Typical SEDAB Ozone Exceedance Days

The SoCAB, containing greater Los Angeles, is a significant source region of anthropogenic pollutant emissions and experiences the most severe ozone air pollution in the United States. For ROG and NO_X, the two major ozone precursor pollutants, the SoCAB has respectively about 8 and 5 times the emissions and 12 times the population as does the SEDAB (Table 3). Both emissions and population density are much lower in the SEDAB. The SoCAB basin is bordered by the complex terrain of the Santa Monica, San Gabriel, and San Bernardino mountain ranges to the north and by the San Jacinto and Santa Ana mountain ranges to the east. Although the SoCAB is open to the Pacific Ocean on its western side, on-shore ocean breezes and the "lid" effect of large-scale atmospheric subsidence inversions effectively close the basin, especially during the warmer months in which these meteorological conditions commonly occur. High SoCAB emissions of ozone precursors and the abundant southern California sunlight create ozone concentrations that regularly exceed the 9pphm state standard and the 12pphm national standard in this trapped air.

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[6] Emissions estimates for Laughlin are not currently available from Clark County, Nevada, but may be compiled as growth in the area continues.

The SoCAB typically is ventilated in the afternoon by winds generated from the pressure gradient between the relatively high coastal pressure and the thermal low pressure over the Mojave Desert. As daytime convection raises the inversion height in the SoCAB, this ventilation typically carries SoCAB pollutants through three transport corridors: Soledad Canyon immediately northwest of the San Gabriel Mountains, Cajon Pass between the San Gabriel and San Bernardino Mountains, and San Gorgonio Pass (also called Banning Pass) between the San Gabriel and San Jacinto Mountains (e.g., Angell et al., 1976; Smith et al., 1983). On some of these typical transport days, the right combination of higher inversion heights and/or up slope winds may carry pollutants right over the mountains and into the SEDAB in addition to ventilation through the transport corridors. If light nocturnal winds persist, Barstow exceedances can be caused by carry-over of SoCAB pollutants to the next day. A typical ozone exceedance day at Barstow is either caused directly by overwhelming SoCAB-to-SEDAB transport or by carry-over of ozone from overwhelming transport on the previous day.[7]

1.5.1.2 Atypical SEDAB Ozone Exceedance Days

Approximately 7% of Barstow ozone exceedance days fail to exhibit the typical transport pattern within the previous 24 hours of the beginning of the Barstow exceedance (Roberts et al., 1992). These atypical days are the primary focus of the CARB analysis to determine if "significant" and/or "inconsequential" transport classifications are appropriate in addition to the "overwhelming" classification. April 29 and September 15, 1989 are two examples of atypical days.

Yet, presence of this atypical pattern alone is not considered sufficient reason by most MDAPTC members to dismiss any possible important contribution of transport from outside the SEDAB to a Barstow exceedance. While it is true that urbanization and population in the SEDAB have increased markedly in the last two decades, the greatest growth has occurred near the mountain passes where SoCAB air often enters the SEDAB. This compounding factor makes transport and its impact on SEDAB air quality more difficult to characterize, especially on days with light and variable winds and/or a complex

[7] A "typical" Barstow ozone exceedance day and "overwhelming" SoCAB-to-SEDAB transport are defined in Section 1.4.3.

atmospheric boundary-layer structure. For example, Palmdale (pop. 69,000) and Lancaster (pop. 97,000) are near Soledad Canyon; Victorville (pop. 40,000) and Hesperia (pop. 50,000) are near Cajon Pass; and Palm Springs (pop 40,000) is near San Gorgonio Pass.[8] Air in these SEDAB cities could also have come from the SoCAB a few hours earlier.

1.5.2 The SJVAB/SEDAB Transport Couple

The CARB staff identified the San Joaquin Valley Air Basin (SJVAB) as a source region with air quality impacts to the SEDAB. After the SoCAB, the SJVAB experiences the second worst air quality in the state (Chow et al., 1992). Several studies have shown the influence of SJVAB air in the northwestern SEDAB (e.g., Rieble et al., 1982; Trijonis et al., 1988). The SJVAB air generally enters the SEDAB through Tehachapi Pass between the Tehachapi Mountains and the Sierra Nevada. Walker Pass, 30 km east of Isabella Lake, is also a suspected transport corridor. In its initial transport assessment, (CARB, 1990), CARB staff provided an example of a day on which overwhelming transport from SJVAB caused an exceedance of the ozone standard at Lancaster.

