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AIR QUALITY ANALYSIS OF THE SOUTHERN CALIFORNIA BIGHT IN RELATION TO POTENTIAL IMPACT OF OFFSHORE OIL AND GAS DEVELOPMENT

AEROVIRONMENT, INCORPORATED

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Final Report

AIR QUALITY ANALYSIS OF THE SOUTHERN CALIFORNIA BIGHT IN RELATION TO POTENTIAL IMPACT OF OFFSHORE OIL AND GAS DEVELOPMENT

By

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16. Abstracts

This report assesses the air quality impacts of oil and gas development activities resulting from the proposed leasing of the offshore tracts comprising OCS Sale 48. Pertinent air quality laws, regulations and standards are summarized. Operations resulting from Sale 48 projections include quantifiable emissions of non-methane hydrocarbons, nitrogen oxides, sulfur dioxide, carbon monoxide, and total suspended particulates. Photochemical (ozone) pollutants are also developed. Air quality levels are calculated through appropriate diffusion modeling within two defined scenarios: a most probable case of combined tanker/barge transport and pipelining; and a case in which all transport is conducted by tankering/barging. Additional impacts due to possible accidents such as spills and blowouts are modeled. Projections of air quality levels during the estimated year of peak production are compared to present standards and recommendations for mitigation measures to control exceedences are discussed. A sixteen-page Executive Summary of this report is available through the sponsoring agency.

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ABSTRACT

This report assesses the air quality impacts of oil and gas development activities resulting from the proposed leasing of the offshore tracts comprising Outer Continental Shelf Sale 48. The lease tracts are located on the Outer Continental Shelf in the Southern California Bight.

Two scenarios of transportation of the recovered oil and gas are analyzed. One scenario, termed the normal tankering case, assumes that a portion of the oil and gas would be piped to shore and the remaining oil and gas would be transported by tankers and barges. The second scenario, termed the 100% tankering case, assumes that natural gas would be reinfected back into the oil field while oil recovered would be transported to shore by tankers and barges.

Operations associated with the Sale 48 leases resulting in quantifiable emissions include oil and gas production and processing, transportation and loading and unloading of oil and gas, and the storage of crude oil. To provide a perspective on the scale of the emissions for Sale 48 operations, emission rates of non-methane hydrocarbons, nitrogen oxides, carbon monoxide, sulfur dioxide and total suspended particulate from those operations are estimated as 1.6%, 4.4%, 0.4%, 0.9%, and 0.6% of the respective emission rates from all other stationary and mobile sources in the South Coast Air Basin. These percentages are for the normal tankering scenario. Under the 100% tankering case, there is a slight increase in non-methane hydrocarbon emissions, from 1.6% to 2.0%; a decrease in nitrogen oxides emissions from 4.4% to 1.7%, and a decrease in sulfur dioxide emissions from 0.9% to 0.3%. The increase in hydrocarbon emissions occurs because of the vapor losses during tanker loading and transportation processes. The decrease in nitrogen and sulfur oxides emissions is due to the elimination of gas processing activities since gas recovered would be reinfected into the oil field. For the normal tankering scenario, a small amount of H_2S would also be emitted during the handling of natural gas produced in the Santa Barbara Channel.

In this study, possible offshore accidents are also investigated. These accidents include a well blowout with and without fire, and small (140 barrels) and large (10,000 barrels) oil spills at four most likely accident sites. Emissions from these accidents are

significant when compared to emissions from routine operations, especially in the case of the 10,000 barrel oil spill. During such an accident, depending on the composition of the crude oil, 150,000 to 260,000 kg of total hydrocarbons would escape into the atmosphere in the first hour and 75,000 to 130,000 kg would escape in the second hour. Vapor loss in the first hour is more than four times the amount of hydrocarbons emitted in the entire South Coast Air Basin in one hour and therefore has significant air quality impacts.

Ambient air quality levels from Sale 48 emissions are calculated through appropriate diffusion modeling. Results indicate that, under the normal tankering scenario, regional ozone levels would be increased under worst-case meteorological conditions by about 0.001 ppm while under the 100% tankering scenario, regional ozone levels would be increased by about 0.003 ppm. These increases, although less than 4% of the Federal standard of 0.08 ppm, are significant since ambient ozone levels in the study area are already exceeding the standards.

The increase in ozone levels from a blowout with or without fire and a small spill is again about .003 ppm. A large spill, on the other hand, has major impact. In such an event, should it occur in the morning, ozone levels could increase from O.115 ppm to 0.184 ppm in the Santa Barbara area; from 0.232 ppm to 0.381 ppm in the Los Angeles area; from 0.123 ppm to 0.203 ppm in the San Diego area; and from 0.064 ppm to 0.141 ppm in Mexico. Photochemical impacts of accidents at other times of day would be less than these worst-case values.

For inert pollutants, carbon monoxide and sulfur dioxide impacts would be insignificant. Standards for these pollutants are not expected to be exceeded at locations impacted by Sale 48 sources. Impacts of total suspended particulate would also be insignificant except at the Los Angeles and Orange County areas. There the background concentrations of total suspended particulate would be above both short and long term standards. Maximum 24-hour total suspended particulate concentrations from Sale 48 activities would only be about 3-4 $\mu g/m^3$. However, any emissions, no matter how minute, would further exacerbate exceedances of standards.

The situation with nitrogen dioxide is slightly more complicated. With normal tankering, natural gas would be processed onshore. Such activities would increase l-hour nitrogen dioxide values from 0.47 ppm to 0.66 ppm in the Ventura area and from 0.30 ppm to 0.31 ppm in the Los Angeles area. They would also increase the “annual average concentration that would already be higher than the standard in Ventura, but would not cause the annual average standard to be exceeded in the Los Angeles area. Under the 100% tankering scenario, the processing of natural gas would be eliminated and thus there would not be any onshore nitrogen dioxide impacts. Emissions of nitrogen dioxide offshore, however, would not cause any exceedance of air quality standards.

The processing of natural gas from the Santa Barbara Channel under the normal tankering scenario would also result in fugitive emissions of hydrogen sulfide at the processing facility in Ventura. Such emissions would result in exceedances of the California 1-hour standard of 0.03 ppm very close to the facility.

Oil spills do not emit inert pollutants. Hydrogen sulfide is the only inert pollutant from a blowout without fire and hydrogen sulfide concentrations would be up to 0.11 ppm downwind of the source in the Santa Barbara Channel. Since it is assumed that the natural gas from all other tracts is sweet, hydrogen sulfide impacts would only be felt in the Santa Barbara Channel. In the case of a blowout with fire, it is expected that short-term sulfur dioxide and total suspended particulate standards would be exceeded; nitrogen dioxide standards would be approached; and carbon monoxide standards would be maintained downwind of the source.

There are no significant impacts from Sale 48 activities on visibility.

PREFACE

This study was accomplished in cooperation with the Bureau of Land Management. The opinions, findings, and conclusions expressed in this report are those of AeroVironment Inc. and not necessarily those of the Bureau of Land Management.

This report was prepared as a support document to the discussion of air quality impacts in the Bureau of Land Management's Environmental Impact Statement for Outer Continental Shelf (OCS) lease Sale No. 48. A separate document, the Executive Summary, is also available. That document is written in non-technical language and capsulize the major perspectives of this study.

In preparing this study, major subcontractual support was provided by Pacific Environmental Services, Inc. In addition, trajectories used in the modeling of photochemical pollutants were developed by Metro Monitoring Services. The following lists, in alphabetical order, the names of the primary participants within each contributing company and their area of responsibility:

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L INTRODUCTION

As a step toward energy self-sufficiency, at least to the extent of reducing American dependence on foreign oil, the Department of Interior declared, in January 1977, that it was making available a list of 217 tracts totalling 1,141,818 acres (462,088 hectares) which were being considered for a possible oil and gas lease sale (Sale No. 48) on the Southern California Outer Continental Shelf (OCS). The proposed sale would augment the 67 tracts presently in various stages of development and production in the Santa Barbara channel and the 56 tracts on the OCS leased during Sale No. 35 conducted in December 1975.

This report covers a study conducted by AeroVironment Inc. and Pacific Environmental Services, Inc. to assist the Department of Interior, Bureau of Land Management (BLM) in its preparation of an Environmental Impact Statement (EIS) for Sale No. 48 in compliance with the National Environmental Policy Act of 1969.

A. Purpose and Objective of the Study

The purpose of this study was to analyze the potential and actual air quality impacts of oil and gas development off the Southern California coast between San Luis Obispo and the Mexican border, in support of the preparation of an EIS for Sale 48 by BLM.

Objectives of this study were:

1) To review and summarize air quality laws, regulations and standards that would relate to activities resulting from OCS Oil and Gas Sale 48.

2) To identify all air pollutant emission sources which would result directly or indirectly from Sale 48 and to quantify their emission rates.

3) To characterize the climate, meteorology and air quality of the possible area of impact through assimilation, compilation and evaluation of available topographic, meteorological and air quality data.

4) To assess the effects on air quality of oil and gas development off the Southern California coast, through application of appropriate atmospheric diffusion models.

5) To assess cumulative effects on air quality of other proposed major sources of pollutants within the projected area of impact, again through appropriate diffusion modeling.

6) To evaluate necessary or desirable means to mitigate potentially adverse air quality impacts,

7) To outline the air quality impacts of OCS Sale 48.

B. Geographic Area Encompassed by the Study

The general locations of the tracts being considered by the Department of the Interior for lease in Sale 48 are shown in Figure 1-1. Also shown are previously leased tracts.

The study area referred to in this report is the area which could potentially incur air quality impacts from the proposed oil and gas development. The landward boundaries of the study area are defined by geographic and meteorological factors, such as physical obstructions of sufficient scale to significantly impede transport of airflow. These boundaries are shown as heavy broken lines in Figure 1-1.

In the San Luis Obispo and Santa Barbara Counties, the landward boundaries coincide with the crests of the San Rafael Mountains and part of the Santa Ynez Mountains. In a recent study, Baboolal, et al (1975)\$ found that air quality in the Santa Ynez Valley north of Santa Barbara was influenced by marine airflow from offshore. Thus, the Santa Ynez Valley is included in the study area although it is north of the northernmost lease tract.

From Ventura County to San Bernardino County, the northern boundaries are marked by the crests of the San Gabriel and San Bernardino Mountains. These boundaries are interspersed with a number of passes. However, these passes are far enough from the lease tracts so that any lease impacts to the air masses passing through them are negligible.

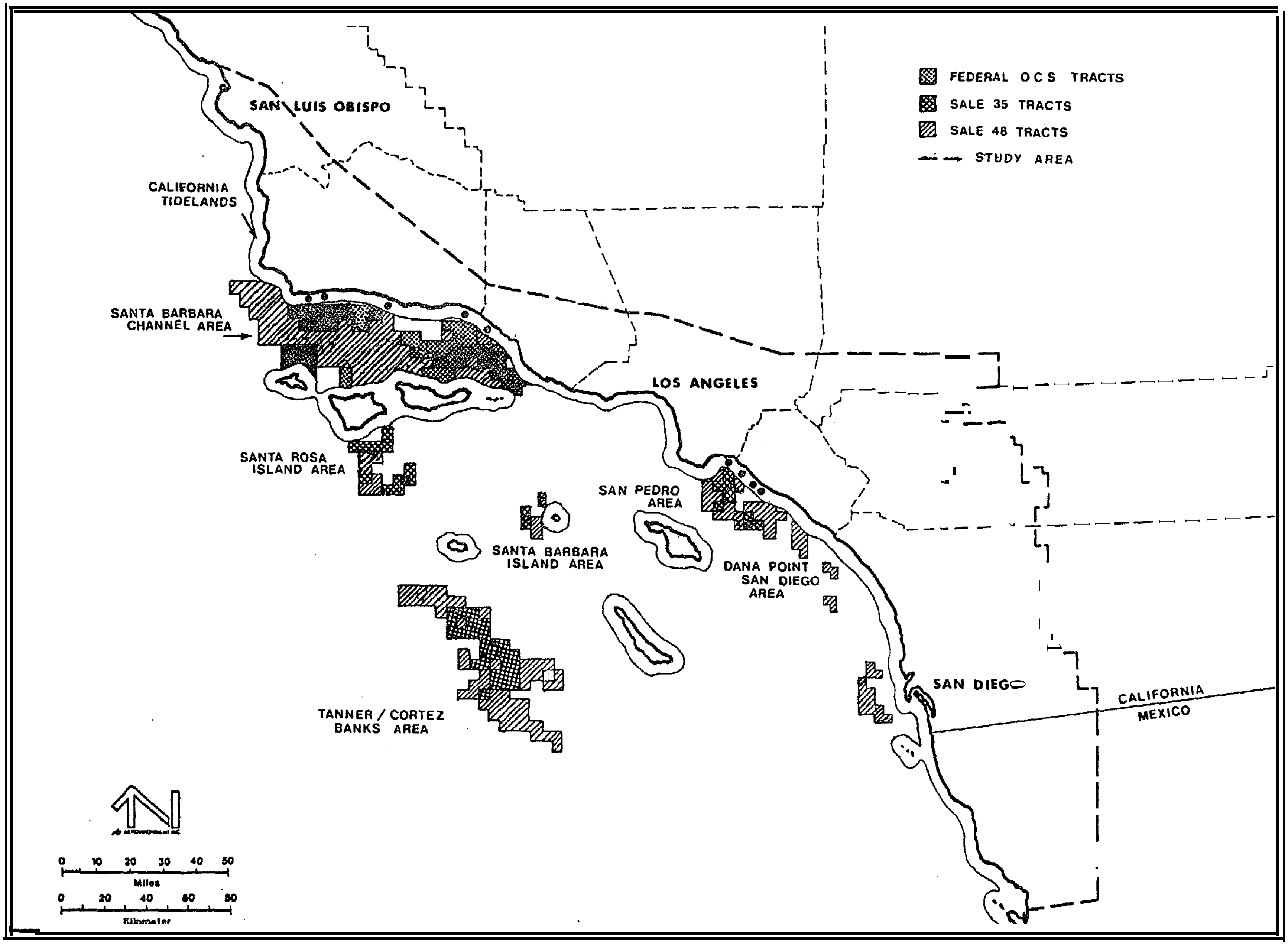


FIGURE I-1. Study area and location of tracts of oil and gas development.

The eastern boundaries of the study area from San Bernardino County to San Diego County are the eastern boundaries of the South Coast and San Diego Air Basins. A discussion of air basins is presented in Section IV.B.1. These boundaries are far enough inland that impacts of the proposed development beyond these boundaries would be negligible.

Although the area of oil and gas development in the Southern California Bight extends only from Point Conception to the US-Mexican border; potential impacts are anticipated to occur beyond these two locations. Thus, included in the study area are the Los Osos and Santa Maria Valleys north of Point Conception and an area south of the US-Mexican border.

c. Study Approach

This study was conducted by utilizing the most up-to-date information available. No original research or measurement was undertaken.

The most recent years for which air quality information is available in a reasonably complete form is 1975. Therefore, 1975, which is not considered an unusual year, was selected as the initial air quality analysis year. The long-range plan year was set at 1986, which has been projected as the year of peak production for Sale 48.

Existing air quality laws, regulations, and standards applicable to oil and gas development activities were reviewed to determine their effects on those activities. All available air quality and meteorological data for the study area were evaluated and analyzed. From this effort, the existing air quality environment was characterized and meteorological conditions influencing the severity of air pollution were identified.

Emissions of pollutants from Sale 48 activities were based upon emission factors available from published reports and revised if necessary after consultation with experts from air pollution control agencies and the oil industry.

Ambient air quality levels with and without Sale 4$ activities were then determined through appropriate diffusion modeling. The REM2 model was used to predict photochemical pollutant (O_3) concentrations while the EPA models PTMAX, PTMTP and CDM were used to predict inert pollutant (TSP, $S0_2$, NO_2, H_2S) concentrations.

Modeling results were compared with Federal and State Ambient Air Quality Standards. The results were also used to assess probable impacts, unavoidable adverse effects, relationships between long and short term uses of the environments any irreversible and irretrievable commitments of resources and to evaluate mitigating measures.

D. REFERENCES

Baboolal, L. B., M.I. Smith and D. W. Allard. 1975. A climatological and air quality characterization and air quality impact assessment for various future growth alternatives in the Santa Ynez Valley. AeroVironment, Inc. Pasadena, CA. Report No. AV FR509 for County of Santa Barbara, Office of Environmental Quality.

II. DESCRIPTION OF OIL AND GAS DEVELOPMENT IN THE SOUTHERN CALIFORNIA BIGHT

This chapter describes the existing and future activities of off-shore oil and gas development in the Southern California Bight. The existing activities include off-shore oil and gas production and lightening (tankering transfer of crude oil). The future activities considered include: changes in existing production; development of Sale 35 and Sale 48 Federal off-shore oil and gas lease tracts; off-shore accidents incidental to this development and other major proposed developments.

For the future activities, two different scenarios of the transport of oil and gas from lease tracts were investigated. One scenario is termed normal tankering of oil and gas. Here, it was assumed that a portion of the oil and gas obtained would be transported to shore by pipelines. The second scenario is termed 100% tankering, which means that no pipelines to shore would be used.

All activity data and assumptions were provided by the Department of Interior (BLM, 1977). These activities have been grouped into one existing scenario and four future scenarios (each with two variants – with normal tankering and with 100% tinkering). The scenarios are summarized below:

<u>Existing (1975)</u>

(1) Off-shore oil and gas production and lightering

<u>Future (1986)</u>

- o Assume normal tankering of oil and gas
  - (1) Base level (without Sale 48) - Changes in existing scenario and effects of Sale 35 (lightering operations will have been discontinued)
  - (2) Base level and Sale 48
  - (3) Base level and Sale 48 and off-shore accidents
  - (4) Base level and Sale 48 and other major proposed activities

- o Assume 100% tankering with no pipelines to shore
  - (1) through (4) scenarios

The following sections of this chapter are divided into the same scenario categories as discussed above. Each section presents a general description of the activities upon which the analysis of the air quality impacts for each scenario was based.

A. Existing Off-shore Activity

The year 1975 has been selected as the base year (or existing year) for future comparison since this is the latest year for which complete air quality data is now available.

Parameters which affect dispersion - mixing height, wind speed – were not unusually different from the 25 year average, although the number of rule 57 days (which measure days with significantly limited dispersion in the basin) were slightly more than normal.

Existing activities consist of off-shore oil and gas development along the State of California tidelands (within 3 mile coastal limit) and in the outer continental shelf (OCS) in the Santa Barbara Channel. Also, lightering activity in the San Clemente Island area and on-shore oil unloading in the Wilmington and El Segundo areas is included. There is no Sale 35 leasing activity for 1975.

Figure II-1 shows the locations of the off-shore activities for 1975 for the existing scenario. Table II-1 presents the 1975 off-shore oil and gas production. Table II-2 presents the 1975 lightening activity.

B. Future Off-shore and On-shore Activity

The year 1986 has been projected as the year of peak production for Sale 48. It has been assumed that co-development of Sale 35 and Sale 48 will take place wherever possible, such as in pipelines to shore, tanker loading, and common platforms.

There is no lightering activity projected for 1986. It is assumed that the required permits for larger tankers to dock on-shore have been approved and that they will go directly to Pier E in Long Beach in 1986.

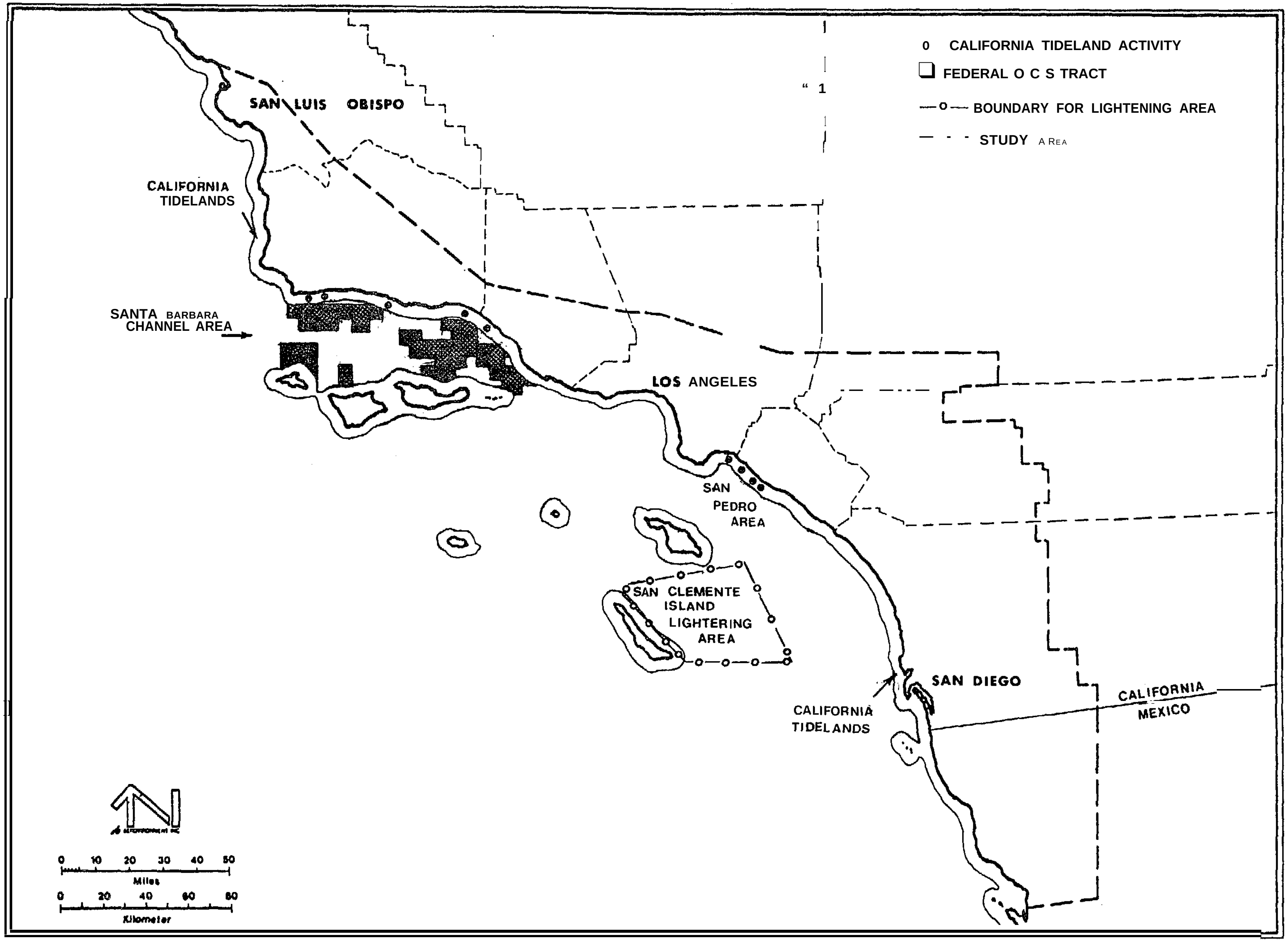


FIGURE H-1. Location of offshore activity for 1975.

TABLE H-1 . Existing Off-shore Oil and Gas Production (1975).

			1975 Production Rates	
Area	Tract	Location	Oil (BOD)[1]	Gas (cfD)[2]
Santa Barbara Area	California Tidelands (within 3 mile limit)	South Elwood	3,500	None
		Carpinteria	3,690	2,500,000
		Summerland	760	3,830,000
		Others	1,550	10,670,000
	Federal OCS	Carpinteria	4,800	2,600,000
		Hueneme	None	None
		Dos Cuadras	33,600	12,300,000
		Santa Clara	None	None
		Santa Ynez	None	None
San Pedro Area	California Tidelands (within 3 mile limit)	Belmont Offshore	5,900	1,400,000
		Huntington Beach	36,800	5,500,000
		Wilmington	103,000	19,600,000
		Others	1,700	1,800,000

[1] bbls of oil per day

[2] cubic feet of natural gas per day

TABLE II-2. Existing lightening activity (1975).

Off-shore Transferring	On-shore Unloading	
San Clem ente Island Area	Within the Study Area	Out of the Study Area
300,000 bbls/day of crude oil transferred to smaller tankers	Wilmington: 25,000 bbls/day	Martinez: 12,500 bbls/day
	El Segundo: 100,000 bbls/day	Anacortes: 12,500 bbls/day Richmond: 150,000 bbls/day

The oil produced in the Santa Barbara Channel is assumed to have the characteristics of the Dos Cuadras Crude. All other areas of off-shore production are assumed to have the same characteristics as Wilmington Crude.

Figure II-2 shows the locations of all off-shore and on-shore activities associated with the 1986 scenarios. Each of the four future scenarios and the two transportation assumptions are discussed below.

- Without Sale 48 Scenario

Table H-3 presents the Without Sale 48 scenario which includes the projected California tidelands and Federal OCS activity, as well as Sale 35 leases. The table identifies the locations, names, facilities? and 1986 production rates for oil and gas. The geographic locations of lease tracts (Sale 35 and other Federal OCS) and tideland platforms were shown in Figure II-2. Platforms and single buoy moors (SBM) will be located within the lease tract boundaries.

- With Sale 48 Scenario

Table II-4 presents the oil and gas production facilities and rates for Sale 48 tracts by area. Also presented are projected wells for drilling during 1 986. Figure II-2 identifies the geographic locations of the lease tracts. Platforms and SBM's will be located within tract boundaries. The With Sale 48 scenario includes all of the tracts shown in the Without Sale 4$ scenario plus the Sale 48 tracts.

- Off-shore Accidents Scenario

Table H-5 presents the accident scenarios to be added to the With Sale 48 scenario for additional impact analysis of the four areas. Each accident case will be analyzed separately as shown below.

- With Sale 48 scenario plus 140 bbl oil spill
- With Sale 48 scenario plus 10,000 bbl oil spill
- With Sale 48 scenario plus 1,000 bbl/day blowout (with fire)
- With Sale 48 scenario plus 1,000 bbl/day blowout (without fire)

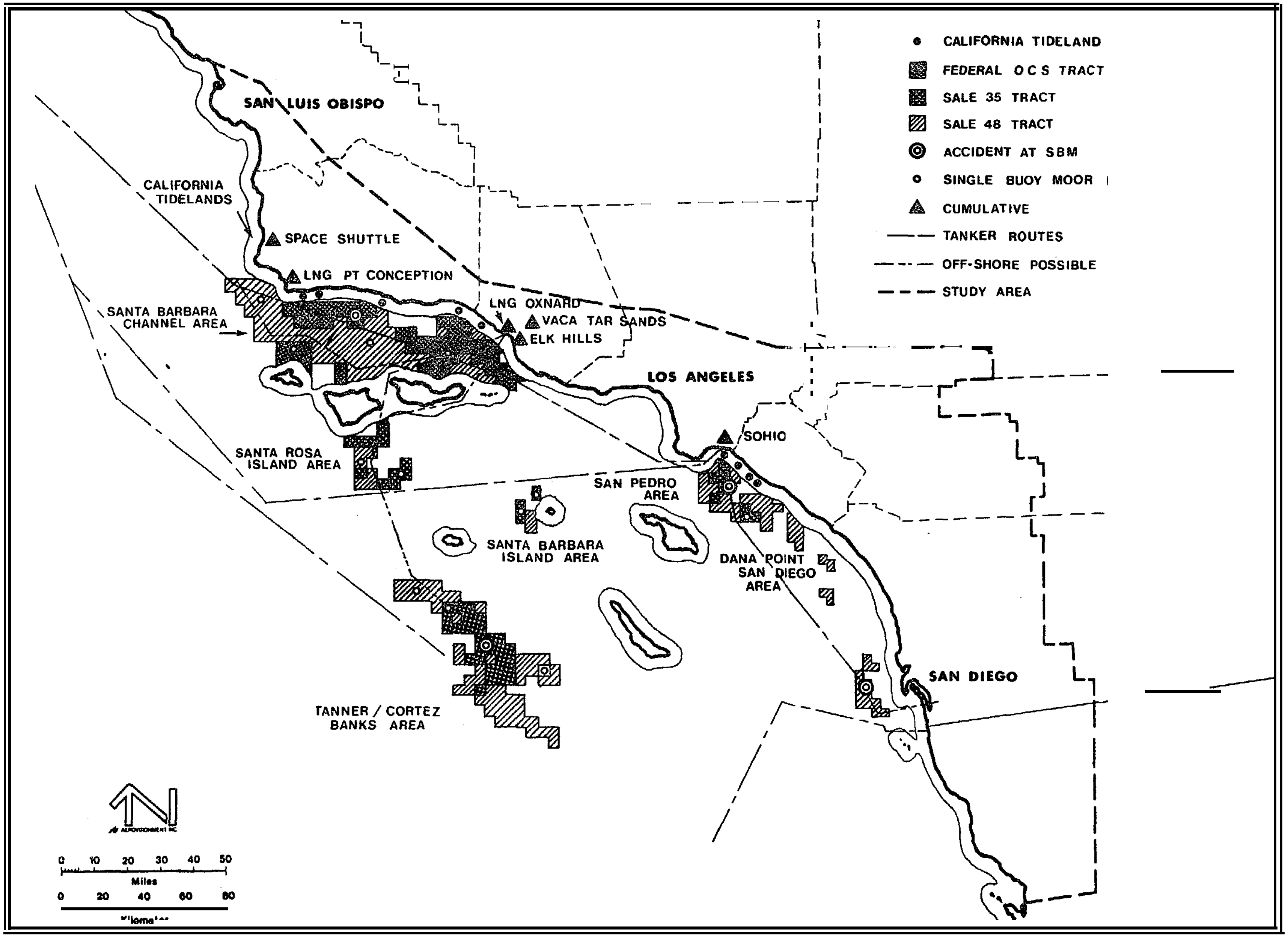


FIGURE II-2. Locations of offshore and onshore activities associated with the 1986 scenarios.

TABLE H-3. Without Sale 48 off-shore oil and gas production.

Area	Tract	Location or Facilities	1986 Production Rates	
			Oil (BOD)[1]	Gas (cfD)[2]
Santa Barbara Channel Area	California Tidelands	South Elwood	7,300	8,800,000
		Carpinteria	1,290	1,000,000
		Summerland	750	2,290,000
		Others	560	3,710,000
	Federal OCS	Hueneme	3,000	-0-
		Carpinteria (Henry)	2,000	1,500,000
		Dos Cuadras	7,000	2,000,000
		Santa Clara (NO)	23,000	28,000,000
		(so)	28,000	45,000,000
		Santa Ynez (Hondo)	95,000	85,000,000
		(Sacate Pescado)	42,000	38,500,000
		5 platforms 3 single buoy moors		
Santa Rosa Island Area	Sale 35	2 platforms 1 single buoy moor	2,186	3,279,000
Santa Barbara Island Area	Sale 35	3 platforms 1 single buoy moor	3,379	2,703,200
Tanner/ Cortez Banks Area	Sale 35	25 platforms 3 single buoy moors	151,053	226,579,500
San Pedro Area	California Tidelands	Belmont Offshore	1,600	400,000
		Huntington Beach	18,100	2,700,000
		Wilmington	32,100	6,100,000
		Others	600	600,000
	Sale 35	8 platforms 2 single buoy moors	39,751	31,800,000
Dana Point/ San Diego Area	None	None	None	None

[1] bbls of oil per day

[2] cubic feet of natural gas per day

TABLE H-4 . Sale 48 off-shore oil and gas production (1986).

Area	Tract	Facilities	1986 Production Rates		Wells drilled during 1986
			Oil (BOD)[1]	Gas (cfD)[2]	
Santa Barbara Channel Area	Sale 48	7 platforms 2 single buoy moors	92,000	92,000,000	39
Santa Rosa Island Area	Sale 48	1 platform 1 single buoy moor	5,000	7,000,000	5
Santa Barbara Island Area	Sale 48	1 platform 1 single buoy moor	3,000	2,000,000	5
Tanner/ Cortez Bank Area	Sale 48	9 platform 2 single buoy moors	88,000	131,000,000	50
San Pedro Area	Sale 48	3 platform 1 single buoy moor	24,000	20,000,000	18
Dana Point/ San Diego Area	Sale 48	3 platform 1 single buoy moor	8,000	12,000,000	18

[1] bbls of oil per day

[2] cubic feet of natural gas per day

TABLE II-5 , Number of accidents for each off-shore area (1986).

Area	Accident Scenarios		
	140 bbl* oil spill	10,000 bbl * oil spill	1,000 bbl$^+$/day blowout (w/ & w/o fire)
Santa Barbara Channel	1	1	1 (Assume 1000 ft^3/bbl of sour$^\#$ nat. gas)
Tanner/ Cortez Banks	1	1	1 (Assume 1000 ft^3/bbl of sweet nat. gas)
San Pedro	1	1	1 (Assume 1000 ft^3/bbl of sweet nat. gas)
Dana Point/ San Diego	1	1	1 (Assume 1000 ft^3/bbl of sweet nat. gas)

Footnotes:

* oil spill: instantaneous and stationary

$^+$blowout: 10 days duration

$^\#$ sour gas: grester than 10 grains of H_2S per $10^3 ft^3$ of natural gas (See Table V-7 for value used)

The 140 and 10,000 bbl oil spills are assumed to be instantaneous and remain as a stationary point source. The blowout is assumed to occur for 10 days at the same location. The locations of these accidents were shown in Figure II-2. They coincide with the middle SBM at the four lease tract areas.

The analysis of the accidents will assume that only one accident will occur in Southern California Bight at one time. Therefore, four accidents at the four lease tracts will not occur simultaneously. It must be noted, however, that the statistical probability of an actual spill or blowout of these magnitudes are quite low, and these assumptions should not be construed as expectations.

o Cumulative Scenario

Under this scenario the cumulative effects of other major proposed actions are studied. Six on-shore related activities are considered as an addition to the With Sale 48 scenario. This scenario builds onto the With Sale 48 case the combined impacts of the following potential developments:

SOHIO tankering
Elk Hills pipeline
Vaca Tar Sands Recovery Project
Space Shuttle activity
LNG terminal at either Point Conception or Oxnard.

The on-shore locations of these cumulative developments were previously shown in Figure II-2. For the SOHIO tankering, it is assumed that 700,000 bbls per day is being tankered into Long Beach. Of this amount, 250,000 bbls/day remains in the L.A. area and 450,000 bbls/day is sent by pipeline to Midland, Texas. For the Elk Hills Pipeline, it is assumed that 250,000 bbls/day is being pipelined to Port Hueneme. Also, it is assumed that 250,000 bbl tankers are being used to transport the oil from Port Hueneme. These tankers take approximately 14 hours to load. Fifty percent of the tankers are assumed to go to Los Angeles, and 50% of the tankers are assumed to go to San Francisco. For the Vaca Tar Sands Project (steam injection) it is assumed that 460 wells have been drilled producing a total of 22,329 bbls/day of oil. It is further assumed that some type of facility has been constructed onsite to handle the very thick oil and that it cannot be pipelined elsewhere without treatment. It was assumed that the oil is diluted with recyclable solvent and piped to a refinery in the area.

o Normal Tankering

Table II-6 presents the normal transportation and storage activity that is assumed when analyzing the four future scenarios the first time.

For the Santa Barbara Channel, Santa Rosa 'island, and Tanner/Cortez Banks areas, it will be assumed that six 150,000 bbl barges will operate for the Los Angeles trips and two 400}000 bbl tankers will operate for the San Francisco trips. For the Santa Barbara Island area, it will be assumed that one 10,000 bbl barge will be sufficient while for the Data Point/San Diego area, it will be assumed that three 10,000 bbl barges will be rotated.

o 100% Tankering

This second transportation and storage assumption which is applied to the four future scenarios assumes that no pipelines will be used to transport oil and gas to shore. For all areas in the Southern California Bight, natural gas will be reinfected into the oil fields. Therefore, only crude oil will be extracted, transported, processed, refined, and distributed as a fuel.

Comparing this 100% tankering assumption to the normal transportation and storage assumption, all pipeline pre-destination and destination activity will be substituted with tankering and barges. Table II-7 presents the 100% tankering situation.

For the Santa Barbara Channel, Santa Rosa Island, and Tanner/Cortez Banks areas, two 400,000 bbl tankers will be assumed for transport to San Francisco, and six 150,000 bbl barges will be assumed to be constantly rotating for the Los Angeles transport. For the Santa Barbara Island area, one 10,000 bbl barge will be assumed. For the last two areas it will be assumed that there will be one 100,000 bbl tanker and four 10,000 bbl barges for San Pedro and Dana Point/San Diego areas, respectively.

C. REFERENCES

Bureau of Land Management. 1977. File memorandum titled, " Proposed Sale 48 OCS Activity Scenarios." Received June 2, 1977.

TABLE II-6. Probable Sale 48 **transport,** storage, and processing activity for off-shore oil and gas production.

Area/Fuel	Off-shore site activity		Pre-destination activity				Destination activity			
							Transport to destination			
	Type	Amount[1]	ype of transpor rom site to pre destination	Amount[1]	Pre-destination location (on-shore)	'rocess-ing	Type	Round-trip[2] time	Destination location	Amount[1]
Santa Barbara Channel										
oil	Production Storage & Processing SBM[3]	292,000 146,000	pipeline N/A	146,000 --	Ventura --	Yes No	barges tankers	65 hrs 5 1/2 days	Los Angeles San Francisco	146,000 166,000
Gas	Production	292, 000,00/	pipeline	292,000,000	Ventura	yes	existing pipelines	N/A	unkn.	
Santa Rasa Island										
Oil	Production	7,186	pipeline	7,186	Ventura	Yes	barges	55 hrs.	Los Angeles	7,186
Gas	Production	10, Z79,OOC	pipeline	10,279,000	Ventura	yes	existing pipelines	N/A	unkn.	
Tanner/ Cortez Banks										
Oil	Production	239,053	pipeline	239,053	Ventura	Yes	barges	65 hrs.	Los Angeles	239,053
Gas	production	357,579,50	pipeline	357,579,500	Ventura	yes	existing pipelines	N/A	unkn.	
Santa Barbara Island										
Oil	Production	6,379	N/A			no	barges	30 hrs.	Los Angeles	6,739
Gas	100% Reinfection	4,703,200	N/A			no	..			
San Pedro										
oil	Production	63,751	N/A			no	pipeline	N/A	Los Angeles	-
Gas	Production	51,800,00(	N/A			no	pipeline	N/A	Los Angeles	-
)ana Point/ San Diego										
oil	production & Processing	8,000	N/A			no	barges	54 hrs.	Los Angeles	8,00(
Gas	Production & Processing	12,000,00(	N/A			no	pipeline	N / A	San Diego	.

[1] Amount: **bbls** of **oil/day**
cubic feet of gas/day

[2] Round trip time includes: **loading;** unloading; travel to and from

[3] **SBM:** single buoy moor

TABLE 11-7. 00% **tankering** and storage activity for off-shore oil production.

Area	Off-shore Site Activity		Destination Activity			
				Transport to Destination		
	Type	Storage Capacity (barrels)	Amount (BOD)	Type	Round Trip Time	Destination Location
Santa Barbara Channel	Storage at 5 SBM's & Processing	600,000	204,400 87,600	Barge Tanker	65 hours 5 1/2 days	Los Angeles San Francisco
Santa Rosa Island	Storage at 2 SBM's & Processing	18,000	7,186	Barge	40 hours	Los Angeles
Tanner/ Cortez Banks	Storage at 4 SBM's & Processing	480,000	166,181 73,872	Barge Tanker	80 hours 5 1/2 days	Los Angeles San Francisco
Santa Barbara Island	Storage at 2 SBM's	14,000	6,379	Barge	30 hours	Los Angeles
San Pedro	Storage at 2 SBM's	130,000	63,751	Barge	24 hours	Los Angeles
Dana Point/ San Diego	Storage at 1 SBM	16,000	8,000	Barge	54 hours	Los Angeles

m. AIR QUALITY REGULATIONS APPLYING TO OCS OIL AND GAS DEVELOPMENT

Legal authority for control of air pollutants is divided among federal, state and local agencies and each has its own specific responsibilities. These are discussed in the sections which follow.

A. Federal Authority

The federal authority is primarily derived from the Clean Air Act of 1970. This act required the Environmental Protection Agency to set national air quality standards which would protect the public health and welfare from any known or anticipated adverse effects resulting from air pollutants. These standards are presented in Table 111-1. The states were required to adopt and submit to EPA plans for achieving, maintaining and enforcing these standards. The Environmental Protection Agency was assigned the responsibility for setting and enforcing motor vehicle emission and fuel standards and aircraft emission standards, but control of other sources was delegated to the states by section 110 of the Clean Air Act. The Clean Air Act does not deal specifically with air quality in the federally controlled Outer Continental Shelf. The Clean Air Act was amended in August 1977. A preliminary review of these amendments indicates that no fundamental changes were made which affect Federal authority pertaining to air pollution from operations in the Outer Continental Shelf.

The Clean Air Act requires that each department, agency and instrumentality of the executive, legislative and judicial branches of the Federal Government having jurisdiction over any property or facility or engaged in any activity resulting in the discharge of air pollutants, comply with Federal, state, interstate and local requirements to the same extent that any person is subject to these requirements. A subsequent Executive Order (# 11752, May 12, 1975) reaffirmed that federal agencies must comply with provisions of the Clean Air Act and placed first priority for compliance on major facilities emitting more than 100 tons per year of any single pollutant and second priority for compliance of minor emitters in high pollution areas. It is clear that these provisions apply to federal facilities onshore, but there has not yet been a court test of their applicability to offshore islands, platforms and single buoy moors. A very recent legal memorandum from the Office of the General Counsel, U.S. Environmental Protection Agency (Sept. 8, 1977) to the USEPA Regional Counsel essentially states that the Outer Continental Shelf Lands

TABLE 111-1. Ambient air quality standards.

pollutant	Averaging Time	California Standards[1]	National andards[2]	
		Concentration	Primary	Secondary
oxidant (ozone)	I Hour	0.10 ppm (200 $\mu g/m^3$)	160 $\mu g/m^3$ (0.08 ppm)	Same as Primary Std.
Carbon Monoxide	12 hour	10 ppm (11 mg/m^3)	--	Same as primary Standards
	8 hour	--	10, mg/m^3 (9 ppm)	
	1 hour	40 ppm (46 mg/m^3)	40 mg/m^3 (35 ppm)	
Nitrogen Dioxide	Annual Average	--	100 $\mu g/m^3$ (0.05 ppm)	Same as Primary Standards
	1 hour	0.25 ppm (470 $\mu g/m^3$)	--	
Sulfur Dioxide[3]	Annual Average	--	80 $\mu g/m^3$ (0.03 ppm)	--
	24 hour	0.04 ppm (105 $\mu g/m^3$)	365 $\mu g/m^3$ [0.14 ppm)	--
	3 hour	--		1300 $\mu g/m^3$ (0.5 ppm)
	1 hour	0.5 ppm (1310 $\mu g/m^3$)	--	--
Visibility Redwing Particles	1 observation	In sufficient amount to reduce the prevailing visibility to less than 10 mi. when rel. humidity is less than 70%	--	--
Suspended Particulate Matter	Annual Geometric Mean	60 $\mu g/m^3$	75 $\mu g/m^3$	60 $\mu g/m^3$
	24 hour	100 $\mu g/m^3$	260 $\mu g/m^3$	150 $\mu g/m^3$
Sulfates	24 hour	25 $\mu g/m^3$	--	--
Lead	30 Day Average	1.5 $\mu g/m^3$	--	--
lydrogen Sulf ide[4]	1 hour	0.03 ppm (42 $\mu g/m^3$)	--	--
Hydrocarbons (Corrected for Methane)	3 hour (6-9 a.m.)	--	160 $\mu g/m^3$ 0.24 ppm)	Same as Primary Standards
Ethylene	8 hour	0.1 ppm	--	--
	1 hour	0.5 ppm		

---

[1] California standards are values that are not to be equaled or exceeded.

[2] National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.

[3] This standard only applies when the California State ozone or particulate standard is exceeded.

[4] Santa Barbara County has an H_2S regulation limiting ambient levels to 0.06 ppm for 3 minutes.

Act (67 Stat. 462) provides the authority for the Clean Air Act to be applied to fixed structures built on the Outer Continental Shelf (Stoll, 1977). This memorandum presents the policy for the USEPA. However, it has not been tested in court.

B. California Authority

The California Air Resources Board (CARB) was created in 1967 by the Mulford-Carrell Act. The board was given the authority to control vehicular emissions, establish air basins within the state, set ambient air quality standards and cooperate with the federal government, and it had accomplished all these things before the Clean Air Act of 1970 was passed. It has since revised some of its air quality standards to make them agree with federal standards (see Table 111- 1), but it has also exercised its prerogative to adopt some standards that are more stringent than the federal standards. California also sets and enforces its own motor vehicle emission standards that are more restrictive than the federal standards.

The primary responsibility for air quality surveillance and stationary source control was given by the Mulford-Carrell Act to local and regional air pollution control districts, but the state, in its supervisory capacity, was given authority to make demands on or assume the powers of the districts. It has done this on rare occasions, but compliance is usually obtained by counsel and negotiations. The California Air Resources Board has not required that the districts adopt uniform rules and regulations except in certain special cases. The degree of participation of the board in local air pollution control activities varies enormously, depending on the size and capabilities of the local district, but the state is always involved to some extent. In Southern California the state used to participate to a very limited extent, but more recently it is exercising a greater degree of supervision in an attempt to solve the particularly difficult air quality problems of the area.

c. Local Authority

The coastal counties of Santa Barbara, Ventura, Los Angeles, Orange and San Diego are all impacted by OCS Sales 35 and 48 and, therefore, must be considered in this discussion. That part of the study area from the northwestern boundary to the Ventura County line is under the jurisdiction of the Santa Barbara County Air Pollution Control

District. The Ventura County Air Pollution Control District has jurisdiction over the Ventura County portion of the study area. The South Coast Air Quality Management District has jurisdiction over the portion of the study area in Los Angeles, Riverside, San Bernardino, and Orange Counties. That. portion of San Diego County in the study area is under the jurisdiction of the San Diego County Air Pollution Control District.. The offshore islands fall under the jurisdiction of the APCD or AQMD in the county to which they belong (i.e., Santa Catalina Island is in Los Angeles County and is therefore under the jurisdiction of the South Coast Air Quality Management District).

In addition to ambient air quality standards established by EPA and CARB, Santa Barbara County Air Pollution Control District has also promulgated a standard for hydrogen sulfide (see Table III-1), which applies only to Santa Barbara County.

Each of these coastal counties has its own unique set of rules and regulations that are applicable to stationary pollution sources within the county. The basic control and enforcement procedures are the same in all counties and have the -following general features:

- Permits are required to construct and operate equipment that emits air pollutants
- Certain specific equipment is exempted from permit requirements
- Equipment must be operated according to the limitations and specifications of the air pollution control district
- New sources usually are required to conform to more stringent limitations than existing sources

Generally each county will adopt rules that apply to industries found within that county, and, if necessary, will adopt new rules when a new industry is started. The specific rules that are applicable to oil and gas production are discussed in the paragraphs which follow.

1. Exemptions - In Los Angeles and Orange counties exemptions are granted to natural gas and crude oil production equipment as follows:

"RULE 219 Section o. A permit shall not be required for the following oil and natural gas production equipment used exclusively for primary recovery of natural gas and crude oil:

1. Free-flow well heads and well pumps.
2. Gas separators and gas boots.
3. Initial receiving, dehydrating, washing, and shipping tanks (except associated with community lease transfer units) with an individual capacity of 254,400 liters (67,200 gallons) or less.
4. Gas recovery equipment exclusively serving above tanks (Item 3).
5. Crude oil and natural gas pipeline transfer pumps.
6. Crude oil well head loading facilities.
7. Gravity-type effluent water separators (except those associated with community lease transfer units).
8. Dry gas dehydrating and repressuring equipment.
9. Hydraulic and pneumatic repressuring equipment (does not include steam generating equipment).