On the average, Barstow is under the influence of SJVAB air more than SoCAB air, but for Barstow ozone exceedance days, the SoCAB influence is far more prevalent (Roberts et al., 1992). The CARB staff considered the possibility of transport from the SJVAB on the April 29, 1989, Barstow exceedance, but found no evidence of SJVAB influence.

1.5.3 The Mexico/SEDAB Transport Couple

In their 1993 assessment, the CARB staff identified Mexico as a source region impacting SEDAB air quality in the Imperial County portion for the SEDAB. The impact of Mexico on Barstow exceedances has not been determined.

1.5.4 Transport from Other States

The CARB back trajectory for the September 15, 1989 ozone exceedance at

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[8] Approximate population figures taken from the 1993 Rand-McNally Road Atlas.

Barstow indicates that the polluted air passed over an area near the California-Nevada border 48 hours prior to the exceedance. Some Committee members suggested that the Las Vegas or the rapidly-growing Laughlin areas in Nevada should be considered as source regions contributing to this exceedance. The density of Las Vegas ROG and NO_x emissions are appreciable given the high population in the relatively small Las Vegas Valley. Dilution factors for air leaving the Las Vegas Valley and potentially arriving at Barstow on September 15, 1995 have not been estimated. Emissions inventories for the Laughlin area are not currently available from Clark County, Nevada.

2.0 ANALYSIS OF STUDIES

Appendix A of this paper, entitled "STUDY ANALYSIS," describes the 33 studies and data bases the Committee considered. It provides the formal documentation of the Committee agreement ("yes", "no", or "partial") on the 33 studies and data bases. A one-page "Air Quality Study Evaluation Form" for each completed study or existing data base is included.

Of the 33 studies and data bases in Appendix A, thirteen have been completed, six are on-going, two have been recommended for the future, and twelve are data bases only. Of the thirteen completed studies, the Committee agrees that six are relevant to the investigation of atypical days where there is the greatest possibility of a shared or local contribution (i.e., significant or inconsequential transport.) However, the conclusions of these six studies, like the committee members, do not always agree. The other seven completed studies are involved primarily or completely with typical days, in particular, overwhelming transport days. One of these seven studies, the "Sensitivity of Peak Ozone Concentrations" (Ireson and Hogo, 1983), is the only modeling study directly involving SoCAB-to-SEDAB transport. The authors state that tripling SEDAB local stationary emissions would have an insignificant impact on SEDAB air quality on overwhelming transport days. This study downplays the possibility of a SEDAB contribution on typical (overwhelming transport) days, and is why the Committee emphasized consideration of atypical days to identify possible shared or local contributions.

The six on-going studies include four which are specifically relevant to atypical days: the "Barstow Halocarbon Study", the "Stationary Source Operational Status" study, the "Ozone Transport Corridor Study" and the "1992 Radar Wind Profiler" study. A fifth on-going study, the "Mobile Source" study, is designed to better assess the mobile source contribution within the

SEDAB using new and potentially higher vehicle emission factors and interstate freeway traffic counts. All six on-going efforts are briefly discussed in Section 3. The two future studies and the twelve data bases are actually recommendations to CARB for consideration and/or further analysis; these will be discussed in Section 5.

Of the six completed studies which are directly relevant to atypical days, only the CARB analyses (CARB 1990; CARB 1993) directly indicate inconsequential transport and the existence of locally-generated Barstow ozone exceedances (i.e., from sources within the SEDAB only). The "Sonoma Tech" study (Roberts et al., 1992) identified eight atypical days during the 1980's with the greatest possibility of being local days, but the report did not rule out other transport patterns for these days. Although primarily overwhelming transport studies, the "MRI/Cal Tech" study (Smith et al., 1983) and the "RESOLVE DOD" study (Trijonis et al., 1988) offer indirect evidence supporting the existence of both inconsequential transport and possible transport on atypical days. The "Sierra Research" study (Tilden et al., 1991) concludes that transport from the SoCAB made a significant contribution during the afternoon of April 29, 1989 and an overwhelming contribution after 1900 PST . The "Cool Water Ozone Feasibility Study" (Keislar et al., 1994) found evidence of regional transport at remote sites downwind (north) of the SEDAB on both April 29 and September 15, 1989.