"RULE 219 Section n item 2. A permit shall not be required for equipment used exclusively for the storage of liquified gases."

In Ventura county exemptions are granted according to Rule 23 Section F items 10 and 11 as follows:

"Item 10. Equipment directly and exclusively used for producing and gathering crude oil.

> "Item 11. Equipment used to compress, store, liquify or separate gases from the air or to compress or store natural hydrocarbon gases, other than engines."

Santa Barbara and San Diego counties do not grant exemptions similar to those above; however, they do exempt equipment used for the storage of liquified gases.

2. Storage and Loading of Crude Oil. All counties regulate the storage and loading of petroleum products, but, in some counties the rules are not applicable to crude oil. San Diego county Rule 61 requires that vapor losses be controlled on tanks greater than 550 gallons capacity which are used to store organic liquids having a vapor pressure of 1.5 psia or greater. The South Coast Air Quality Management District's (SCAQMD) Rule 463 is similar, but applies to tanks of more than 150,000 liters (39,630 gallons) capacity. Rule 463 also contains a requirement for installation of vapor controls on oil field storage tanks, with capacities of 254,000 liters (67,200 gallons) or less which are used exclusively for crude oil storage. Ventura and Santa Barbara counties regulate the storage of petroleum distillates but not the storage of crude oil.

San Diego county (Rule 63) requires that vapor recovery equipment be installed at any facility where loading into tank truck or trailer, tanker, railroad tank car or stationary storage tank exceeds 2000 gallons per month or where a tank of more than 550 gallons capacity is involved. This regulation applies to any organic liquid with a vapor pressure of more than 1.5 psia. Ventura county (Rule 63) and the SCAQMD (Rule 463) have regulations that apply to facilities loading 20,000 gallons/day or more of liquids with vapor pressures of 1.5 psia or greater into tank trucks, trailers or railroad tank cars. Santa Barbara county regulates the loading of petroleum distillate but not the loading of crude oil. The suggested control systems are similar in all counties except San Diego. The San Diego rules have been challenged in court and still await the final outcome.

3. Emissions of Sulfur Compounds – Each county regulates the emissions of sulfur compounds to the atmosphere. These regulations apply primarily to large fuel burning operations, but they may relate to certain oil and gas processing activities as well. The regulations fall into three general categories which are discussed in the following sections:

a. Sulfur Content of Fuels. All counties limit the sulfur content of liquid and solid fuels to 0.5% (San Diego Rule 62, SCAQMD Rule 431, Ventura Rule 64, Santa Barbara Rule 32). These same rules also limit the sulfur content of gaseous fuels from a low of 10 grains per 100 cubic feet (San Diego) to a less stringent 800 ppm or 50 grains per 100 cubic feet (northern Santa Barbara and SCAQMD). The rules do not apply to the incineration of waste gases.

b. Sulfur Content of Discharges. All counties restrict the concentration of sulfur compounds that may be present in stack gases (San Diego Rule 53, SCAQMD Rule 53, Ventura Rule 54, Santa Barbara Rules 19 and 19.1). The allowable concentrations vary slightly from one county to the next and range from 0.03% to 0.2%. Ventura county has a specific limit of 10 ppm for hydrogen sulfide, but the other counties have single regulations that apply to all sulfur compounds. Ventura and Santa Barbara counties also limit the allowable ground level concentrations of sulfur dioxide in the vicinity of a point source. In addition, Ventura county limits the ground level concentrations of hydrogen sulfide. In Santa Barbara county (Rule 39) and Ventura county (Rule 60), no fuel burning equipment may be installed which emits more than 200 pounds per hour of sulfur compounds (calculated as SO_2).

c. Sulfur Recovery Units. The SCAQMD (Rule 468) and Santa Barbara county (Rule 20. 1) have special rules that limit emissions from sulfur recovery units that produce elemental sulfur.

4. Effluent Oil Water Separators. Specific requirements for vapor recovery on oil water separators are imposed by the SCAQMD (Rule 464), Santa Barbara county (Rule 29) and Ventura count y (Rule 61). These regulations do not apply to crude oil separators if the water contains less than 5 ppm of hydrogen sulfide or organic sulfides. San Diego county does not have a similar rule because there are no oil processing facilities in that county.

5. New Sources. Regulations applicable to new sources are generally uniform because they are based on model regulations proposed by EPA. Performance standards have been adopted for petroleum refineries and for storage vessels for petroleum liquids,

but no standards have been adopted for petroleum production. Applications for permits to construct new sources must undergo a special "new source review" process in all Southern California Air Pollution Control Districts since these air basins are all in violation of one or more of the federal air quality standards. Local review policies must conform to certain state and federal criteria and guidelines which are so recent that they have not been thoroughly tested at the time of this writing. It is clear that any new source must conform to all regulations applicable to existing sources; that it must also conform to new source performance standards if they exist for that industry; and that a permit to construct may still be denied if the emissions from that source will interfere with attainment of air quality standards. Current policy requires that new emissions be offset by reducing emissions from existing sources. At the present time each county is still working out its own policies and procedures for dealing with new sources; however, the 1977 amendments of the Clean Air Act may be interpreted in a way that will change the emission offset policy after 1979.

D. Miscellaneous

The major mechanism for regulating OCS oil and gas development is the "new source review" process. At present this authority has been delegated to the counties since the action resulting from such review is the issuance or denial of a permit to construct - an activity normally carried out by local agencies. It is clear that counties cannot require permits for offshore developments which are outside their jurisdictions; therefore, they could take no direct action even if they were to conduct a new source review. The state also has no jurisdiction beyond the three mile limit. EPA has the administrative structure and manpower to conduct its own new source reviews, but it is unclear at the present time whether EPA can take any action other than making recommendations to the BLM and the USGS.

In principle, all agencies – federal, state and local – can enact new rules to meet new needs. In practice, this is accomplished rather easily at local and state levels and with much greater difficulty at the federal level. There is no question that San Diego county will adopt rules to regulate oil and gas production and refining if these operations are proposed for that county, and the CARB is considering regulations for the SCAQMD and San Diego APCD to control the emissions from lightering operations. Under the authority cited in Section III-A – more specifically in the Sept. 8, 1977 legal memorandum from the Office of the General Counsel – it now appears that the Region IX office of the U.S. Environment Protection Agency would require that fixed structures built on the Outer Continental Shelf be subject to a New Source Review. However, no applications have been filed, nor has this ruling been tested in court.

E. References

California Health and Safety Code Sec. 39000 et seq, the Mulford-Carrell Act.

CleanAir Act, 42 U.S.C., Sec. 1857 et seq, the Clean Air Act Amendments of 1970.

Clean Air Act Amendments of 1977, Public Law 95-95, August 1977.

San Diego, CA, County of, Rules and Regulations, revised Sept. 1974.

Santa Barbara, CA, County of, Rules and Regulations of the Air Pollution Control District including additions of November 23, 1976.

South Coast Air Quality Management District, Rules and Regulations, Spring, 1977.

Stoll, John, Office of General Counsel, U.S. EPA, Personal communication. Sept. 9, 1977,

Ventura, CA, County of, Rules and Regulations of the Air Pollution Control District including amendments of July 15, 1977.

Iv. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. Climate Summary

1. General Circulation - The semipermanent high pressure area over the Eastern North Pacific Ocean is the dominating factor over the weather in the Southern California coastal region.

During the summer months, the Pacific high pressure center moves northward and storm tracks are shunted far to the north. The weather is generally partly cloudy and COOL The circulation along the Pacific coastal region is from the northwest. The strength and persistence of this airflow at the surface causes upwelling immediately off the coast and colder water from below is brought to the surface. Comparatively warm, moist Pacific air masses drifting over this band of cold coastal water form a bank of coastal ocean stratus which is swept inland by the prevailing northwest winds.

Another dynamic aspect related to this anticyclonic circulation is the marked descent of air with vertical convergence and horizontal divergence. Since the air at upper levels is initially stable, this sinking and convergence motion frequently leads to the formation of subsidence inversions. The occurrence of this type of inversion over the Los Angeles area is most frequent and persistent during late summer and autumn and is a primary cause of the acute smog problem there.

During the winter season, the high retreats southward and permits intermittent storm centers to enter Southern California. The weather during the winter is mostly fair with precipitation from passing storms.

2. Prevailing Winds - During the nighttime hours, the radiative cooling of the sloping coastal area causes offshore airflow, and during the daylight hours solar heating of the land causes drops in air pressure with respect to the air mass over the ocean, leading to onshore airflow. However, the variability of topography of the coastal area and the offshore islands create complex flow patterns when interacted with the prevailing synoptic pattern.

Figures IV- 1 and IV-2 show the prevailing airflows during the nighttime hours for each midseason month (April, July, October, and January). The flow around Pt.

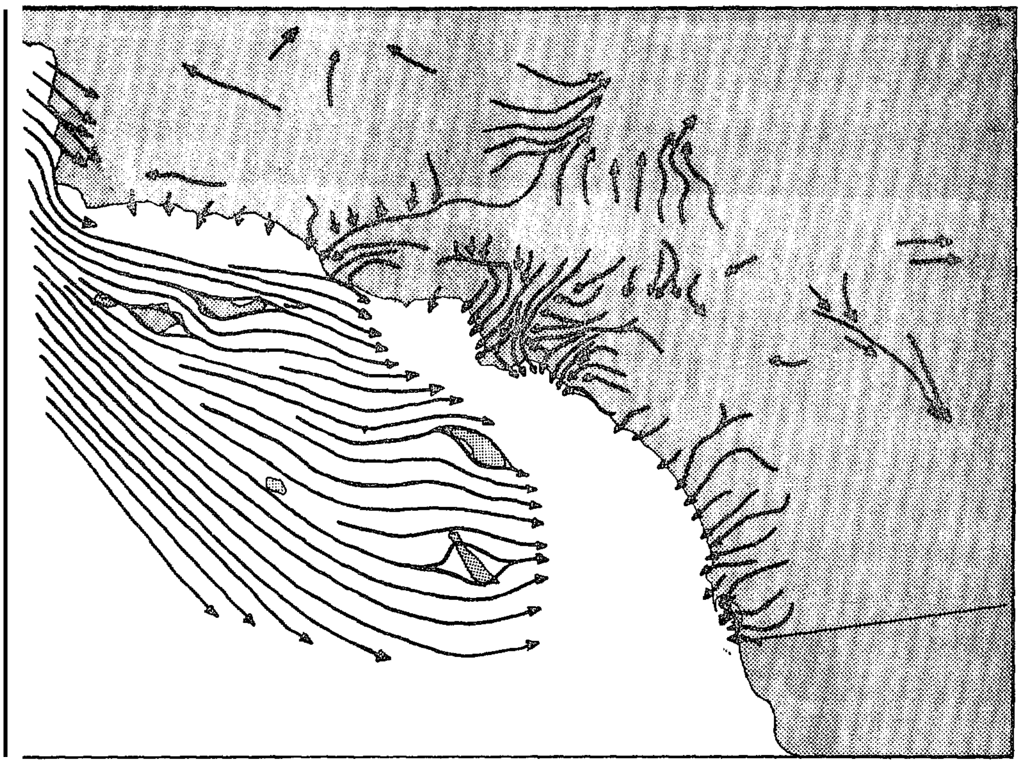


FIGURE IV-la. Streamline chart for April, 0000 -0600 PST. .

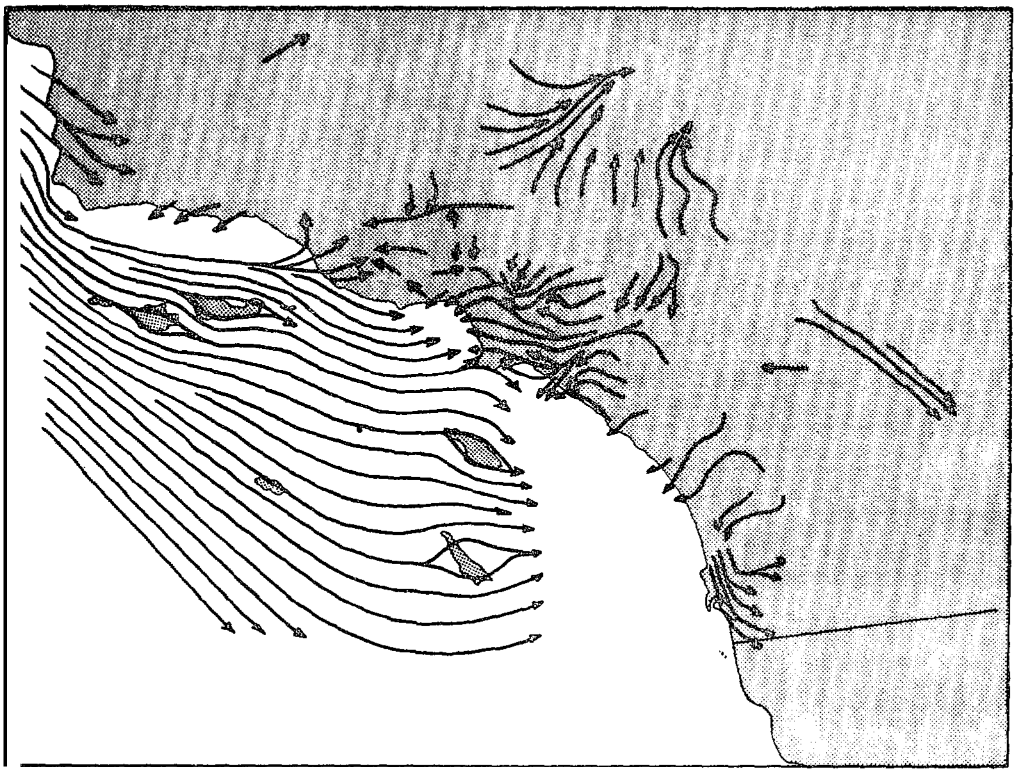


FIGURE IV-1b. Streamline chart for July, 0000-0600 PST. Source: DeMarrais, 1965.

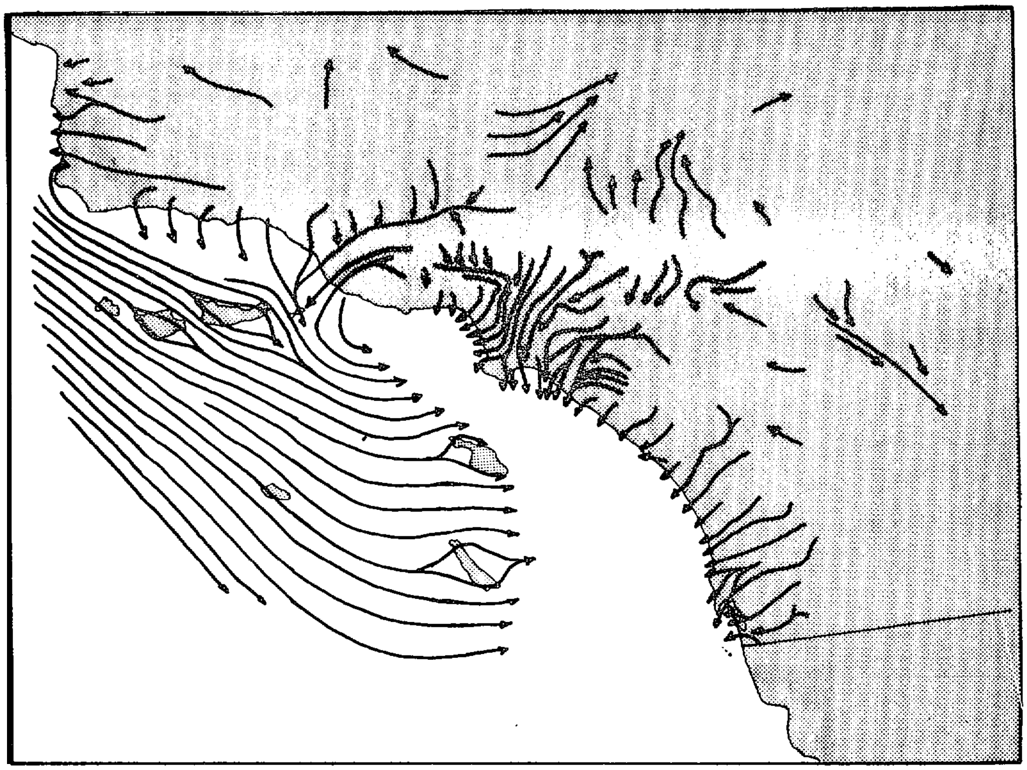


FIGURE IV-2a. Streamline chart for October, 0000 – 0700 PST.

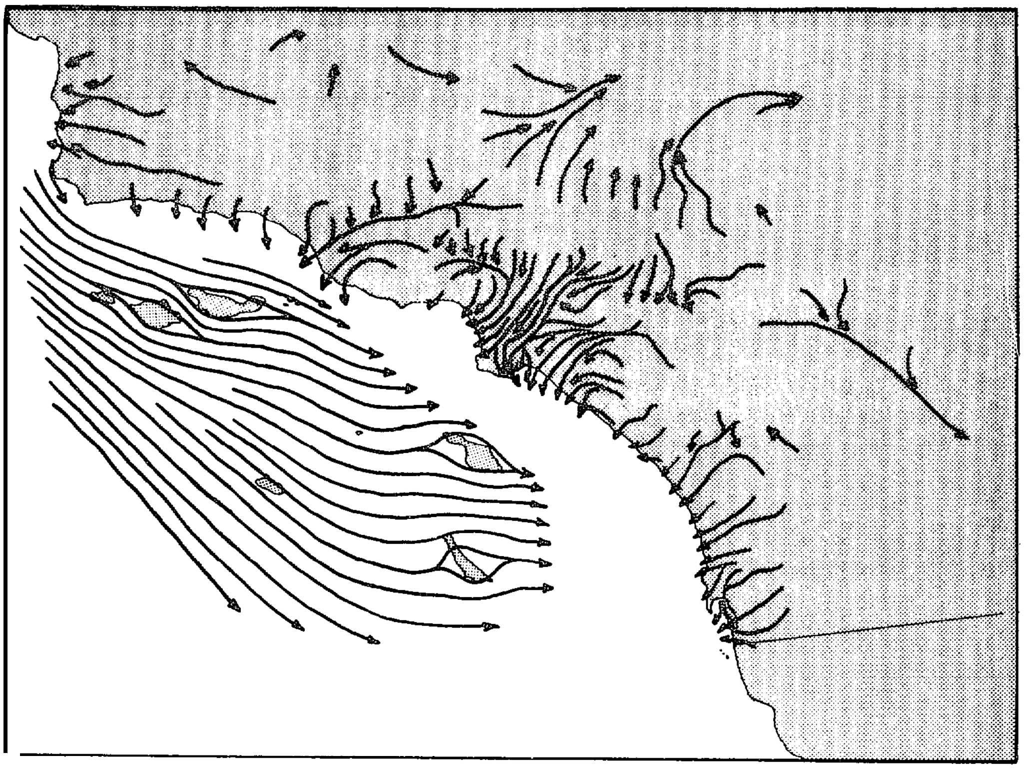


FIGURE IV-2b. Streamline chart for January, 0000 – 0700, PST. Source: DeMarrais, 1965.

Conception is relatively strong and has a component from the north. In the area west of San Nicholas Island the flow is from the northwest and the flow around the islands is typical of that around obstructions. The prevailing drainage flow on the land area goes from high areas of the hills and mountains into valleys and canyons and then offshore, The area between offshore and ocean westerlies is dependent on the strength of either flow on a given day. If the synoptic pattern has a strong high pressure over the western Intermountain Basin the offshore flow will be stronger and will push continental air several miles out to sea. Basin pressures in excess of 1035 mb are usually sufficient to cause warm, dry east-northeast winds (Rosenthal, 1972). This is the so-called Santa Ana condition. Such conditions are most common in fall and winter. Conversely, if the Pacific high is stronger, drainage and continental flow will not penetrate very far off the coast.

Figures IV-3 and IV-4 show the prevailing daytime airflow pattern, again, for each midseason month. The streamlines bend to the coast after swinging around Pt. Conception area due to the solar heating of the coastal hills and land areas. This situation is strongest during the summer months and weakest during the winter. The horizontal air movement over the ocean merges continuously with the air over the land. The so-called Santa Ana condition can also persist during daylight hours which results in air flow out to sea, which is the reverse of the normal flow.

3. Inversions and Mixing Heights – An inversion is a meteorological condition in which the temperature increases upward in a layer of air.

Three basic types of inversions can be identified in the study area: advection inversion, radiation inversion and subsidence inversion. Advection inversions occur in spring and early summer when warm air flows from the land area over the ocean surface. Radiation inversions occur on clear nights over the land area. They are strong in winter and weak in summer. Subsidence inversions are common in late summer and autumn as a result of the semi-permanent anticyclone that is located over the eastern North Pacific Ocean.

These inversions limit the vertical dispersion of pollutants. In general, the base of advection and radiation inversions is the ground surface. The air is very stable within these inversions and the dispersion of primary pollutants is inhibited. Fortunately! they last only for short durations (several hours).

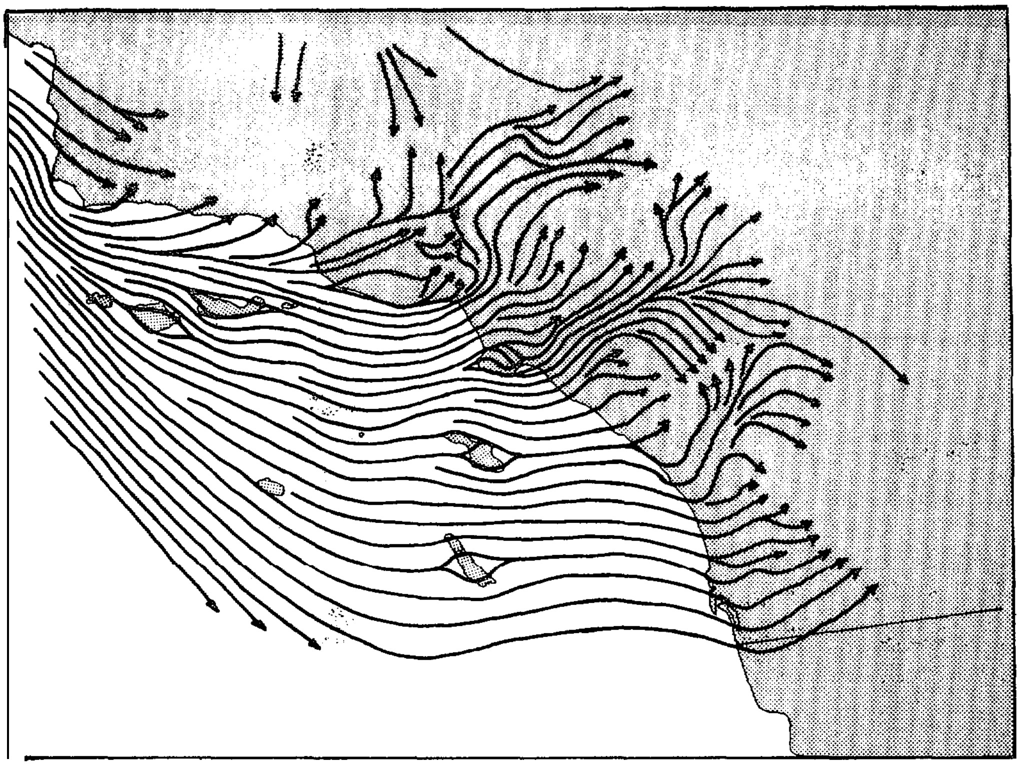


FIGURE IV-3a. Streamline chart for April, 1200 – 1700, PST.

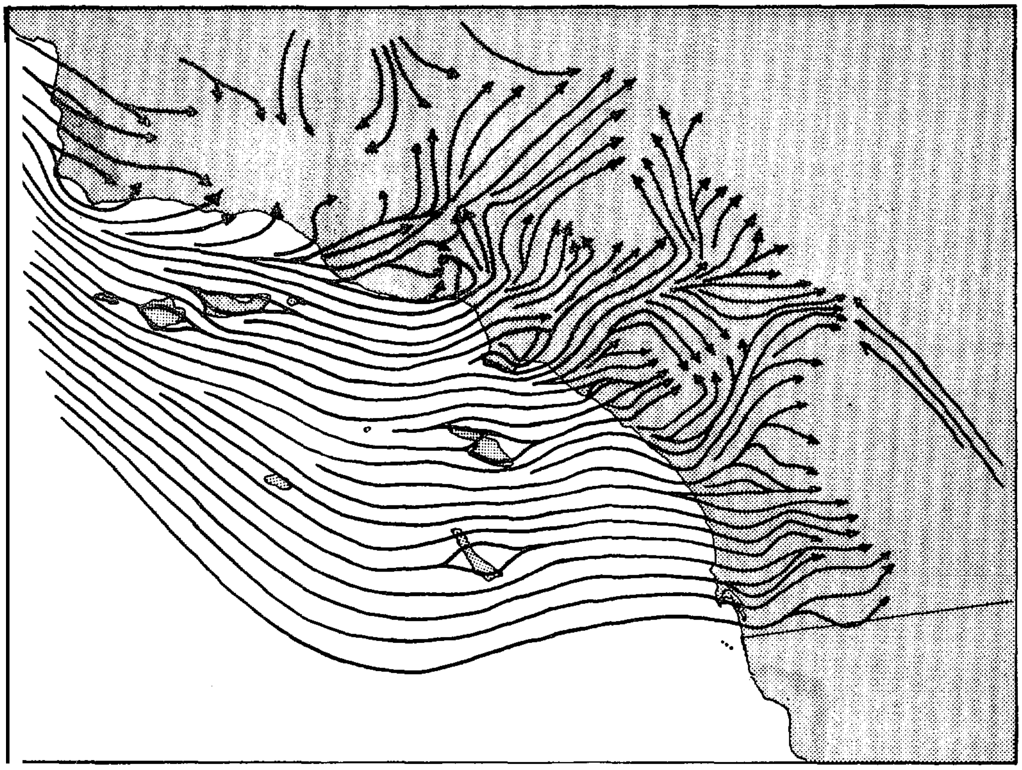


FIGURE IV-3b. Streamline chart for July, 1200 – 1800, PST. Source: DeMarrais, 1965.

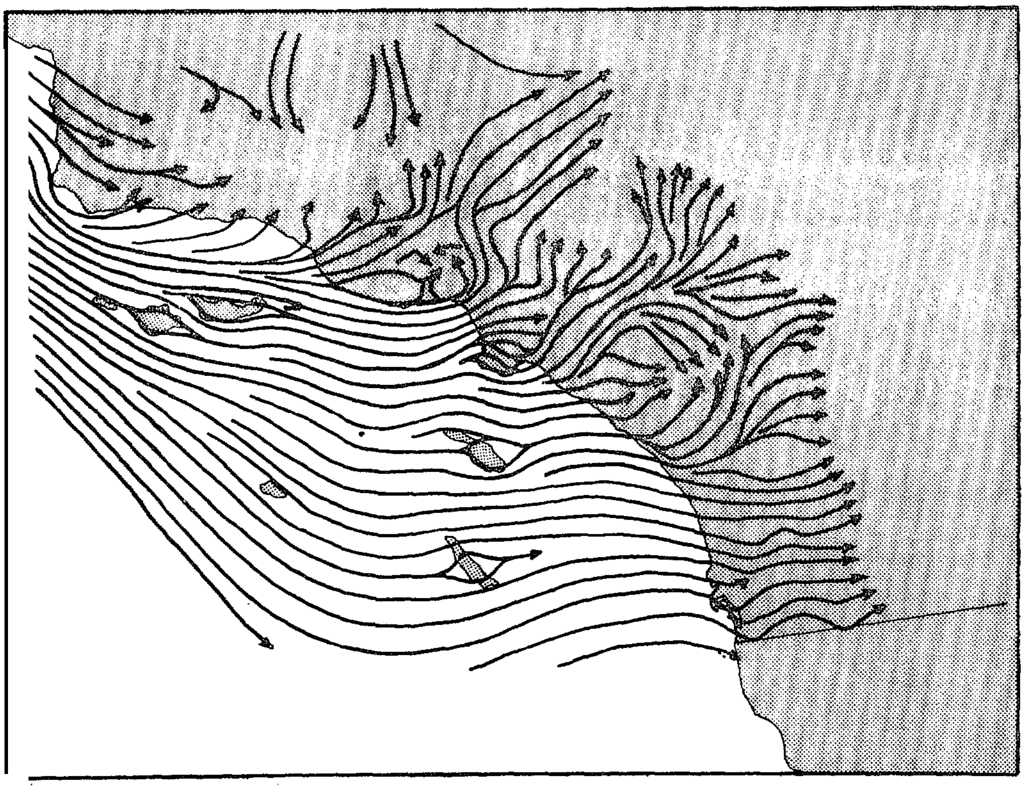


FIGURE IV-4a. Streamline chart for October, 1200-1800, PST.

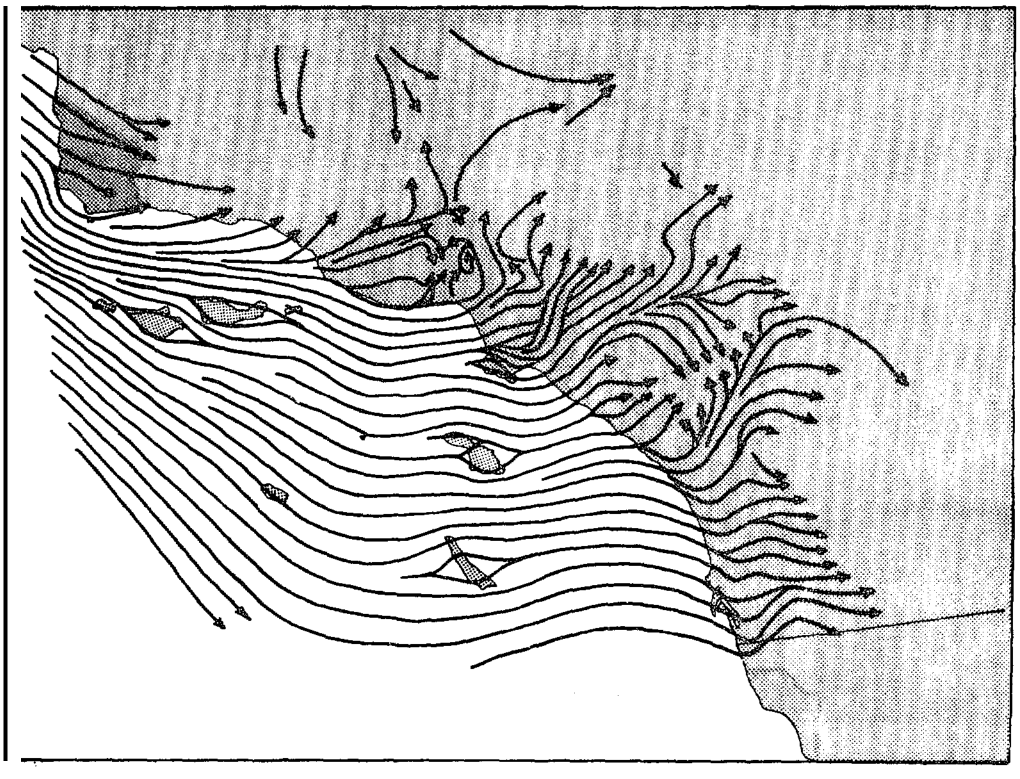


FIGURE IV-4b. Streamline chart for January, 1200-1700, PST. Source: DeMarrais, 1965.

Subsidence inversion, however, can persist for extended periods (several weeks) and trap pollutants sin the area. It is also a significant contributing factor to the severe smog conditions in the Los Angeles Basin. According to Neiburger, et al (1961), the average annual base and top of this subsidence inversion are 400 m and 800 m at Pt. Conception and 500 m and 1000 m at San Diego. Figure IV-5 shows a resultant topography of the inversion base over the Eastern Pacific during the summer months.

The mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. The height of the base of a subsidence inversion is an example of the mixing height. In the California Bight area, the mixing height is synonymous with the marine layer. In general, the marine layer is shallowest at the coast and increases in depth both landward and seaward. Table IV-1 shows the mean seasonal and annual morning and afternoon mixing heights for four selected coastal sites. The lowest mean afternoon mixing heights occur during the summer season and the lowest mean morning mixing heights occur in the winter.

4. <u>Temperatures</u> - Along the coastal area, temperature fluctuations (both diurnal and annual) are small due to the influence of the marine air. However, occasions of offshore continental flow can bring extremes in temperatures. Freezing or near freezing has been observed at sea level during the winter even at the Avalon Pleasure Pier on Santa Catalina Island. The synoptic weather pattern showing a deep cut-off low over the southwestern United States usually brings cold, arctic air directly into the area. Table IV-2 presents the maximum and minimum temperatures recorded at selected stations throughout the study area.

The 38°C (100°F) isotherm can be observed near sea level during strong ridging aloft. During these heat wave conditions the subsiding air overhead drives the inversion to or near the surface.

Figures IV-6 and IV-7 show the mean surface air temperatures over the Bight area during the coldest (February) and warmest (August) months.

5. <u>Precipitation</u> – Approximately 95% of the precipitation in the area occurs during the winter season between November and April.

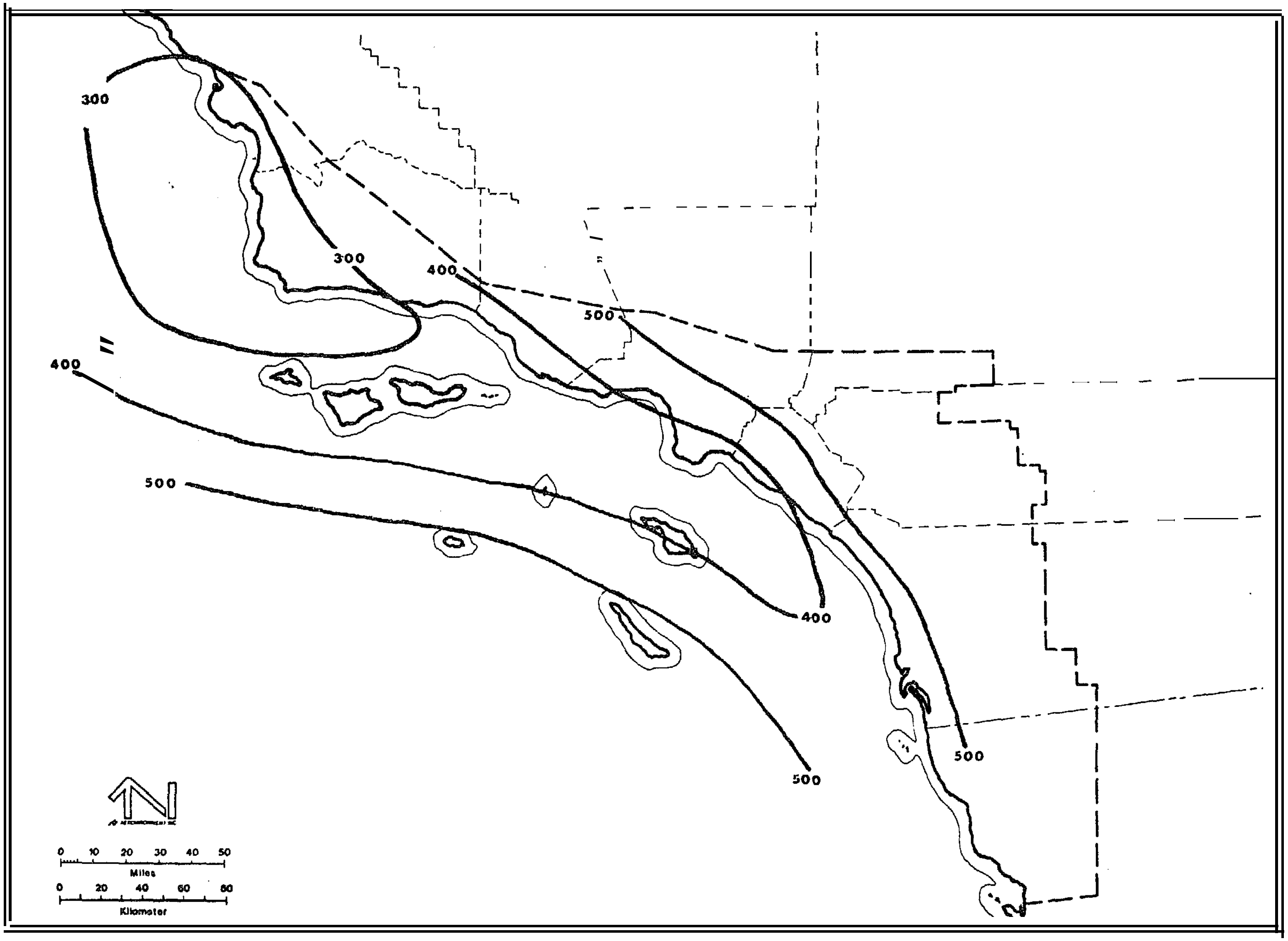


FIGURE IV-5. Topography (m) of the summer inversion base off southern California in 1944. (Source: Neiburger, et al, 196 .)

TABLE IV- 1. Mean Seasonal and Annual Morning and Afternoon Mixing Heights (m) +

Station	Period	Season				Annual
		Winter	Spring	Summer	Fail	
San Diego	Morning	333	851	538	578	625
	Afternoon	1021	1085	566	834	877
Santa Monica	Morning	422	676	362	510	542
	Afternoon	893	973	603	798	814
Santa Barbara	Morning*	470	720	400	500	523
	Afternoon*	850	900	580	700	758
Santa Maria	Morning*	490	670	410	500	540
	Afternoon #	837	903	540	657	734

* Estimated from Source (1).

Source (+): Holzworth, G. C.; (1972).

(#): Holzworth, G. C.; (1964).

TABLE IV-1A. Maximum and minimum temperatures in the Southern California coastal and offshore area.

Station	Elevation (ft)	Maximum (°F)	Minimum (‘F)
Avalon Pleasure Pier	30	100	32
Burbank	699	111	28
Chula Vista	30	105	26
Laguna Beach	56	106	21
LAX	99	108	23
Los Angeles Civic Center	270	110	28
Long Beach	50	111	21
Oceanside	20	102	29
Ojai	750	119	13
Oxnard	51	104	26
Pt. Mugu	12	104	27
San Diego	19	104	29
Santa Ana	133	112	22
Santa Barbara	120	115	20
Santa Maria	236	109	21
Santa Monica	110	105	33
San Nicholas Island	300	105	33
Torrance	80	111	24

Source: U.S. Weather Bureau, “Climatology Summary of the United States – California Section.

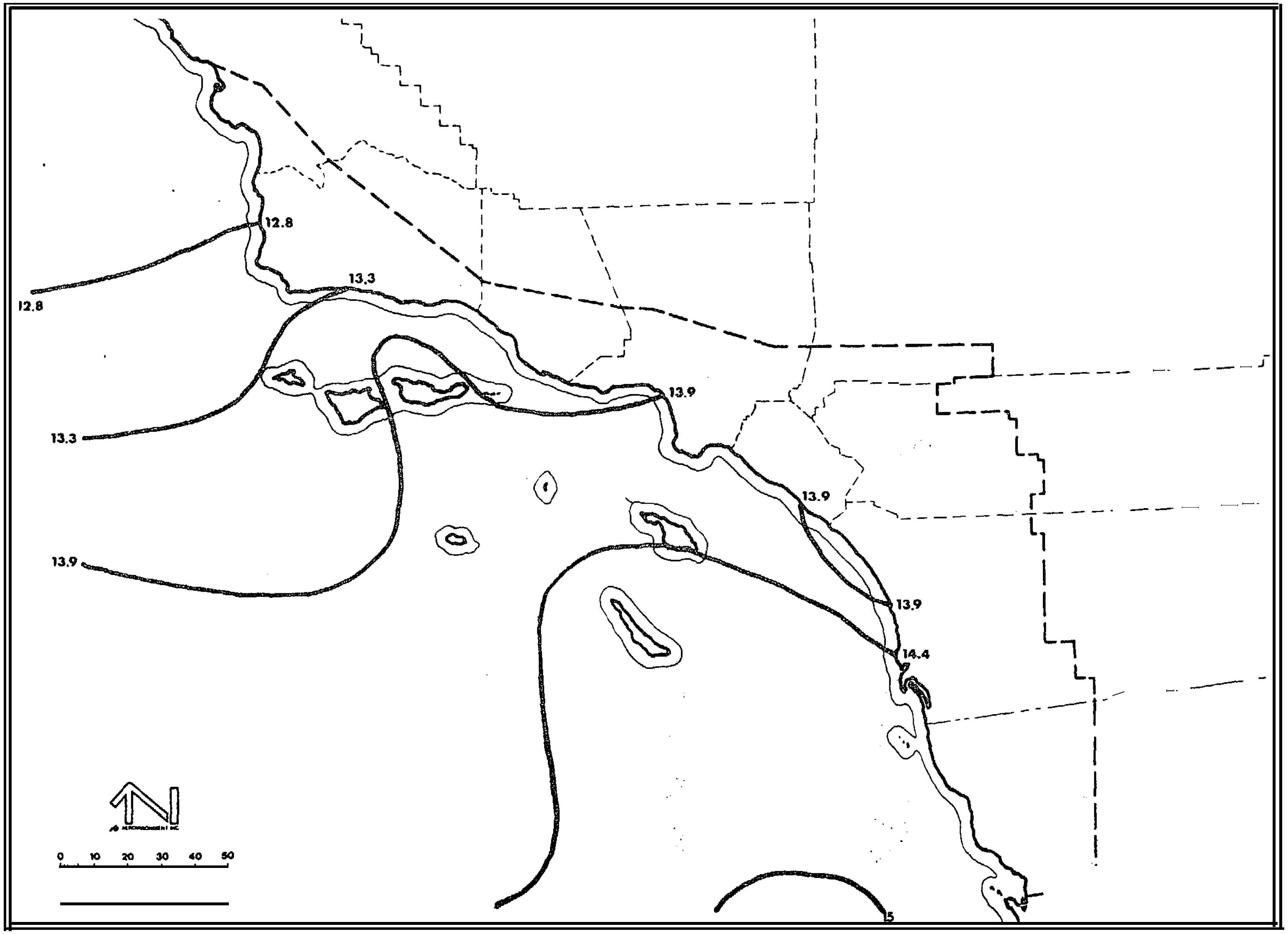


FIGURE IV-6. Mean air temperatures (°F) - February. (Source: Fleet Weather Facility, San Diego, 971.)

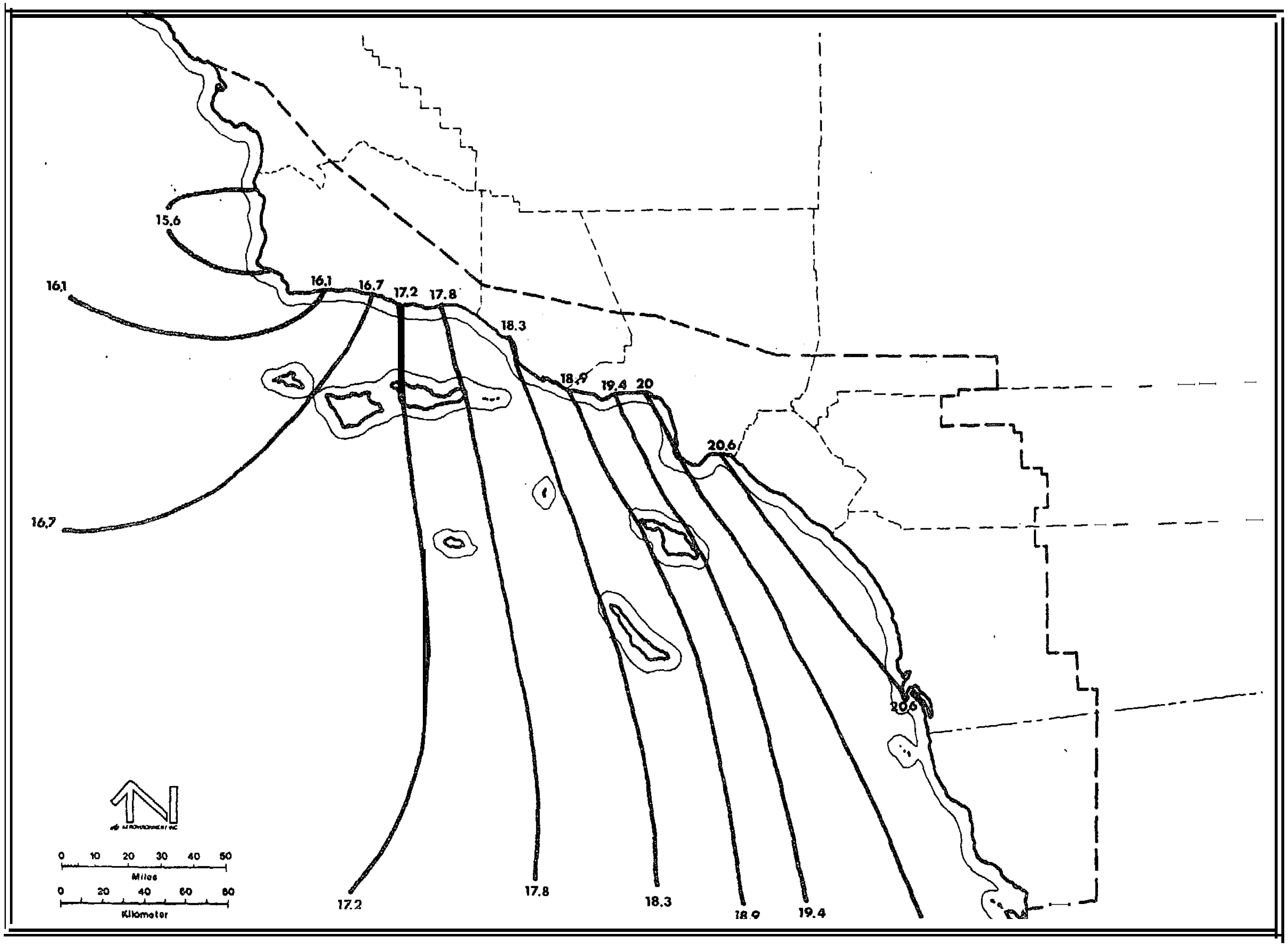


FIGURE IV-7. Mean air temperatures (°F) - August. (Source: Fleet Weather Facility, San Diego, 1977.)

Rainfall distribution is influenced heavily by a combination of wind direction and topography. Most of the storms come from the northwest and are preceded by south-southwest winds which change to northwesterlies after the frontal passage. Amount of precipitation is dependent upon the strength and proximity of the storm.

Table IV-3 presents mean monthly precipitation at selected stations throughout the study area.

Less common, but significant is the storm type that arrives from the south or southwest in winter. Heavy rainfall amounts can occur and many maximum 24-hour rainfall records have occurred with this situation.

On occasion, moist tropical air during late summer or early fall will invade the area and produce scattered showers and thunderstorms. Dying tropical storms can also drop copious amounts of precipitation in the Southern California area. For example, in September 1939, 13.77 cm (5.42 inches) of rain fell in one such storm. A similar situation in August 1977 also brought several centimeters of rain.

Since the majority of the storm tracks arrive from the northwest there is a decrease of 5-8 cm (2-3 inches) in the mean annual rainfall over the Bight area from north to south, when terrain effects are neglected.

6. <u>Evaporation</u> - Only two stations were found that measure evaporation within the study area – Chula Vista (near San Diego) and Cachuma Lake (north-northwest of Santa Barbara) – throughout the year. Evaporation is measured in the standard weather service-type pan with a 4-foot diameter. Table IV-4 shows the 30-year averages for Chula Vista and a 6-year average for Cachuma Lake.

No measurements of evaporation over the ocean in this study area are known to the authors. However, according to Sverdrup (1951), the rate of evaporation from the ocean at this latitude is about 0.30 cm (0.12 inches) per day.