No one study is conclusive, and the conclusions of the six studies taken together are conflicting. Each has its merits and potential shortcomings.

A brief summary of the "Sonoma Tech" study (Roberts et al., 1992) and the most relevant features of CARB (1990) and CARB (1993), Tilden et al. (1991), and Keislar et al. (1994) are presented in the following subsections.

2.1 The "Sonoma Tech" Study

Roberts et al. (1992) performed a comprehensive review of 462 Barstow exceedance days during the ten ozone seasons, 1980 through 1989. They noted that the majority of days (331 out of 462 or 72%) exhibited the three overwhelming transport day characteristics defined in Section 1.4.3 of this report. They deliberately searched for and analyzed days which did not display these characteristics on the given or preceding day. They found 109 days that did not exhibit Characteristic A, i.e., days that had exceedances starting at 1400 PST or earlier. But of these 109 days, most exhibited a pattern of carry-over from the previous day when Lancaster, Victorville, or Barstow exceedances had occurred and light winds prevailed during the previous night.

After elimination of these carry-over days, only eight days remained which they described as "Barstow exceedance days with possible local effects," and as "days which are most likely to contain the effects of local contributions." **These eight unusual Barstow ozone exceedance days represent only 1.7% of the 462 Barstow exceedances occurring over ten years, a frequency of less than once per year.** However, Roberts et al. does not consider the evidence for local generation to be conclusive, and does not rule out additional second-day reaction of morning precursors: "It is possible . . . that significant carry-over could be present in unmonitored areas of the desert."

Roberts et al. identified six days that lacked only Characteristic B, and called these days "Barstow exceedance days without Lancaster or Victorville exceedances." These days were considered unusual because air passing through the transport corridors of Soledad Canyon or Cajon should pass through Lancaster or Victorville, respectively, en route to Barstow. It is possible that transport could have occurred aloft. They also identified 16 other days that lacked Characteristic C only and called these days "Barstow exceedance days with poor transport timing differences." Once again, they state that these 22 cases (6+16) could result from "a shared contribution . . . or a continued reaction in the desert . . . "

In summary, Roberts et al. found 30 days (8+6+16) over ten years, which comprise only 6.5% of the total 462 Barstow exceedance days studied, that are called "atypical" days by the committee as defined in Section 1.4.3. Of these 30 atypical days, only eight days (1.7% of exceedances) had the "greatest possibility" of "local effects." However, Roberts et al. felt the local days could be even less than those eight days. The evidence for inconsequential transport and local generation is circumstantial.

2.2 April 29, 1989

The CARB meteorologists picked this day based on wind patterns that did not indicate transport, at least not overwhelming transport for the afternoon exceedance hours from 1400-1800 PST. They cite the gradual prolonged rise in ozone concentrations from just below the state standard early in the day. This rise is not consistent with the more abrupt increases in concentration due to overwhelming transport or the mixing down of an elevated ozone layer. The CARB back trajectory plots (CARB, 1990, Figure 21) showed that:

- air arriving at Barstow at 1400 PST on April 29 was 40 miles northeast of Edwards AFB at 1900 on the previous day, and
- air arriving at Barstow at 1900 PST on April 29 was 25 miles east-northeast of Palmdale at 1900 PST on the previous day.

The CARB meteorologists stated that it was unlikely there was carry-over coming into Barstow from transport into the two source regions identified in the back trajectory above on the previous day. They based this on an upper air sounding taken at China Lake on the previous day which showed predominantly easterly winds aloft. Consistent with the critique of CARB methodology presented in Section 1.1, some committee members questioned the representativeness of a single China Lake sounding to represent April 28, especially during the generally light and variable conditions accompanying a stagnant high pressure ridge over the western U.S. There was no general agreement about the possibility of some subtle form of transport.