7. <u>Relative Humidity</u> - Humidity refers to the moisture in the air and relative humidity is defined as the amount of water vapor actually present in the air compared with the greatest amount that could be present at that same temperature, and is usually

TABLE IV-1B. Mean monthly precipitation at selected stations (inches)*.

Station	Month J	F	M	A	M	J	J	A	S	O	N	D	Annual
Avalon Pleasure Pier	2.37	2.4	1.75	1.21	.13	.03	*01	0	.11	.41	1.05	1.94	11.92
Burbank	3.15	3.09	2.16	1.42	e35	.05	.01	.05	.12	.36	2.14	2.22	14.89
Chula Vista	1.64	1.27	1.55	.91	.17	.05	.02	.07	.12	.35	1.19	1.57	8.90
Laguna Beach	2.28	3.27	1.76	1.23	.20	.10	.01	.02	.16	.33	1.58	1.81	11.75
LAX	2.52	2.32	1.71	1.10	.08	.03	.01	.02	.07	.22	1.76	1.75	11.59
LA Civic Center	3.10	2.77	2.19	1.27	.13	.03	0	.04	.17	.27	2.02	2.16	7.35
Long Beach	3.26	2.16	1.20	.89	.07	.04	0	.02	.09	.19	1.38	1.65	10.25
Oceanside	1.72	1.68	1.63	.81	.14	.08	.04	0	.04	.32	1.41	1.75	9.63
Ojai	4.63	4.17	2.98	2.08	*31	.04	.02	.01	.16	.39	2.74	3.24	20.77
Oxnard	3.13	2.81	2.18	1.36	.10	.04	.01	.01	.06	.27	1.87	2.47	14.25
Pt. Arguello	2.57	2.52	3.07	1.48	.21	.04	.03	.01	.06	.71	1.56	2.32	13.78
San Diego	1.88	1.48	1.55	.81	.25	.05	.01	.07	.13	.34	1.25	1.73	9.45
San Luis Obispo	4.60	4.02	3.25	2.06	.34	*05	.04	.01	.13	.69	2.56	3*95	21.92
San Nicholas	1.42	1.03	.95	.42	.09	.01	.01	.01	.02	.15	1.36	1.04	6.51
Santa Ana	2.63	2.45	2.01	1.32	.18	.03	.02	.04	.12	.26	1.70	2.16	12.92
Santa Barbara	3*94	3.41	2.61	1.80	.27.	607	.03	.01	.07	.38	2.16	2.66	17.41
Santa Maria	2.25	2.40	1.98	1.31	.19	.04	.03	.02	.10	.52	1.36	2.05	12.25
Santa Monica	2.52	2.47	1.87	1.07	.06	.01	.03	.04	.02	.01	1.86	2.09	12.36
Torrence	2.74	2.56	1.73	1.06	.08	.02	0	.01	.10	.18	1.79	1.94	12.21

* 2.54 cm = 1 inch

TABLE IV-2. The Average Monthly Pan Evaporation Data for Chula Vista and Cachuma Lake.

	Chula Vista	Cachuma Lake
Month	Evaporation Average (cm)	Evaporation Average (cm)
Jan	6.86	6.68
Feb	8.48	6.99
Mar	12.60	11.71
Apr	14.96	14.76
May	17.91	18.01
Jun	18.34	22.50
Jul	19.58	24.79
Aug	18.72	22.68
Sep	15.01	18.67
Ott	12.29	14.07
Nov	9.09	10.39
Dec	7.06	8.18
Annual	160.91	179.43

Source: U.S. Weather Bureau, (1964).

expressed in percent. The highest relative humidity, 100%, usually occurs in foggy conditions. Even in showers the relative humidity is usually some value less than 100%. The normal relative humidity at coastal stations varies from about 50% during the afternoon to over 80% during the night hours.

Over the ocean, diurnal variations in relative humidity are small. In the Southern California Bight region, the nighttime relative humidity is about 78% while the daytime relative humidity is about 82%.

8. Solar Insolation/Cloud Cover - Solar insolation is the rate at which radiation from the sun is received at the earth's surface. The amount of cloud cover controls the amount of solar energy received. Table IV-5 gives the mean cloud cover for selected coastal stations. Elevation and distance from the ocean as well as surrounding topography are important factors that effect the amount of cloud cover over land. The average daily solar radiation rates at Santa Maria and Los Angeles International Airport which correspond to the .42 and .47 mean daytime cloud cover figures in Table IV-3 are 471 and 446 ly/day respectively.

Over the ocean, the mean daytime cloud cover is about .55.

9. Statistics of Frontal Passages and Storm Activity – A perusal of 5 years (1972-1976, inclusive) of synoptic maps shows an average of 32 frontal passages a year with a maximum during late winter through early spring. As springtime progresses, the storm fronts become increasingly weaker and many times little or no precipitation is encountered. The reverse is true going from September through November. During the summer months, frontal passages are rare. Even if they occur, they are usually weak and dry.

Occasionally, a strong upper-level low pressure will stall off the Southern California Coast and can produce several frontal waves at the surface in a short period of time. This condition tends to be infrequent in occurrence even during mid-winter.

During late summer and early fall, tropical storms are common off the west coast of Mexico. They nearly always dissipate well to the south of San Diego. Only about a dozen have reached the lower half of the study area in the last 100 years (Aldrich and Meadows, 1962).

TABLE IV-3. Mean Daytime Cloud Cover (fraction) for Selected Coastal Stations.

Site	Mean Cloud Cover
Santa Maria	.42
Los Angeles Int'l Airport	.47
Long Beach	.46
San Diego	.47

Source: U.S. Weather Bureau

10. Air Pollution Potential – The potential of the atmosphere to disperse pollutants within an air basin bounded by prominent topographic barriers depends primarily on three meteorological parameters: wind speed, turbulence, and the depth of the mixing layer.

In the most idealized conditions, the initial concentration of pollutants in an air mass passing over a source depends on the speed at which the air parcel travels over the source, with the resulting concentration inversely proportional to wind speed. The dilution of this initial concentration depends on the turbulence mixing which takes place among the polluted parcel and the cleaner surrounding air.

The turbulence and wind speed are seldom independent, however, and increasing wind speed is usually accompanied by increasing turbulence generated by the stronger shears which result, as well as by the increased mechanical mixing near the ground.

The mixing layer is representative of the volume of air available for the dispersal of pollutants since the mixing layer represents the vertical limit of mixing. The height of the mixing layer is often synonmous with the height of the base of an inversion. Surface inversions are common before sunrise, while inversions aloft are common during the rest of the day due to warm, dry subsiding air aloft.

The Southern California Air Quality Management District (SCAQMD) utilizes a measure of dispersion called "Rule 57" which combines the dispersion inhibiting effects of low inversions (morning inversion base height less than 1500 feet), low maximum mixing heights (less than 3500 feet), and low wind speeds (average 0600-1200 PST wind speed less than 5 mph). These conditions normally occur on 24% of the days each year, most frequently in August (14 days) and least frequently in March, April, and May (4 days each).

According to the Southern California Air Pollution Control District (1976), the input of pollutants into the Los Angeles atmosphere is fairly constant from day to day: 85% from automobiles (carbon monoxide, oxides of nitrogen, and hydrocarbons) and 15% from stationary sources (a complex mixture). The dispersion-inhibiting parameters of morning inversion base height, maximum mixing height, and wind speed thus determine the day-to-day pollutant concentrations.

B. Air Quality

This section presents a discussion of air basins, a characterization of the air quality during the base year, and a discussion of pollution trends.

A discussion of ambient air quality standards and regulatory agencies was presented in Chapter III. Federal standards for gaseous pollutants were given in $\mu g/m^3$ or mg/m^3, while California standards are in ppm. For ease of discussion, all data are presented in ppm in this report.

1. Air Basins: An air basin is defined as an area over which local and regional air flow is relatively unimpeded by major topographic barriers. Such substantial barriers generally define the boundaries of air basins and limit flow into or out of the air basins. Three basins, as determined by the California Air Resources Board (ARB Bulletin, August 1976), lie wholly or partially within the study area and are shown in Figure IV-8. The boundaries of these basins, however, were a compromise between actual physical limits to pollutant transport and politically defined limits.

It should be noted that the concept of air basins holds only to a degree. The assure pt ion of contained flow is most accurate under drainage or light flow conditions. Under vigorous, large-scale flow, the assumption breaks down and mixing between air basins occurs with relative ease.

The study area includes part of the South Central Coast Air Basin (the southern Coastal sector from the Los Osos Valley near San Luis Obispo to the Los Angeles County boundary), part of the South Coast Air Basin (the Los Angeles basin including the coastal plain, the San Fernando, San Gabriel, and Pomona-Walnut Valleys, and the San Bernardino-Riverside area), and all of the San Diego Air Basin.

2. Base Year: The most recent year for which air quality information is available in a reasonably complete form is 1975. Therefore, 1975 has been chosen as the base year for impact analysis. Data from other years will be used, however, to aid in defining pollutant trends and in characterizing the air quality of the offshore waters.

FIGURE IV-8. California air basins, with study area hatched.

During the base year in the study area, there were continuous measurements of oxidants (OX) or ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), total suspended particulate matter (TSP), non-methane hydrocarbons (NMHC), lead, and sulfate. Hydrogen sulfide (H_2S) was measured periodically while only spot checks were made of ambient levels of ethylene.

Locations of monitoring stations referred to in the ensuing discussion are presented in Figure IV-9.

3. Photochemical Oxidants (OX): Photochemical oxidants are a group of pollutants, primarily ozone (03), that result from a series of complex chemical reactions involving other chemicals like hydrocarbons (HC), oxides of nitrogen (NO_x) and sunlight. Health effects include irritation of the eye, nose and throat. Extended periods of high levels of oxidants produce headaches and cause difficulty in breathing in patients suffering from emphysema.

All of the continuous oxidant (or ozone) monitoring stations in the study area in 1975 reported exceedances of the Federal one-hour ambient air quality standard (AAQS) of 0.08 ppm. Table IV-6 presents highest hourly averages, mean daily maximum hourly averages (which is the mean of the maximum l-hour average for all days in the year), and days exceeding the Federal Standard for selected representative stations in the study area in 1975. The highest recorded one-hour average in the monitoring network was 0.42 ppm recorded at the Upland station (not shown in Table IV-4).

Figure IV-10 presents isopleths of mean daily maximum hourly averages. The isopleths were drawn for areas which have monitoring stations and were not drawn in all areas due to lack of data. Highest levels are found near the Pomona-Walnut Valley, while lowest concentrations occur along the coastal sector of the study area.

Figure IV- 11 presents the seasonal variation of oxidant in the study area. The peak season is summertime when sunshine is most abundant and the subsidence inversion is persistent. Lowest concentrations occur in wintertime when ventilation is good in the afternoon and solar radiation is weak.

Frequency distributions of ozone at four selected stations are shown in Figures IV-12 and IV- 13. The frequency of occurrence of low concentrations is similar at all of the

KEY

1: Santa Barbara
2: Ventura
3: Camarillo
4: Reseda
5: Burbank
6: Pasadena
7: Azusa
8: West Los Angeles
9: Los Angeles
10: Lennox
11: Long Beach
12: Los Alamitos
13: La Habra
14: Costa Mesa
15: Santa Ana Canyon
16: Chino
17: Riverside
18: San Bernardino
19: Upland
20: San Diego
21: Chula Vista
22: San Ysidro
23: Imperial Beach
24: San Nicholas Island
25: San Luis Obispo

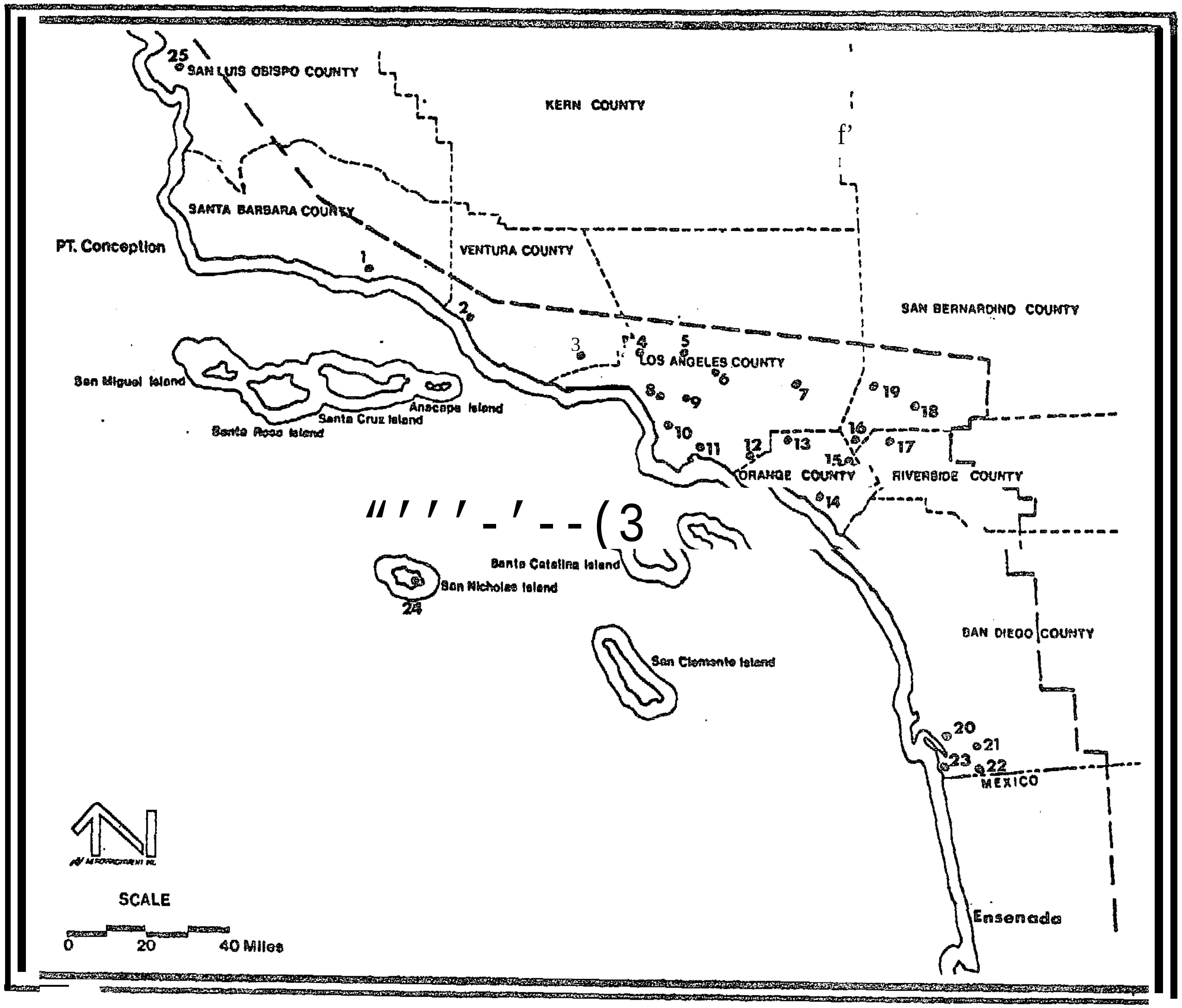


FIGURE IV-9. Locations and names of monitoring sites.

TABLE IV-4. Ozone data (ppm) for selected representative stations in the study area.

Station	Air Basin[1]	County	Max. Hourly Avg.	Mean Daily Max. Hourly Avg.	“Days Exceeding Federal Standard
San Luis Obispo	SCC	San Luis Obispo	.09	.037	2
Santa Barbara - State St.	SCC	Santa Barbara	.19	.037	9
Ventura - Telegraph Rd.	SCC	Ventura	.16	.050	24
Long Beach	Sc	Los Angeles	.14	.033	9
Pasadena - Walnut	Sc	Los Angeles	.32	.105	183
West Los Angeles	Sc	Los Angeles	.19	.059	65
Riverside - Rubidoux	Sc	Riverside	.37	.089	185
San Bernardino	Sc	San Bernardino	.32	.102	174
Santa Ana Canyon	Sc	Orange	.33	.082	135
Costa Mesa	Sc	Orange	.18	.043	19
San Diego - Overland Ave.	SD	San Diego	.22	.058	55

[1] SCC: South Central Coast
Sc: South Coast
SD: San Diego

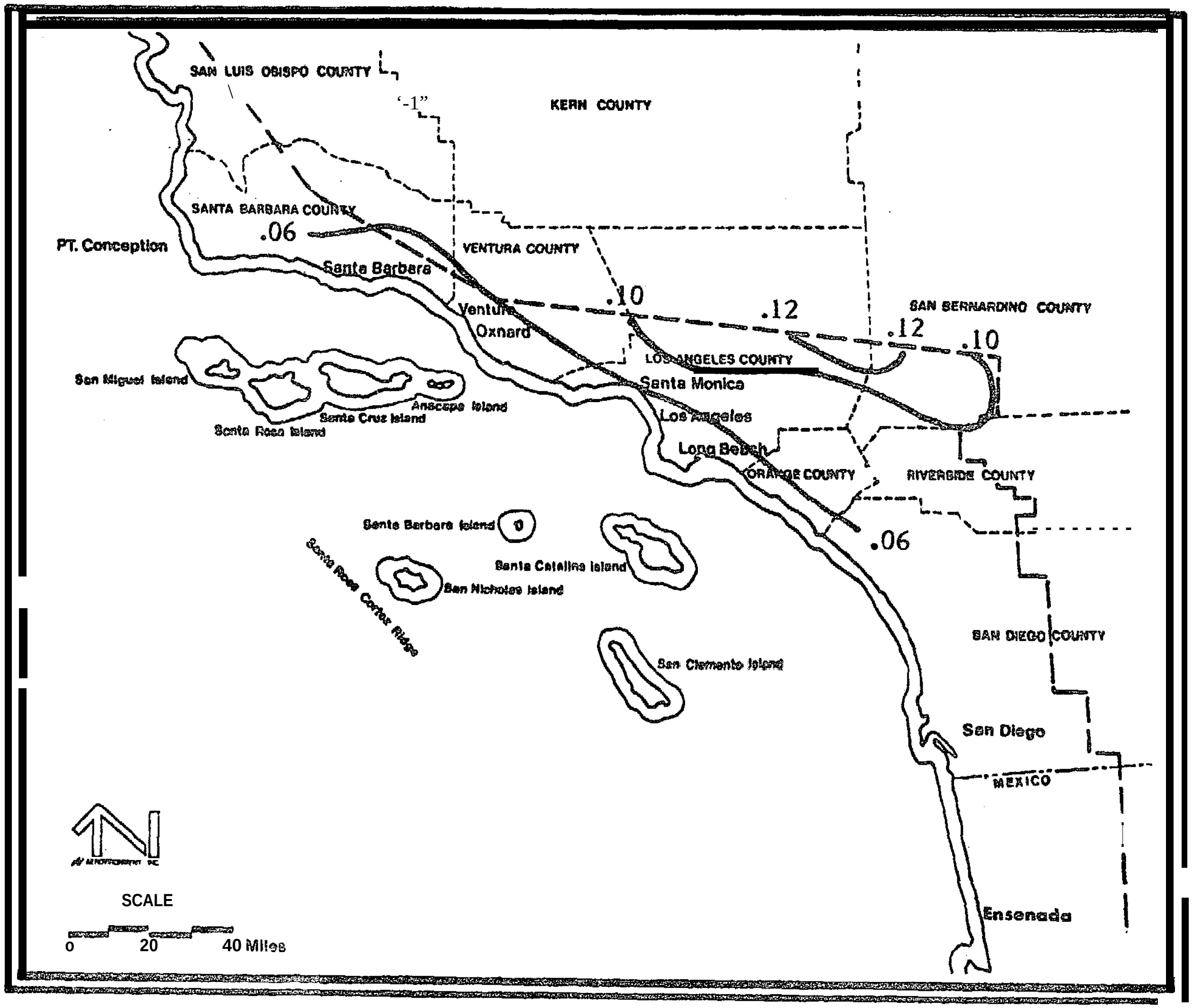


FIGURE IV-10. Isopleths of mean daily maximum hourly average ozone concentrations (ppm) in 1975.

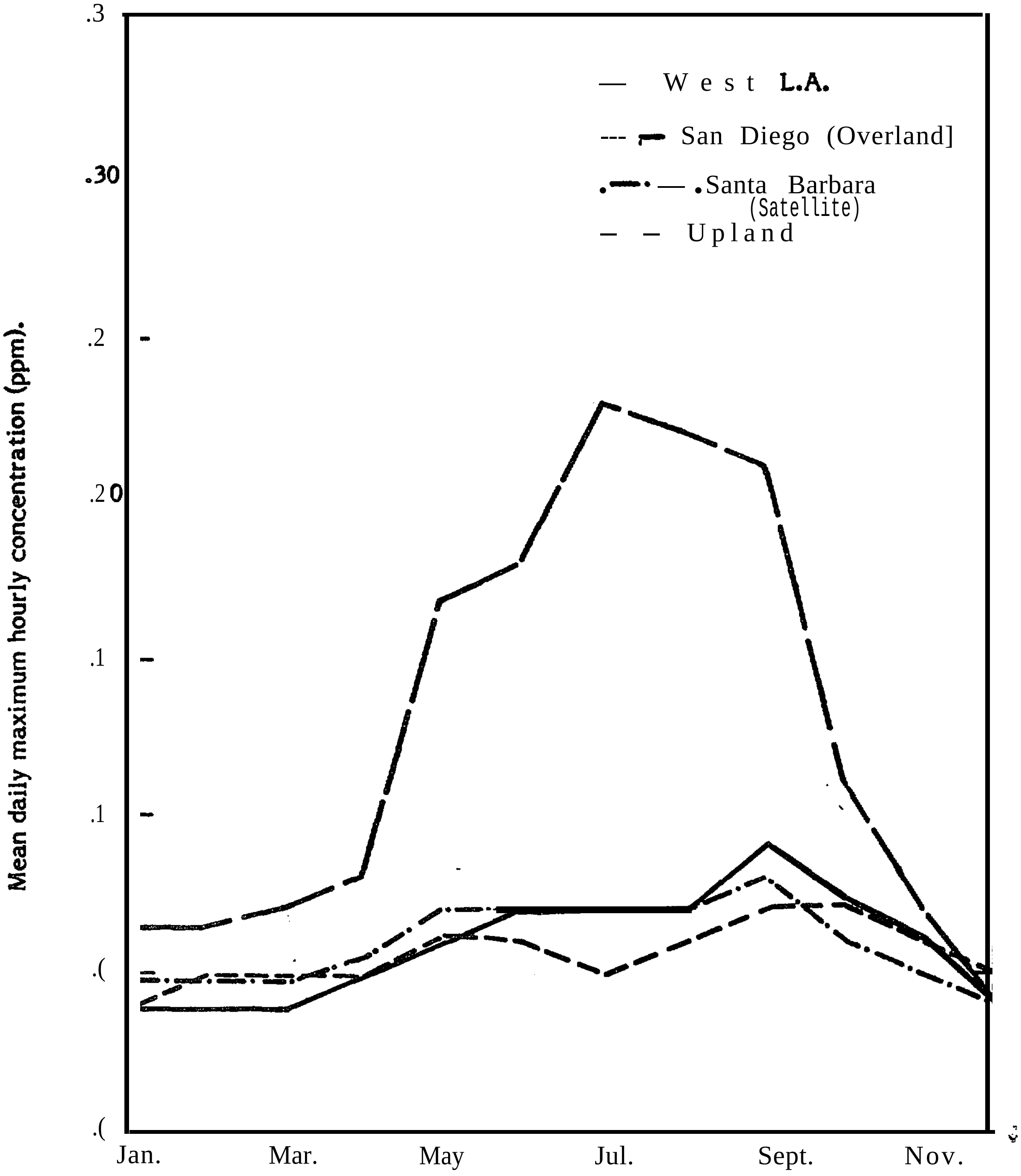
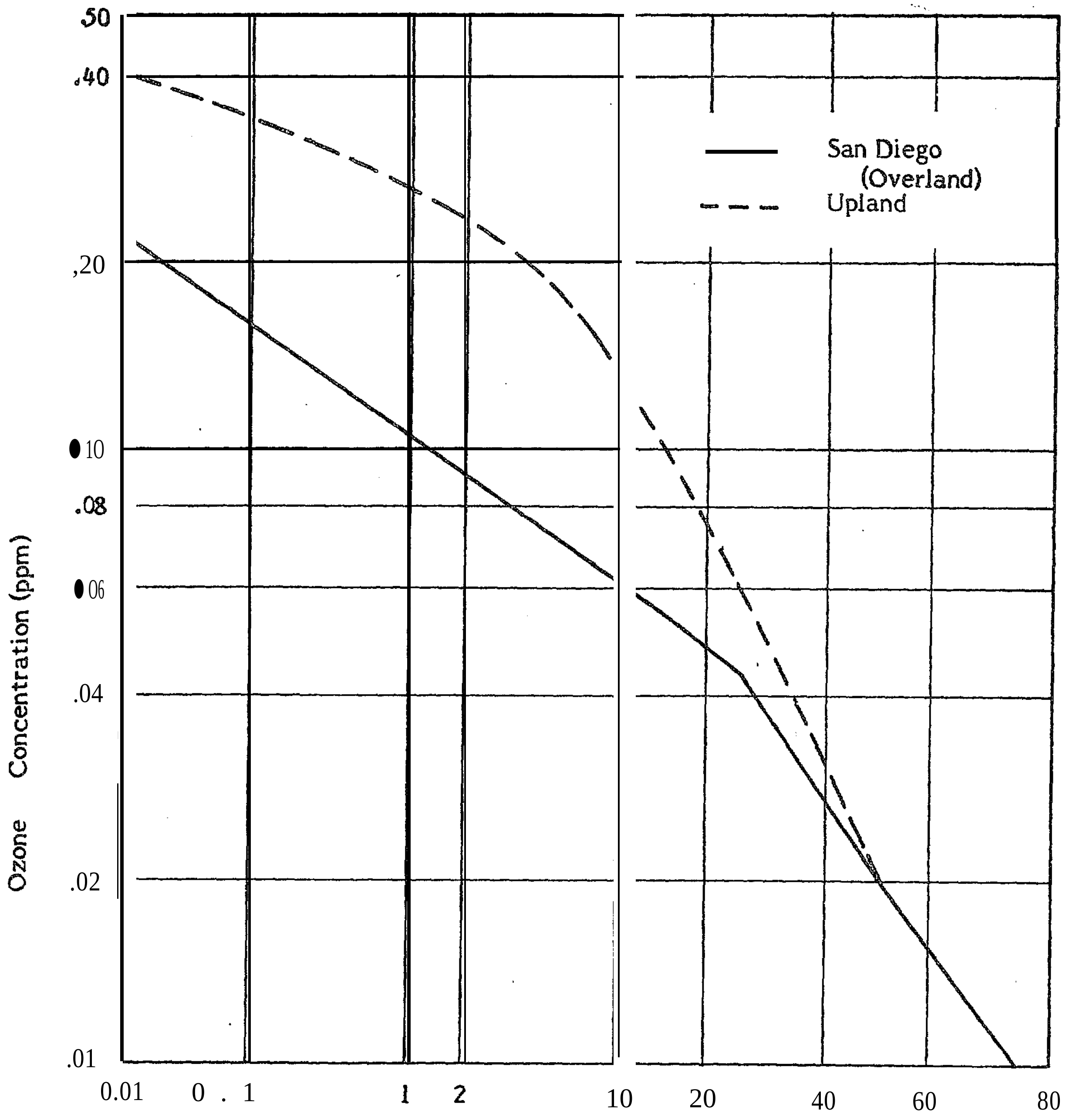
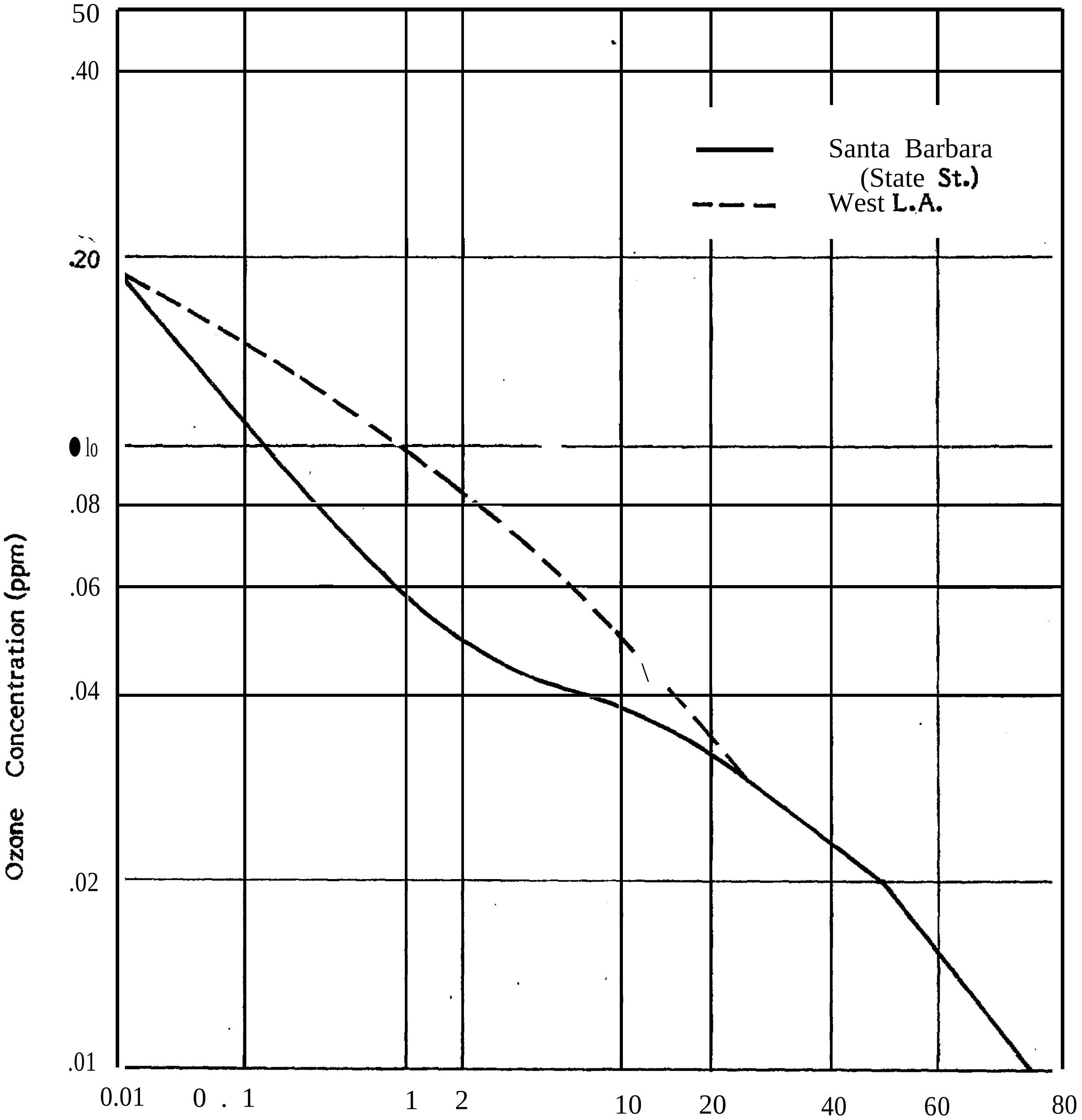


FIGURE IV-11. Seasonal variation of oxidant. Mean daily maximum hourly concentration at selected stations in 1975.



Frequency (percent) of observations equaling or exceeding indicated concentrations

FIGURE IV-12. Cumulative frequency distribution for ozone measurements made during 1975 at San Diego and Upland.



Frequency (percent) of observations equaling or exceeding indicated concentrations

FIGURE IV-13. Cumulative frequency distribution for ozone measurements made during 1975 at Santa Barbara and West Los Angeles.

selected stations. The frequency of occurrence of concentrations greater than 0.06 ppm is, however, much higher at the inland station (Upland) and somewhat greater at the West Los Angeles station, located in the South Coast Air Basin.

Oxidant generally demonstrates a diurnal variation such that peaks occur in the early afternoon after precursors have had time to react in the sunshine. Lowest concentrations generally occur in the early morning hours when the scavenging properties of NO are most effective in keeping oxidant concentrations down.

4. <u>Carbon Monoxide (CO)</u>: Of the world's total human CO production, the major portion is produced by automobiles. This also holds in the study area. This colorless and odorless gas, when inhaled in large quantities, can cause headache, dizziness, nausea, vomiting, difficulty in breathing, unconsciousness, and finally death.

Exceedances of the Federal one-hour carbon monoxide ambient air quality standard (AAQS) of 35 ppm were reported at 6 stations in the study area in 1975, all in the South Coast Air Basin. The highest recorded one-hour average was 53 ppm in Reseda.

Exceedances of the Federal eight-hour carbon monoxide AAQS of 9 ppm were reported at more than 20 stations in the study area in 1975, most frequently in Los Angeles County as shown in Table IV-7. No 8-hour exceedances were recorded in Ventura County. The highest recorded 8-hour average in 1975 was 30 ppm reported at the Lennox station.

Spatial variation is demonstrated by Figure IV-14. Highest concentrations generally occur in the coastal areas of Los Angeles County and inland to the eastern San Fernando Valley. The southern and northern portions of the study area experience relatively low CO levels.

The seasonal variation of CO in the study area is shown in Figure IV-15. CO readings are generally highest in late fall and wintertime when surface-based inversions are strongest due to long hours of nighttime cooling. Lowest readings occur in late spring arid summer when stable layers near the surface do not tend to persist into morning traffic hours.

TABLE IV-5., Carbon monoxide data (ppm) for selected representative stations in the study area.

Station	Air Basin[1]	County	Max. Hrly. Avg.	Mean Daily Max. Hrly. Avg.	Max. 8-hr. Avg.	Days Exceeding Federal 1-hr. Standard	Days Exceeding Federal 8-hr. Standard
San Luis Obispo	SCC	San Luis Obispo	14	2.8	10	0	1
Santa Barbara - State St.	SCC	Santa Barbara	22	5.2	14	0	14
Ventura	Scc	Ventura	17	3.3	6	0	0
Lennox	Sc	Los Angeles	40	10.4	30	3	96
Burbank	Sc	Los Angeles	36	10.7	27	1	125
Long Beach	SC	Los Angeles	21	7.2	17	0	57
Riverside - Rubidoux	SC	Riverside	14	4.4	13	0	5
San Bernardino	SC	San Bernardino	20	4.6	12	0	8
Costa Mesa	Sc	Orange	31	11.4	23	0	40
La Habra	SC	Orange	38	8.1	17	1	23
San Diego - Island Ave.	SD	San Diego	17	4.4	13	0	14

[1] SCC: South Central Coast

Sc: South Coast

SD: San Diego

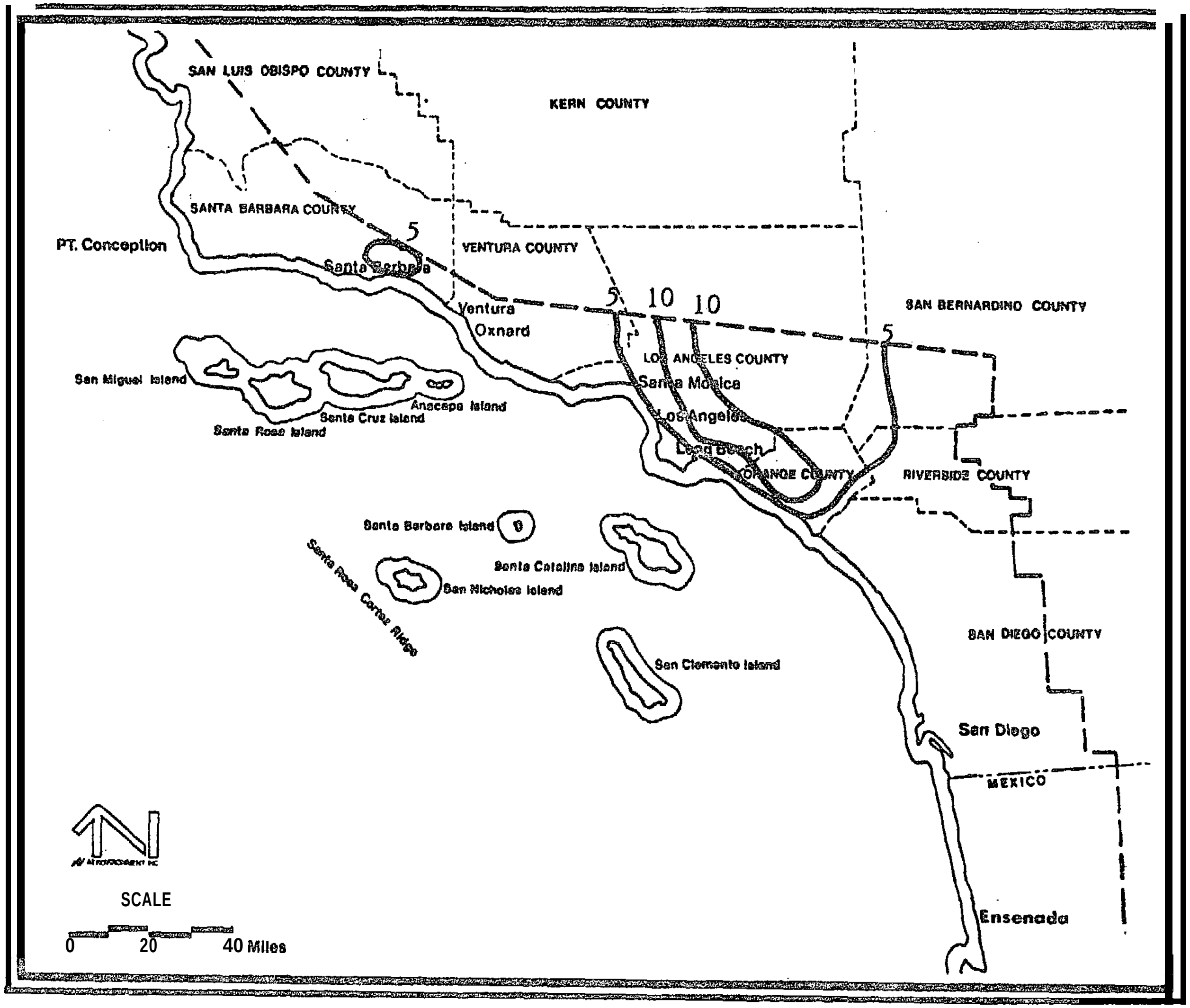


FIGURE IV- 14. Isopleths of mean daily maximum hourly average CO concentration (ppm) in 1975.

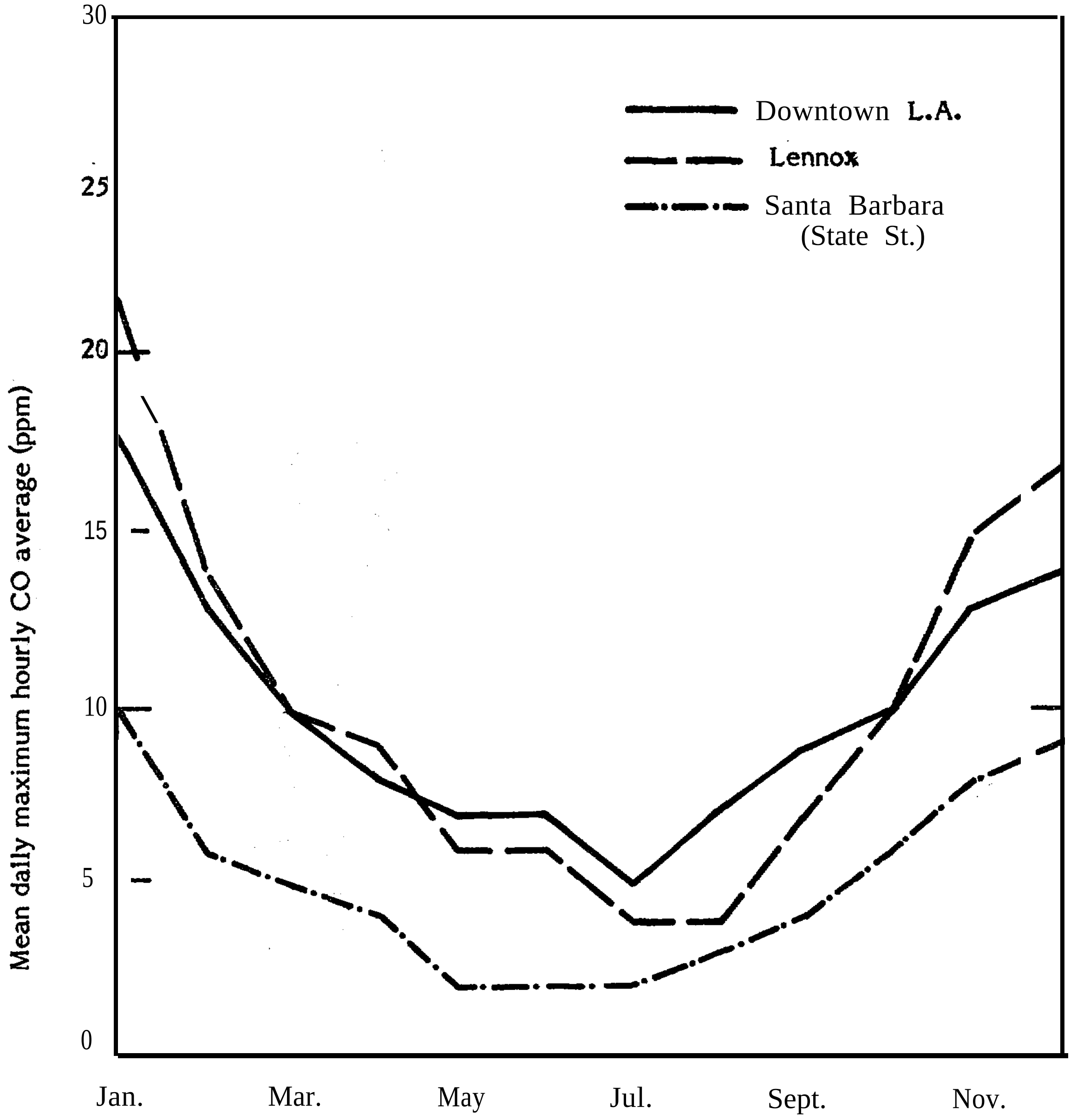


FIGURE IV-15. Seasonal variation of CO. Mean daily maximum hourly average at selected stations in 1975.

Figures IV-16 and IV-17 present frequency distributions of hourly CO averages for selected stations in various parts of the study area. Concentrations in the northern and southern portions of the study area (Santa Barbara and San Diego) are relatively low with a median value of 2 and 1 ppm respectively. Concentrations in the South Coast Air Basin (Lennox and downtown Los Angeles) were considerably higher with median values of 3 and 4 ppm respectively.

Highest concentrations of carbon monoxide are generally found in the early morning or evening hours when the atmosphere is stable and traffic emissions are high. Lowest concentrations occur in the afternoon when atmospheric conditions favor dispersion.

5. Nitrogen Dioxide (NO_2): This is a pungent gas which is a contributor to the haze over cities. Nose and eye irritation and pulmonary discomfort areassociated with very high NO_2 levels. Another oxide of nitrogen, nitric oxide (NO) is easily converted to NO_2 in the atmosphere? and the term oxides of nitrogen (NO_x) is often used to describe the sum of NO and NO_2. Both NO and $N0_2$ participate in photochemical reactions leading to smog.

Exceedances of the annual average Federal AAQS for $N0_2$ of 0.05 ppm occurred at 13 of 31 monitoring locations in 1975, all located in the South Coast Air Basin. Exceedances of the one-hour California AAQS of 0.25 ppm were recorded at 27 of 33 monitoring stations. Table IV-8 presents annual averages, maximum one-hour average, mean daily maximum one-hour average, and the number of days on which the California AAQS was exceeded at selected representative stations. The highest annual average was .081 ppm recorded at Pasadena. The highest one-hour average was 0.67 ppm recorded in Chino (not shown in Table IV- 8).

Figure IV-18 illustrates the spatial variability y of $N0_2$ concentrations in the study area using the annual average. Highest annual average concentrations occur in the San Gabriel Valley, while lowest annual average concentrations occur in the coastal sections of the northern and southern portions of the study area. Peak hourly averages can, however, occur in the coastal section under certain meteorological conditions.

Highest concentrations generally occur in the fall and winter when strong, surface-based inversions are most likely. Lowest concentrations of $N0_2$ occur in late spring and

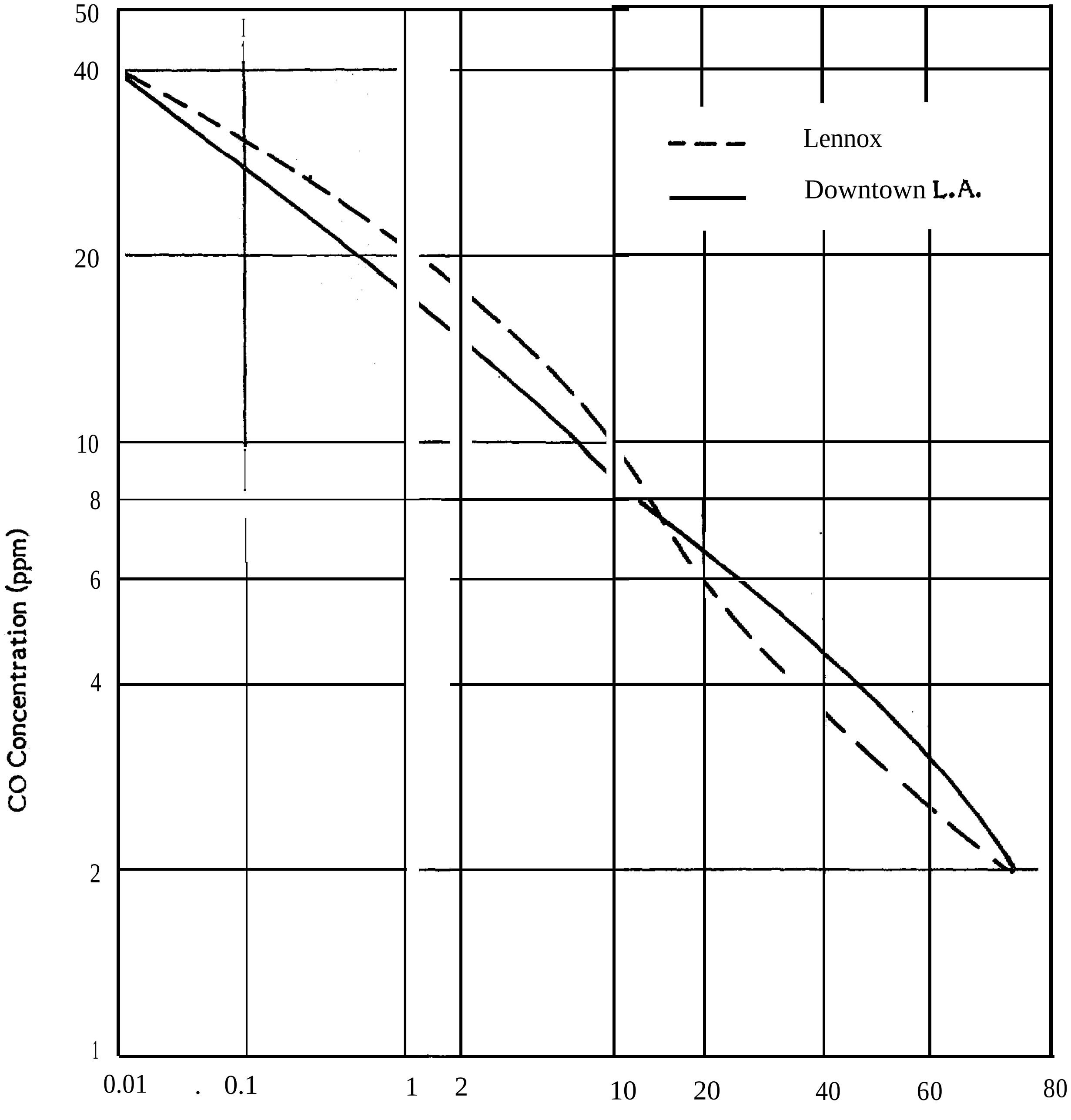


FIGURE IV-16. Cumulative frequency distribution for CO measurements made during 1975 at Lennox and downtown Los Angeles.

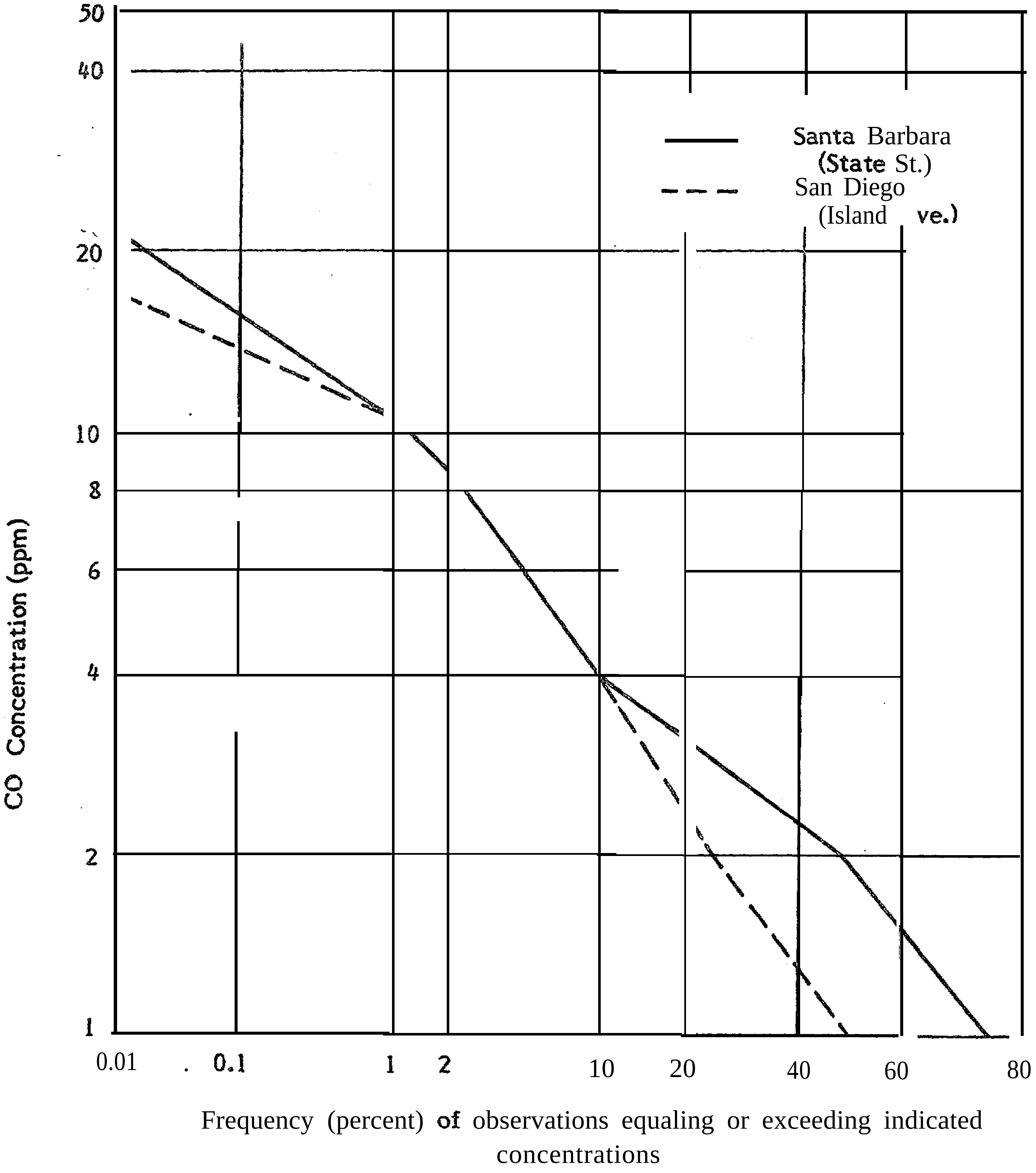


FIGURE IV-17. Cumulative frequency distributions for CO measurements made during 1975 at Santa Barbara and San Diego.

TABLE IV-6. Nitrogen dioxide annual average, maximum hourly average, and mean daily maximum hourly average (ppm) and number of days exceeding Federal standard for selected representative stations in the study area.

Station	Air Basin[1]	County	Annual Average	Max. Hourly Average	Mean Daily Max. Hrly. Average	Days Exceeding Calif. Std.
San Luis Obispo	SCC	San Luis Obispo	0.020	0.10	0.035	0
Santa Barbara - State St.	Scc	Santa Barbara	0.032	0.21	0.053	0
Camarillo - Elm Dr.	Scc	Ventura	0.022	0.18	0.043	0
Lennox	Sc	Los Angeles	0.056	0.40	0.101	10
Pasadena	Sc	Los Angeles	0.081	0.49	0.141	35
Long Beach	Sc	Los Angeles	0.062	0.45	0.110	26
Riverside - Magnolia	Sc	Riverside	0.056	0.30	0.096	--
San Bernardino	Sc	San Bernardino	0.040	0.25	0.080	1
Costa Mesa	SC	Orange	0.030	0.35	0.065	3
La Habra	Sc	Orange	0.064	0.46	0.109	16
San Diego - Overland Ave.	SD	San Diego	0.031	0.37	0.065	2

[1] See: South Central Coast
Sc: South Coast
SD: San Diego

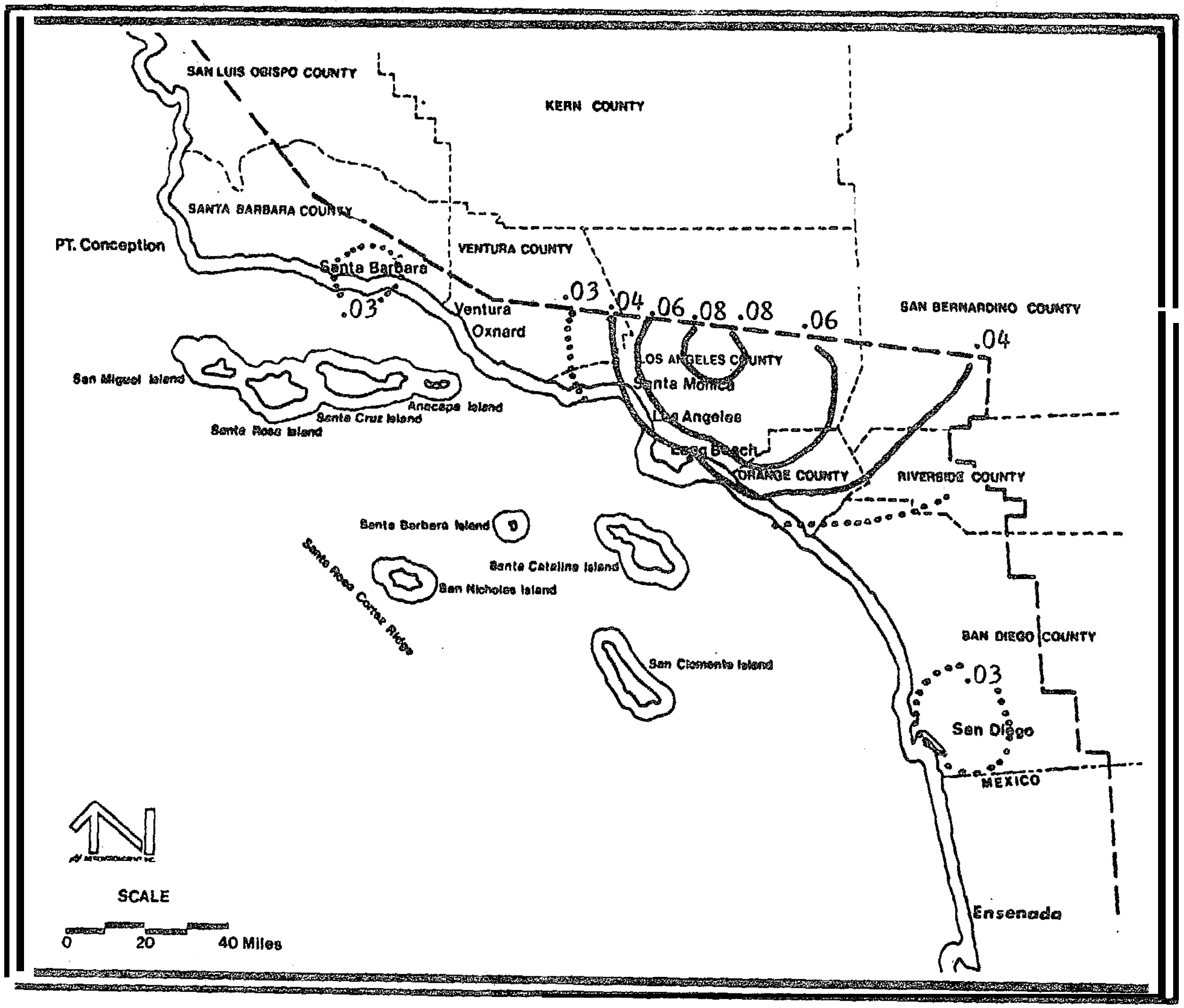


FIGURE IV-18. Isopleths of annual average NO_2 (ppm) in 1975.

summer when morning surface based inversions are not as strong. NO_2 may also be formed as a secondary pollutant from the reaction between NO and 0_3. This reaction is more important to the annual mean concentration than to the maximum hourly average.

6. Sulfur Dioxide (SO_2): This colorless, pungent gas causes irritation to the respiratory tract and the eyes. At high concentrations, sulfur dioxide is known to produce broncho-constriction.

No exceedance of the Federal annual average AAQS of 0.03 ppm $S0_2$ was recorded at any station in the study area in 1975. The highest annual average was 0.025 ppm at the Whittier station in' the southeast portion of the Los Angeles Basin.

Violation of the 24-hour Federal standard for $S0_2$ was also not recorded. The maximum 24-hour average was 0.064 ppm recorded at the Long Beach station.

Violation of the California one-hour standard of 0.5 ppm was also not experienced at any station. The highest one-hour concentration was 0.26 ppm recorded at the Whittier station.

Table IV-9 presents annual averages and maximum 24- and one-hour averages for selected representative monitoring sites.

Spatial variability y of $S0_2$ is presented in Figure IV-19 using the annual mean concentration. Highest concentrations occur in the southeast portion of Los Angeles County. Lowest concentrations occur outside the Los Angeles basin. Wintertime is the severe season for $S0_{20}$ Morning surface based inversions inhibit vertical dispersion during this time period while summertime concentrations are relatively low due to better vertical mixing.

7. Suspended Particulate Matter: Inert particles cause irritation to the respiratory tract. Sorption of gases on small particulate increases the effect, particularly if the particles penetrate to deeper portions of the lungs.

Exceedances of all California and Federal AAQS for total suspended particulate (TSP) were reported in the study area in 1975 as shown in Table IV-10. The highest

TABLE IV-7. SO_2 annual averages and maximum 24- and l-hour averages (ppm) for selected representative stations in the study area.

Station	Air Basin[1]	County	Annual Average	Max. 24-hr. Avg.	Days Excd. Fed. Std.	Max. l-hr. Avg.	Days Excd. Cal. Std.
Camarillo - Elm Dr.	SCC	Ventura	.000	.016	0	0.04	0
Lennox	SC	Los Angeles	.020	.055	0	0.19	0
Los Angeles (downtown)	Sc	Los Angeles	.020	.061	0	0.12	0
Long Beach	SC	Los Angeles	.021	.064	0	0.23	0
Riverside	SC	Riverside	.007	.030	0	0.06	0
San Bernardino	SC	San Bernardino	.010	.040	0	0.10	0
Costa Mesa	SC	Orange	.009	.030	0	0.13	0
Los Alamitos	SC	Orange	.013	.040	0	0.21	0
San Diego - overland	SD	San Diego	.000	<.040	0	0.03	0

[1] See: South Central Coast
SC; South Coast
SD: San Diego

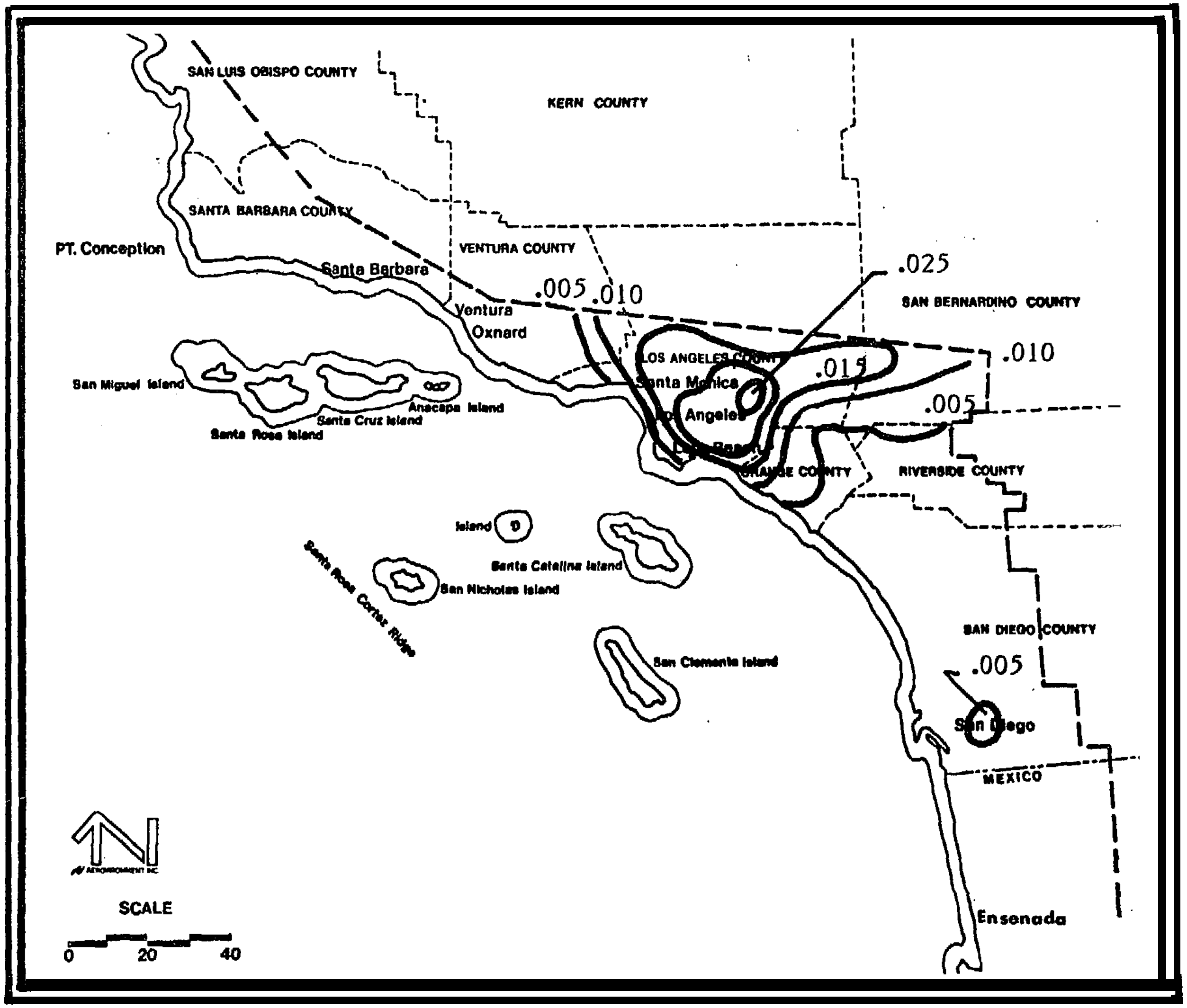


FIGURE IV-19. Isopleths of annual average SO_2 concentration (ppm) in 1975.

TABLE IV-8. Total suspended particulate annual geometric mean (AGM), maximum 24-hour average (µg/m^3), and exceedances of Ambient Air Quality Standards (AAQS) for selected stations in the study area.

Station	Air Basin[1]	County	AGM	Max. 24-hr. Avg.	Exceedance Days*		
					1	2	3
San Luis Obispo	Scc	San Luis Obispo	45.6	90	0	o	0
Santa Barbara - State St.	SCC	Santa Barbara	62.6	125	0	0	5
Ventura - Telegraph Rd.	Scc	Ventura	67.0	146	0	0	7
Lennox	Sc	Los Angeles	92.6	227	0	8	24
Azusa	Sc	Los Angeles	116.2	213	0	16	43
West Los Angeles	Sc	Los Angeles	78.0	156	0	2	17
Riverside- Rubidoux	Sc	Riverside	149.0	467	10	37	42
San Bernardino	Sc	San Bernardino	103.3	264	2	20	34
Costa Mesa	Sc	Orange	74.4	177	0	3	20
La Habra	Sc	Orange	111.0	220	0	15	39
San Diego - Island Ave.	SD	San Diego	74.4	153	0	1	12

[1] SCC: South Central Coast
SC: South Coast
SD: San Diego

[2] 1: Exceedances of primary Federal 24-hour standard: 260 µg/m^3
2: Exceedances of secondary Federal 24-hour standard: 150 µg/m^3
3: Exceedances of California 24-hour standard: 100 µg/m^3

geometric mean (ACM) was 167.7 µg/m^3 for six months at the San Ysidro monitoring site (not shown in Table 1-10), near the Mexican border. An ACM of 149 µg/m^3 was recorded at the Riverside (Rubidoux) monitoring location. The highest 24-hour average was reported at the Riverside (Rubidoux) monitoring site in Riverside County. This site also reported the greatest number of exceedances of the Federal 24-hour' AAQS of 260 µg/m^3.

Figure IV-20 indicates the spatial variability of TSP concentrations using the annual geometric mean. Lowest concentrations are generally found in coastal sections while higher concentrations occur downwind of industrialized areas.

Maximum TSP concentrations tend to be found in wintertime, although seasonal variability is not well-defined in some locations.

8. Other Pollutants: Non-Methane hydrocarbons, lead, sulfate, hydrogen sulfide, ethylene and visibility are discussed here.

Non-Methane Hydrocarbons (NMHC): This category includes all hydrocarbons except methane, which is excluded because it does not participate significantly in photochemical reactions. The three-hour 6:00 to 9:00 a.m. Federal Standard for NMHC was established to reduce the formation of photochemical pollutants (OX) through reactions with NO_x, and not as a health standard, per se.

In the study area, the standard was exceeded at all 19 stations for which data was available, most frequently (318 days) at the San Diego (Island Ave.) station. The maximum one-hour average recorded was 12.0 ppm at the same station.

Other stations report total hydrocarbon data (THC, methane included). Highest hourly averages reported ranged from a minimum of 5.0 ppm at Chula Vista in San Diego Count y to 21 ppm at San Bernardino.

Lead: Airborne lead in the study area is derived almost entirely from automobile exhaust as a direct result of the use of anti-knock agents in gasoline – tetraethyl and tetramethyl lead. Lead poisoning affects the blood-forming mechanism, the nervous system, the gastrointestinal tract, the kidneys and the heart.

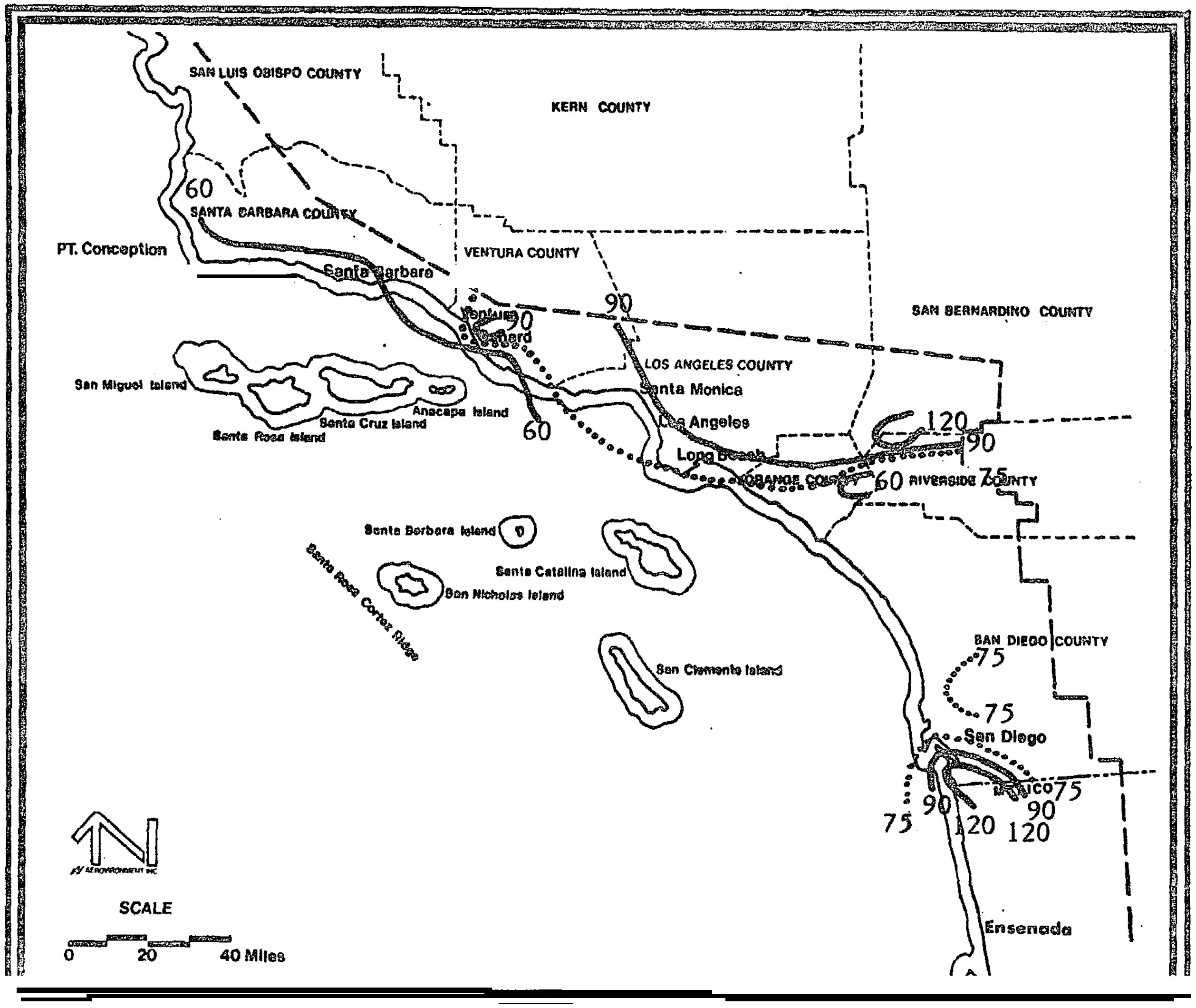


FIGURE IV-20. Isopleths of total suspended particulate annual geometric mean ($\mu g/m^3$). Isopleths terminate where data is scarce or non-existent.

The 30-day California AAQS for lead of 1.5µg/m^3 was exceeded at twenty-five of the 30 monitoring stations in the study area. The highest monthly average of 9.39 µg/m^3 was recorded at the Lennox station in December. Table IV-11 presents lead concentrations at selected representative stations in the study.

In winter the measured concentrations of lead tend to be higher than in summer, although exceedances were recorded during every month in 1975.

Sulfate: Sulfates are formed from gaseous sulfur dioxide. The acidic nature of sulfate aerosols makes them potential irritants.

The 24-hour California AAQS for sulfate of 25 µg/m^3 was exceeded at most of the monitoring stations in the study area. The highest 24-hour average was 109.1 µg/m^3 recorded at the Chino station.

Hydrogen Sulfide: Although a state AAQS for H_2S, a poisonous gas characterized by a "rotten egg" odor, has been promulgated, monitoring has been performed only periodically Results of such monitoring by the South Coast Air Quality Management District indicate that the State standard of 0.03 ppm for one hour was not exceeded.

Ethylene: The California standards were promulgated not for human health reasons but to protect sensitive plants. Only spot checks of ethylene concentration were made in 1975 in the study area. In January, the average value of spot checks was 0.292 ppm and the average value of spot checks in May was 0.150 ppm.

Visibility: The California AAQS for visibility reducing particles was established primarily for aesthetic reasons.

Frequent exceedances of this standard were recorded in 1975, especially in the South Coast Air Basin. All seven of the South Coast AQMD monitoring stations exceeded the standard on over 100 days while five exceeded it on over 200 days, mostly at inland monitoring stations.

9. Air Quality Offshore and in Baja California: There is a distinct lack of air quality data for the offshore portions of the study area. The California Air Resources

TABLE IV-9. Lead concentrations (µg/m^3) at selected stations in the study area.

Station	Air Basin[1]	County	Maximum 30 Day Average	Annual Average
Santa Barbara (State St$_o$)	SCC	Santa Barbara	3.28	1.47
Camarillo	SCC	Ventura	1.66	0.77
West Los Angeles	Sc	Los Angeles	3.75	1.52
Los Angeles (downtown)	Sc	Los Angeles	6.84	2.44
Lennox	Sc	Los Angeles	9.39	“2. 84
San Bernardino	SC	San Bernardino	3.19	1.38
Riverside - Rubidoux	Sc	Riverside	2.86	1.13
Costa Mesa (Harbor)	Sc	Orange	3.99	1.08
Los Alamitos (Orangewood)	Sc	Orange	5.85	1.52
San Diego (Island Ave.)	SD	San Diego	3.56	1.35

[1] See: South Central Coast
Sc: South Coast
SD: San Diego

Board has done a year of ozone monitoring on San Nicholas Island. The data from San Nicholas Island indicated that the highest hourly averages occur in the fall (October and November) probably under the influence of mild Santa Ana conditions (off shore flow). These highest values approached 0.20 ppm. Lowest values occurred during July, August, and February, with maximum hourly averages of only about .05 ppm.

Total suspended particulate is the only pollutant monitored in Baja California. It is measured in Tijuana and Mexicali by the Mexican government. The recorded TSP levels are much lower than the "levels reported across the border at San Ysidro, but the accuracy of the Mexican data is highly suspect at this point in the development of their monitoring system. Analysis of San Ysidro data indicates that Tijuana is the source of the high particulate readings observed there (AGM = 167.7 $\mu g/m^3$), based on a strong correlation between high TSP readings and air flow from Tijuana.

Since gaseous pollutants are not monitored in Baja California, the air quality of the area cannot be accurately assessed. Some inferences can be made from monitoring done near the Mexican border at San Ysidro and Imperial Beach. Ozone levels probably exceed 0.10 ppm, especially directly downwind of San Diego and Tijuana, since Imperial Beach" reported 0.19 ppm in 1975. CO levels may remain below 35 ppm for one hour and 9 ppm for 8 hours based on border data. However, sources are not well-controlled in Baja California so there is a high potential for exceedance. Nitrogen dioxide levels remained below 0.25 ppm for one hour and below 0.05 ppm for the annual average along the border, SO_2 levels were also well below standards. The highest hourly average of SO_2 was 0.04 ppm at San Ysidro.

10. Pollutant Trends: Oxidant levels have generally been decreasing throughout the study area in recent years. The beginning of the downward trend varies from station to station and is sometimes difficult to pinpoint since yearly variability is greater than the magnitude of this downward trend. Figure IV-21 presents the trend of mean daily maximum hourly average concentrations for four locations in the study area, three in the coastal sector and one (Azusa) inland in the Los Angeles Basin. All stations exhibit the general downward trend, although the lack of data at Santa Barbara makes trends difficult to recognize. Also, the San Diego station appears to have experienced a slight upward trend in the last five years.

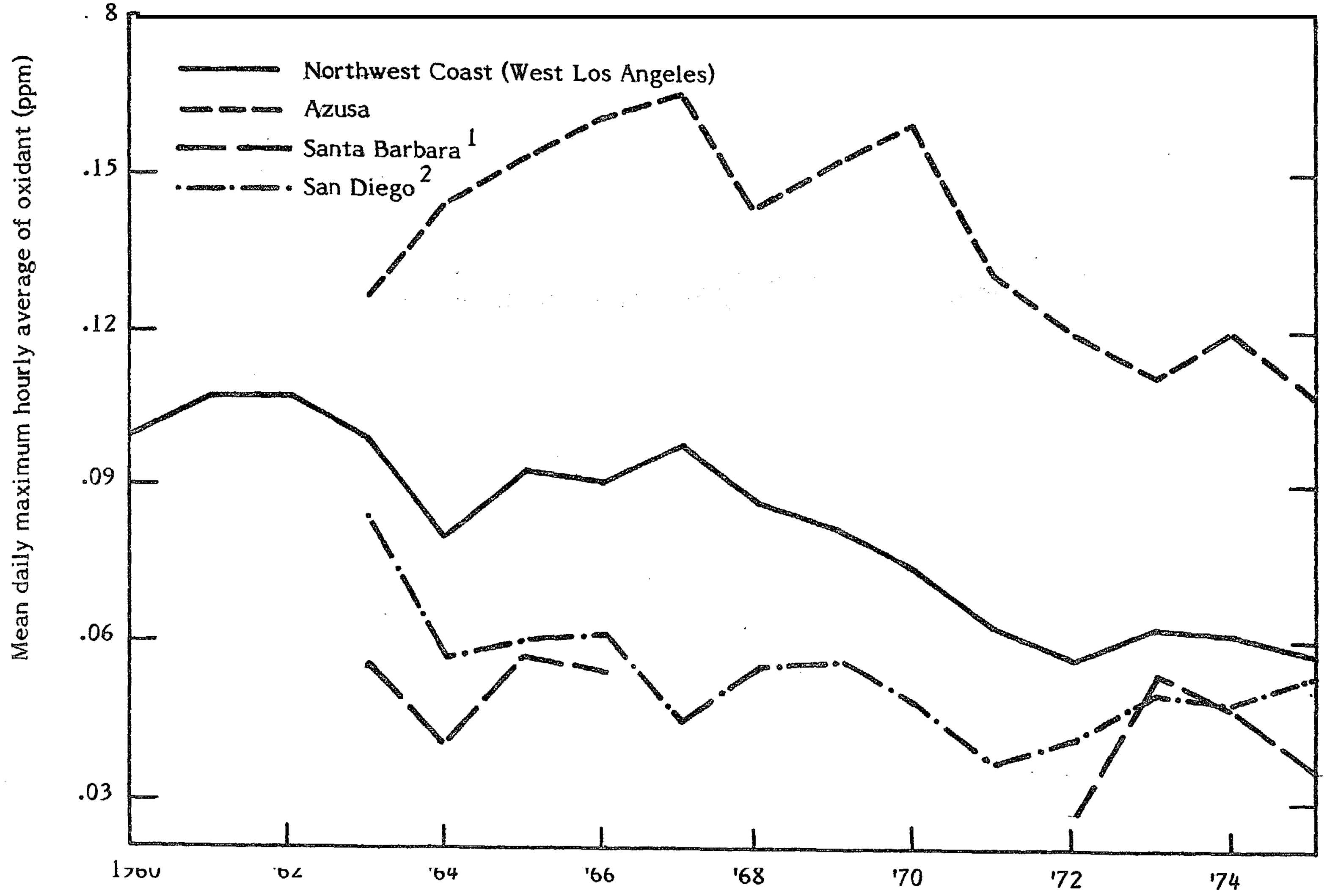


FIGURE IV-21. Oxidant trends. Mean daily maximum hourly average for selected stations (1960-1975).

1 Health Dept., 1963-1966; State St. for 1972

2 8th & E St. for 1963-1972; Island Ave. for 1973 - 1975.

A downward trend in CO levels is also apparent. The annual averages of daily one-hour CO maxima (Figure IV-22) illustrate this trend. Four stations have been selected: one each for the northern, central, and southern portions of the coastal sector and one inland station (downtown Los Angeles). The trend is most pronounced at the Lennox station whose 1975 mean daily maximum hourly average of 10.3 ppm is 60% lower than the 1966 mean.

Trijonis, et al (1976) found that, based on analysis of 11 stations, $N0_2$ concentrations in the Los Angeles basin have increased by about 20% over the last ten years while NO_x emissions have increased by about 36%. This trend is, however, not as well defined as for oxidant and CO. Figure IV-23 demonstrates that the mean daily maximum hourly $N0_2$ concentrations at four selected stations demonstrate no clear upward or downward trend.

Figure IV-24 presents SO_2 annual averages for three stations in Los Angeles County. The 1975 annual mean at the Southern Coastal (Long Beach) station was 32% lower than the maximum annual mean of 0.031 ppm reported in 1968. However, there is no readily apparent area-wide downward trend, although most 1975 annual means were lower than the ten-year averages.

Particulate trends in the study area are generally not well-defined, although downtown Los Angeles exhibited a strong downward trend from 1971 until 1975 when it reversed. A downward trend was also noted at the Lennox station during the last five years prior to 1976.

The data base for sulfates, lead, and H_2S is not complete enough to allow trend determination.

c. Emissions

Total emissions estimated for 1975 in generalized source categories are presented in the following four tables for the four main study areas:

(1) Table IV-12: South Coast Air Basin (Thomas, 1977)
(2) Table IV-13: San Diego (San Diego Air Quality Planning Team, 1975)
(3) Table IV-14: Ventura (Barnes and Thuman, 1976)
(4) Table IV-15: Santa Barbara (Nordsieck, 1976)

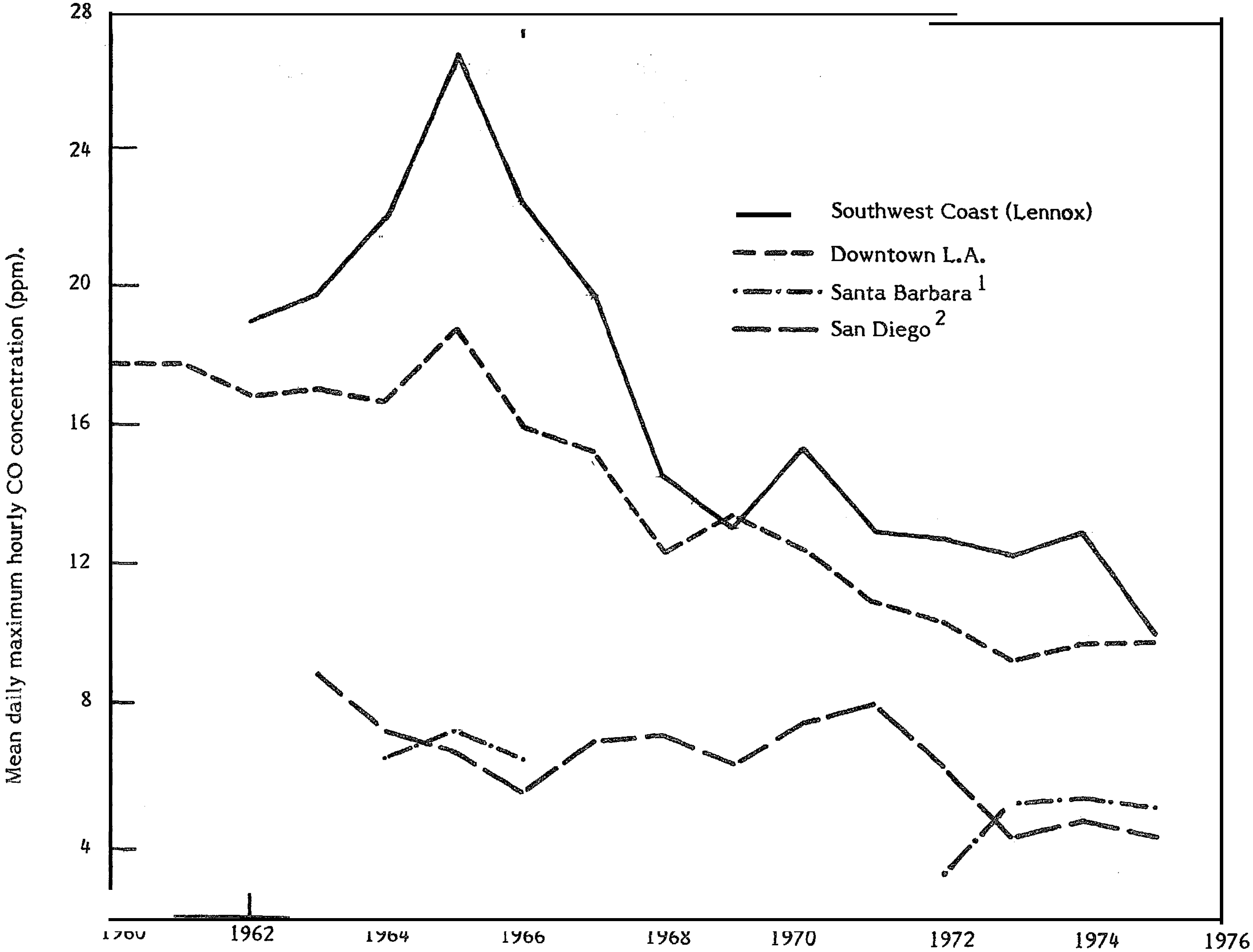


FIGURE IV-22. Mean daily maximum hourly CO concentrations for selected stations in the study area.

[1] Health Dept. for 1964-1966; State St. for 1972-1975.

[2] 8th and E St. for 1963-1972; Island Ave. for 1973-1975.

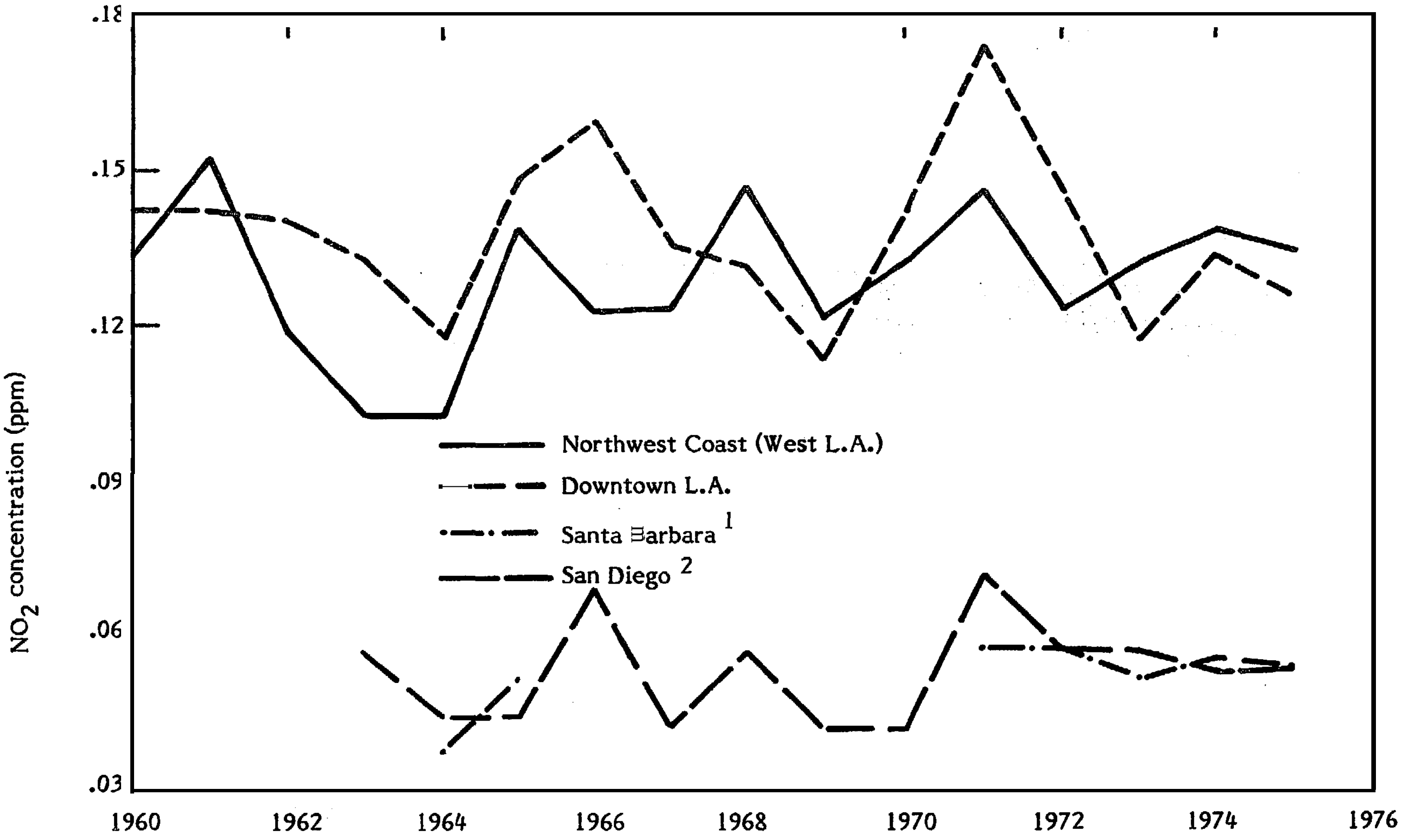


FIGURE IV-23.. Mean daily maximum hourly NO_2 concentrations (ppm) for selected stations in the study area.

[1] Health Dept. for 1964-1965; State St. for 1971-1975.

[2] 8th and E St. for 1963-1972; Island Ave. for 1973-1975.

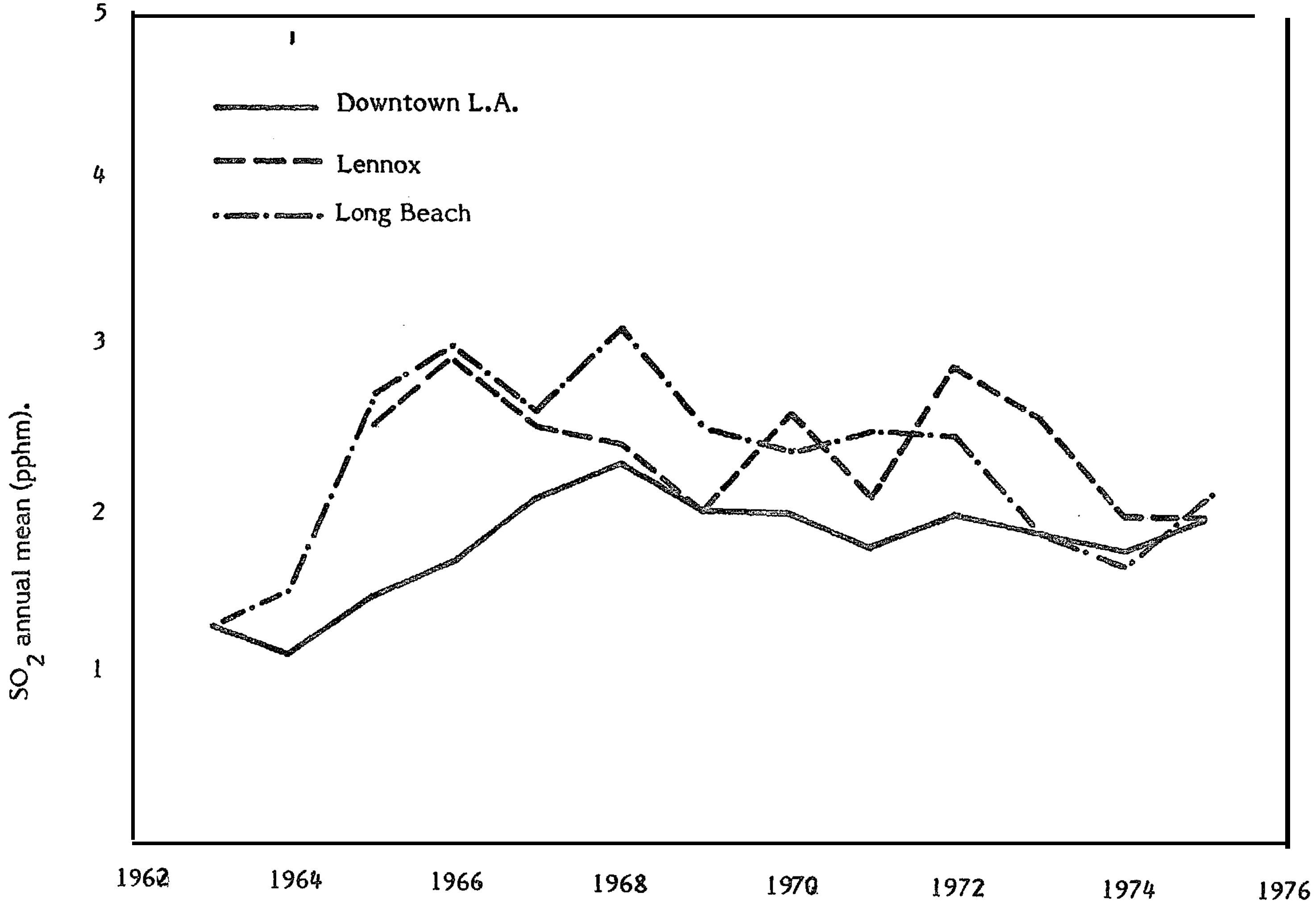


FIGURE IV-24. SO_2 annual mean trend for 3 selected stations.

TABLE IV-10. South Coast air basin 1975 emissions inventory (tons/day).[1]

Emission Category	NO_x	co	THC	NMHC	SO_2	Part.
1. Los Angeles County						
Stationary sources	248.6	17.5	504.0	476.0	214.1	55.6
Mobile sources	728.2	4637,6	517.1	491.1	53.8	91.1
Area sources	10.0	421.0	66.2	66.2	0.0	53.1
Sub total	986.8	5076.1	1087.3	1033.3	267.9	199.8
2. Orange County						
Stationary sources	22.1	4.1	98.3	88.4	24.9	4.8
Mobile sources	174.3	1200.5	134.1	126.2	9.7	20.3
Area sources	0.4	30.4	6.9	6.9	0.0	7.6
Sub total	196.8	1235.0	239.3	221.5	34.6	32.7
3. San Bernardino County						
Stationary sources	97.3	282.1	30.3	30.3	44.8	12.3
Mobile sources	100.4	605.6	68.9	65.3	5.5	11.2
Area sources	0.2	13.7	3.1	3.1	0.0	5.8
Sub total	197.9	901.4	102.3	98.7	50.3	29.3
4. Riverside County						
Stationary sources	20.9	9.0	30.2	30.2	42.4	17.5
Mobile sources	82.9	511.8	59.8	56.7	4.1	8.6
Area sources	0.1	9.8	2.2	2.2	0.0	17.3
Sub total	103.9	530.6	92.2	89.1	46.5	43.4
Grand Total	1485.4	7743.1	1521.1	1442.6	399.3	305.2

[1] 907.2kg/day=1ton/day

TABLE IV-11. San Diego 1975 emission inventory (tons/day)

Emission Category	NO_x	CO	THC	RHC	SO_x	Part.
Process Losses	0.2	0.0	155.6	124.3	0.0	29.0
Motor Vehicles	143.0	966.1	167.7	152.7	4.0	16.1
Aircraft	7.2	19.2	8.4	8.0	0.0	4.2
Combustion	32.5	5.1	2.4	0.7	27.0	5.3
Ships/Boats	4*7	9.3	2.8	2.1	9.5	0.9
Railroads	2.0	0.7	0.4	0.4	0.3	0.1
Waste Burning	0.0	1.1	0.2	0.2	0.0	0.2
Fugitive Dust	0.0	0.0	0.0	0.0	0.0	429.9
Miscellaneous	0.7	48.2	8.6	3.8	0.0	0.0
TOTAL	190.4	1050.0	346.3	292.4	41.0	485.0

TABLE IV- 12. Ventura County 1975 emissions inventory (tons/day).