Furthermore, this day was not identified by Roberts et al. as one of the most likely days for local effects. Tilden et al., 1991 concluded that transport from SoCAB made a significant contribution during the afternoon of April 29, 1989 and an overwhelming contribution after 1900 PST. This different interpretation was reached despite a back trajectory similar to that generated by CARB and despite analysis of the same surface air quality data. The CARB meteorologists agreed to the interpretation of overwhelming transport after 1900 PST but defended their conclusion of inconsequential transport for the five exceedance hours from 1400-1800 PST.

The "Cool Water Ozone Feasibility Study" (Keislar et al., 1994) found evidence of regional transport on April 29, 1989 at a remote site in the Owens Valley lying 200 km north of the SEDAB. A definite peak of the endemic SoCAB/SJVAB tracer, the stable halocarbon methyl chloroform (MC), was present in Owens Valley from 1500-1800 PST. The MC peak is 300 ppt, significantly above the 175 ppt background at the site, and it is accompanied by a coincident ozone peak, some 20 ppb above the ozone concentration of the previous and following hours (Keislar et al., 1994, Figure 3). The southerly wind component at the Owens Valley site indicates that the polluted air mass arrived from the northwestern corner of the SEDAB. One CARB meteorologist argued that there are other sources of MC, and the peak could be explained by activity at a military base such as Naval Air Weapons Station (NAWS), China Lake. In fact, Appendix A shows there was only partial agreement on the conclusiveness of MC as a SoCAB tracer, after committee discussion on the Greater Los Angeles Distant Impact Study (GLADIS) (Rogers et al., 1988), one of the seven completed studies involving overwhelming transport. But the MC peak in Owens Valley was accompanied by a perchloroethylene (PCE) peak that occurred simultaneously with the MC peak. PCE is another endemic tracer for urban air, and the coincident peaks suggest that the source of both halocarbons was from the SoCAB or SJVAB and not from contamination by a military base or other local MC user in the transport path. Of course, evidence of regional transport from SoCAB or SJVAB does not necessarily prove that the transported urban air impacted Barstow. The on-going Barstow Halocarbon Study, discussed in Section 3, may guide the interpretation of the April 29, 1989 halocarbon data from Owens Valley.

2.3 September 15, 1989

The stagnation conditions of a high pressure ridge dominated the previous two days of September 13-14, 1989. As with the April 29 case, back trajectory analysis was performed and surface air quality and available upper air data were considered. The CARB back trajectory (CARB, 1993) showed that:

- air arriving at Barstow at 1200 PST on September 15 was 40-50 miles northeast of Barstow at 1200 on the previous day, and
- that same air was 20-30 miles northwest of Needles at the California-Nevada border 48 hours before arriving at Barstow.

The CARB meteorologists considered it unlikely that there was carry-over coming into Barstow from previous-day transport into the two source regions identified in the back trajectory above. They based this on surface winds and an Edwards Air Force Base sounding the morning of September 15 which showed predominantly light and variable winds aloft. District representatives raised the possibility of pollutants from Las Vegas or

Laughlin, Nevada impacting Barstow, but the committee knows of no way to investigate this further and obtain a definitive answer for this particular date.

The CARB analysis was questioned on similar grounds as with the April 29 case. The representativeness of a single sounding taken some 40 miles west was unconvincing to many committee members. Analysis of the prior mornings of September 13 and 14 as well as September 15 show at least one layer with a southerly component which could transport SoCAB air above ground (Keislar et al., 1994, Figure 9). There was once again MC tracer evidence of persistent regional transport at the Owens Valley site with peaks 50-60 ppt above background. And under the stagnation conditions, the above-background concentration could have been significantly higher in the SEDAB.

No clear consensus was reached for this day. The Committee did agree however that a shared contribution could not be ruled out. However, a majority of members also agreed that possible transport on days with stagnation conditions and the concomitant light and variable winds was not well-known but could not be ruled out, especially at night when significant boundary-layer complexity was possible above the surface inversions. The possibility remained that a meandering, elevated, nocturnal urban plume could mix down in an unmonitored area of the desert and then be slowly advected into Barstow from an unusual direction by light surface winds on the following morning. This scenario would indeed be rare, but so are the "possible local effects days" found by Roberts et al. (1992), as mentioned in Section 2.1.