Emission Category	NO_x	CO	THC	SO_x	Part.
Stationary sources	46.1	13.6	34.2	48.0	7.4
Mobile sources	42.3	273.8	50.3	4.0	6.7
Miscellaneous area sources	0.8	54.3	5.3	0.0	23.1
Total	89.2	341.8	89.9	52.0	37.2

TABLE IV-13. Santa Barbara County (South Coast area) 1975 emissions inventory (tons/day).

Emission Category	NO_x	CO	RHC
Motor vehicles	16.2	95.7	8.5
Aircraft	0.1	2.4	0.2
Stationary	2.0	4.4	4.8
Total	18.3	102.5	13.5

The South Coast Air Basin emissions (Table IV-12) are tabulated separately for Los Angeles County, Orange County, San Bernardino County, and Riverside County. The emissions are presented as described in the references; units are in short tons/day.

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V. AIR EMISSIONS FROM OCS OIL AND GAS DEVELOPMENT AND OTHER PROPOSED PROJECTS

A. Introduction and Overview

As was discussed in Chapters I and 11, the oil and gas developments in the Southern California Bight were defined by the Bureau of Land Management (BLM) in terms of barrels of oil per day or cubic feet of gas per day in each of the following production areas:

- Santa Barbara Channel
- Santa Rosa Island
- Santa Barbara Island
- Tanner/Cortez Banks
- San Pedro
- Dana Point - San Diego

Certain additional information was provided by the BLM on the means of transporting the oil and gas - pipeline or tanker – and on the general locations of onshore processing operations. No specific descriptions were provided for the equipment that would be located offshore and onshore since this will be determined primarily by the lease holders. Nor was any information given on the exact locations of the offshore platforms because this will depend on the exact outcome of the lease sale.

Air emissions associated with OCS development were, therefore, estimated by general techniques which involve assuming that operations can be divided into a number of categories as shown below:

- Oil production
- Gas production
- Oil processing
- Gas processing
- Marine loading
- Marine transport
- Storage

Factors have been developed for each of these categories (or subcategories) that can be used to estimate air emissions of hydrocarbons nitrogen oxides, carbon monoxides, sulfur oxides and particulate based on the throughput of oil or gas.

The modeling studies, described in Chapters VI and VII, require that emissions be distributed in space by assigning them to the appropriate location in a network of grid squares. Each of the production areas in the list above encompassed several grid squares so the emissions were apportioned evenly to several discrete locations within each production area. The crude oil and gas from the Santa Barbara Channel has a slightly different chemical composition than that from the other production areas, so different emission factors were used for this area when appropriate. This method of approach predicts that most platforms within a given area will have identical emissions that depend on the total oil and gas from the specified production area, and that Santa Barbara Channel platforms will have slightly different emisisons because of the different crude oil in that area.

In the sections which follow, the rationale is given for the choice of emission factors, assumptions regarding the production scenarios are described, and methodology for calculating emissions is explained. The calculated emissions are tabulated in Appendix A.

B. Emission Factors

All emission factors used in this work were taken from published sources and modified as necessary on the basis of consultation with experts from agencies and industry. No original field tests were performed to improve the existing data base. Factors are discussed by category in the sections which follow.

1. Oil And Gas Production and Processing – Air pollutant emission factors are shown in Table V-1. Except for the hydrocarbon and H_2S factors, these are taken primarily from Taylor (1977) with the units changed from lb/hr to kg/hr. Discussions with personnel from the California Air Resources Board (Leach, 1977) and the Radian Corporation (Burklin, 1977) revealed that there was a general opinion that hydrocarbon emissions from offshore operations were lower than those from corresponding onshore operations and consequently were overestimated in Taylor's calculations. Accordingly, a search was made for information that could be used to derive more representative emission factors.

TABLE V-1. Emission rates for oil and gas production and processing. (From Taylor, 1977, except as noted.)

Pollutant	Oil Production	Oil Processing	Gas Production	Gas Processing
	(kg/hr per 10^3 bbl/day)		kg/hr per 10^6 scf/day)	
HC	0.38*	0.38*		3.31*
NO_x	0.41	0.82	0.95	2.77
co	0.32			
SO*	0.15			0.20
TSP	0.15			
H_2S				0.09* (sour gas)
H_2S				0.0001* (sweet gas)

*See text for derivation of factor

Three sources were consulted (Dames and Moore, 1974; Woffinden, 1976; Burklin and Honerkamp, 1976). A comparison of the current state of knowledge on hydrocarbon emission factors for various processes was given in the Burklin report and is shown in Table V-2. Variations of 25 fold have been reported in emission factors derived for the same process or equipment located in an oil production field, a refinery with no emission controls and a refinery with emission controls. Even lower emission rates have been estimated for proposed facilities. Dames and Moore (1974) estimated overall hydrocarbon losses to be no greater than 10^{-4} of the total OCS oil production, but provided no data to justify this factor. Woffinden (1976) reports on field tests at ARCO's Elwood facility that show heavy hydrocarbon leak rates of 0.34 lb (.15 kg) per day at the 4,000 barrel per day facility, and he estimates that only 0.35 lb (.16 kg per day would be lost from a proposed 20,000 barrel per day facility. These figures are an order of magnitude lower than the lowest factors shown in Table V-2. For the purposes of this study, the lowest factor for each equipment category was used from Table V-2 except for the pipeline valve/flange category where an even lower value of 1.4 kg per 103 barrel was used. This factor was derived from a recommendation by Leach (1975) that the emissions in this category be reduced to 1/4 of the Table V-2 value because 75 percent of the pipeline valves and flanges were submerged. The total hydrocarbon emissions from all equipment categories come to 11.4 kg per 10^{3} barrel for oil production and processing taken together. In addition, there are hydrocarbon emissions of 6.8 kg per 10^{3} barrel that originate from diesel engines used in the operation. Natural gas may be substituted for diesel fuel in some offshore production operations. The 100% diesel scenario was chosen to represent the worst case operation with respect to hydrocarbon emissions. This results in an overall total of 18.2 kg of hydrocarbons per 103 barrels of oil which must be apportioned between oil production and oil processing.

Assignment of these hydrocarbon emissions to oil production and processing was made according to recommendations by Taylor (1977) and concurrence by Murray (1977). All emissions from diesel engines and one-half of the emissions from pump seals and relief valves were assigned to production (9.1 kg/103 bbl). The remainder was assigned to processing (9. 1 kg/103 bbl). When converted to kg/hr per 10^{3} bbl/day these yield the factors shown in Table V-1.

Factors for hydrogen sulfide were taken from Leach (1975) for sour gas. Leach assumed an average hydrogen sulfide content of 0.9 percent for sour gas, and the estimate

TABLE V-2. Hydrocarbon emission rates from equipment used in petroleum production and refining. (from Burklin, 1976)

Equipment	Uncontrolled Refinery	Controlled Refinery	Onshore Oil Production
	(kg per 103 barrel)		
Wastewater separator	91	4.6	3.6
Pump seals	7.7	4.6	34
Compressor seals	2.3	N.A.	1.8
Relief valves	5	Neg.	3.6
Pipeline valves/flanges	13	N.A.	5.5

Natural gas processing plant 68-91 kg (150-200 lbs) per 10^6 scf for sweet gas (0.2 grains of hydrogen sulfide per 100 standard cubic feet (scf) of gas) was made by scaling down Leach's emission factor in proportion to the hydrogen sulfide content of the gas. Leach's assumption that hydrogen sulfide is emitted during gas processing, and not during any other operation, was used in the current study,

2. Marine Transportation - This category includes emissions associated with combustion of fuel to power tankers and tugboats and also for pumps used to unload the crude oil. Tankers use the same engines for unloading and maneuvering; tugboats do not carry cargo and therefore do not unload; and barges are equipped with pumps for unloading but are otherwise not powered. Emission factors are listed in Table V-3. These factors were taken from published sources (Goodrich and Shewmaker 1974; U.S. EPA, AP-42; Goodley et al 1976) and are given as pounds of pollutant emitted per barrel or 103 gallons of fuel consumed. Tankers use #6 fuel oil, and tugboats and barges use diesel fuel. Fuel consumption rates are discussed in Section C of this chapter which explains the emissions calculations. The NO_x emission factor for tanker engines requires some comment. The factor listed by Goodrich and Shewmaker (1974) was 4.36 lb/bbl fuel, but subsequent field tests showed that this factor was too high. Based on preliminary results of recent test programs, Goodley et al (1976) recommended that a value of 2.03 lb/bbl fuel was more reasonable. This estimate has been used in the current calculations.

Hydrocarbon vapors can be lost from crude oil cargoes during transit. These losses have been estimated according to published methods (Burklin and Honerkamp, 1976; U.S. EPA AP-42; API, 1956) as follows:

Loss = 0.1 PW lb/week per 10^3 gal transported
where P = true vapor pressure, psia
w = density of condensed vapors, lb/gal

This equation was assumed to be applicable to tankers and barges. Vapor pressures and other characteristics of the OCS crude oils are given in Table V-4.

3. Loading and Unloading of Tankers and Barges - Hydrocarbons are emitted during the loading of crude oil into tankers and barges and during lightering operations in which oil is transferred from a large tanker into several smaller tankers so that it can be unloaded at a port which cannot accommodate a large tanker. Prior to loading, the tanker or barge holds air that contains vapor from the previous cargo (or relatively clean air if

TABLE V-3. Emission factors for marine transport of crude oil. (Compiled by Goodrich & Shewmaker, 1974, EPA, AP-42; Goodley, Blower & Murray, 1976).

Pollutant	Tanker Engines (Pounds/bbl fuel*)	Tugboat Engines Idle (Pounds/10^3 Gal Fuel)	Tugboat Engines Under Load (Pounds/10^3 Gal Fuel)	Barge Pumps* (Pounds/10^3 Gal Fuel)
	0.13	3	3	37.5
NO_x	2. 03*	22.2	44.5	469
co	0.08	4	4	102
SO_2	6. 70S**	28	28	28-
TSP	0.97	15	15	33,5

*See text

**S indicates percent sulfur content of fuel by weight -- 0.5 or 1.0 for a tanker coming into port in Southern California; otherwise 2.5.

(1) .45 kg/bbl = 1 lb/bbl

(2) .019 kg/bbl = 1 lb/10^3 gal

TABLE V-4. Average properties of crude oil from selected sources. (compiled from Bureau of Mines, 1966; Kelleher, 1977; BLM, 1977).

	Wilmington Crude	Dos Cuadras Crude	Lightered Oil
°API	21	27	36
Sp G.	0.93	0.89	0.84
Reid Vapor Pressure	2.1 psi	5.5 psi	4.3 psi
Total Sulfur	1.46 % by wt.	1.3% by wt.	N.A.
Front end composition			
ethane	0.0% by vol.	<0.0 % by vol.	N.A.
propane	0.10	0.1 - 0.2	N.A.
i - butane	0.14	0.1 - 0.2	N.A.
n - butane	0.35	1.1 - 1.6	N.A.
i - pentane	0.24	0.2 - 0.4	N.A.
n - pentane	0.30	0.4 - 0.8	N.A.

N.A. - Not Available

the cargo tank has been cleaned or ballasted), and as loading proceeds the air takes on additional vapor from the incoming oil. At the conclusion of loading, a volume of hydrocarbon-laden air equal to the volume of the cargo has been expelled. These emissions are very substantial because of the extremely large volumes involved. Loading of barges results in losses which are greater than those for loading tankers (Burklin, et al. 1976) because barges are shallower, have a comparatively larger surface area of oil, and are rarely cleaned or ballasted. Data from Burklin, et al. (1976) recommend multiplying tanker loading factors by three should adapt them to barge loading.

Table V-5 shows the hydrocarbon emission factors used in this study for tanker and barge loading. The OCS development involves oil from the Dos Cuadras field (Santa Barbara Channel) and the Wilmington field (all areas except Santa Barbara Channel). In addition, lightening operations are occurring offshore which involve imported oil. Separate factors are listed in Table V-5 for each type of oil along with the average temperature and vapor pressure assumed for each. Factors listed in Burklin & Honerkamp (1976), Goodrich & Shewmaker (1974); U.S. EPA, AP-42, and Roger (1977) were compared after normalizing them to a vapor pressure of 2.8 psia. The normalized values ranged from 0.9 to 1.57 and averaged 1,0. This average value was then readjusted to the vapor pressures listed in Table V-5 to give the factors listed in that table.

Unloading losses were assumed to be negligible since air is drawn into the cargo tanks during unloading. If water is drawn into emptied cargo tanks to help maintain tanker stability – a process called ballasting - some hydrocarbon-laden air is displaced. Tankers of the type used to deliver crude oil to California ports in 1986 will not put ballast into cargo tanks, so emissions from this activity can be neglected. For lightening operations in 1975, ballasting is involved, and the factors listed in Table V-5 for loading can be applied.

4. Storage – Storage facilities are required offshore for temporary storage of crude oil prior to loading into tankers and onshore for storage at processing facilities. Onshore storage tanks were assumed to be of the floating roof type while offshore tanks were assumed to be fixed roof in keeping with the present practice of using oil tankers or barges for offshore storage. Storage losses are of two types: (1) breathing/standing losses and (2) working losses that are associated with loading the tank. No significant losses occur during emptying of storage tanks. Breathing/standing losses depend on the capacity

TABLE V-5. Hydrocarbon emission factors for loading* of crude oil into tankers and barges. (compiled from Burklin, 1976; Goodrich, 1974; EPA, AP-42; Roger, 1977).

Crude Oil	T	TVP	Factor Tankers	 Barges
	(°F)	(psia)	(Pounds/10^3 Gal	Loaded)
Dos Cuadras	80	4,6	1.6	4.8
Wilmington	90	1.8	0.6	1.8
Lightered Oil	70	2,8	1,0	3.0

*Factors are also applicable to ballasting operations of the storage tank while working losses are independent of the capacity and are dependent on the throughput of oil. A single factor was used for all tanks under 70,000 bbl capacity and another for all tanks over 70,000 bbl capacity. The factors used in this study were taken from Burklin & Honerkamp (1976) and are summarized in Table V-6.

Working losses were calculated from the following equation (Burklin, & Honerkamp, 1976):

$$\text{Loss} = 2.40 \times 10^{-2} MPK_n K_c$$

where Loss = fixed roof working loss in lb/103 gal throughput
M = molecular weight of vapor (50 lb/mole)
P = true vapor pressure, psia
K_n = turnover factor (<0.4 for 2 day storage)
Kc = crude oil factor (0.84)

Separate factors for working losses were calculated from this equation for Dos Cuadros (True vapor pressure (TVP) 4.6 psia) and Wilmington crude (TVP 1.8 psia).

5. Accidents - In this study, emission factors are required for instantaneous oil spills of 140 barrels and 10,000 barrels, and for a blowout of 1,000 barrels per day accompanied by 1,000 scf of gas per barrel of oil. Factors are required for blowouts with and without fires. Emission factors for these events are not listed in any of the conventional sources such as EPA's AP-42 probably because no field measurements have ever been reported for such accidents. Factors were derived for this study using the best technical judgment of the project team and incorporating all published information that seemed to apply.

a. Hydrocarbons - Hydrocarbon emissions for spills and blowouts without fires were calculated by estimating the percentage (by weight) of the volatile fraction of the spilled crude and the time required for volatilization. Spills and blowouts were calculated in the same way except for the addition of gas emissions to the blowout. Emission factors are summarized in Table V-7. Data on volatile fractions of the crudes were provided by the Union Oil Company (Kelleher, 1977; UCLA, 1976). The extent and rate of volatilization was estimated from Swadier and Mikolaj (1973) and McAullife (1976) which indicate that 50% of the

TABLE V-6. Hydrocarbon emission factors for storage of crude oil.
(from Burklin, 1976, Table 4.3-4, section 4.3.2 equation 2)

Type of Tank	Breathing/Standing Loss (1 hr per 10^3 capacity)	Working Loss (lb per 10^3 bbl throughput)
Floating roof		
under 70,000 bbl	0.035	Neg.
over 70,000 bbl	0.022	Neg.
Fixed roof		
Under 70,000 bbl	0,12	75,6*
Over 70,000 bbl	0,086	75.6*

*This value is for Dos Cuadras crude with TVP 4,6 psia. The value for Wilmington Crude (TVP 1.8 psia) is 29,4, Breathing/standing losses are given for an average of the two crudes. The losses are so small compared to working losses that separate values for the two crudes were not necessary,

TABLE V-7. Emission factors and associated data for oil spills and blowouts. (see text for sources used)

	Dos Cuadras	Wilmington
Hydrocarbons		
Reid Vapor Pressure	5.5 psi	2.1 psi
Volatiles through 500°F	35% by wt.	20% by wt.
Density	146 kg/bbl	149 kg/bbl
Volatilization in 1 hours	26 kg/bbl	15 kg/bbl
Volatilization in 2 hours	39 kg/bbl	22.5 kg/bbl
Unburned during a fire	7.4 kg/bbl	7.4 kg/bbl
In gas associated with blowout	20 kg/10^3 scf	20 kg/10^3scf
Sulfur Compounds		
H_2S in gas	0,08 lb/10^2 scf*	0.2 grains/10^2 scf
Total sulfur in gas	0.08 lb/10^2 scf*	0.5 grains/10^2 scf
SO_2 from gas combustion	0,16 lb/10^2 scf	0.0001 lb/10^2 scf
Total sulfur in oil	1.90 kg/bbl	2,24 kg/bbl
SO_2 from oil combustion	3,8 kg/bbl	4.5 kg/bbl
Other pollutants from fires		
NO_x	0.5 kg/bbl	0.5 kg/bbl
co	7.4 kg/bbl	7.4 kg/bbl
Total Suspended Particulate	1,5 kg/bbl	1.5 kg/bbl

* All Sulfur assumed to be H_2S for conservatism in analysis

volatiles are lost in the first hour and 75% are lost in the the first two hours. Since this study is concerned with the periods of highest emissions, it was not necessary to compute emission factors beyond the second hour. In the event of oil fires, it is unlikely that the hydrocarbons would be completely burned. A factor of 1 pound/103 gallons (.27 pounds/ton) has been given (EPA, AP-42) for the burning of residual oil, but this is certainly much too low for an oil fire. A factor of 100 pounds/ton was chosen for use in this study. This represents 95% combustion of hydrocarbons by the fire.

b. Sulfur Compounds – During blowouts hydrgen sufide and other sulfur compounds may be released along with the natural gas that accompanies the oil. Sulfur compounds are also present in the oil, but these are assumed to be non-volatile for purposes of this study. For blowouts with fires, it was assumed that all of the sulfur in oil and gas is converted to sulfur dioxide. Table V-7 shows the emission factors for sulfur compounds for Dos Cuadras and Wilmington crudes. Information on sulfur content of gas was obtained from Leach (1975) and from Corbeil (1977); sulfur contents of oil were obtained from the sources cited for Table V-4.

c* Nitrogen Oxides - Nitrogen oxides are produced during fires and the emission rate is strongly dependent on the conditions of combustion; under open burning conditions it is likely to be relatively low. A factor of 6 pounds per ton (0.5 kg/bbl) was chosen as intermediate between the values listed in EPA's AP-42 for open burning of wastes (2-6 lb/ton) and burning of fuel oil (10-25 lb/ton).

d. Carbon Monoxide – There are no data of any kind on which to base an estimate of these emissions. Carbon monoxide emissions are produced only during fires and were assumed to be equal to the unburned hydrocarbon emissions from the fire.

e. Particulate Matter - Particulate are produced during fires from ash resulting from non-combustibles in the oil and from soot that is generated by incomplete combustion. The ash content of these crudes is approximately 0.1 % and particulate from soot would be expected to be greater. A factor of 1% for total particulates was chosen which is larger than the burning of municipal waste, scrap wood and agricultural waste and similar to that cited for the burning of automobile components.

c. Emission Calculations

Emissions from OCS developments for each scenario were calculated as kg/hr for each pollutant at each location in the network of grid squares. When emission rates were not constant, the maximum hourly emission rate was used. This task generated thousands of numerical values that are given in Appendix A of this report. This text explains the methodology used in the calculations and gives the assumptions and data – in addition to those described in Chapter II – that were required to complete the calculations.

1. Oil and Gas Production - Emissions from oil and gas production at offshore platforms were calculated by applying the emission factors of Table V-1 to production values as listed in Table V-8. For certain of the modeling needs, it was necessary to identify those emissions that came from heated stacks and to characterize the stack. All emissions from gas production were identified as coming from gas turbines; 25% of the hydrocarbon emissions were identified as coming from unheated sources (fugitive); and the remainder of the emissions were characterized as coming from diesel engines. Tables were generated for the following scenarios:

- All 1975 production activities
- 1986 activities exclusive of Sale 48, both for normal tankering and 100% tankering
- 1986 activity from Sale 48 with normal tankering
- 1986 activity from Sale 48 with 100% tankering

These tables, together with the locations of each of the platforms (by UTM coordinates), may be found in Appendix A.

2. Oil and Gas Processing - According to the scenarios provided by the BLM (1977), the nature and location of oil and gas processing were different for each production area. Four processing options were indicated: (1) oil and gas are processed onshore, (2) all of the gas and half the oil are processed onshore with the remaining oil

TABLE V-8. Offshore Oil and Gas Production in 1975 and 1986. (from BLM, 1977).

	1975 Activity			1986 Activity with Normal Tankering Including Sale 35 but without Sale 48		
	Oil (bbl/day)	Gas (scf/day)	No. of Platforms	011 (bbl/day)	Gas (scf /day)	No. of Platforms
Non OCS-Tidelands						
Santa Barbara Channel						
South Elwood	**3,500’**	**0**	1	**7,300’**	**8,800,000[1]**	1
Summer land	7601	3,830,000[1]	1	750[1]	2,290,000[1]	1
Carp interia	3,690[1]	2,500,000[1]	1	1,290[1]	1,000,000’	1
Other	1,550[1]	10,670,000[1]	2	5601	3,710,000[1]	2
Los Angeles						
Belmont Offshore	5,900[1]	1,400,000’	1	1,600[1]	400,000’	1
Huntington Beach	36,800[1]	5,500,000’	1	18,100[1]	2,700,000[1]	1
Wilmington	103,000[1]	19,600,000[1]	1	32,100[1]	6,100,000[1]	1
Other	1,700[1]	1,800,000[1]	1	6001	600, 000[1]	1
OCS						
Santa Barbara Channel						
Carpinteria (Henry)	4,800[1]	2,600,000[1]	1	2,000[1]	1,500,000’	1
Hueneme	o	0	1	3,000[1]	0	1
Dos Cuadras	33,600[1]	12,300,000[1]	0	7,000[2]	2,000,000[1]	1
Santa Clara (N)	o	0	0	23,000[2]	28,000,0001	1
Santa Clara (S)	o	0	0	28,0002	45,000,000[1]	1
Santa Ynez (Hondo)	o	0	0	95,0002	85,000,000[1]	1
Santa Ynez (Secata Pescado)	o	0	0	42,000[2]	38,500,0001	1
Proposed Sale 48	0	0	0	0	0	0
Santa Rosa Island	o	0	0	2,186[1]	3,279,000[1]	2
Santa Barbara Island	o	0	0	3,379*	2,703,200**	3
Tanner/Cortez	o	0	0	151,053’	226,579,000[1]	25
San Pedro	o	0	0	39,751[1]	31,800,000[1]	8
San Diego/Dana Point	o	0	0	0	0	0

[1] Processed onshore

[2] 1/2 processed offshore and 1/2 processed onshore

* Processed offshore

• * Not processed (reinfected)

TABLE V-8. (Continued).

	1986 Activity Sale 48 with Normal Tankering			1986 Activity with 100% Tankering Including Sale 35 but without Sale 48			1986 Activity Sale 48 with 100% Tankering		
	Oil (bbl/day)	Gas (scf /day)	No. of Platforms	Oil (bbl/day)	Gas (scf/day)	No. of Platforms	011 (bbl/day)	Gas (scf /day)	No. of Platforms
Ocs									
Santa Barbara Channel									
Carpinteria (Henry)				2,000*	1 ,500,000**	1			
Hueneme				3, 000*	0	1			
Dos Cuadras				7, 000*	2,000 ,000**	1			
Santa Clara (N)				23, 000*	28 ,000,000**	1			
Santa Clara (S)				28,000*	45,000,000**	1			
Santa Ynez (Hondo)				95,000*	85,000,000**	1			
Santa Ynez (Secata Pescado)				42, 000*	38,500 ,000**	1			
Proposed Sale 48	92,0002	92,000,000[1]	7	0	0	0	92,000*	92,000,000**	7
Santa Rosa Island	5,000[1]	7,000,000’	1	2, 186*	3,279, 000**	2	5,000*	7,000 ,000**	1
Santa Barbara Island	3,000*	2,000 ,000**	1	3,379*	2,703,000**	3	3,000*	2,000,000**	1
Tanner/Cortez	88,000’	131,000,000’	9	151,000*	226,579, 000**	25	88,000’	131,000,000**	9
San Pedro	24,000[1]	20,000,000’	3	39,751*	31,800, 000**	8	24,000*	20,000 ,000**	3
San Diego/Dana Point	8,000[1]	12,000,000*	3	0	0	0	8,000*	12,000,000**	3

[1] Processed onshore

[2] 1/2 Processed off shore and 1/2 processed onshore

* Processed offshore

● * Not processed (reinfected)

processed offshore, (3) all of the gas is processed onshore and all of the oil is processed offshore, and (4) all of the gas is reinfected (not processed) and all of the oil is processed offshore. Table V-8 shows this information as given for each production area. Onshore processing was assumed to occur at or near existing facilities, unless otherwise specified, and offshore processing was assumed to occur at single buoy moors located according to information provided by the BLM (1977). The emission factors of Table V-1 were applied to production values derived from Table V-8 to generate tables of emission rates for oil and gas processing for the same four scenarios mentioned in Section V-C. 1 above. This information is included in the Appendix A tables of emissions from single buoys moors and onshore facilities. As will be shown later," there are also emissions from other activities which occur onshore and at single buoy moors. The tables in Appendix A give total emissions at these locations and do not show processing emissions separately.

3. Marine Transportation – Emissions are associated with tanker engines used to maneuver and unload tankers, tugboat engines used to assist tankers and move barges, and barge pumps used to unload barges. To compute these emission rates it is necessary to specify the approximate size of each vessel, its origin and destination and the sulfur content of the fuel used by the vessel. For this study, tanker emissions were considered to be unimportant when the tanker passed beyond the boundaries of the overall study area. Thus, the final destination of the tanker is irrelevant if it is outside the study area. Emission calculations made for a previous study (Bryan et al 1976) showed that the impacts of emissions from vessels at sea were negligible compared to those from vessels in port or loading at a single buoy moor. Emissions at sea were, therefore, not calculated for this study as input to the modeling effort.

Emissions from marine transport are discontinuous because it may take many days to produce sufficient oil at a given location to fill a tanker or a barge. Oil is accumulated in storage tanks and when a sufficient quantity is available? it is transferred to a tanker or barge over a period of 2 to 20 hours. When oil production increases, the frequency of loading increases, but the maximum hourly or daily emission rates may not change. Using the production scenario provided by BLM and discussed in Chapter II, a detailed scenario was developed for the maximum probable daily activity involving loading and unloading of OCS oil which is based on the following assumptions:

- o Oil is not transported in partially filled vessels, except for vessels loading from more than one SBM.

0 Wilmington and Dos Cuadras crudes are transported in separate vessels
o All OCS oil loaded into tankers is shipped to San Francisco
o All OCS oil loaded into barges is shipped to Los Angeles

The specific details of unloading are given in Table V-9 and details of all loading operations are shown in Table V-10. Using the fuel consumption rates of Table V-1 i, calculations were carried out for emission rates for marine transport for all of the scenarios described in Tables V-9 and V-10. These data are included in Appendix A as part of the total emissions tabulated for single buoy moors and onshore processing activities, but they are not listed separately.

In 1975 the marine trasnport activities included an operation known as "lightering." This operation will be discontinued by 1986 and does not need to be considered in any of the scenarios involving OCS oil and gas production. Emissions from lightening in 1975 are discussed separately in Section V-C.7 because the calculations are so complicated and detailed.

4. <u>Loading and Unloading of Tankers and Barges</u> – These emissions are closely associated with those just discussed for marine transport. Hydrocarbon losses during unloading were considered to be negligible, so the only emissions associated with unloading are combustion emissions from pumps used to transfer the oil and ballasting of lighter tankers (1975 only). These were calculated as explained above for marine transportation using the appropriate fuel consumption rates from Table V-11. Hydrocarbon losses from loading were calculated from the emission factors given in Table V-5 which are expressed as pounds per gallon of crude loaded. To calculate the maximum hourly emisssion rate, it is necessary to know the maximum hourly loading rate for the vessel. These rates are given in Table V-12 and were derived from information provided by the BLM (1977). This information was then applied to the detailed unloading and loading scenarios given in Tables V-9 and V-10 to compute emissions for specific locat ions. These are presented in Appendix A in the tables dealing with emissions onshore and at single buoy moors and are identified on these tables as emissions from loading operations.

5. <u>Storage</u> - As discussed in Section B4 of this chapter, storage losses are categorized as breathing/standing losses which occur continuously, and working losses

TABLE V-9. Specific details of barge unloading of OCS oil.

Tankering Scenario	Location	
	Port in Los Angeles Area	Other Locations
1975 Activity	none	none
1986 Activity with Normal Tankering		
Without Sale 48	1 150,000 bbl barge 1 2000 HP tug 1 10,000 bbl barge 1 800HP tug	none none none none
Including Sale 48	same as without Sale 48	none
1986 Activity with 100% Tankering		
Without Sale 48	3 150,000 bbl barges 3 2000 HP tugs 1 10,000 bbl barge 1 800 HP tug	none none none none
Including Sale 48	3 150,000 bbl barges 3 2000 HP tugs 2 10,000 bbl barges 2 800 HP tugs	none none none none

TABLE V-10. Specific details of tanker and barge loading of OCS oil.

	LOCATION						
Tankering Scenario	Santa Barbara Channel	Santa Rosa Island	Santa Barbara Island	Tanner/ Cortez	San Pedro	San Diego/ Dana Point	On Shore Activities
1975 Activity							
Single Buoy Moors	-o-	-0-	-0-	-0-	-o-	-o-	NA
Lightering				See Table V-1 2.			
1986 Activity with Normal Tankering							
Without Sale 48							Ventura
Single Buoy Moors (SBM)		0	1	0	0	0	NA
Storage at each SBM (bbl)	150:000	0	B,000	0	0	0	included in processing 2B, LA
Pickup vessel and destination	T, SF		b, LA				
Total average daily tankering (bbl)	1000000	0	3,379	0	0	0	NA
Including Sale 48							Ventura
Single Buoy Moors (SBM)		0	2	0	0	1	NA
Storage at each SBM (bbl)	150:000		8,000 and 6,000	0	0	16,000	included In processing 2B, LA
Pickup vessel and destination	T, SF		b, LA				
Tot. Avg. Dly. Tnkerng. (bbl)	146,000	0	6,379	0	o	8,000	
1986 Activity with 100% Tankering							
Without Sale 48							Los Angeles
Single Buoy Moors (SBM)	‘3	1	1		1	0	
Storage at each SBM (bbl)	150,000	8,000	8,000	100:000	80,000	0	1,4%000 “
Pickup vessel and destination	T, SF 4 B, LA	Vessels from Tanner/Cortez also stop here	b, LA,	T, SF 4 B, LA	8, LA	0	NA
Tot. Avg. Oly. Tnkerng. (bbl)	140,000	2,186	3,379	105,081	39,751	0	290,000
Including Sale 48							Los Angeles
Single Buoy Moors (SBM)		1	1		2		NA
Storage at each SBM (bbl)	120:000	18,000	14,000	120:000	80,000 and 50,000	16:000	2,275,000
Pickup vessel and destination	T, SF 4 B, LA	Vessels from Tanner/Cortez also stop here	b, LA	T. SF 4 B, LA	B, LA	4 b, LA	NA
Tot. Avg. Oly. Tnkerng. (bbl)	292,400	7,186	6,379	240,053	63,751	8,000	454,897

T = 400,000 bbl capacity tanker. 8 = 150,000 bbl capacity barge and a 2000 HP tug.
b = 10,000 bbl capacity barge and a 800HP tug. SF = San Francisco. LA = Los Angeles
NA = Not Applicable

	Fuel Consumption in Gal /Hr		
Vessel	Underway	Load	Unload
Tanker - 400,000 bbl capacity	1155 (27.5 bbl/hr)	420 (10 bbl/hr)	664 (15.8 bbl/hr)
10,000 bbl Barge and 800 HP tug	35	5	25
100,000- 150,000 bbl Barge and 2000 HP tug	75	10	14

TABLE V-12. Tanker/barge loading and unloading rates.

Vessel	Capacity (bbl)	Load Rate	Unload Rate
		(bbl/hr)	
Tanker	250,000	17,860	17,860
Tanker	400,000	20,000	20,000
Barge	10,000	5,000	2,000
Barge	100,000 150,000	15,000	10,000

which occur only when the tank is being filled. Breathing/standing losses depend on the capacity of the storage tank and were calculated by applying the appropriate factor from Table V-6 to the storage capacity data from Table V-10 assuming fixed roof tank at SBM's and floating roof tanks onshore. Working losses were calculated from the average daily tankering of oil as given in Table V-10 on the assumption that this also equals the average daily filling rate of storage tanks. During periods of tanker loading (storage tank emptying), breathing and working losses were assumed to be negligible. The results of these calculations are given in Appendix A under emissions from single buoy moors where they are combined with emissions from processing, which also occurs at the same locations, and are not separately identified. Calculations for onshore emissions are similarly given in the Appendix A tables.

6. Accidents – The scenario as defined by the BLM and discussed in Chapter II specified the consideration of the four following accidents:

- 140 bbl instantaneous spill
- 10,000 bbl instantaneous spill
- 1,000 bbl/day blowout with 1,000 scf of gas per barrel of oil
- the above blowout accompanied by fire

Four locations were specified. The emission factors from Table V-7 were applied to the quantities of oil and gas involved in each accident. The emission rates of each pollutant at each location are summarized in Appendix A.

7. Lightering - Lightening operations were defined by representatives of the Shell Oil Company, Chevron U.S.A. Inc. and the BLM. Shell and Chevron bring to the Pacific Coast an averge of 300,000 bbls/day of crude oil on very largr crude carriers (VLCC). Since local ports are not able to handle these large tankers readily, the oil is offloaded (lightered) into smaller tankers in an area north to northeast of San Clemente Island and southeast of Santa Catalina Island. The arrival frequency of the Shell VLCC is once every four weeks and for the Chevron VLCC's, almost once a week. This scheduling permits two VLCC's to be in the San Clemente area at the same time. A tabular description of the lightening scenario is given in Table V-13.

Emissions associated with lightering arise from fuel burning by VLCC's and lighter vessels, hydrocarbon losses during loading, ballasting and traveling, and from tug assistance during arrival and departure from port. Using the emisison factors from Tables V-3 and V-5 and the data from Table V-13, hourly emission rates were calculated for a 106 hour sequence of events associated with lightening by Chevron and for a 208 hour sequence of events for Shell lightening. These results are given in Appendix A. The following assumptions were made in addition to those listed with Table V-13.

- Tug assistance of 1/2 hour each way is required during arrival and departure from port.

- For vessels without segregated ballast tanks, emission factors for loading are applicable to ballasting.

- For vessels with segregated ballast tanks, ballasting emissions are negligible.

The calculations show that hydrocarbon emission rates are highest during the actual lightering operation, but sulfur oxides and nitrogen oxides emissions are highest during the arrival and departure of the VLCC. Emissions in port are less than those at the offshore lightening locations.

8. Miscellaneous OCS Emissions - Sale 48 activities include the drilling of wells, which has not been discussed previously. Emissions arise from the combustion of diesel fuels to power the drilling engines. Emission factors from EPA AP-42, Table 3.3.3-1 for industrial engines were used. Assuming a fuel consumption of 80 gal/hour per well, Table V-14 was generated which lists drilling emissions on a "per well" basis. Table V-15 summarizes the total yearly well drilling activity, and from this information it was concluded that no more than 1 well per platform would be drilled at any time. Accordingly, emissions from drilling of 1 well were included with other emissions listed in Appendix A for platforms associated with Sale 48.

D. Emissions From Other Proposed Projects

One of the objectives of the overall study is to model the impact of Sale 48 in a scenario that includes other proposed projects as well as those related to OCS developments. It was thus necessary to estimate the emissions from these other projects - LNG terminal, including the two separate potential locations of this facility at Point Conception and Oxnard, SOHIO project, space shuttle, Elk Hills pipeline terminal,

TABLE V- 13. Tanker lightening scenarios (from BLM, 197’7).

	Shell		Chevron	
VLCC Size (DWT)	190,000		212,000 - 272,000 (250,000 Ave)	
Load (bbl)	1,400,000		1,850,000	
Average Offload (bbl /day)	50,000		250,000	
Arrival Frequency	28 days.		7.5 days	
Location	118.0°W, 33.0°N		118° 13’ W, 33° 10' N	
Fuel Consumption (bbl /day)				
At Sea	915		960	
Loading	320		320	
Discharge	530		565	
Lighter Tankers				
No - DWT	1 - 49%000		1 - 66,000	2 - 80,000
Bbl transported	350,000		370,000	555,000
Delivery Sequence	Destination	Bbl/Load	Destination	Bbl/Load
1	Wilmington	350,000	El Segundo	370=000
2	Wilmington	350,000	Richmond	555,000
3	Martinez	350,000	Richmond	555,000
4	Washington	350,000	El Segundo	370,000
Ful 1 Consumption (bbl/day)				
At Sea	660		660	
Loading	240		240	
Discharge	360		380	
Lighter Tankers				
Times Assumed For:				
Tanker Loading (hrs)	20		20	
Local Round Trip (hrs)	16		16	
Discharge (hrs)	24		24	
Overall Local Round Trip (hrs)	60		60	
Round Trip to Bay Area, Ca.	7 days		7 days	
Round Trip to Anacortes, Wa.	sufficient		N.A.	

Ballast - VLCCs and Chevron tankers are not segregated
- VLCC, assume 20% of crude volume unloaded taken on as ballast
- Chevron tanker, assume 15% of capacity taken on as ballast into crude oil tanks

Fuel - VLCC, assume 2.5% S in fuel.
- Local tankers, 1.0% S in fuel.

TABLE V-14. Emission factors for well drilling (derived from EPA, AP-42).

Pollutant	kg/hr per well
HC	1.4
NO_x	17.0
CO	3.7
SO_2	1.0
TSP	1.2

TABLE V-15. Number of wells drilled during 1986 for Sale 48 (from BLM, 1977).

Area	No, of Platforms	No. of Wells Drilled	Wells per Platform
Santa Barbara Channel	7	39(4)*	6
Santa Rosa Island	1	5	5
Santa Barbara Island	1	5	5
Tanner/Cortez	9	50(3)*	6
San Pedro	3	18(3)*	7
Dana Point - San Diego	3	18(4)*	7

*Number of subsea completions by drill ships (not included in number of wells drilled) and Vaca Tar Sands thermal oil recovery – to provide input to the modeling effort. To the extent possible, emissions were taken directly from EIS's and related documents. Calculations were limited to changing the units in which the emissions were expressed and supplying routine calculations to correct obvious omissions in published reports. The one exception was the Vaca Tar Sands project which is in the preliminary planning stages and has no EIS that describes the project. A detailed calculation was done by PES for this facility.

1. LNG Terminals - Emissions estimates for the trim heaters and vaporizers for use at Point Conception and Oxnard, and the seawater heater at the Oxnard locations were obtained from Reference Documents (UCLA, 1976; Dames and Moore, 1974a, Volume 111). Peak NO_x emissions from the seawater heater at Oxnard were given as 88 gm/sec which converts to 317 kg/hour. This value is inconsistent with similar emission estimates for other proposed units. PES assumed that the value was a typographical error and that the correct value was 8.8 gm/sec (31.7 kg/hour). The estimated emission rates from LNG terminals are given in Table V-16. These values compare favorably with estimates made by the Ventura County Air Pollution Control District (1977).

Hydrocarbon emissions from storage tanks were estimated by applying emission equations from Compilation of Air Pollutant Emission Factors, Second Edition, EPA Document AP-42 to tanks described in the Dames and Moore EIR's (1974a, Volumes II and III). The calculations associated with these emission estimates are shown in Appendix E.

2. SOHIO Project - Emissions for the SOHIO project were obtained from two sources for 700,000 bb/day delivery of crude oil. The EIR (Long Beach, 1977) gives average emissions at the port and a CARB (1977) report gave total emissions occurring south of Point Conception. These values are given in kg/hour in Table V-17.

3* Space Shuttle - Each launching of a space shuttle will involve the ignition of a solid propellant rocket booster (SRB) as well as the orbiter main engines. In a normal launch, a "ground cloud" of exhaust products is formed at the base of the launch platform. This cloud includes hot exhaust products from the SRB's, the main liquid propulsion engines, steam from launch platform cooling and acoustic damping water injection, and some sand and dust drawn into the cloud from the platform area. Because of the high temperature of the gas cloud, buoyancy effects cause it to rise to an altitude of 0.7 to 3 km (0.4 to 1,8 miles) where it stabilizes because of the cooling of the gases.

TABLE V-16. Estimated LNG emissions.

LNG TERMINAL EMISSIONS (UNLOADING FACILITY) AT PEAK OPERATION

Operation	NO_2(kg/hr)	SO_2(kg/hr)	HC(kg/hr)
Oxnard			
Storage Tanks	-		1.13
Trim Heaters	10.4	0.31	
Vaporizers	45.36	1.8	
Seawater Heater	31.7 (corrected)	1.17	
Total	87.46	3.28	1.13
Point Conception			
Storage Tanks			1.13
Trim Heaters	27.18	0.9	-
Peaking Vaporizers	45.36	1.8	
Total	72.54	2.7	1.13

TABLE V-17. Estimated SOHIO Project emissions (700,000 bbl/day delivery)

	(kg/hr)				
At terminal*	THC	SO_2	NO_x	co	TSP
TOTAL	41	45	26	1.5	4.4
Storage tank	38.'2	0	0	0	0
Fugitive	1.3	0	0.15	0.92	0
Tanker exhaust	0.83	21.5	11.3	0.16	1.96
Tanker fueling	0.04	0	0	0	0
Tugboat	0.07	0.21	3.1	0.46	0.14
Electricity generation	0.88	23.5	11.2	Neg.	2.3
Total emissions south of Point Conception (most probable case)**					
	1525	420	147	Not Given	21

*Long Beach, 1977

**CARB, 1977

Combustion products are released into various layers of the atmosphere as the vehicle gains altitude during launch. Table V-18 shows the amounts of combustion products (NASA, 1977) released to the surface boundary layer (O to 500 m). These estimates take into account the ground cloud effect and afterburning within the rocket plume which converts large quantities of emitted CO to CO_2.

4. Elk Hills Pipeline Terminal - It is to be assumed that 250,000 bbl of oil per day will be pipelined to Port Hueneme, and oil will be loaded into tankers for subsequent transport to Los Angeles or San Francisco. Data presented in the Elk Hills EIS (URS Company, 1977) were used to estimate the emissions in Table V-19.

5. Vaca Tar Sands - Vaca Tar Sands recovery project, according to BLM assumptions, will be producing a total of 22,329 bbls per day of oil in 1986 through 460 wells. Oil recovery will be facilitated by injecting steam into the wells to make it possible to pump this very viscous crude. Most of the emissions result from the combustion of fuel to generate steam. Indications from test wells in "better areas" are that 1 bbl of oil should be recoverable with 1 bbl of steam (1 bbl of liquid water converted to steam) at a pumping rate of 10 bbl/day per well (Husky, 1977). A representative of the Chase Refinery at Oxnard estimates a value of 4-5 bbls of steam per bbl of oil. For the higher pumping rates of almost 50 bbls per day per well, 5 bbls of steam per barrel of oil will be assumed as worst case.

Fuel for steam generation can range from natural gas to other (not Vaca Tar Sands) available Ventura crude mixed with diesel such that effective emissions of SO_2 would not exceed that of fuel containing 0.5% S.

Other assumptions:

- 350,000 BTU required per barrel of steam
- steam generator operates at 80% thermal efficiency
- heating value for natural gas = 1050 BTU/scf
- heating value for residual oil .150,000 BTU/gal
- AP-42 Table 3.2.3-2 emission factor for industrial external combustion applicable
- on-site dilution of recovered crude and piping to refinery (Union, 1977)

TABLE V-18. Exhaust products emitted per launch by the space shuttle vehicle into the surface boundary layer. (NASA, 1977).

Exhaust	Quantity (kg)
Hydrogen Chloride	20,324
Chlorine	2,312
Nitric Oxide	1,446
Carbon Monoxide	75
Carbon Dioxide	44,216
Water	70,138
Particulate (aluminum oxide)	32,334

TABLE V-19. Estimated emissions from Elk Hills (kg/hr).

Source	THC*	RHC	SO_2	CO	TSP	NO_x
Tank farm (fugitive)	23.0	6.9	0	0	0	0
Tanker loading (fugitive)	377	113**	0	0	0	0
Ship exhaust	0.3	0.3**	2.8	Neg.	0.3	0.5
Tugboat exhaust	not given		1.2	5.0	0.95	not given
Power station	not given		21.8	not given	2.3	29,0

*Calculated using factors from EIS (URS Company)

**Values in EIS corrected

- additional combustion requirements on-site are negligible
- fugitive emission factors for seals, valves, flanges, wastewater separation for oil production/refining assumed applicable (Table V-2)

Conclusions:

- bbl H_2O required

  5 x 22,329 = 111,645 bbls/day

- BTU required/hr $\frac{(350,000)(111,645)}{(0.8)\ (24)} = 2.035 \times 10^9$ BTU/hr

- Fuel required

  natural gas $\frac{2.035 \times 10^9}{1050} = 1.94 \times 10^6$ scf/hr

or

  residual oil $\frac{2.035 \times 10^9}{150,000} = 13.6 \times 10^3$ gal/hr

Applying AP-42 Table 3.2.3-2 emission factors for combustion, the resultant emission rates given in Table V-20 were obtained.

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TABLE V-20. Vaca Tar Sands emission rates (kg/hr).

Source	THC	NO_x	SO_2	CO	Particulate
Natural gas combustion	2.6	154	0,5	15,0	8.8
Residual oil combustion	18,5	370	490	24,7	142
Fugitive	14.3	0	0	0	0

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VI. MODELING OF INERT POLLUTANTS

A. Description of Models

The pollutants, TSP, SO_2, NO_2 and H_2S are modeled as inert pollutants. The concentrations due to inert pollutants were determined using several EPA developed computer models, namely PTMAX, PTMTP, and CDM. A pollutant is inert if its concentration does not change significantly by atmospheric chemical reactions. These pollutants behave in this manner except for NO_2. Although NO_2 is involved in the photochemical "smog" reactions, it is modeled as an inert pollutant to determine impact. Impacts from photochemically derived pollutants, like O_3, are determined using a different and are addressed in Chapter VI. A brief description of these models and their assumptions follows:

1. Point/Maximum (PTMAX) - PTMAX is used to determine both the maximum concentration and the distance to maximum concentration for a point emission source. The computations are performed according to the techniques presented in the Workbook of Atmospheric Dispersion Estimates (Turner, 1970). For a set of wind speed and stability conditions, the plume rise is calculated using the equations of Briggs (1975). This plume rise is added to the physical stack height to determine the effective height of emission. The model assumptions are:

- A steady-state Gaussian plume model is applicable to determine ground-level concentrations,
- The parameter values used for the horizontal dispersion coefficient, σ_y, and the vertical dispersion coefficient, u_z are those given in Figures 3-2 and 3-3 of the Turner Workbook,
- The stated wind speed occurs at the stack top and applies for the plume rise and plume dilution,
- The stated stability occurs throughout the mixing layer. If there is a limit to vertical mixing, it occurs far enough above the top of the plume so that it has no influence upon the maximum concentration,

0 There are no topographic obstructions in the vicinity of the source, i.e., the source is located in either flat or gently rolling terrain.

PTMAX is applicable to situations where single sources exist in relatively uniform flat terrain. It is not applicable if aerodynamic downwash around buildings in the vicinity of the source can affect the plume emitted from the stack. This program is useful in determining that combination of wind speed and stability which produces maximum concentrations. Also, the critical wind speed, i.e., the wind speed that causes the maximum concentration, can be determined for a given stability. Thus, this program was used to derive worst-case meteorological conditions for assessing short-term air quality impacts using the model PTMTP.

2. Point/Multiple Point (PTMTP) - PTMTP produces hourly concentrations at up to 30 receptors whose locations are specified from up to 25 point sources. The AeroVironment version has been modified to accept considerably more sources and receptors. A Gaussian plume model is used. Inputs to the program consist of the number of sources to be considered, and for each source the emission rate, physical height, stack gas temperature volume flow, or stack gas velocity and diameter, and the location, in coordinates. The number of receptors, the coordinates of each and the height above ground of each receptor are also required. Concentrations for a number of hours up to 24 can be estimated, and an average concentration over this time period is calculated. For each hour the meteorological information required is wind direction? wind speed, stability class, mixing height, and ambient air temperature. The model assumptions are the same as stated for PTMAX.

Calculations for each hour are made by considering each source-receptor pair. Plume rise is calculated according to Briggs' plume rise estimates. For each source-receptor pair, the downwind and crosswind distances are determined. If the downwind distance is closer than the distance to final rise, the plume rise for this distance is calculated. The concentration from this source upon this receptor is determined using these distances by the Gaussian model.

3. Climatological Dispersion Model (CDM) - The Climatological Dispersion Model (CDM) calculates long term (seasonal or annual) concentrations for quasi-stable pollutants at an array of ground-level receptors. Average emission rates from point and area sources

along with the joint frequency distribution of wind direction, wind speed, and stability for the same period are the basic inputs to the model. In this analysis only point sources were considered. The model employs Brigg's plume rise formulae, and uses a power law increase in wind speed with height as a function of atmospheric stability after the method of DeMarrais (1959). An AeroVironment modified version of the model was used for calculating the annual averages of total suspended particulate matter (TSP). This version forms the annual geometric mean to allow comparison with the ambient air quality standards, but is identical to CDM in all other respects.

B. Model Inputs

To use the models described in the previous section it was necessary to decide what meteorological conditions would produce the most realistic estimate of' impacts for all sources and regions under consideration and to select the proper meteorology for each region. The regions considered are identified in Figure VI-1. Three separate regions were analyzed because of differing meteorological influences. Regions I & 11 are significantly influenced by the land/ocean airflow while region 111 is far enough away from the coast that the synoptic influences dominate. Although the onshore boundaries of Regions I and II are shown in Figure VI-1 to be generally at the coastal mountains, the modeling actually encompassed the whole study area. The inert pollutant impacts farther inland were found to be essentially nonexistent, thus detailed analyses were not carried out there and will not be discussed here.

It was also necessary to determine the effect of deviations from the model assumptions, viz, how realistic were Pasquill-Gifford dispersion algorithms for plume passage over water.

1. Meteorology - In order to define the meteorology for use with PTMTP, sources were selected for each inert pollutant (SO_2, CO, TSP, NO_x) as representative sources in each of Regions I, 11, 111. These sources include platforms, single buoy moors, and gas processing and oil processing facilities. Each of these cases was run on the PTMAX program to determine the meteorological condition which produced the maximum center line concentration and the location of the concentration. Meteorology was then identified which produced maximum concentrations for each source type. An interesting

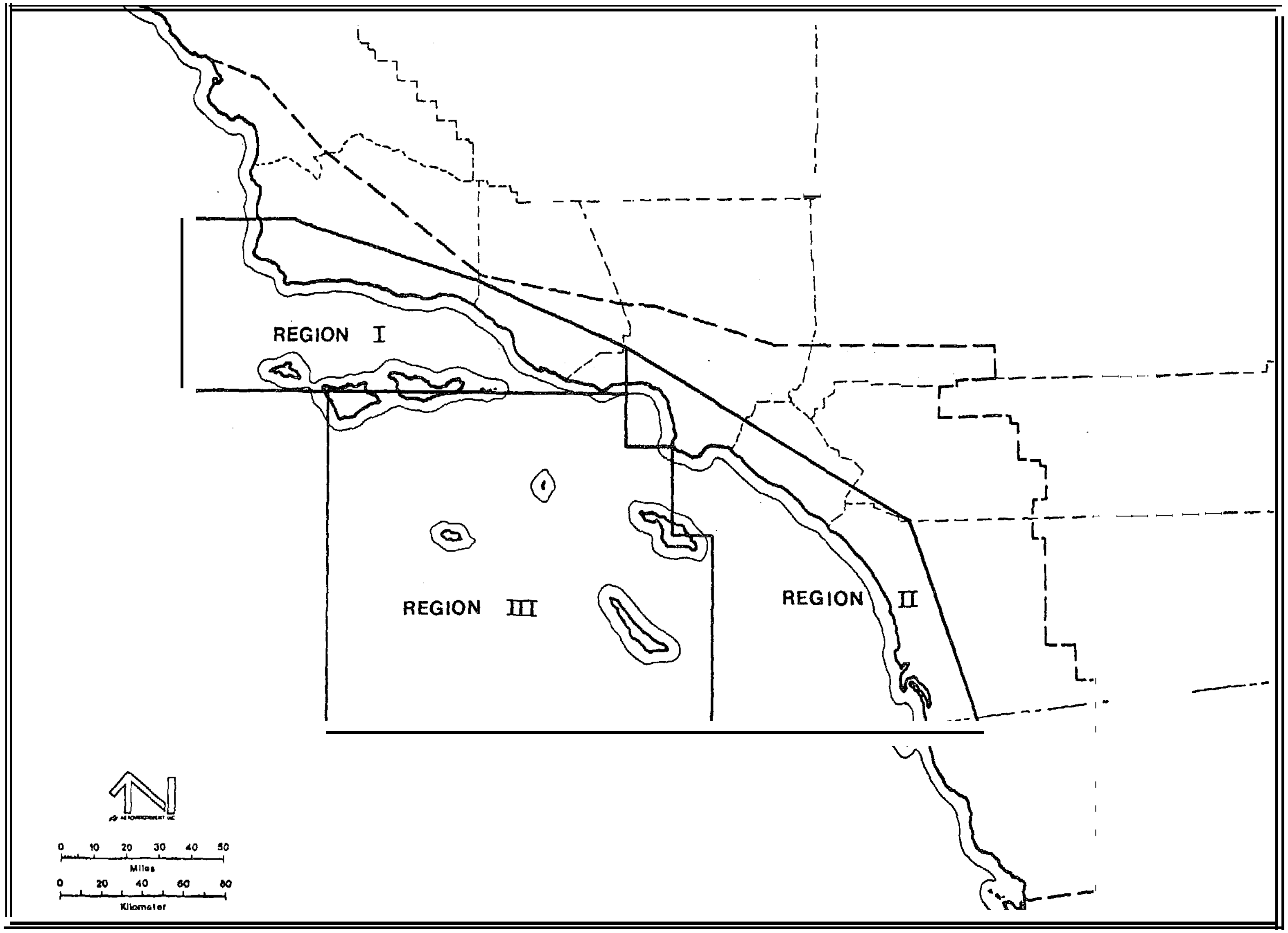

FIGURE VI-1. Map showing region delineation for regional analysis.

conclusion of this study was that the worst case meteorology is a function of the buoyancy flux and that no single meteorological condition produces the worst concentrations for all sources. The results can be summarized roughly as follows.

For small buoyancy flux sources such as offshore platforms and small single buoy moors (typical of sale 48), the maximum plume center line concentration occurs under neutral to unstable thermal conditions and very low wind speeds. For low to intermediate buoyancy flux, such as at larger SBM's, the maximum concentrations occur under neutral to unstable conditions and moderate wind speeds. For large buoyancy fluxes, such as occur at onshore processing plants, the worst conditions occur under very low wind speeds and stable conditions. However, under these conditions, the distance of travel from the source to the point of maximum concentration as predicted by PTMAX is so large that the stable condition would probably not persist long enough for the plume to traverse that range. For both the low and intermediate buoyancy fluxes the maximum center line concentration under stable conditions was lower than in the neutral cases but the lower concentration persisted over a greater range and the flatter distribution caused the concentration for the stable cases to exceed that for the neutral cases at longer ranges.

Due to the indication that the persistence of stable meteorology might be unrealistic for larger buoyancy cases, the meteorology for the combined sources was selected to be of low wind speed and neutral stability. This meteorology is representative of the Southern California shoreline situation, especially for overcast periods, and represents conditions which would allow the pollutants to pass over coastal hills and spread into inland valleys, producing realistic impact situations with maximum concentrations at moderate ranges from the sources. The wind direction for offshore sources was always selected to produce the shortest path to the shoreline for Regions I & 11. Region III is considered to be far enough from shore to be dominated by the usual offshore flow, which is generally parallel to the coastline, and does not impact on the mainland coast. Table VI- 1 lists the meteorology selected for inert pollutant modeling of the three regions. Appendix B discusses meteorological input to modeling in more detail.

A sensitivity analysis was performed to determine the effect of increasing the stability and to estimate the effect this would have on the modeling study conclusions. Typical worst cases were rerun with stable meteorology and are presented in the results section. For annual averages, the meteorology was determined using joint frequency distributions which were obtained locally for the region from STAR (Stability Array) data.

TABLE VI- 1. Worst case meteorological conditions used in modeling inert (see Appendix B)

	Wind Direction	Wind Speed (m/s	Stability Class	Mixing Height (m)
Region 1	210°	.5	4*	580
Region 11	215°	.6	4	580
Region III	300°	.5	4	580

* Neutral stability defined by Pasquil-Gifford stability class designation (Turner, 1970)

2. Emission - All sources modeled were assumed to be point sources. Stack characteristics of these sources are presented in Appendix B while their emission rates are given in Appendix A.

In this study, four different types of accidents were investigated, namely, small spill, large spill, blowout without fire and blowout with fire. Since oil spills do not result in the release of inert pollutants, modeling was only performed to assess photochemical pollutant impacts using REM2, as described in the next chapter. For the case of blowout without fire, H_2S would be the only inert pollutant being released and, thus, downwind H_2S concentrations were calculated. For the case of blowout with fire, $N0_2$, CO, $S0_2$ and TSP would be emitted and were modeled . Emission rates of pollutants emitted during accidents are also listed in Appendix A.

3. Dispersion Algorithms (Sigmas) - The EPA models discussed in Section A employ the Pasquill-Gifford dispersion algorithms in estimating concentrations. These algorithms were developed for non-buoyant plumes in smooth terrain. For buoyant plumes over land these algorithms generally produce conservative estimates of pollution levels (give predictions that are higher than measurements). Over water, however, studies such as Raynor et al (1975) indicate that the algorithms produce results that are too optimistic. Raynor indicate that there is less turbulence and less mixing over water.

Thus, in order to approximate the results of Raynor, the values of σ_Y and σ_z were reduced" by a factor of two and concentrations were calculated for a typical offshore source (gas turbine). Figure VI-2 shows a comparison of Plume centerline concentrations for the Pasquill-Gifford sigma values and for these the values reduced by a factor of two. For the reduced σ_y and σ_z the peak is reduced by about 25% and is shifted from 2.5 to 7km. However, the reduced sigma peak is much broader and beyond 5 km the concentrations are higher than the usual Pasquill-Gifford sigmas by approximately a factor of two. Similar results can be noted in Figure VI-3 when the maximum case produced by PTMAX was selected from the slightly stable category.

For plume trajectories which pass over water onto land, it is unrealistic to assume that this extreme sigma condition will persist for any significant distance inland. Onshore flow usually occurs during the day time when upflows due to solar heating over the land draw sea breezes inland. The reduced sigma condition should thus rapidly diminish upon

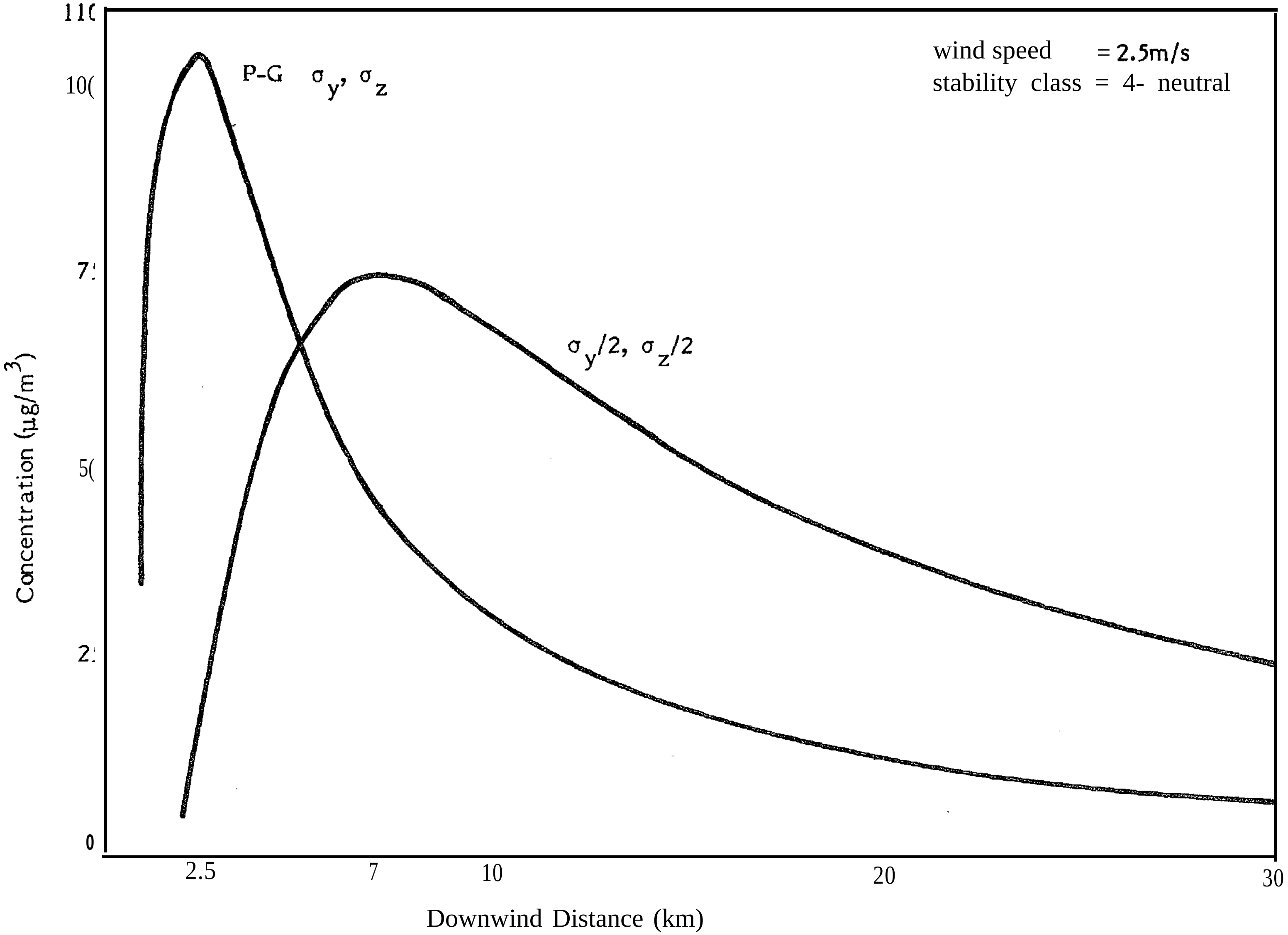

FIGURE VI-2. Comparison of impacts of a source in neutral stability for Pasquill Gifford σ_y and σ_z and for a case with the sigmas halved (diffusion reduced).

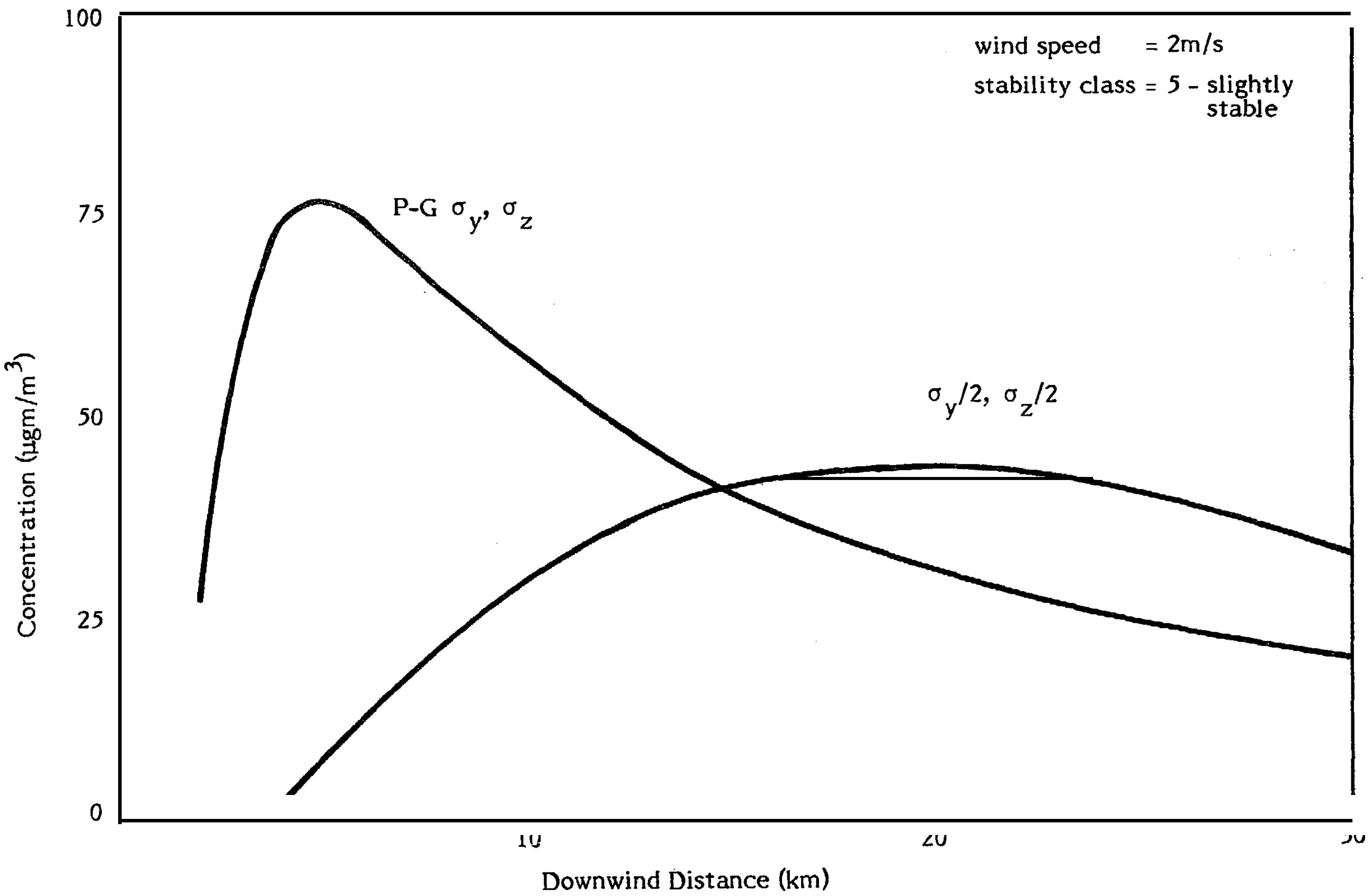

FIGURE VI-3. Comparison of impacts of a source in slightly stable conditions for Pasquill Gifford σ_y and σ_z and for these sigmas halved. The source modeled is the same one as in Figure VI-2.

reaching the coastline. For onshore sources the usual sigmas should result in the normal conservative predictions. For this study several of the onshore sources (processing plants etc.) dominate the emissions inventory and use of the EPA models should be conservative, when considering all sources combined.

4. Background Concentrations - Worst-case background concentrations in 1986 were determined by scaling maximum concentrations in 1975 by the ratio of 1986 emissions to 1975 emissions. Then, isopleths of worst-case background over the study area were obtained to allow interpolation at any point for which impact was to be determined. These isopleth plots and a more detailed discussion of background computation methodology are presented in Appendix B.

5. Philosophy - The approach used in this study was to first consider the impacts of all scenarios using the EPA models, and then, by adding in background to determine which cases showed impacts approaching or exceeding the ambient air quality standards. This combination of largest OCS impact with worst case background concentrations was used to determine a conservative worst case situation. Those cases which showed impacts far below the ambient air quality standards and which had no chance of approaching the standards, even if changes were made to the dispersion parameters were eliminated from further consideration. The remaining cases were examined in more detail to determine if model assumptions were realistic and to identify which sources were causing exceedances. The results of these analyses are presented in the following sections.

c. Model Results

1. Regional Impacts - As a first approach, all the scenarios were run using the PTMTP model to identify the peak concentrations. Table VI-2 lists all the scenarios considered and the maximum concentrations encountered. The scenario nomenclature is defined in Table VI-3. A cursory examination of this table will identify those cases which have little impact and do not need further detailed consideration. Those cases with peak concentrations approaching or exceeding standards are indicated with an asterisk (*) and were considered in more detail.

TABLE VI-2. Peak regional l-hour average concentrations.

Pollutant	Region	Scenario [a]	Maximum Cone.	Maximum Located > 3 mi. Offshore	Bkgnd. Cone. at Maximum	Total[b]
CO (ppm)	I	N48	< 0.1		4	4.0
		N48 + 48	< 0.1	Yes	4	4.0
		N48 + 48 + Other	0.1		5	5.1
		N48 + 48 + Acc	0.3	Yes	4	4.3
		N48T	< 0.1	Yes	4	4.0
		N48T + 48T	< 0.1	Yes	4	4.0
		N48T + 48T + Other	< 0.1		5	5.0
		N48T + 48T + Acc	0.3	Yes	4	4.3
	11	N48	< 0.1	Yes	4	4.0
		N48 + 48	< 0.1	Yes	4	4.0
		N48 + 48 + Other	< 0.1	Yes	4	4.0
		N48 + 48 + Acc at SD/Dana	1.3	Yes	4	5.3
		N48 + 48 + Acc at San Pedro	0.7		10	10.7*
		N48T	< 0.1	Yes	4	4.0
		N48T + 48T	< 0.1	Yes	4	4.0
		N48 T + 48T + Other	< 0.1	Yes	4	4.0
		N48T + 48T + Acc at SD/Dana	1.3	Yes	4	5.3
		N48 + 48T + Acc at San Pedro	0.7		10	10.7*
	III	N48	< 0.1	Yes	4	4.0
		N48 + 48	< 0.1	Yes	4	4.0
		N48 + 48 + Acc	0.6	Yes	4	4.6
		N48T	< 0.1	Yes	4	4.0
		N48T + 48T	< 0.1	Yes	4	4.0
		N48T + 48T + Acc	0.6	Yes	4	4.6

TABLE VI-2. (Continued)

Pollutant	Region	Scenario[a]	Maximum Cone.	Maximum Located >3 mi. Offshore	Bkgnd. Cone. at Maximum	Total[b]
TSP ($\mu g/m^3$)	I	N48	12	Yes	50	62
		N48 + 48	12	Yes	50	62
		N48 + 48 + Other	417		190	607*
		N48 + 48 + Acc	63	Yes	50	113*
		N48T	14	Yes	50	64
		N48T + 48T	14	Yes	50	64
		N48T + 58T + Other	417		190	607*
		N48T + 48T + Acc	63	Yes	50	113*
	II	N48	2	Yes	120	122*
		N48 + 48	12	Yes	130	142*
		N48 + 48 + Other	12	Yes	130	142*
		N48 + 48 + Acc at SD/Dana	283	Yes	100	383*
		N48 + 48 + Acc at San Pedro	145		160	305*
		N48T	2	Yes	120	122*
		N48T + 48T	15	Yes	130	145*
		N48T + 48T + Other	15	Yes	130	145*
		N48T + 48T + Acc at SD/Dana	283	Yes	100	383
		N48T + 48T + Acc at San Pedro	145		160	305*
	III	N48	5	Yes	50	55
		N48 + 48	10	Yes	50	60
		N48 + 48 + Acc	91	Yes	50	141*
		N48T	7	Yes	50	57
		N48T + 48T	34	Yes	50	84
		N48T + 48T + Acc	91	Yes	50	141*

TABLE VI-2 . (Continued)

Pollutant	Region	Scenario [a]	Maximum Conc.	Maximum Located >3 mi. Offshore	Bkgnd. Cone. at Maximum	Total[b]
SO_2 (ppm)	I	N48	0.01	Yes	.02	.03
		N48 + 48	0.01	Yes	.02	.03
		N48 + 48 + Other	0.55		.03	.58 *
		N48 + 48 + Acc	0.08	Yes	.02	.10
		N48T	0.01	Yes	.02	.03
		N48T + 48T	0.18	Yes	.02	.20
		N48T + 48T + Other	0.55”		.03	,58 *
		N48T + 48T + Acc	0.18	Yes	.02	.20
	11	N48	<0.01		.23	.23
		N48 + 48	0.01	Yes	.08	.09
		N48 + 48 + Other	0.01	Yes	.08	.09
		N48 + 48 + Acc at SD/Dana	0.34	Yes	.08	.42*
		N48 + 48 + Acc at San Pedro	0.15	Yes	.12	.27
		N48T	<0.01		.23	.23
		N48T + 48T	0.01	Yes	.08	.09
		N48T + 48T + Other	0.01	Yes	.08	.09
		N48T + 48T + Acc at SD/Dana	0.34	Yes	.08	.42*
		N48T + 48T + Acc at San Pedro	0.17	Yes	.12	.29
	III	N48	<0.01	Yes	.02	.02
		N48 + 48	<0.01	Yes	.02	.02
		N48 + 48 + Acc	0.19	Yes	.02	.21
		N48T	<0.01	Yes	.02	.02
		N48T + 48T	0.22	Yes	.02	.24
		N48T + 48T + Acc	0.23	Yes	.02	.25

TABLE VI-2. (continued)

Pollutant	Region	Scenario [a]	Maximum Cone.	Maximum Located >3 mi. Offshore	Bkgnd. Cone. at Maximum	Total[b]
NO_2 (ppm)	I	N48	0.37		.10	.47 *
		N48 + 48	0.56		.10	.66 *
		N48 + 48 + Other	0.56		.10	.66 *
		N48 + 48 + Acc	0.56		.10	.66 *
		N48	0.03	Yes	.02	.05
		N48T + 48T	0.05	Yes	.02	.07
		N48T + 48T + Other	0.52		.08	.60 *
		N48T + 48T + Acc	0.06	Yes	.02	.08
	11	N48	0.01		.30	.31 *
		N48 + 48	0.06	Yes	.18	.23 *
		N48 + 48 + Other	0.06	Yes	.18	.24 *
		N48 + 48 + Acc at SD/Dana	0.07	Yes	.02	.09
		N48 + 48 + ‘Ace at San Pedro	0.07	Yes	.18	.25 *
		N48T	0.01		.30	.31 *
		N48T + 48T	0.06	Yes	.18	.24 *
		N48T + 48T + Other	0.09	Yes	.18	.29 *
		N48T + 48T + Acc at SD/Dana	0.08	Yes	.02	.10
		N48T + 48T + Acc at San Pedro	0.08	Yes	.12	.20
	111	N48	0.01	Yes	.02	.03
		N48 + 48	0.04	Yes	.02	.06
		N48 + 48 + Acc	0.04	Yes	.02	.06
		N48T	0.02	Yes	.02	.04
		N48T + 48T	0.06	Yes	.02	.08
		N48T + 48T + Acc	0.07	Yes	.02	.09

TABLE vi-2. (Concluded)

Pollutant	Region	Scenario[a]	Maximum Cone.	Maximum Located >3 mi. Offshore	Bkgnd. Cone. at Maximum	Total[b]
H_2S	I	N48	0.004	no	0.0	.004
		N48 + 48	0.004	no	0.0	.004
		N48 + 48 + Acc	0.10	yes	0.0	0.10 *
		N48T	0.002	no	0.0	0.002
		N48T + 48T	0.002	no	0.0	0.002
		N48T + 48T + Acc	0.10	yes	0.0	0.10 *

[a] See Table VI-3 for nomenclature.

[b] Values identified with an * are discussed in more detail in the text.

TABLE VI-3. Explanation of symbols used in the previous table.

Symbol	Definition
N48	Base level – includes changes in existing and Sale 35 oil and gas development activities; assumes normal tankering of oil and gas.
N48T	Base level - includes changes in existing and Sale 35 oil and gas development activities; assumes 100% tankering of oil and gas.
48	Sale 48 – assumes normal tankering of oil and gas “““
48T	Sale 48 – assumes 100% tankering of oil and gas.
Acc	Accidents - two types are analyzed: blowout without fire and blowout with fire.
Other	Other proposed actions: 1) In Region I, two sets of other proposed actions are studied. The first set includes the Space Shuttle Program, the LNG terminal at Point Conception, the Vaca Tar Sands Project and the Elk Hills Project. The second set assumes that the LNG Terminal would be at Oxnard instead of at Point Conception. 2) In Region H, the other proposed action is the SOHIO Project. 3) There are no other proposed actions in Region HI.

a. CO

As shown in Table VI-2, CO impact from Sale 48 is insignificant for both normal and 100% tankering scenarios. For Regions I & III the maximum background CO concentration at the maximum impact location for all scenarios with normal or 100% tankering is 5 ppm and less. With the maximum impact from the scenarios of less than 1 ppm, the resulting maximum concentrations are well under the Federal l-hour standard of 35 ppm, and under the 8-hour standard of 10 ppm, In Region 11, the l-hour background CO concentration at the location of maximum impact in the San Pedro area is 10 ppm. The corresponding 8-hour background, however, is only 7 ppm. Adding the impact from the accident scenario of 0.7 ppm to these backgrounds still results in concentrations that are within the ambient air quality standards.

b. TSP

The ambient air quality standards for TSP include one for a 24 hour period as well as an annual geometric mean standard. Although no hourly TSP standard is listed for California or nationally, TSP was initially analyzed in this study for an hourly average to test the severity of the TSP problem. Any scenario which is below the 24-hour standards during the worst-case hour will surely satisfy 24-hour requirements, since the varied 24-hour meteorology will reduce the concentrations in any given direction. Cases which indicated high hourly values were examined more closely and reanalyzed if required on a 24-hour basis and annual basis to determine if standards were actually violated.

For Region I the peak impact of Sale 48 occurs beyond 3 miles from shore. The background TSP concentration is 50 $\mu g/m^3$ at the maximum impact location. The maximum impact from base level plus Sale 48 with normal tankering is 12 $\mu g/m^3$ for 1 hour average. Thus, the sum is 62 $\mu g/m^3$-- well below the California 24-hour standard of 100 $\mu g/m^3$. The two cases which have larger impacts and background concentrations are the combination of base level, Sale 48 and other major projects with normal and 100% tankering. Figure Vi-4 is an isopleth plot of the worst-case TSP impacts in Region I for Sale 48 with normal tankering plus other major projects, not including background. The plus signs on the plot indicate the coastline and channel islands. The maximum isopleths are located in the Ventura area in the vicinity of the Vaca Tar Sands Project. For both cases, the 24-hour average was determined to be about 83 $\mu g/m^3$ with maximum 24-hour

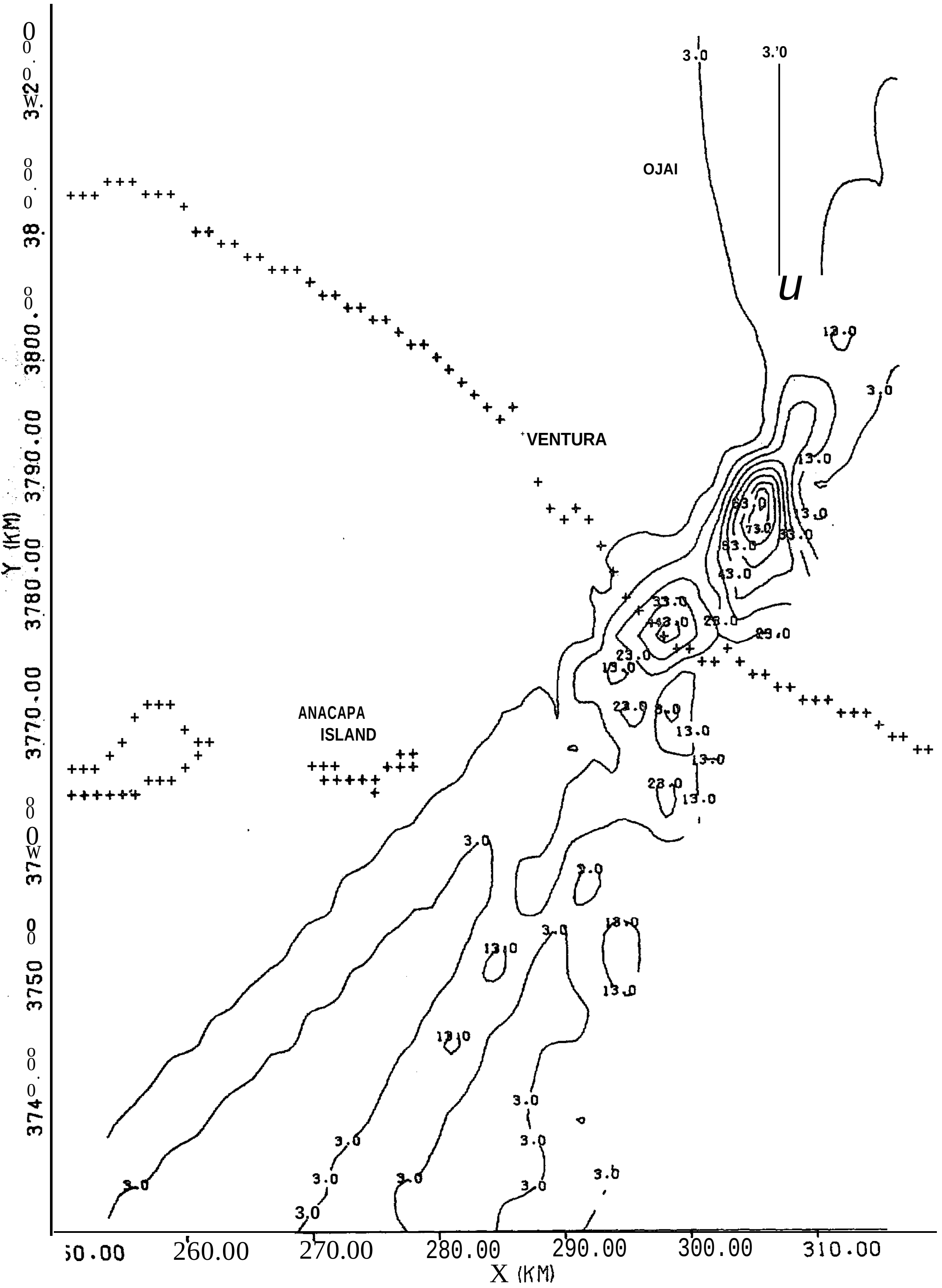

FIGURE VI-4. Above-background 24-hour TSP impacts in Region I from the combination base level and Sale 48 activities with normal tankering and other proposed projects.

background value of 190 µg/m^3 there. Thus the expected 24-hour maximum concentration is expected to total 273 µg/m 3. However, the contribution from Sale 48 to this total is insignificant (<1 µg/m^3).

Region II has maximum 24-hour and annual geometric mean background TSP concentrations above the respective standards even beyond 3 miles from shore. Thus, several scenarios which indicated high concentrations in Table vI-3 were analyzed to determine 24-hour and annual averages. The maximum 24-hour impact above background from normal operations associated with Sale 48 is about 3 µg/m^3 for normal tankering and 4 µg/m^3 for 100% tankering located beyond 3 miles from shore. The maximum l-hour impact in Region II from the various scenarios is under the accident scenarios, which results in 145 to 283 µg/m^3 maximum concentration above background. These result, adding background values, in concentrations of 305 to 383 µg/m^3. Because the accident is the major TSP emission source, there is no difference in the maximum impact between normal and 100% tankering. The maximum regional 24-hour impact of the accident value was 33 µg/m^3. Thus, with maximum 24-hour background, the accident located in San Pedro could result in a 24-hour TSP concentration of 193 µg/m^3.

In Region 111 the impacts are all located well out to sea. The accident scenario was the only one resulting in l-hour average TSP concentrations above the state standard of 100 µg/m^3. The 24-hour average impact from the accident scenario is 33 µg/m^3 plus the maximum TSP background of 50 µg/m^3 yielding 83 µg/m^3. All other TSP scenarios were so far below 24 hour standards (on an hourly basis) that they were eliminated from further consideration.

c. $\underline{SO_2}$

‘or ’02 , the combined cases of Sale 48 with normal or 100% tankering plus the other major projects result in the only predicted exceedances of the state l-hour standard of 0.5 ppm, although the accident cases in Region II approach the standard. When Sale 48 was analyzed without the other major projects, the maximum impacts were located well offshore and were insignificant for normal tankering (.03 ppm including maximum background of .02ppm) and were .20 ppm for 100% tankering including .02 pprn for background. Region I was considered in more detail to determine the location of the problems for the combined cases.

The predicted impact of the combined case of Sale 48 and other major projects with normal tankering is shown in Figure VI-5. The impact in the Ventura area exceeds the hourly standard and reaches the 0.55 ppm level. The major impacts are caused by the other major projects included in the analysis – mainly Elk Hills and Vaca Tar Sands. The impacts from Sale 48 are insignificant (<.01 ppm). Figure VI-6 represents the results for this case for a 24-hour averaging time.. The maximum predicted concentration for 24 hours was 0.12 ppm, which exceeds the California standards.

Annual average concentrations were determined using the CDM program. The SO_2 annual average without background is shown in Figure VI-7. The maximum SO_2 concentration is approximately 0.01 ppm. Background concentrations at this location are 0.01 ppm which results in a total of 0.02 ppm, which is about two thirds of the Federal annual average standard of 0.03 ppm. The accident cases for Region 11 approach the standard. The accident impacts are further discussed below in the discussion of impacts of specific sources.

d. NO_2

For NO_2, the conservative assumption that all NO_x emissions are NO_2 was used in this analysis. This assumption results in overprediction of the actual NO_2 values to be expected. The $N0_2$ modeling results, in Table VI-2, show that all normal tankering cases for Region I, including the base level case, exceed the state l-hour standard. For 100% tankering, however, only the combined case of Sale 48 plus other major projects exceeds the standard.

Figures IV-8 through IV-10 show dramatically the steadily increasing impact of increasing development, without background included, in the Ventura area. Figure VI-8 shows that the base level case with normal tankering and without Sale 48 results in a one-hour impatct of 0.37 ppm; Figure VI-9 shows the combined base level and Sale 48 with normal tankering impact of 0.56 ppm, thus the Sale 48 impact is 0.19 ppm. Both these levels alone exceed the l-hour California standards of 0.25 ppm. Finally, the addition of other major projects provides further additional local impacts as illustrated in Figure VI-10.

The situation is dramatically different when the 100% tankering scenario is considered (Figure VI- 11). Even the inclusion of accidents causes minimal increases with

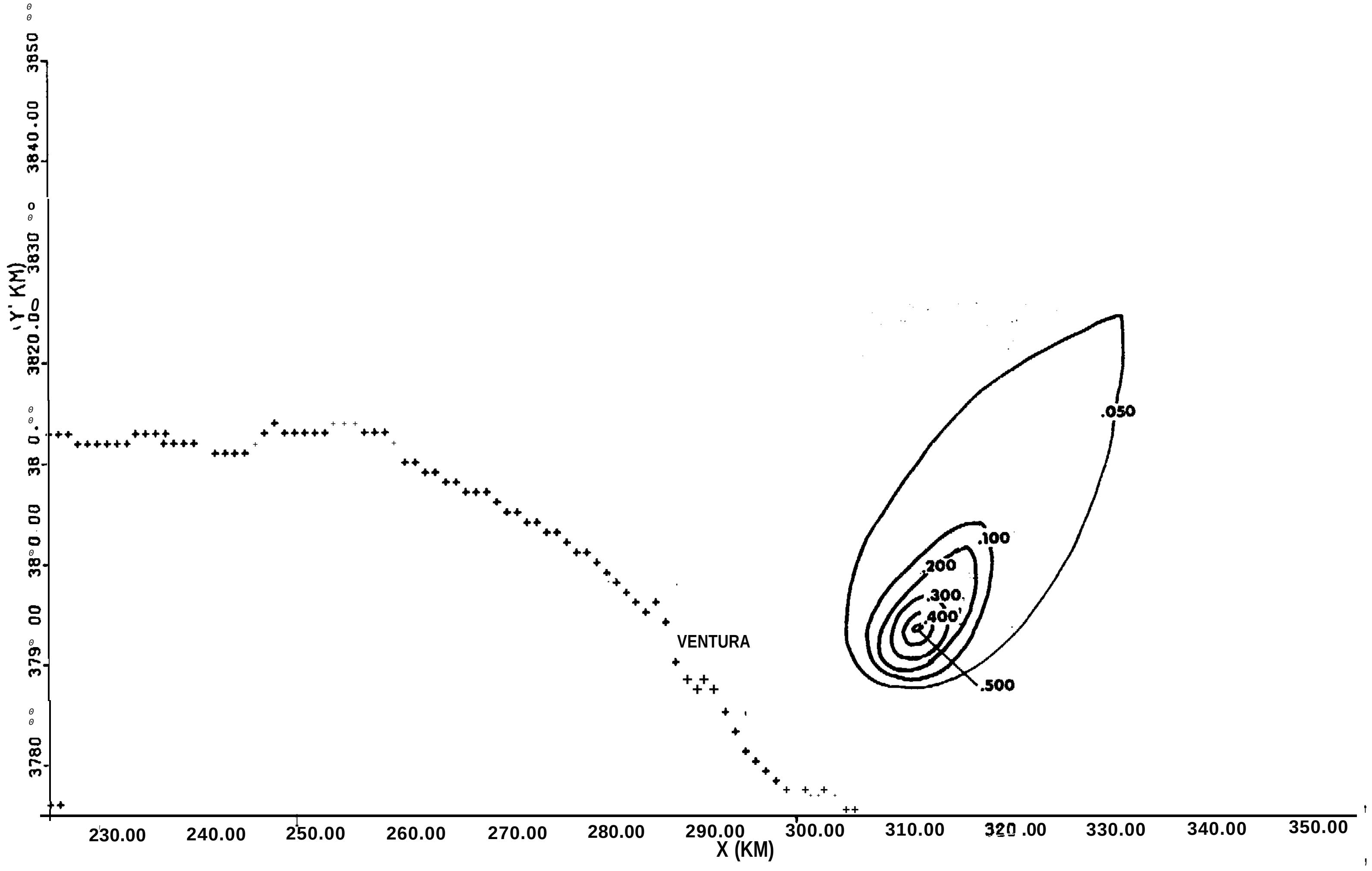

FIGURE VI-5. Regional worst-case 1-hour SO_2 impact (in ppm) in Region I for Sale 48 plus other major projects for normal tankering.

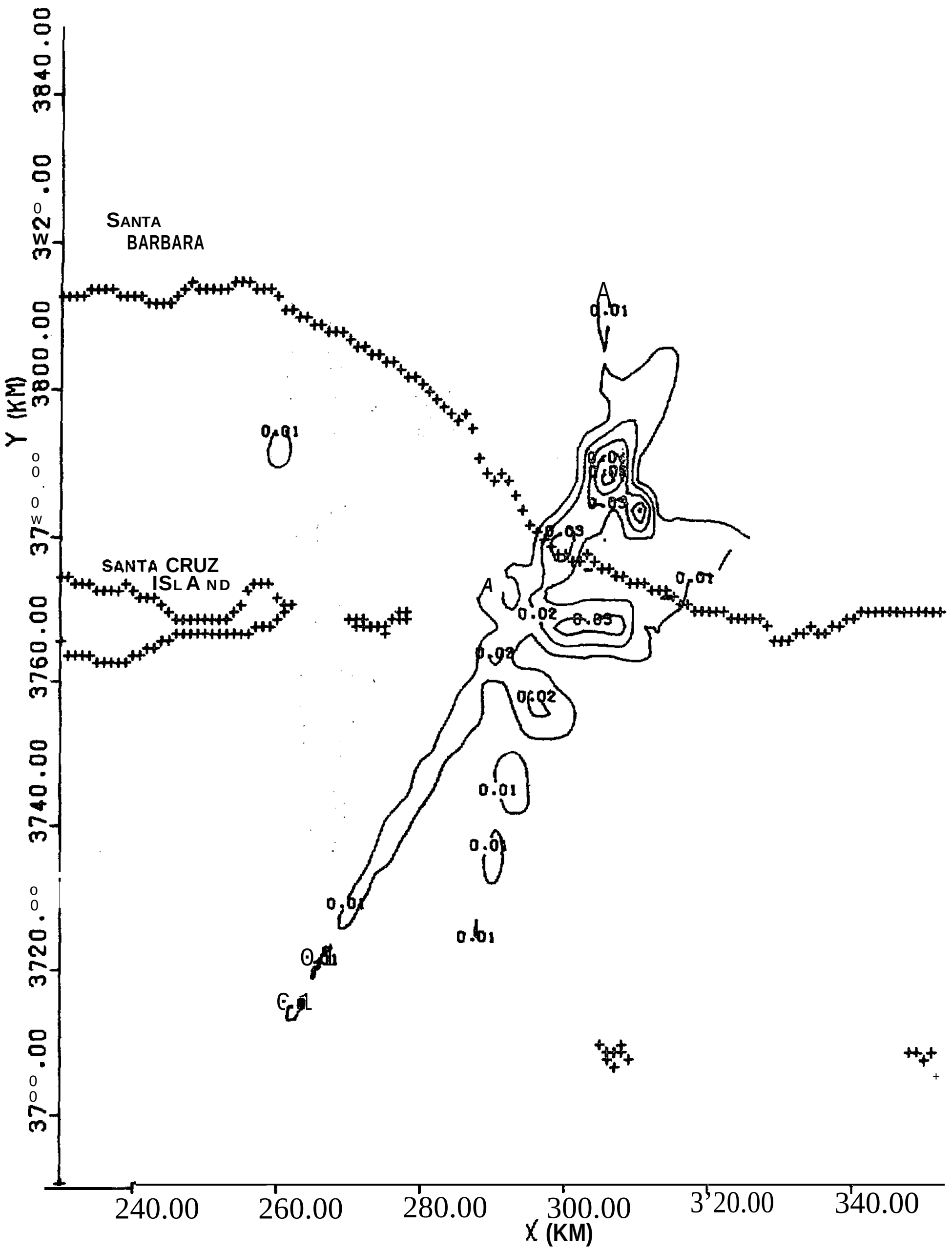

FIGURE VI-6. Regional worst-case 24-hour SO_2 impact (in ppm) in Region I for Sale 48 plus other major projects with normal tankering.