3.0 RELEVANT CURRENT AND PLANNED STUDIES

The MDAPTC is tracking the results of the following studies which are part of the MDAPTC "STUDY ANALYSIS" in Appendix A:

CURRENT:

- Project MOHAVE includes investigation of long-range transport from urban areas, like the SoCAB, to pristine areas of the Colorado Plateau to determine impacts to visibility. The final report is expected in December of 1995.

- The Barstow Halocarbon Study is designed to provide a better characterization of SoCAB influence on Barstow ozone by using halocarbon tracers of opportunity (MC and PCE) to detect the presence or absence of SoCAB and possibly SJVAB air in Barstow. The study period was August 1, 1994 through October 31, 1995, overlapping the CARB summer 1995 ozone monitoring study. The cost of this study was a joint effort of the California Air Resources Board, the Mojave Desert Air Quality Management District, and substantial contributions from the regulated community in the Mojave Desert including military bases.

- Mobile source traffic counts on SEDAB interstates are being collected by the district from the California Department of Agriculture. There is no current schedule for completion of the analysis of these data.

- The CARB has chosen a contractor for the 1992 Radar Wind Profiler Data Analysis (ARB RFP 94-2). The final report is scheduled to be released in 1996.

PLANNED:

- Further analysis of the 12 available data bases is possible, but at present unplanned.

- Transport Corridor Study - The primary objective of the Transport Corridor Study is to collect continuous ozone and meteorological data at critical locations in the Mojave Desert during the summer of 1995 (June - October). This monitoring network was designed to supplement the permanent network and to provide additional data which would minimize the uncertainties associated with previous analyses of the pollution processes in the desert. Additional monitoring sites have been established near the most common transport corridors (Cajon Pass, Soledad Canyon, and Tehachapi Pass) and on isolated peaks with the intent of identifying when transport is occurring and when ozone concentrations are present aloft, above the traditional surface-based monitoring. To increase the information available about conditions aloft, CARB has also established two sites (radar wind profilers with radio acoustic sounding systems) to monitor vertical profiles of wind and temperature. The CARB has also contracted with the National Oceanic and Atmospheric Administration for remote sensing measurements during early August to generate vertical profiles of ozone, wind and temperature. The aerometric data being assembled during the Transport Corridor Study from all available sources will provide the most comprehensive data base ever for assessing the air quality processes occurring in the Mojave Desert and the frequency with which they occur.

- The Committee recommends inclusion of the Mojave Desert in the domain of the Southern California special monitoring program tentatively planned for the summer of 1997. The surface and aloft monitoring network should build upon what is learned from the 1995 studies.

4.0 CONCLUSIONS OF THE MDAPTC BASED ON PREVIOUS STUDIES

The committee reached the following conclusions.

- Meteorology is the dominant factor controlling the change in air quality from one day to the next in the desert. On most ozone exceedance days, a thermal low pressure develops over the desert due to hot rising air; cooler air moves into this low pressure area resulting in transport into the desert.

- Two types of state exceedance days were identified. **Typical exceedance days** (93% of exceedance days at Barstow) were defined as those exceedance days which were the result of overwhelming transport. **Atypical exceedance days** (7% of exceedance days at Barstow) are those occurring under more subtle and complex meteorological conditions and for which the cause is not clearly understood. Atypical exceedance days could be caused by overwhelming transport unrecognized as coming from one or more other transport corridors, a combination of transport and local contribution, or only by local contribution.

- The available evidence from the six relevant studies is conflicting. Shared days, where local contribution might be significant, were not studied or identified. No single study was considered sufficient to conclusively establish the presence or absence of transport on atypical exceedance days.

- All exceedances of the Federal ozone standard in SEDAB are the direct result of transport.

- According to Section 5 of the Roberts, et al, 1992 Report, state exceedance days at Barstow, with the greatest possibility of local effects, have occurred at a rate of less than one per year over 10 ozone seasons during the 1980's.