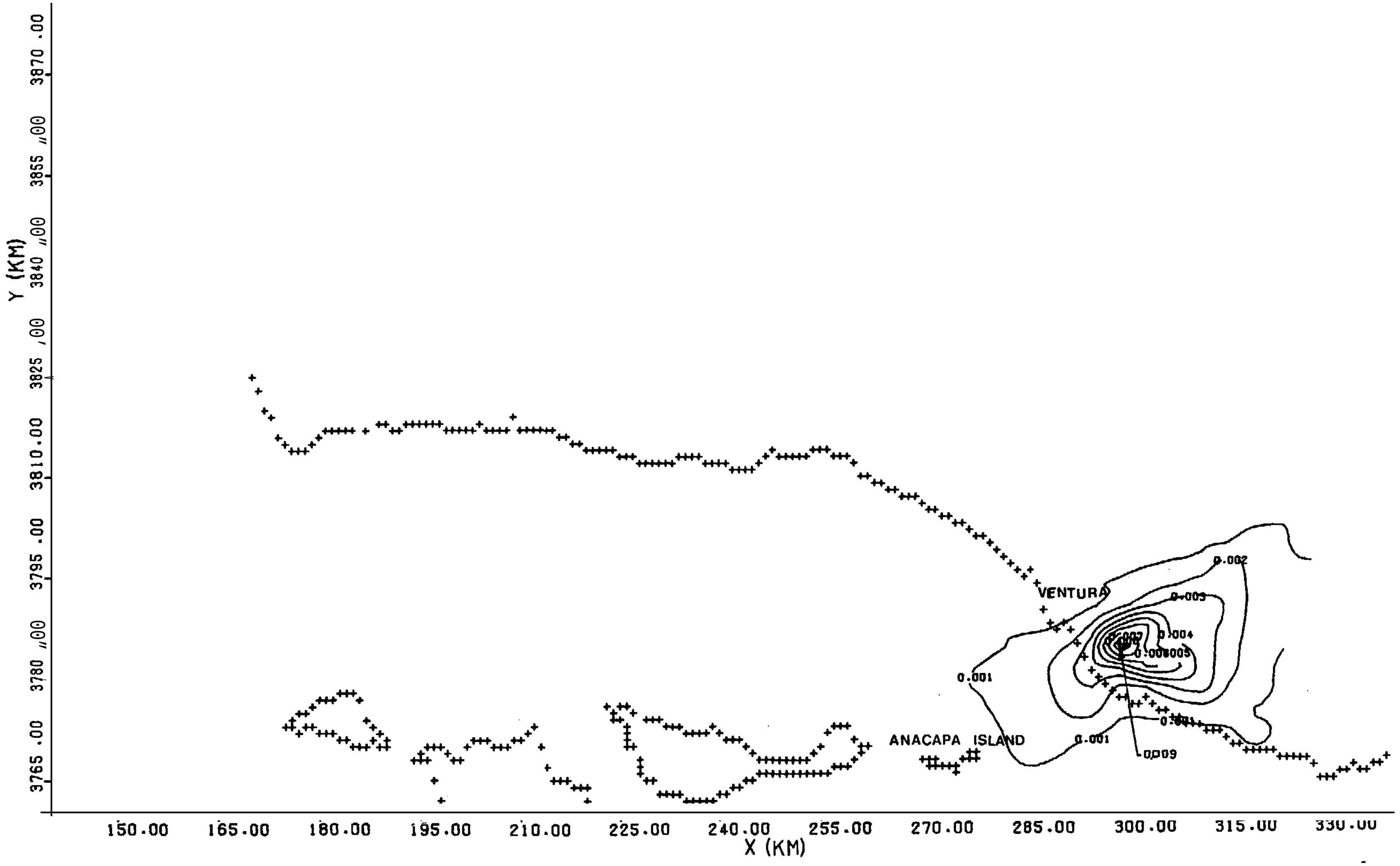

FIGURE VI-7. Regional annual average SO_2 impact (in ppm) in Region I for Sale 48 plus other major projects with normal tankering.

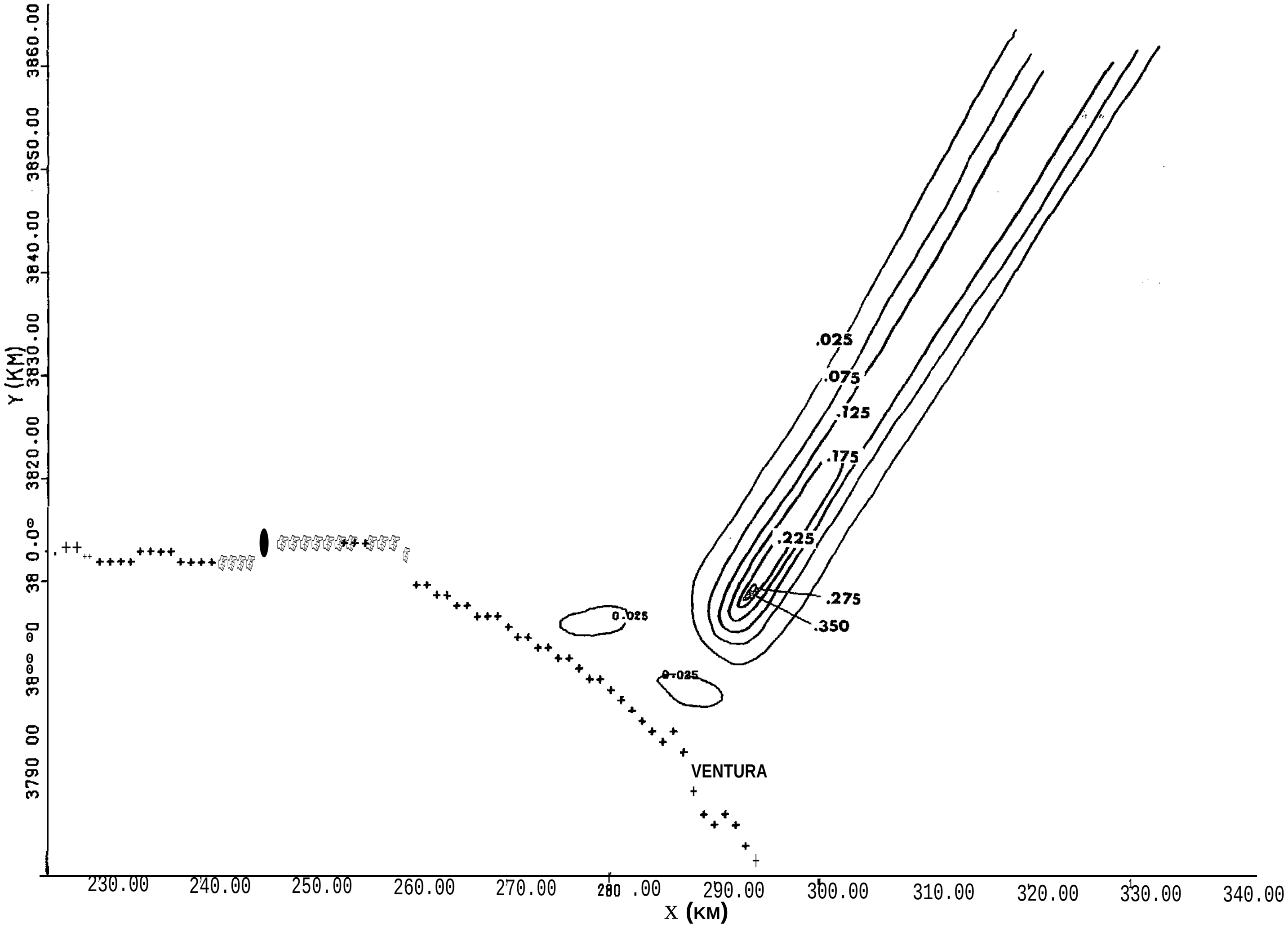

FIGURE VI-8. Region I l-hour N0$_2$ impact (in ppm) of base-level {without Sale 48) for normal tankering.

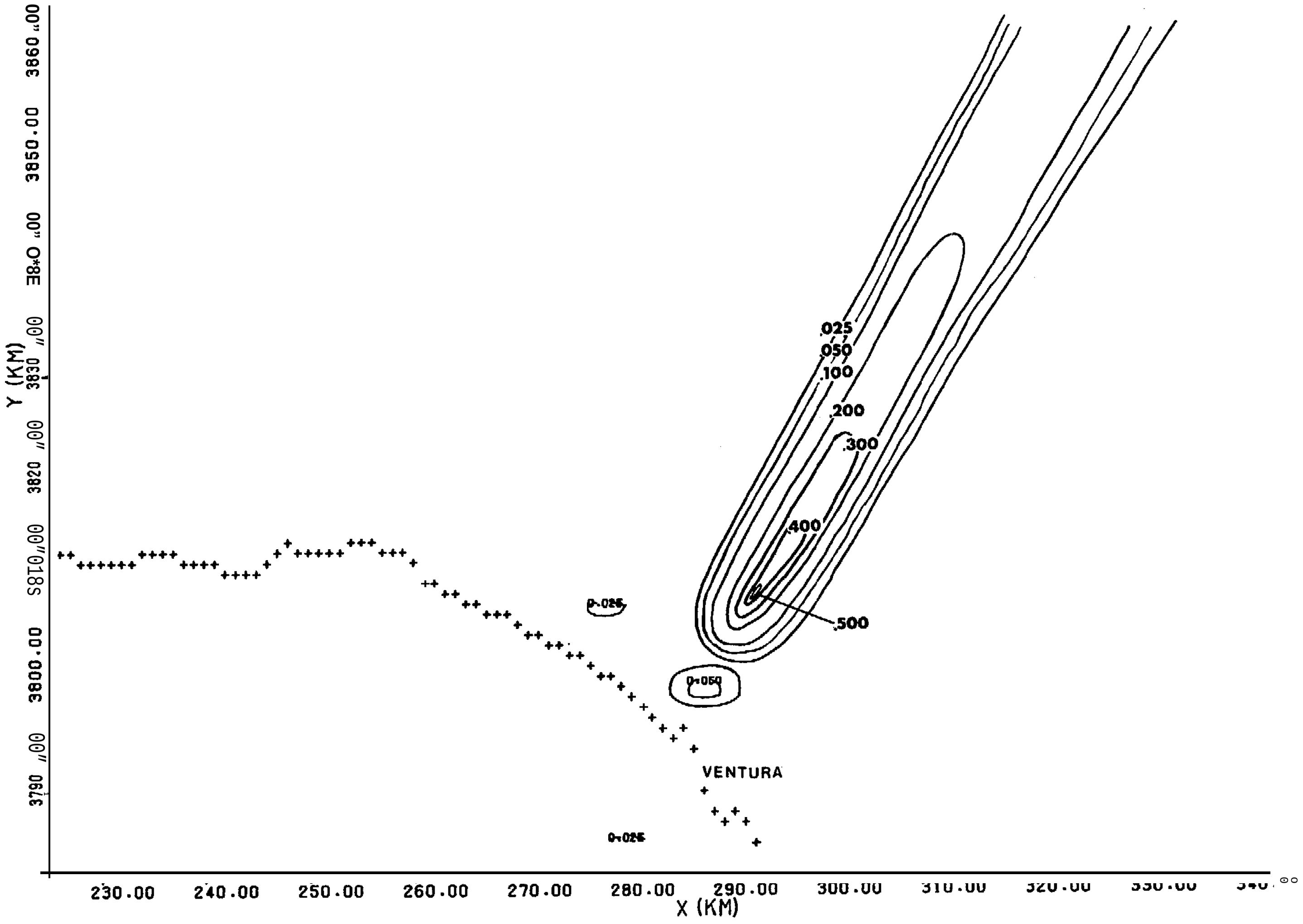

FIGURE VI-9. Region I 1-hour NO_2 impact (in ppm) of Sale 48 for normal tankering.

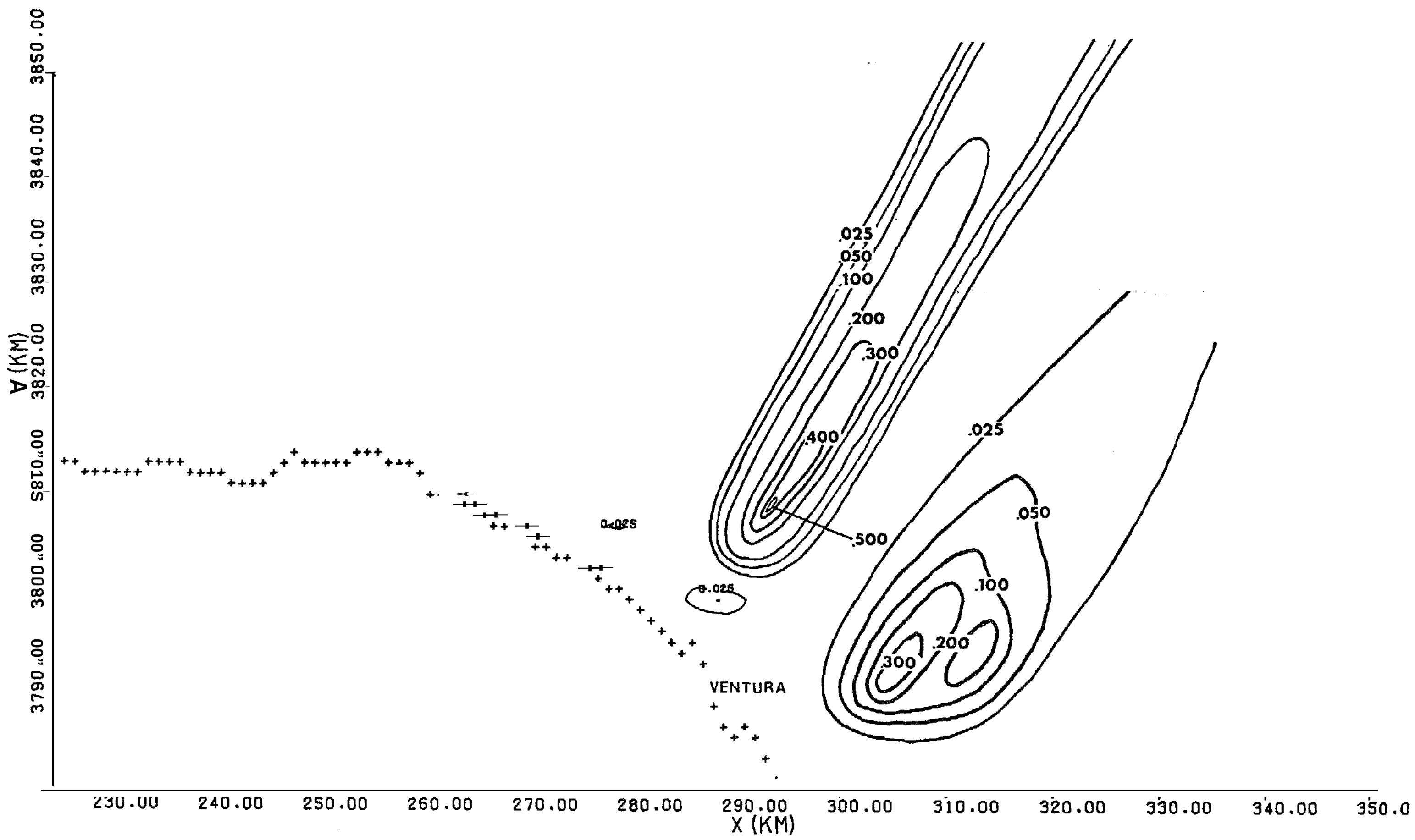

FIGURE VI-10. Region I 1-hour NO_2 impact (in ppm) of Sale 48 and other major projects for al

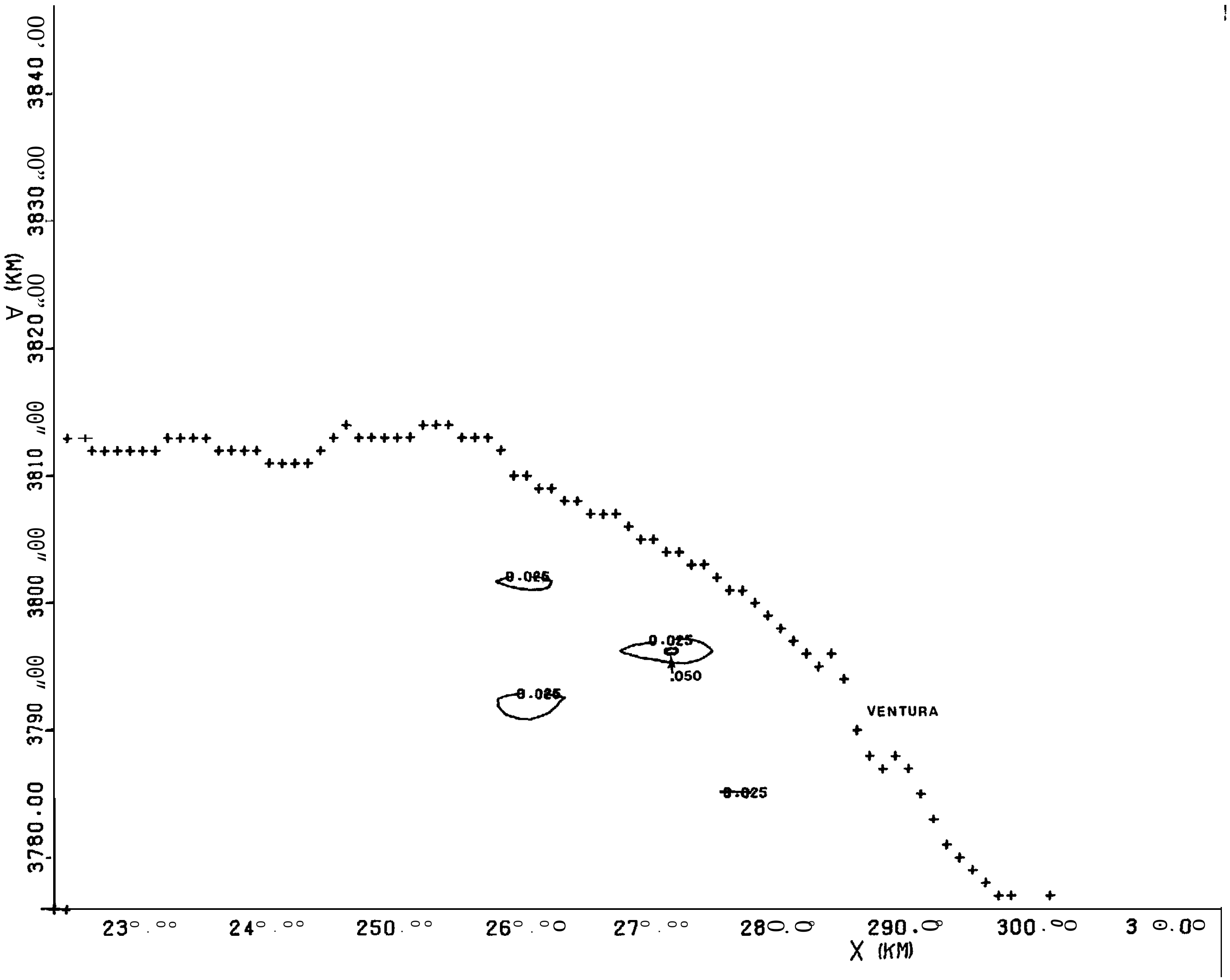

FIGURE VI-11. Region I 1-hour NO_2 impact (in ppm) of Sale 48 with 100% tankering.

maximum concentrations in both cases far below standards. The added impact of the other major projects results in impacts exceeding standards (Figure VI-12), with the maximum impact calculated to be over 0.5 ppm.

Since the $N0_2$ one-hour average impact predictions in Region I exceeded the California standards under a variety of circumstances, $N0_2$ was also modeled using the CDM program to determine annual averages. Figures VI- 13 and VI-14 show contours for $N0_2$ for the Sale 48 with normal tankering case and the Sale 48 with normal tankering plus cumulative projects case, without background included. The predicted maximum impact for both cases was 0.034 ppm. The annual average background of .03 ppm raises the total to .06 ppm which is above the Federal annual average standard of ,05 ppm.

Thus the modeling of the gas and oil processing facilities in Ventura results in the prediction of significant impacts for NO_2 (and H_2S, as shown below). This modeling may be overly conservative, however. The emissions compilation, based on inputs from BLM, indicated that all gas and all oil processing in Ventura were to be done at a single location. The model used a single point for all of these emissions. These emission sources will probably be spread out spatially which would reduce the maximum impact.

Region 11 has maximum l-hour NO_2 background values of .30 ppm in the areas impacted most by the scenarios. The maximum impact for Sale 48 is expected to be .01 ppm onshore for normal and 100% tankering, resulting in a total of .31 ppm. No exceedance of the annual standard is anticipated, however.

In Region HI, $N0_2$ concentrations with background included are well under the standards for all scenarios.

e. $\underline{H_2S}$

H_2S emissions from the gas processing facility in Ventura (Sale 48 with normal tankering) do not result in a regional impact onshore; localized impacts are discussed later. With 100% tankering, the H_2S emissions associated with normal operation of Sale 48 are removed. The comment in the $N0_2$ discussion above, about the conservativeness of the impact modeling of this facility, also applies here.

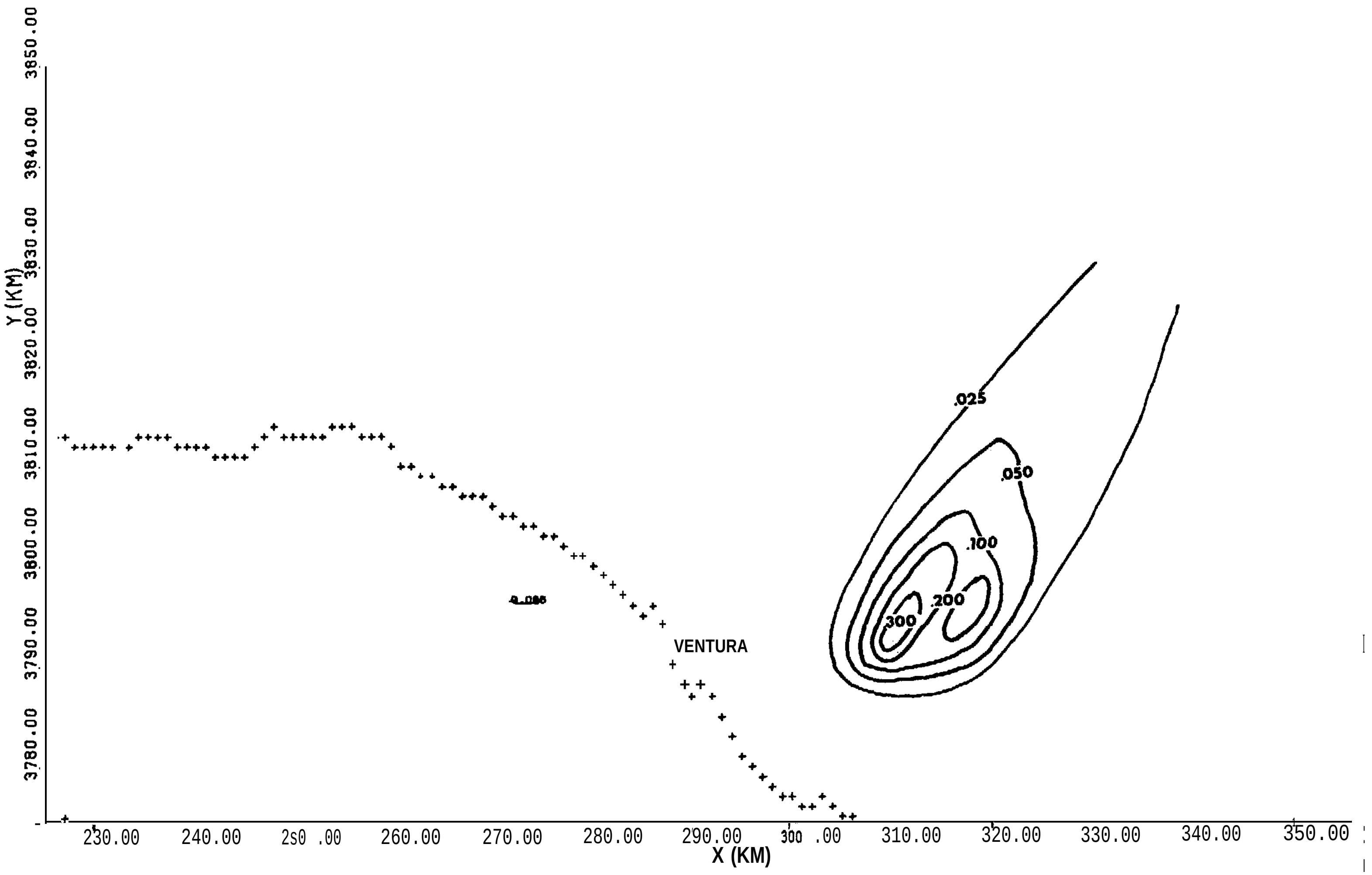

FIGURE VI-12. Region 1 1-hour NO_2 impact (in ppm) of **Sale** 48 with other major projects for 100% **tankering.**

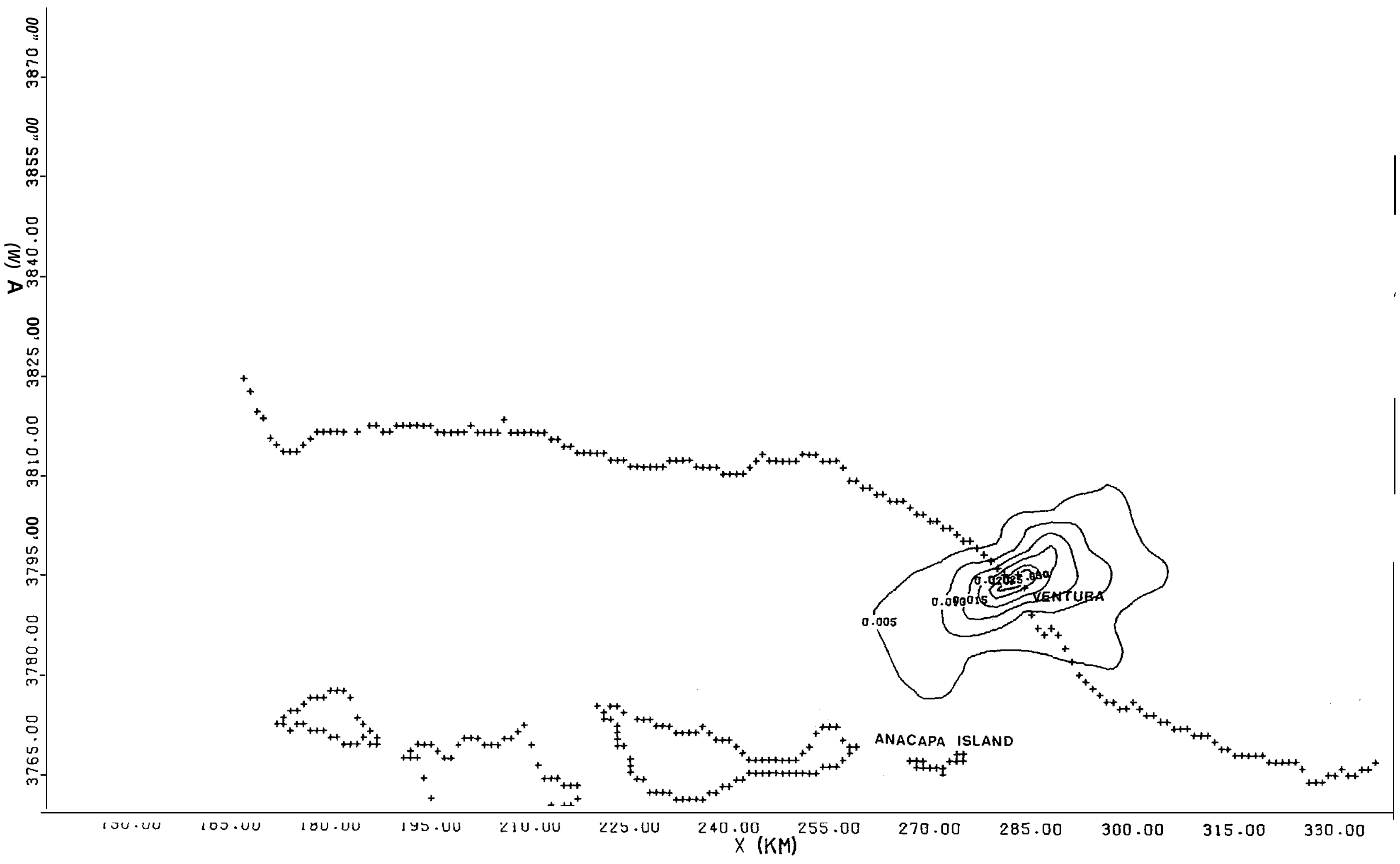

FIGURE VI-13. Regional annual average NO$_2$ impact (in ppm) in Region I for Sale 48 with normal

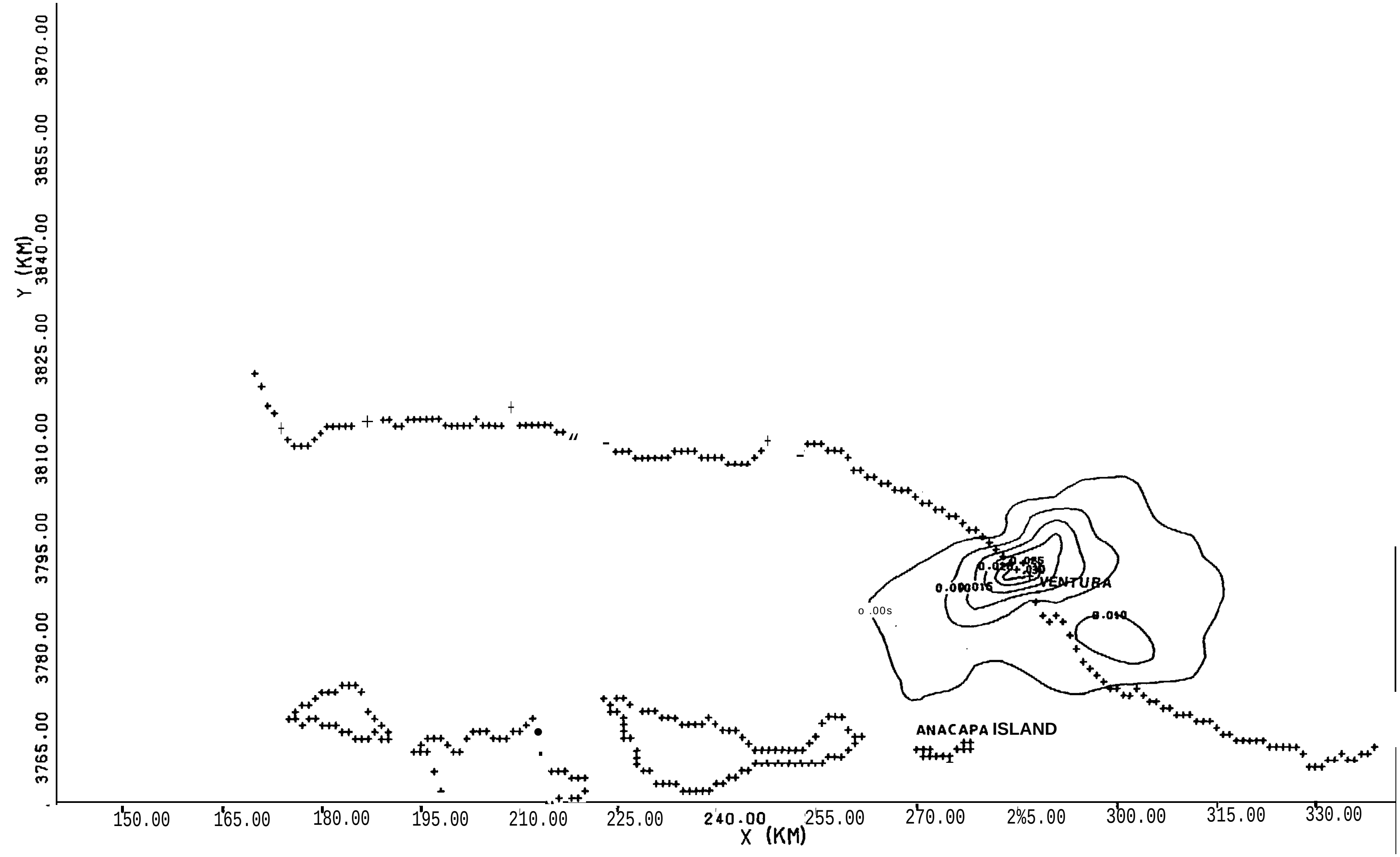

FIGURE VI- 14. Regional annual average NO_2 impact (in ppm) in Region I for Sale 48 plus other major projects.

H_2S emissions from a blowout accident without fire result in l-hour concentrations of 0.10 ppm located beyond 3 miles from shore. This value is above the H_2S California standard of 0.03 ppm. This impact is also discussed later, when the effects of specific sources are treated.

2. Impacts of Specific Sources

The maximum impacts were calculated for a single buoy moor and a platform for each region and for the oil and “gas processing facilities in Los Angeles and Ventura. This type of analysis shows the microscale impact of each type of source. The concentrations were calculated for each pollutant. Table VI-4 presents the results of this analysis. For each source type a figure is referenced which presents a graph of concentration versus downwind distance representative of the worst-case downwind impacts profile for this source type, and is informative for illustrating the nature of the surface impact, where it peaks and how rapidly it decays.

a. Platforms

The results for platforms indicate that pollutants peak about 1.4 km downwind with values well under the appropriate standards.

b. Oil and Gas Processing Facilities

The gas and oil processing facilities in LA and Ventura both result in significant maximum concentrations. The increases in centerline concentrations due to Sale 48 can be determined by comparing the base level case and Sale 48 case. For the gas and oil processing facility in Los Angeles the $N0_2$ concentrations, ignoring background, increase from 0.21 to 0.23 ppm. Thus, the impact of Sale 48 is 0.02 ppm. The impact on maximum $N0_2$ concentrations of Sale 48 on the gas processing facility in Ventura is 0.06 ppm, the difference between 0.10 ppm and 0.16 ppm; while at the oil processing facility in Ventura the maximum impact is 0.19 ppm, the difference between 0.35 ppm and 0.54 ppm. The shape of the concentration graphs is such that the high concentrations occur over a broad range downwind. The maximum H_2S centerline concentration predicted is 0.15 ppm, well over the California standard of 0.03 ppm close to the source (within 2 km), and decrease rapidly farther away.

TABLE VI-4. Maximum above-background plume centerline concentrations from various sources for l-hour average.

Source	Location	Scenario[a]	Pollutant	Maximum Concentration 1	Downwind Distance (km)	Representative Figure
Platform	Tanner/Cortez	S48	TSP	28	1.4	VI-16
			N 0_2	.17	1.4	VI-16
			SO*	.01	1.4	VI-16
			co	.1	1.4	VI-16
		S48T	NO	.06	3.2	VI-16
	San Diego	S48T	TSP	16	1.4	VI-16
			N 0_2	.10	1.4	VI-16
			5 0_2	.01	1.4	VI-16
			co	< .1	1.4	VI-16
		S48T	NO_x	.10	1.4	VI-16
	San Pedro -	S48	TSP	24	1.4	VI-16
			NO_2	.10	1.4	W-16
			SO_2	.01	1.4	VI-16
			CO	.1	1.4	VI-16
		S48T	N 0_2	.10	1.5	VI-16
	Santa Barbara	S48	TSP	33	1.4	VI-16
			NO_2	.03	1.4	VI-16
			SO_2	.01	1.4	VI-16
			co	.01	1.4	VI-16
		S48T	NO_2	< .01	10.9	VI-16

TABLE VI-4. (Continued)

Source	Location	Scenario[a]	Pollutant	Maximum Concentration[1]	Downwind Distance (km)	Representative Figure
SBM	Santa Barbara Island	S48	TSP	5	.5	VI-15
			NO_2	.01	3	VI- 16
			SO*	< .01	.5	VI-15
			CO	< .1	.5	VI-15,
		S48T	NO_2	.01	3	VI- 16
	Santa Barbara Channel	S48	TSP	4	8.5	VI-16
			NO_2	< .01	8.5	VI- 16
			SO_2	.03	8.5	VI- 16
			CO	< .1	8.5	VI-16
		S48T	NO_2	.11	3	VI-16
	San Diego	S48	TSP	4.5	.5	VI-1
			NO_2	.02	2.5	VI-16
			SO_2	< .01	.5	VI-15
			CO	< .1	.5	VI-15
		S48T	NO_2	.02	2.5	VI- 16
Accidents	--	with fire	TSP	1380^c	1	VI-16
			NO_2	$.25^c$	1	VI- 16
			SO_2	1.64^c	1	VI- 16
			CO	6.3	1	VI- 16
		without fire	H_2S	$.11^c$	1.4	VI- 16

TABLE VI-4. (Concluded)

Source	Location	Scenario[a]	Pollutant	Maximum Concentration[1]	Downwind Distance (km)	Repre-sentative Figure
Gas & Oil Processing	Los Angeles	N48T	TSP	39	.5	VI-15
			NO_2	.22	2	VI-16
			SO_2	.03	.5	VI-15
			CO	< .1	1.4	VI-16
		N48 T + 48T	TSP	43	.5	VI-15
			NO_2	.23	1.5	VI-16
			SO_2	.03	.5	VI-15
			CO	.1	1.5	VI-16
Oil Processing	Ventura	N48	NO_2	.10	8.0	VI-16
			SO_2	< .01	2.4	VI-16
		N48 + 48	NO_2	.16	8.2	VI-16
			SO_2	< .01	2.4	VI-16
Gas Processing	Ventura	N48	SO_2	.02	18.8	VI-16
			H_2S	(b)	--	--
			NO_2	.35^c	10.9	VI-16
		N48 + 48	SO_2	.03	18.7	VI-16
			H_2S	.15^c	.5	VI-15
			NO_2	.54^c	11.	VI-16

1) Concentrations are given in $\mu g/m^3$ for TSP and ppm for all gaseous pollutants.

a) See Table VI-3 for nomenclature.

b) No emissions

c) Values are greater than California ambient air quality standard

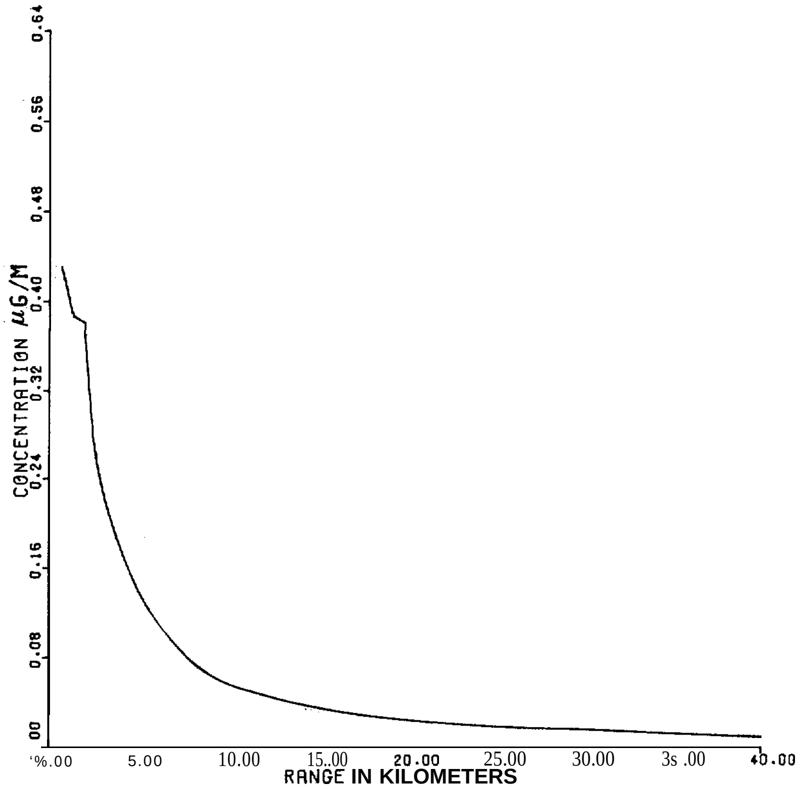

FIGURE VI-15. Nature of the downwind profile of ground-level impacts from a variety of non-buoyant surface-level sources. The concentration scale is in arbitrary units.

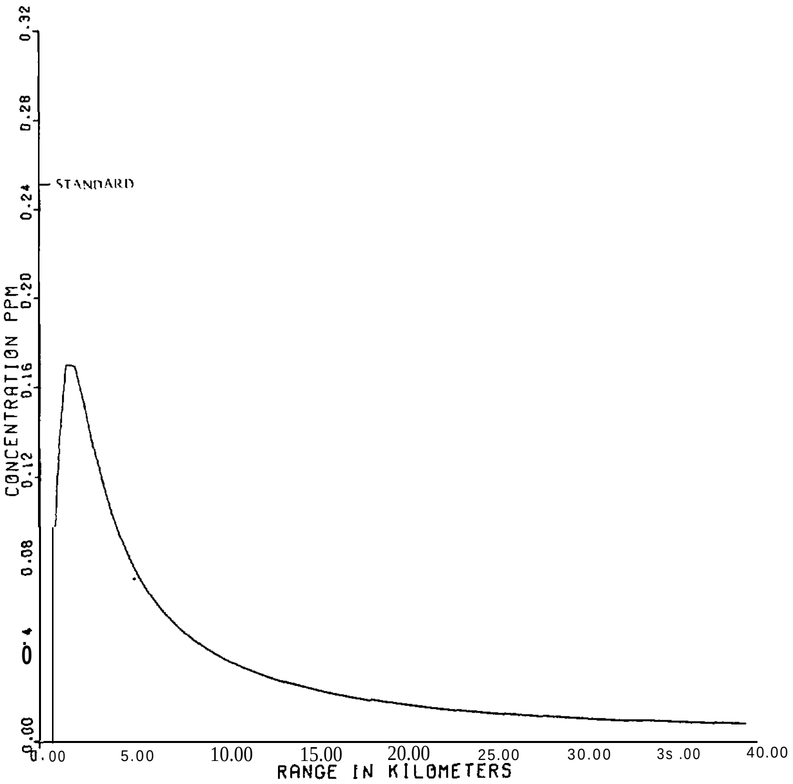

FIGURE VI-16. Nature of the downwind profile of ground-level impacts from a variety of sources with significant buoyancy. The concentration scale is in arbitrary units.

c. SBM's

Tanker loadings in the Santa Barbara Channel result in maximum concentrations beyond 8 km from the source while emissions from tug boats in other areas result in maximum concentrations very close to the source. All concentrations, however, are well below any applicable standards.

d. Accidents

The accident case of blowout without fire indicates a maximum H_2S impact of .11 ppm. For the accident cases of blowout with fire, TSP, $S0_2$, and NO_2 concentrations, show significant l-hour average impacts for quite some distance downwind. The maximum $S0_2$ and NO_2 impacts are both over their respective apportioned standards..

D. Visibility

Any discussion of visibility must first note that visibility is a' poorly defined parameter, mainly because it is physiometrically determined. Although having the generally understood meaning of the distance a person can see (more precisely called the "visual range") and often including criteria as to how much of the hoizon circle this applies, this distance will depend on the observer's physical condition, his familiarity with the targets he is viewing, the sun angle, and a multitude of other factors unrelated to the clarity of the air mass through which he is looking. The aesthetic visibility will also differ from the functional visibility, and the color of the obscuring medium will play a role in an aesthetic evaluaion of visibility degradation to scenic vistas.

Degradation of visibility results mainly from the scattering of light by gas molecules, fine particles, and liquid droplets, with absorption of light a factor in certain cases (e.g.,, dense soot clouds). Rayleigh scattering by air molecules limits the maximum visual range to about 200 km if the entire sight path is at sea level. Curvature of the earth insures that part of the sight path will be through the thinner air of higher altitudes, and thus the theoretical limit to visibility is somewhat higher.

The visual impact of the projected OCS developments (aside from the aesthetic effect of structures) will occur from a general degradation of atmospheric clarity due to particulate matter emitted from the facilities or formed chemically from gaseous emissions. Because atmospheric aerosols tend to assume a self-preserving size distribution when far from a source, the relationship between atmospheric clarity and particulate mass concentration can be handled adequately by formulas such as those discussed by Tombach (1972). Recent papers in the literature have further refined the formulas summarized in the Tombach paper. All of these formulas assume certain physiometric properties of the eye, which can be adjusted depending on the nature of the desired visual range description.

L_v, a visual (meteorological) range, was defined in 1924 by Koschmieder (Middleton, 1963) as the greatest distance at which a black object of a certain sufficiently large size could be seen against the horizon sky by an observer who can perceive a contrast difference of 2%. It is related to the scattering of light by the formula:

$$L_v - \frac{3.9}{b}$$

where b is the scattering coefficient, an index of the degree of light scattering.

If the particulate size distribution remains reasonably constant in time, so that the relative scattering contributions of various portions of the size distribution do not vary appreciably, then b will be proportional to the number of particles per unit volume. For aerosols which also have a relatively constant specific gravity distribution with size, this proportionality thus extends also to the mass concentration m. Based on a study performed by Hidy et al (1975) the equation relating m and b for the Southern California area was found to be:

$$m = 0.31\ b$$

where

m = mass concentration (g/m^3).

and

b = scattering coefficient (m^{-1},

Combining these equations gives

$$L_v = \frac{1.2}{m}$$

for L_v in meters and m in g/m^3.

In addition to the assumptions suggested above in the definition of visual range, this relationship further assumes a homogeneous atmosphere, an aged particle size distribution, and a relative humidity of less than 70%.

High humidity interjects a complicating factor into an otherwise straightforward analysis procedure. Much of particulate matter is hydroscopic, and its mass, size, and light scattering ability increase as the humidity increases. The effect is insignificant for most aerosol constituents when the relative humidity is below 70%. This deliquescent quescent behavior can increase light scattering by up to an order of magnitude, and thus decrease the visibility by the same factor, explaining the hazy visibilities on humid days. Fog, of course, introduces yet another variable, and increased particulate matter can serve as nuclei for increased fog.

“Using the relationship between L_v and m, with the TSP values used for m, visual ranges with and without the proposed project were calculated at points of maximum impact for conditions when the relative humidity is below 70%. . ..’

In Region I, no significant visibility impact is forecast since no significant impact on particulate concentrations is expected from Sale 48.

In Region II, some degradation is expected. Assuming, for a worst case situation, an observer is looking through the densest part of the particulate plume, the visual range would be reduced from 18 km to 17.4 km for normal tankering operations under worst-case impacts and to 17.1 km for 100% tankering. The 18 km figure represents an average visual range for the area of maximum impact, approximately 4 km offshore of central Orange County.

In Region III, some degradation is also expected. For worst-case meteorology, visual range would be reduced from 34 km to 32.9 for normal tankering operations and to 29.4

km for 100% tankering. Again, 34 km represents an average visual range for the region.

It should be noted that L_v is a representation of the local air quality, and whether or not L_v relates well to the actual visibility depends on, among other things, relative humidity and the homogeneity of the atmosphere over distances corresponding to the visual range. The impact estimates given here are thus conservative, because the worst-case maximum concentration is assumed to apply over the entire sight path.

E. Conclusion

1. Inert pollutant modeling of Sale 48 with normal tankering can be summarized as follows:

- CO concentrations are insignificant

- SO_2 concentrations are only a problem around the other major projects considered; Sale 48 itself has an insignificant impact on SO_2 concentrations

- NO_2 has two problem areas. Concentrations downwind from the gas and oil processing facilities for Sales 35 and 48 in Ventura exceed NO_2 standards. Sale 48 increases the maximum 1-hour concentration from 0.47 ppm to 0.66 ppm, including background and the annual average from 0.03 ppm to 0.06 ppm. The gas and oil processing facility in Los Angeles also causes the maximum regional impact in its area, increasing the concentration from 0.30 ppm to 0.31 ppm. There would, however, not be an exceedance of the annual average standard. The exceedance in the Los Angeles area is due to background alone, so that the small impact from Sale 48 increases the exceedance. The offshore facilities have an insignificant impact on onshore concentrations.