- The impact of mobile source emissions from major transportation corridors (State Highway 58 and Interstates I-40 and I-15) on atypical exceedance days is not quantified.

- Research, such as the 1995 Mojave Desert Study preliminary data, reaffirmed the need to account for three dimensional atmospheric structure. Further research (such as the 1997 SCOS Study) is needed to quantify transport and to evaluate the effectiveness of future control schemes aimed at improving SEDAB air quality.

5.0 RECOMMENDATIONS OF THE MDAPTC

Based on the MDAPTC investigations, the Committee submits the following recommendations to CARB management.

- In light of AB 421 (Olberg-1995), also know as the Mojave Desert Air Basin Bill, the committee's conclusions should be considered in the redesignation of the new basin created by the legislation.

- The impact of transport from outside the SEDAB and from out-of-area mobile sources is not sufficiently defined to determine the effectiveness of such a control scheme in improving air quality in SEDAB. Recognizing this uncertainty, control strategies to achieve attainment and their effectiveness need to be re-evaluated.*

- CARB staff should continue development of a quantitative characterization of transport, such as a transport index. This index would define the contribution of transport.

- The impact of South Coast Air Basin (SoCAB) vehicles traveling on major transportation corridors to/from Nevada and/or Colorado River recreational and gaming areas should be considered by Cal Trans or the Southern California Association of Governments (SCAG). CARB staff should promote CalTrans or SCAG involvement with improving the mobile source inventory.

- Resources should be dedicated to further improve UAM modeling for transport impacted areas. Efforts should be directed at upgrading meteorological and transportation corridor inputs.

- Continue Transport Committee meetings to more accurately define meteorological events of influence and to further improve the understanding of air quality in the Mojave Desert. The committee inputs to the regulatory and planning process should be utilized to avoid the potential cost to society of rulemaking for Mojave stationary sources, without any subsequent, significant improvement in air quality and the accompanying public health benefit.

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APPENDIX A

SUMMARY OF STUDY ANALYSIS

APPENDIX B

AIR QUALITY STUDY EVALUATION FORM

REV. 8-15-94

STUDY ANALYSIS

STUDY NAME	SCAQMD (SIP MODELING)	Project MOHAVE	Washington University	G.L.A.D.I.S.
STUDY NUMBER	1	2	3	4
STUDY REVIEW COMPLETE	✔			✔
CONCLUSION: Useful for overwhelming	Slight/Maybe		No conclusions	Yes
Useful for significant	Unlikely		No conclusions	No
Useful for inconsequential	No		No conclusions	No
HOW ACCOMPLISHED? Winds aloft				✔
Passes				✔
Other	UAM Modeling Study		Capita Modeling	Tracers of Opportunity/Halocarbons
SUGGESTIONS FOR FURTHER STUDY:	District will review for future			1. Correlate surface Ozone in South Coast with Desert. 2. Look at Carryover. 3. Check Mexico/Yuma wind direction?
OTHER:	SIP Modeling exercise		Data Base Only	Grab samples at Lockheed showed
	EPA required model			negative at 20 meters.
	Disperses emissions,			Shows carryover is a reality.
	transports, reacts			
	and deposits.			
AGREEMENT: Yes	✔			
No				
Partial				✔ Conclusiveness of methyl chloroform
ACTION:	Meet with SCAQMD for questions	Awaiting Completion Due 12/94	Awaiting Completion-Due 7/1/94 Evaluation next meeting	

STUDY ANALYSIS

STUDY NAME	Barstow Halo-carbon Study (SCE UNIT)	Sierra Research (Backward trajectory) DRI reviewed	MRI/Cal Tech Study	Sonoma Tech 4/92
STUDY NUMBER	5	6	7	8
STUDY REVIEW COMPLETE		✔		✔
CONCLUSION: Useful for overwhelming		Yes	Yes	Yes
Useful for significant		Yes	No	Yes
Useful for inconsequential		No	Maybe	Yes
HOW ACCOMPLISHED? Winds aloft			✔	
Passes				
Other		Winds 2-D Trajectory Study	Tracer Study	Data Analysis
SUGGESTIONS FOR FURTHER STUDY:				
OTHER:		Suggests Carryover	Found Carryover	10 Ozone Seasons
			Found Elevated Layers	462 Barstow exceedances
			Historical	16 poor timing transport Atypical days
				6 no Lancaster/Victorville exceed. days
				8 local generation, 30 atypical days out of 462
AGREEMENT: Yes		✔	✔	✔
No				
Partial		✔ Significant		
ACTION:	Report due 4/15/95 Prelim. info as avail.		Dig out concentrations at Barstow and SCAQMD Keisler - Aug or Sept.	

STUDY ANALYSIS

STUDY NAME	RESOLVE Study	SVAQS February, 1994	Cool Water Coal Gasification	Lucerne Valley Baseline Ambient Air
STUDY NUMBER	9	10	11	12
STUDY REVIEW COMPLETE		✔		✔
CONCLUSION: Useful for overwhelming	Yes	No	Data to be	No Conclusions
Useful for shared	No	No	analyzed	No Conclusions
Useful for local	Yes	No	No conclusions	No Conclusions
HOW ACCOMPLISHED? Winds aloft				
Passes				
Other	Filter Analysis	Mainly PM_{10}		
SUGGESTIONS FOR FURTHER STUDY:			DRI Still studying	
OTHER:	Visibility Study		Ambient Air Quality	No emission sources in locale
	not Ozone		Monitoring Data	Data base only
	China Lake Area			Ambient Background Characterizations
	Shows amount of sources			
	in Desert is small			
AGREEMENT: Yes	✔	✔		✔
No				
Partial				
ACTION:	Does high particulate days corrolate to high Ozone days in Barstow John/Gene		Compare Barstow data to Cool Water for Ozone DRI/SCE/AQMD-Aug/Sept.'94	

STUDY ANALYSIS

STUDY NAME	IVANPAH	RICE	CADIZ	CIMA
STUDY NUMBER	13	14	15	16
STUDY REVIEW COMPLETE	✔	✔	✔	✔
CONCLUSION: Useful for overwhelming	No conclusions	No conclusions	No conclusions	No conclusions
Useful for shared	No conclusions	No conclusions	No conclusions	No conclusions
Useful for local	No conclusions	No conclusions	No conclusions	No conclusions
HOW ACCOMPLISHED? Winds aloft				
Passes				
Other				
SUGGESTIONS FOR FURTHER STUDY:				
OTHER:	No emission sources in locale	No emission sources in locale	No emission sources in locale	No emission sources in locale
	Data base only	Data base only	Data base only	Meteorological Data only
AGREEMENT: Yes	✔	✔	✔	✔
No				
Partial				
ACTION:				

STUDY ANALYSIS

STUDY NAME	Jean, Nev Met Monitoring	Mt. Pass	CADIZ (Rail Cycle)	ARB Backward Trajectory Analysis	
STUDY NUMBER	17	18	19	A 20 4/29/89	B 9/15/89
STUDY REVIEW COMPLETE	✔				
CONCLUSION: Useful for overwhelming	No conclusions	No conclusions	No conclusions	Yes	Yes
Useful for shared	No conclusions	No conclusions	No conclusions	Yes	Yes
Useful for local	No conclusions	No conclusions	No conclusions	Yes	Yes
HOW ACCOMPLISHED? Winds aloft					
Passes					
Other				Streamlined Back Trajectory Methodology	Isobaric + wind Back Trajectory Methodology
SUGGESTIONS FOR FURTHER STUDY:					
OTHER:	No emission sources in locale				
	Meteorological Data only				
AGREEMENT: Yes	✔			✔	✔
No					
Partial					
ACTION:		Need review by Team 1 Next meeting	Need review by Team 1 Next meeting	Looking at pressure gradients to predict Transport Next Meeting	Looking at pressure gradients to predict Transport. DRI running winds 2D Model on Data

STUDY ANALYSIS

STUDY NAME	Mobile Source A-Tunnel B-Traffic Cnt	UPPER AIR (Edwards, China Lake)	Stationary Source Operational Status	3-D Transport SEDAB
STUDY NUMBER	21	22	23	24
STUDY REVIEW COMPLETE		✔		
CONCLUSION: Useful for overwhelming		No conclusions		
Useful for shared		No conclusions		
Useful for local		No conclusions		
HOW ACCOMPLISHED? Winds aloft				
Passes				
Other	Mobile sources			
SUGGESTIONS FOR FURTHER STUDY:	No conclusions to date			
OTHER:		Data Base Only		
AGREEMENT: Yes		✔		
No				
Partial				
ACTION:	MDAQMD to check using Yermo Agri. Station for Traffic count		Alex get list of 12 exceedence days/day of week, 1989-violations of particulate(s) stds. days (PM10) (Blythe)	DRI Report (Draft) for review by S. Marsh August 15

STUDY ANALYSIS

STUDY NAME	Compare like Met.	Trend Analysis of Current Data	~ RAWS Network	Sensitivity of peak Ozone Concentrations
STUDY NUMBER	25	26	27	28
STUDY REVIEW COMPLETE			✔	
CONCLUSION: Useful for overwhelming			No conclusions	Yes
Useful for shared			No conclusions	Maybe
Useful for local			No conclusions	No
HOW ACCOMPLISHED? Winds aloft				
Passes				
Other				Modeling
SUGGESTIONS FOR FURTHER STUDY:	Future	Future		
OTHER:			Data Base Only	
AGREEMENT: Yes			✔	✔
No				
Partial				
ACTION:	Needs definition and assignment	What are resources for study? ARB will consider		Need to discuss days of high winds vs days of stagnation in desert. August meeting A. Guilin's study

STUDY ANALYSIS

STUDY NAME	1992 Radar Profile & Aircraft Data.	Mohave Power Project	Cool Water Ozone Feasibility Study	A Multi-year Atmospheric Transport Study
STUDY NUMBER	29	30	31	32
STUDY REVIEW COMPLETE		✔	✔	✔
CONCLUSION: Useful for overwhelming		**No conclusion**	**Yes**	
Useful for shared		**No conclusion**	**No**	
Useful for local		**No conclusion**	**Yes**	
HOW ACCOMPLISHED? Winds aloft	✔			
Passes				
Other			Halocarbons tracers of opport.	
SUGGESTIONS FOR FURTHER STUDY:				
OTHER:	ARB Study under way	Data base only	Study complete	Similar to Study 29
	DRI using data as part of			Complete report out
	Study 24			7/13/94
AGREEMENT: Yes		✔	✔	
No				
Partial				
ACTION:	ARB Final Report - Due 1996		Found halocarbon evidence of regional transport days	Need comments to read before deciding. DRI/Wilson to review/prepare evaluation sheet

STUDY ANALYSIS

STUDY NAME	SCAQS Southern California Air Quality Study			
STUDY NUMBER	33			
STUDY REVIEW COMPLETE	✔			
CONCLUSION: Useful for overwhelming	Yes			
Useful for shared	No			
Useful for local	No			
HOW ACCOMPLISHED? Winds aloft				
Passes				
Other	Tracer Study			
SUGGESTIONS FOR FURTHER STUDY:				
OTHER:	1987 South			
	Coast Air Basin			
	Study			
AGREEMENT: Yes	✔			
No				
Partial				
ACTION:				

APPENDIX B

AIR QUALITY STUDY EVALUATION FORM

Mojave Desert Air Pollution Transport Committee

Air Quality Study Evaluation Form

Report Title:		
Author(s):		
Name and Address of Organization Performing Study:	Name and Address of Organization Sponsoring Study:	
Report Date:	Report Number:	Pages:
Type of Study (check one): ____Model ____Tracers ____Literature Review _____Field Study ____Other		
Area Studied:		
Study Objectives:		
Major Findings of Study:		
Evaluation of Study - Quality of Results and Relevance to Desert Air Quality Issues:		
Relation to Previous Air Quality Studies and/or Recommendations for Further Studies, Including Data Needs:		
Evaluation Prepared By:	Date of Evaluation:	

If necessary place additional information on reverse side of form.