- TSP concentrations on land from Sale 48 facilities are very small. The other proposed major projects in the Ventura area cause exceedance of the TSP standards, but Sale 48 impact in this location is insignificant. Background concentrations of TSP exceed short and long term standards, even out to the offshore facilities in the Los Angeles and Orange County areas; the small impact from Sale 48 in this offshore location increases the 24-hour average background of 130 $\mu g/m^3$ to 133 $\mu g/m^3$. The impact on onshore concentrations is insignificant.

- H_2S centerline concentrations downwind from the gas processing facility in Ventura exceed state standards close to the emission source (within 2 km). No other sources associated with Sale 48 release significant quantities of H_2S.

2. Inert pollutant modeling of Sale 48 with 100% tankering can be summarized as follows:

- CO concentrations are insignificant

- SO_2 concentrations are insignificant

- NO_2 concentrations from Sale 48 have the largest impact offshore of Orange County where the concentration is increased from 0.18 ppm to 0.27 ppm. There would not be an exceedance of the annual average standard. The offshore facilities have an insignificant effect on concentrations onshore. The gas and oil processing facility does not exist for the 100% tankering scenario.

- TSP impact is slightly larger but still very small for Sale 48 with 100% tankering. The 24-hour average concentration offshore of Los Angeles and Orange Counties is increased from 130 $\mu g/m^3$ to 134 $\mu g/m^3$ at the maximum impact location. The annual geometric mean of background TSP would be above the standard with or without Sale 48. The impact onshore is insignificant.

- H_2S concentrations from Sale 48 activities are insignificant.

3. Inert pollutant modeling of possible accidents associated with Sale 48 can be summarized as follows. The 1,000 bbl/day blowout with fire is the worst-case for CO, SO_2, NO_2, and TSP and without fire is the worst-case for H_2S.

- CO concentrations are below standards even very near local sources. The regional modeling shows that the maximum impact locations, including background, are all within standards.

- SO_2 concentrations are above standards in the plume downwind of the fire with a maximum at 1 km of 1.6 ppm. Impacts above the air quality standard are all located beyond 3 miles from shore.

- NO_2 peak concentrations approach the standard downwind of the fire.

- TSP plume centerline concentrations for l-hour peak at 1380 $\mu g/m^3$, well over the 24-hour standard of 100 $\mu g/m^3$ downwind of the fire. Meteorological changes (like wind direction) during the day will scatter the plume and reduce the 24-hour average concentration from the fire, but will still result in TSP concentrations above the standard.

- H_2S concentrations associated with a blowout without fire in Santa Barbara Channel will have a maximum impact of 0.11 ppm - well above the state standard of 0.03 ppm. The impact is located close to the platform; concentrations will be within the standard by i O km downwind.

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VII. MODELING OF PHOTOCHEMICALLY REACTIVE CONTAMINANTS

A. Modeling Approach

The Pacific Environmental Services REM2 photochemical air quality simulation model was used to assess the impacts of the proposed Sale 48 oil leases on photochemical air pollution in Southern California. Ozone (0_3) and nitrogen oxides are photochemical pollutants that are determined with REM2. REM2 is a Lagrangian air quality model which uses a 34-reaction chemical mechanism to simulate photochemical pollutant concentrations. Because of the photochemically reactive nature of the pollutants, it is necessary to model these dynamic reactions in order to determine the concentrations of ozone. Worst case analysis of NO_2 is discussed in Chapter VI. The model is described in detail in Appendix C.

Validation runs of the REM2 model were made, using 1975 emission data bases, to test the accuracy of the model's predicted concentrations in three different locations: Santa Barbara, Los Angeles, and San Diego. The validation runs are described below in Section VIIC. The REM2 model showed excellent agreement between predicted and observed concentrations for days with high photochemical pollutant concentrations in 1975.

Simulation runs using the REM2 model were made for the year 1986 to assess the photochemical air quality impacts of the proposed Sale 48 oil leases. Model runs were made for three main scenarios, described in more detail in Section II:

(1) Normal tankering emissions
(2) 100% tankering emissions
(3) Accidents

In each case, model runs were made with and without Sale 48 emissions in order to assess the incremental air quality impacts of Sale 48. Model trajectories were chosen which passed directly over Sale 48 emission sources during daylight hours, thus simulating the maximum air quality impacts of Sale 48.

B. Model-Inputs

1. Emission-Grids - The REM2 model requires a gridded emission inventory of freeway traffic, street traffic, and point and area source emissions for the region of interest. Due to the extremely large study area, separate emission grids were used in each of the four major areas of interest:

(1) Santa Barbara -2 km x 2 km grid squares (Eschenroeder, et al, 1976).

(2) Ventura -1 km x 1 km grid squares (Barberio, 1977).

(3) Los Angeles - 2 mile x 2 mile grid squares (Nordsieck, 1974).

(4) San Diego - 2 km x 2 km grid square-s (ARB Modeling Staff, 1977).

The Los Angeles emissions grid was based on 1970 emissions, however, projection factors given in the emissions report (Nordsieck, 1974) were used to estimate emissions for 1975 and 1986. For the other three land areas (Santa Barbara, Ventura, and San Diego), the available emission inventories represented only 1975 emissions. Estimates were made f or 1986 emissions by. applying population growth factors in each area to traffic vehicle miles traveled and to area source NO_x and CO emissions; area source hydrocarbon emissions were assumed to remain constant due to probable hydrocarbon controls in 19~6.

Emission estimates for off-shore activities in 1975 and 1986 (see Section V) were allocated to a large 10 km x 10 km emissions grid covering the ocean off Southern California. The distinction between the ocean emission grid and the land emission grids was made by allocating all emissions, closer than 3 miles from shore to the land grids and allocating all emissions further than 3 miles from shore to the ocean grid. All islands were allocated to the ocean grid and were assumed to have negligible emissions. In the model operation, the emissions grid was changed (e.g., from the ocean grid to. a. land grid) whenever a trajectory approached 3 miles from shore. Emissions north of Point Conception and south of the Mexican border were not considered.

AH traffic and area source NO_x emissions were assumed to be 100% nitric oxide (NO). All traffic and airport non-methane hydrocarbon (NMHC) emissions were assumed to consist of 75% (by weight) more-reactive hydrocarbons and 25% (by weight) less-reactive hydrocarbons, as defined in Table VII-1. All other land area sources were assumed to emit 20?6 (by weight) more-reactive hydrocarbons and 80% (by weight) less-reactive hydrocarbons. All off-shore sources (e.g., platforms, oil spills) were assumed to emit 10% (by weight) more-reactive hydrocarbons and 90% (by weight) less-reactive hydrocarbons, as defined in Table VII-1. The breakdown by weight percent of the above hydrocarbon emission sources is based on Trijonis and Arledge (1975).

2. Trajectories and Meteorology - The trajectories and meteorological conditions which were used for the 1975 validation runs and the 1986 simulations runs are described below. A detailed description of hourly trajectory position, mixing height, tern perature, and relative humidity for each run is presented in Appendix D. All model runs assumed zero cloud cover to model conservatively the photochemical reactions and a horizontal diffusion coefficient corresponding to neutral atmospheric stability.

The methodology used to determine the trajectories used is described in Appendix D." Table VII-2 is a tabulation of the trajectories used in each analysis including the trajectory designation and the figure illustrating the trajectory.

3. Initial Concentrations - The initial air quality concentrations for each run were derived, when possible, from measured air quality from a monitoring station near the trajectory starting point. The initial concentrations for all the validation runs were based on actual measured data from monitoring stations. For trajectories beginning in the ocean, initial concentrations were estimated from limited airborne data (Kauper, 1977) over the ocean and available data from monitoring sites on islands. Initial concentrations for 0_3, $N0_2$, CO and non-methane hydrocarbons (NMHC) which were used for each trajectory are presented in Table VII-3. The NMHC initial concentration for each case was assumed to consist of 20% more reactive hydrocarbons and 80% less reactive hydrocarbons, as defined in Table VII-1. The starting locations for which ambient air concentrations were estimated are listed in Appendix D for each trajectory.

c. REM2 Validation Results

Validation runs of the REM2 model were made in three different locations, using the 1975 emission data bases, to test the accuracy of the model's predicted concentrations.

TABLE W-1. REM2 hydrocarbon reactivity classes.

Unreactive	Less Reactive	More Reactive
methane	paraffins (other than methane)	olefins
	acetylene	aldehydes
	benzene	cycloparaffins
	acetone	aromatics (other than benzene)
	methanol	ketones (other than acetone)
		alcohols (other than methanol)

TABLE VII-2. Trajectories used in photochemical modeling.

Trajectory Designation	Figure
Validation Analysis	
SB	VII -1
LA	VII -1
SD	VII -1
Regional Analysis	
SB1	VII -2
SB3'	WI -2
V2	VII -3
V3	VII -3
LA1	VII -4
LA2	VII -4
SD1	VII -5
SD2	VII -5
SM1	VII -6
SD3'	VII -6
Cumulative Analysis	
SM1	VII -7
c l	VII -7
C2	VII -7
C3	VII -7
Accident Analysis	
SB3'	VII -8
LA1	VII -8
SD3'	VII -8
V1	VII -8
TC	VII -8

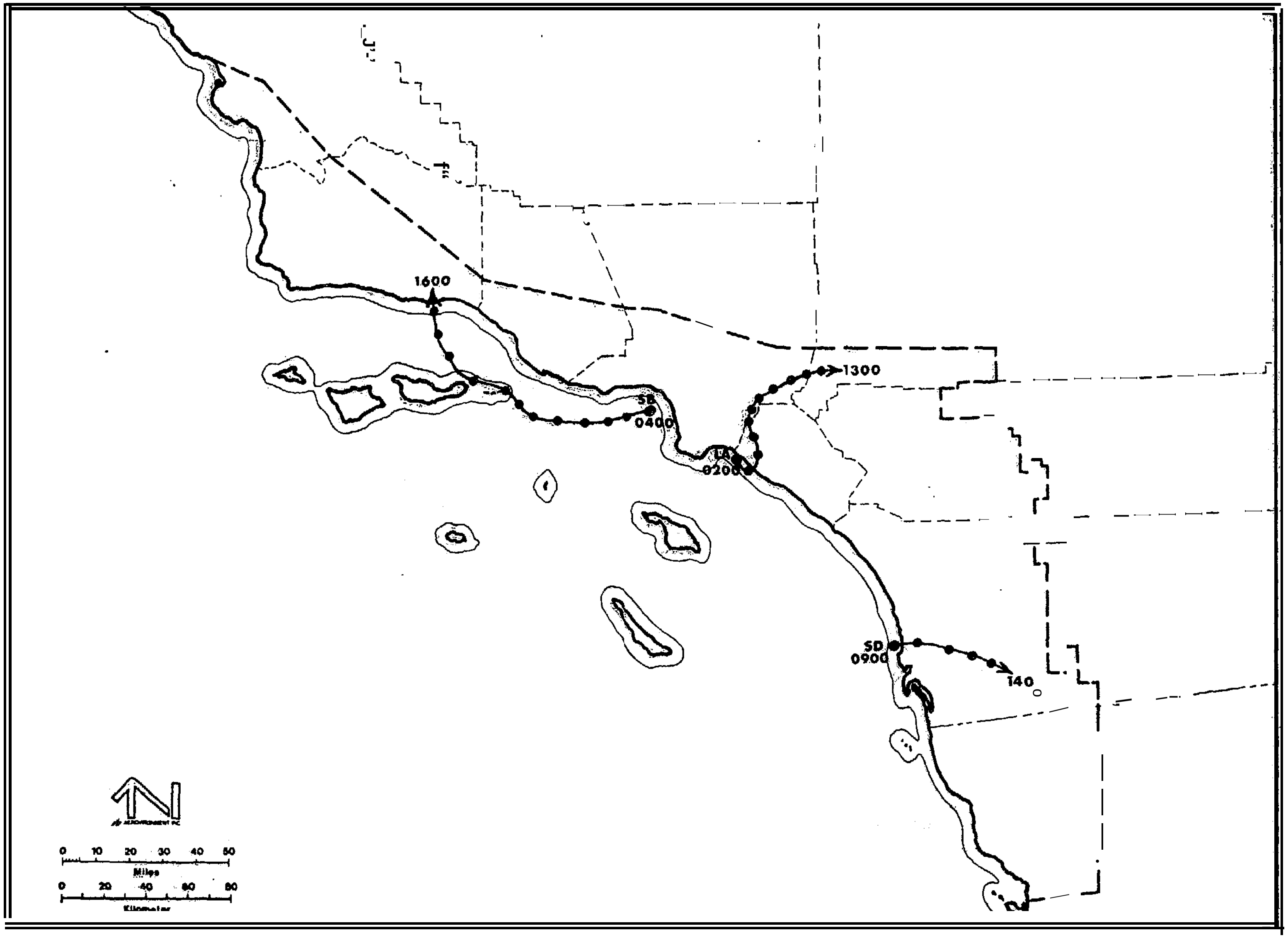


FIGURE VII-1. Trajectories for validation analysis showing start and end times.

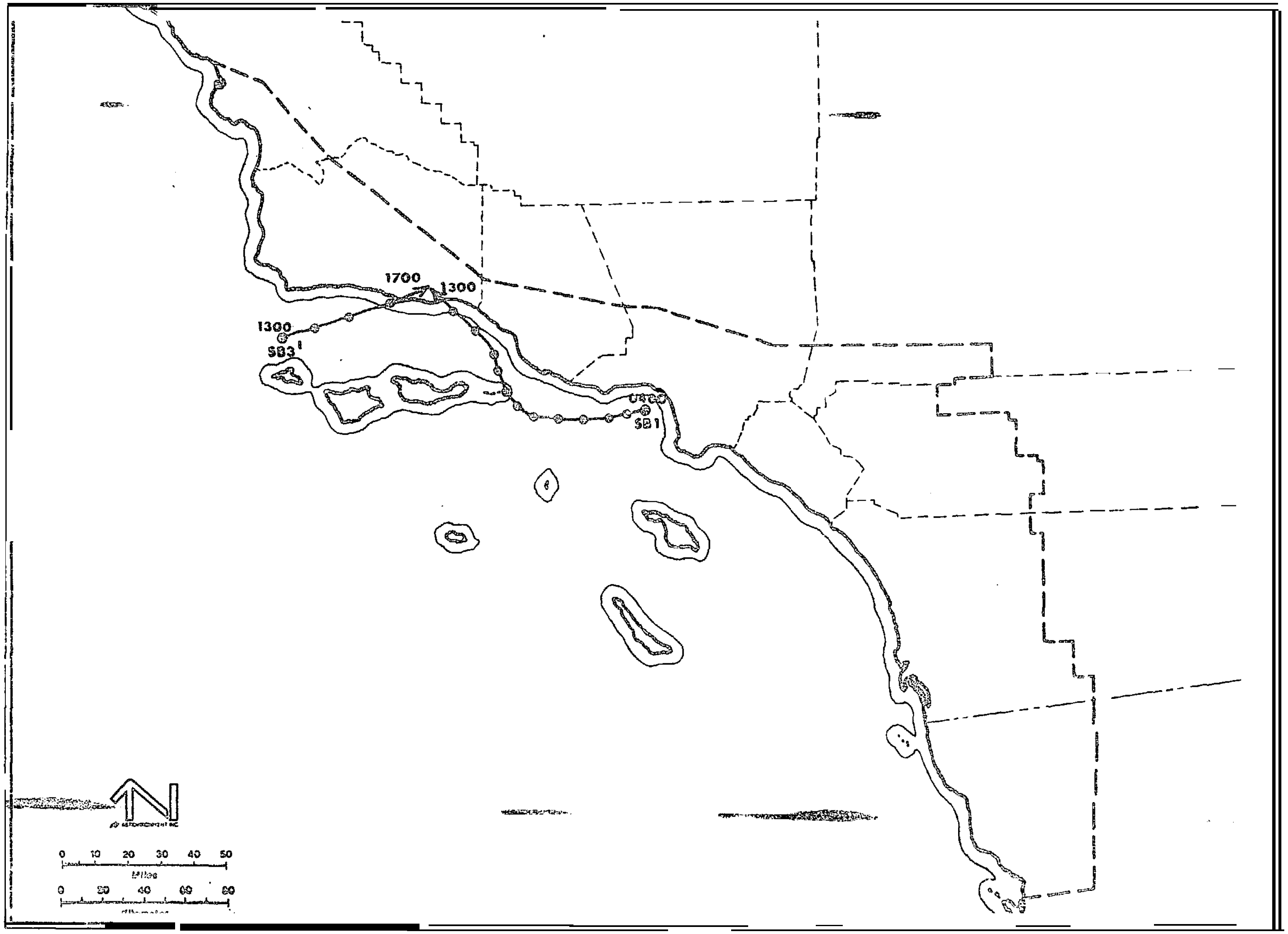


FIGURE VII-2. Trajectories for regional analysis showing start and end times

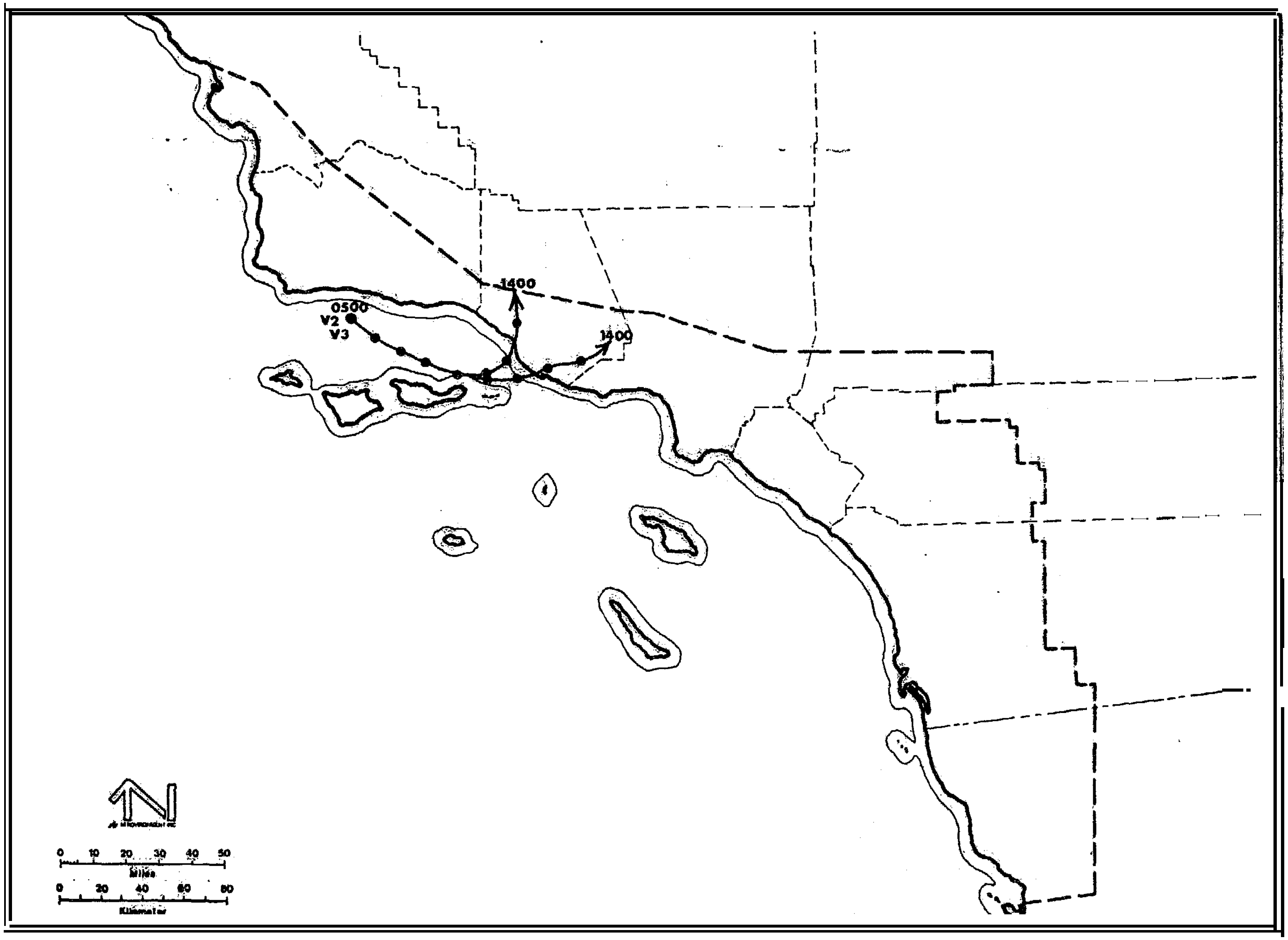


FIGURE VII-3. Trajectories for regional analysis showing start and end times.

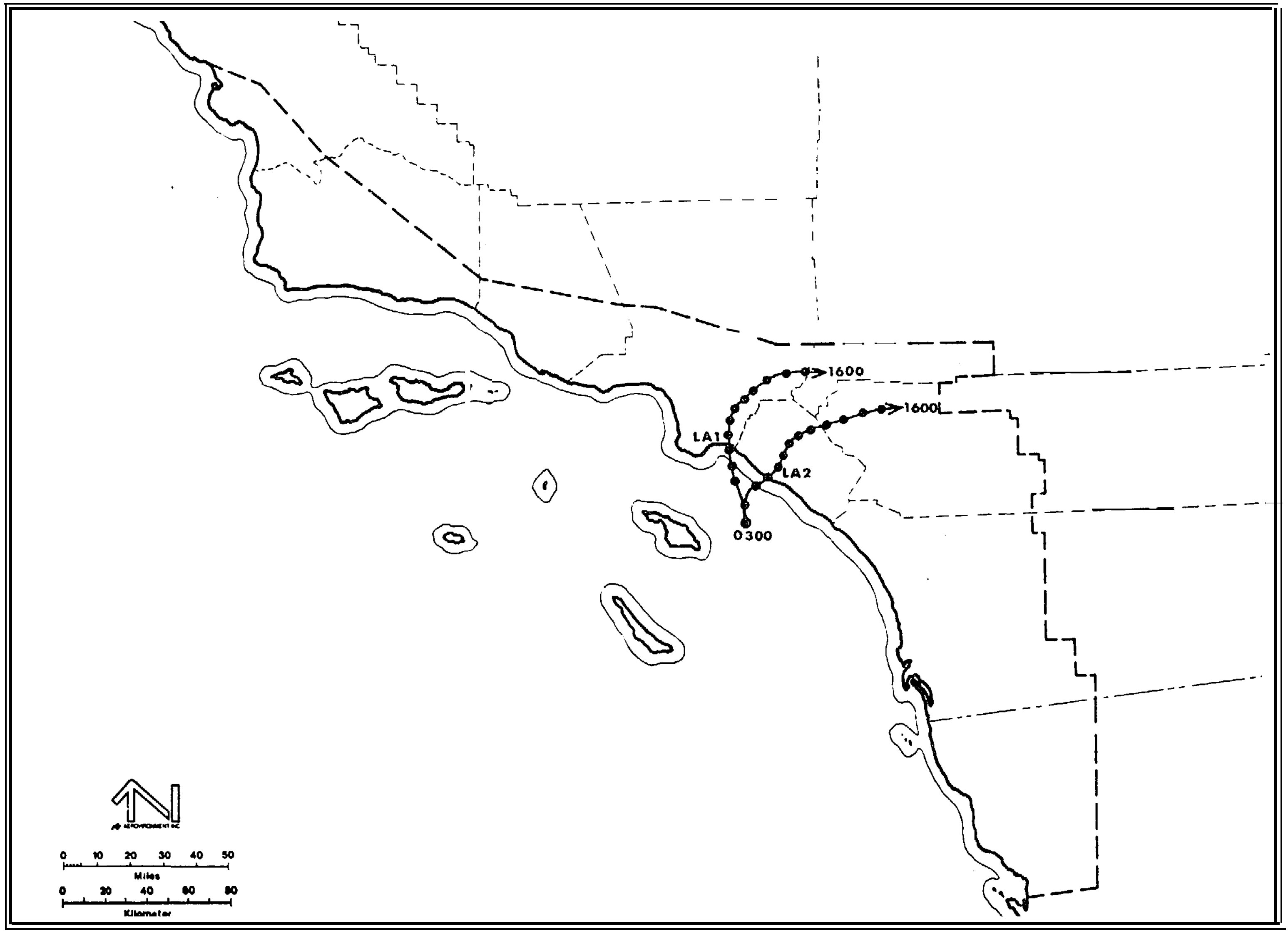


FIGURE VII-4. Trajectories for regional analysis showing start and end times.

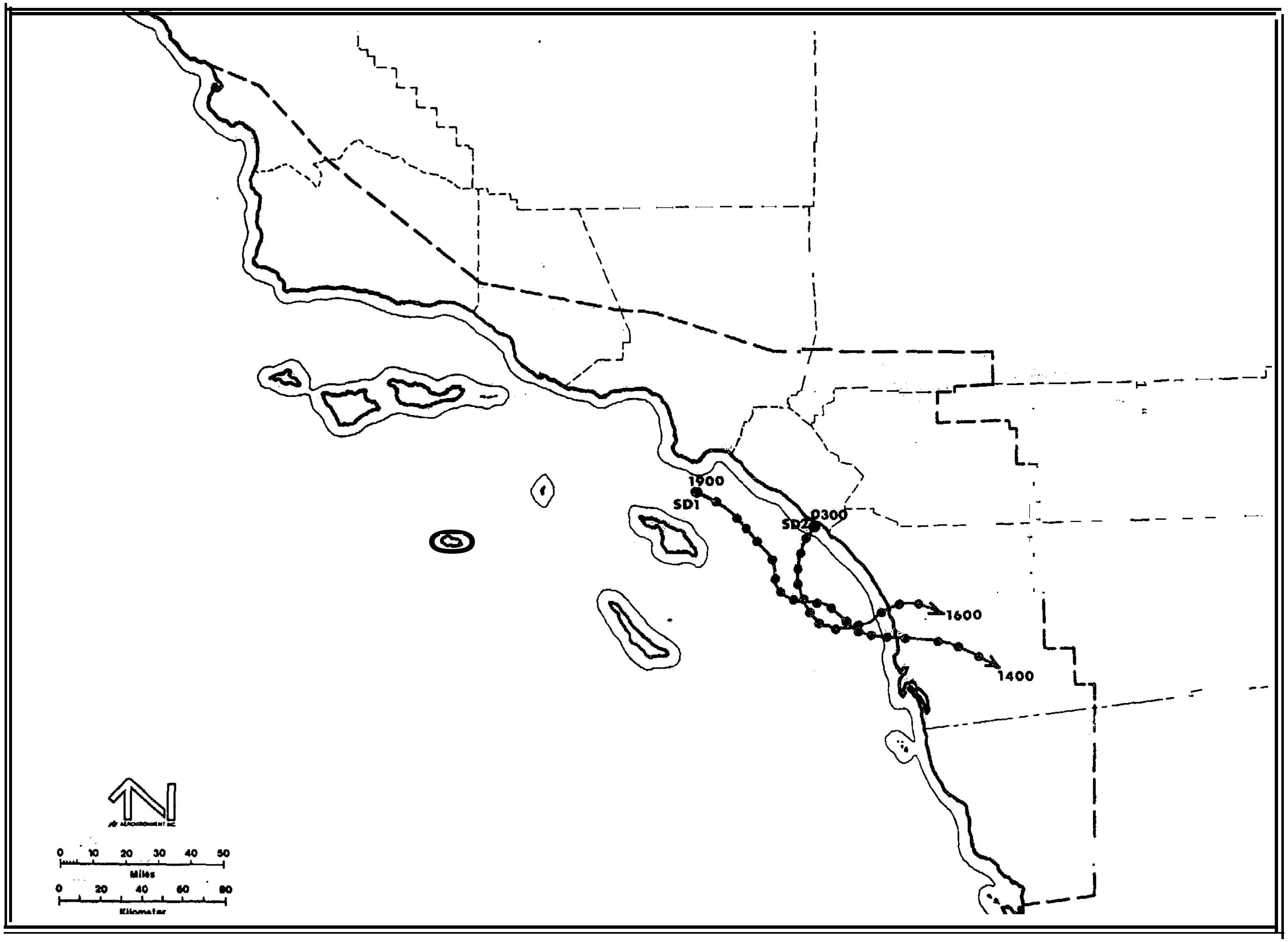
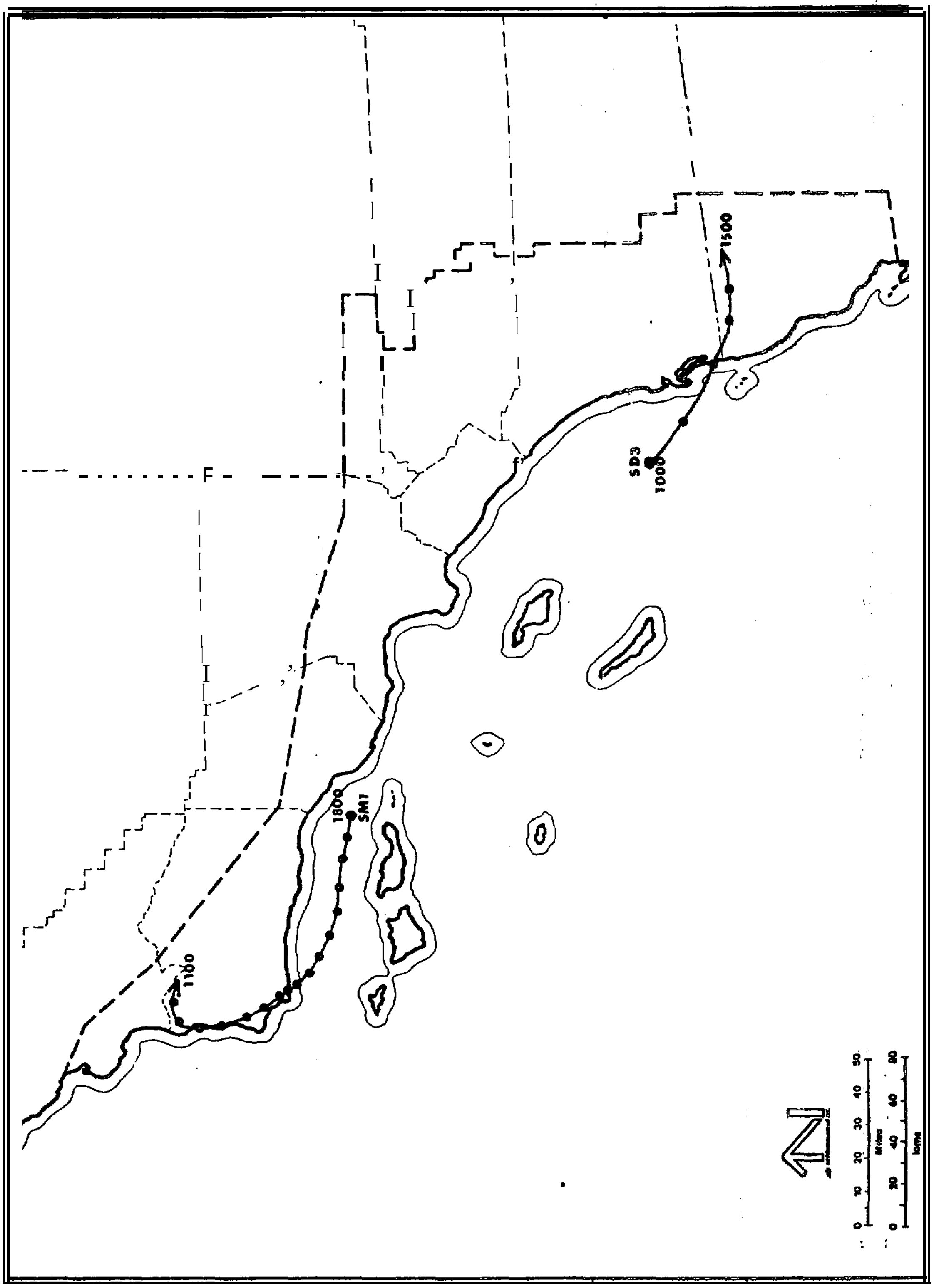


FIGURE VII-5. Trajectories for regional analysis showing start and end times.


SD3
1000
1500
SM1
1800
1100
Miles
0 10 20 30 40 50
kms
0 20 40 60 80

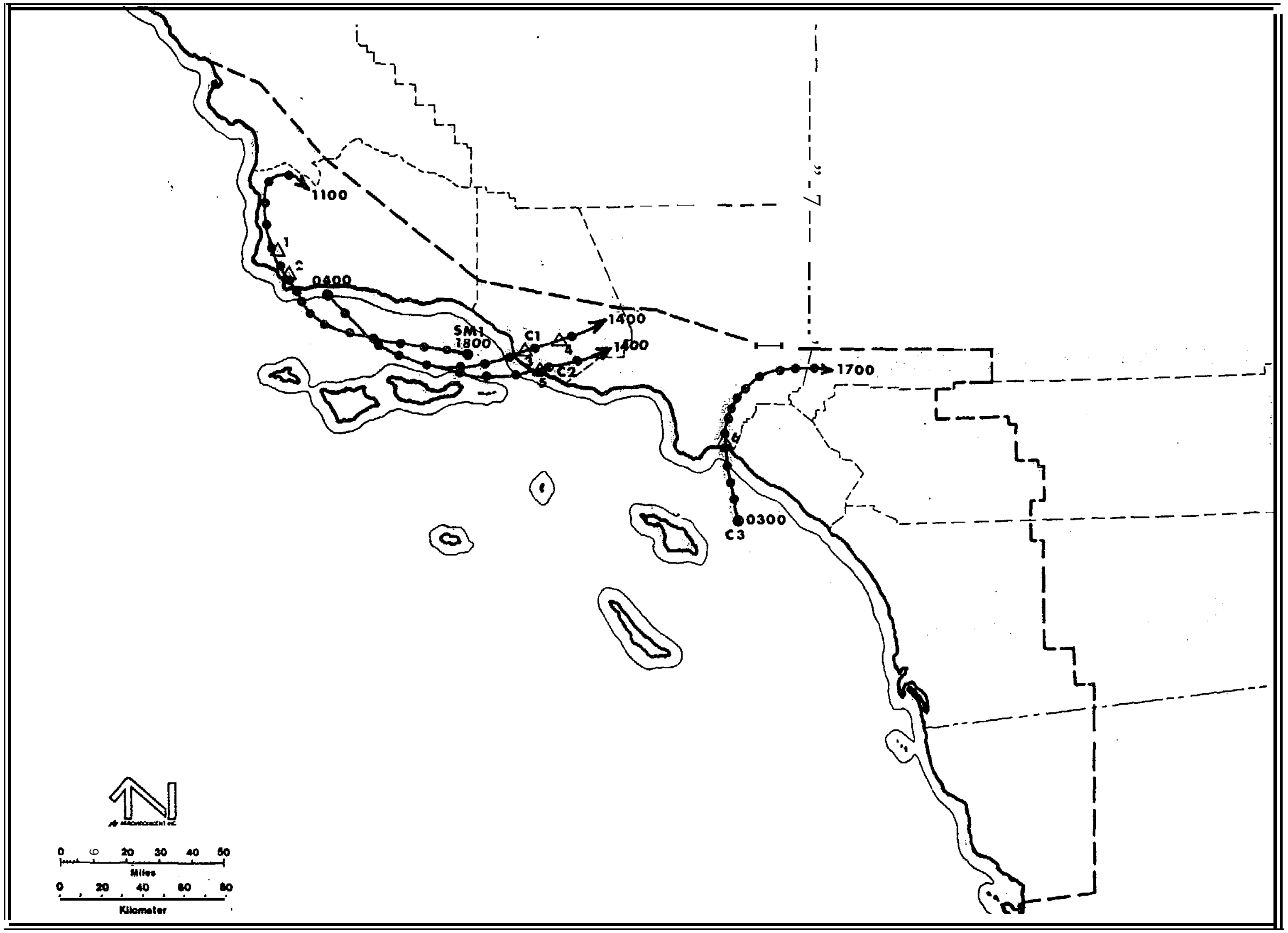


FIGURE VII-7. Trajectories for cumulative analysis showing start and end times.

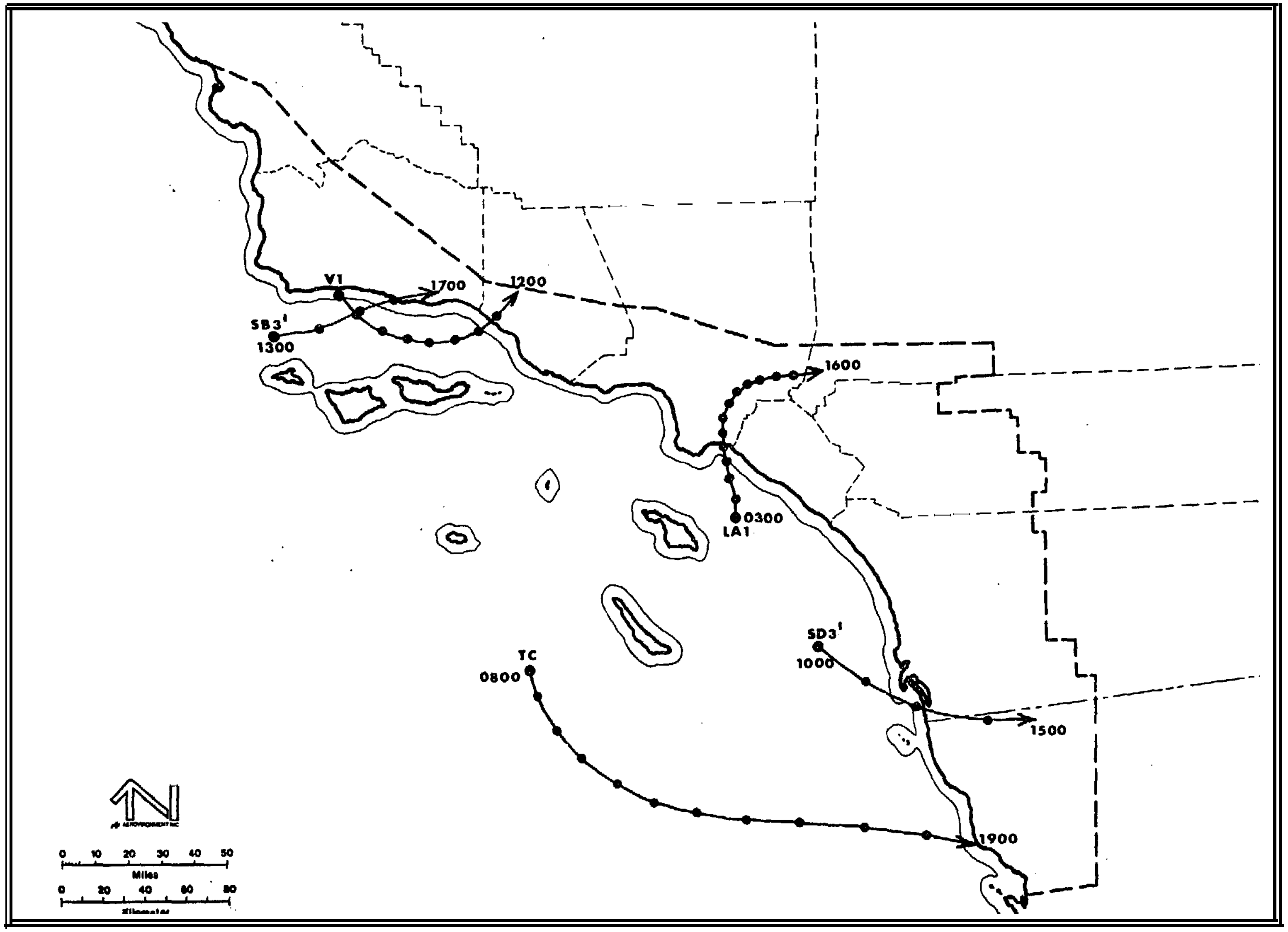


FIGURE VII-8. Trajectories for accident analysis showing start and end times.

TABLE VII-3. Initial Concentrations.

Run [a]	O_3 (ppm)	NO_2 (ppm)	NO (ppm)	NMHC (ppmC)	“co (ppm)
Validation					
SB	0.01	0.05	0.04	2.0	2.0
LA	0.01	0.04	0.03	2.0	3.0
SD	0.03	0.06	0.02	1.5	1.0
Regional					
SB1	0.01	0.04	0.03	1.5	2.0
SB3’ [c]	0.05	0.04	0.01	1.0	1.0
V2	0,01	0.02	0.01	1.0	0.5
V3	0.01	0.02	0.01	1.0	0.5
LAI [c]	0.01	0.04	0.03	2.0	2.0
LA2	0.01	0.04	0.03	2.0	2.0
SD1	0.01	0.05	0.02	1.5	1.0
SD2	0.01	0.03	0.02	1.0	1.0
SM1 [b]	0.01	0.04	0.01	1.0	1.0
SD3' [c]	0.03	0.03	0.01	1*0	0.5
Cumulative					
cl	0.01	0.02	0.01	1.0	0.5
C2	0.01	0.02	0*01	1.0	0.5
C3	0.01	0.04	0.03	2.0	2.0
Accident					
V1	0.01	0.02	0.01	0.5	0.5
TC	0.03	0.01	0.05	0.25	0.5

[a] See Table VII-2 for figure & reference.

[b] Trajectory SM 1 is used in both regional and cumulative analysis.

[c] Trajectories used in both regional and accident analysis.

Three days in 1975 with high photochemical pollutant levels were chosen, and the actual air quality and meteorological conditions for those days were used as inputs to the model. The three validations runs were as follows:

(1) Santa Barbara trajectory - West Los Angeles to Santa Barbara - 9/25/75

(2) Los Angeles trajectory - Long Beach to Upland - 7/25/75

(3) San Diego trajectory - Oceanside to Alpine - 9/3/75

The predicted concentrations at the end of the trajectories were compared to the actual measured concentrations at the specific locations on the days of interest. The results are shown in Table VII-4. The complete model results, showing all concentrations as a function of time along the trajectory, are presented in Appendix D. The REM2 model showed excellent agreement between predicted and observed concentrations at each of the three validation sites. It should be noted that these validations were made on a "hands-off" basis, i.e., there were no model parameters which were optimized for the best validation.

D. Simulation Results (1986) Normal Tankering Emissions

1. Assumptions - For the 1986 normal tankering simulations, REM2 model runs were made with and without Sale 48 emissions in order to assess the incremental air quality impacts of Sale 48. Model trajectories were chosen which passed directly over Sale 48 emission sources, thus simulating the maximum air quality impacts of Sale 48.

The normal tankering emission assumptions are discussed in Section V. In the modeling runs, no tankers or barges were assumed to be loading at single buoy moors during the base case (without Sale 48). One tanker was assumed to be loading at a single buoy moor in the Santa Barbara Channel, one barge was assumed loading off Santa Barbara Island, and one barge was assumed to be loading off San Diego during the model run with Sale 48. This approach maximized the impacts of the Sale 48 emissions. In the cumulative modeling runs, the fuel oil option for the Vaca Tar Sands facility was assumed.

TABLE VII-4. REM2 validation results.

1. Santa Barbara Trajectory - Santa Barbara, 1600, 9/25/75

Pollutant	Measured (ppm)	Predicted (ppm)
O_3	0.17	0.18
NO_2	0.04	0.05
NO	0	0
CO	2	2

2. LosAngeles Trajectory - Upland, 1300, 7/25/75

Pollutant	Measured (ppm)	Predicted (ppm)
O_3	0.32	0.25
NO_2	0.08	0.09
NO	0.01	0
CO	4	3

3. San Diego Trajectory - Alpine, 1400, 9/3/75

Pollutant*	Measured (ppm)	Predicted (ppm)
O_3	0.19	0.16

*Only O_3 was measured at Alpine

2. Regional Results - Two different model runs were made in each of the four main areas of interest for the normal tankering emissions case:

(1) Santa Barbara (SB1, SB3)
(2) Ventura (V2, V3)
(3) Los Angeles (LA 1, LA2)
(4) San Diego (SD1, SD2)

In addition, one run was made north of Point Conception (SM 1) and south of the Mexican border (SD3). The model results for 0_3 and NO_2 are summarized in Table VII-5. The complete model results, showing all concentrations as a function of time along the trajectory, are presented in Appendix D.

The normal tankering impacts of Sale 48 on photochemical air quality were extremely small, as shown in Table VII-5. Typically, predicted ozone levels were raised by only 0.001 ppm or less. The greatest calculated impact was in the V2 trajectory, ending at Ojai, with an 0_3 increase of 0.004 ppm, or roughly a 4% increase in the predicted 0_3 level.

3. Cumulative Results - Four model runs were made to determine the cumulative air quality impact of Sale 48 normal tankering emissions and other proposed sources:

(1) LNG facility located at Point Conception site (SM1)
(2) LNG facility located at Oxnard site and Vaca Tar Sands facility (C1)
(3) Elk Hills facility (C2)
(4) SOHIO project (C3)

The space shuttle project was not estimated to produce any photochemically reactive pollutants and thus was not modeled. The model results for 0_3 and $N0_2$ are summarized in Table VII-6. The complete model results, showing all concentrations as a function of time along the trajectory, are presented in Appendix D.

Again, the impacts of normal tankering Sale 48 emissions on photochemical air quality were extremely small, as shown in Table VII-6. The greatest calculated impact was in the C3 trajectory, ending at Upland, with an 0_3 increase of 0.003 ppm, or roughly a

TABLE VII-5. Regional impacts - normal tankering emissions.

Run	Case	O_3 (ppm)	NO_2 (ppm)
SB1	without Sale 48 with Sale 48	0.156 0.156	0.048 0.049
SB3'	without Sale 48 with Sale 48	0.115 0.116	0.051 0.052
V2	without Sale 48 with Sale 48	0.099 0.103	0.031 0.034
V3	without Sale 48 with Sale 48	0.083 0.085	0.055 0.056
LA1	without Sale 48 with Sale 48	0.232 0.233	0.091 0.092
LA2	without Sale 48 with Sale 48	0.187 0.187	0.063 0.064
SD1	without Sale 48 with Sale 48	0.139 0.140	0.048 0.049
SD2	without Sale 48 with Sale 48	0.107 0.107	0.044 0.044
SM1	without Sale 48 with Sale 48	0.070 0.071	0.042 0.043
SD3'	without Sale 48 with Sale 48	0.123 0.124	0.041 0.041

TABLE VII-6. Cumulative impacts - normal tankering emissions.

Run	Case	O_3 (ppm)	NO_2 (ppm)
SM1	without Sale 48	0.070	0.043
	with Sale 48	0.070	0.044
C1	without Sale 48	0.096	0.036
	with Sale 48	0.098	0.037
C2	without Sale 48	0.095	0.032
	with Sale 48	0.097	0.033
C3	without Sale 48	0.248	0.089
	with Sale 48	0.251	0.091

1% increase in the predicted 0_3 level. It should be noted that theresults in Table VH-6 show only the air quality impacts of Sale 48 emissions – the effects of the other proposed sources are included in both the cases considered.

E. Simulation Results (1986) - 100% Tankering Emissions

1. Assumptions - As in the normal tankering emission simulations, REM2 model runs were made with and without Sale 48 emissions, assuming 100% tankering, in order to assess the incremental air quality impacts of Sale 48. Model trajectories were chosen which passed directly over Sale 48 emissions sources, thus simulating the maximum air quality impacts of Sale 48.

The 100% tankering emission assumptions are discussed in Section V. In the modeling runs, no tankers or barges were assumed to be loading at single buoy moors during the base case (without Sale 48). One barge was assumed to be loading off Santa Barbara Island, off San Pedro, and off San Diego, and one tanker and one barge were assumed to be loading at single buoy moors in the Santa Barbara Channel during the model runs with Sale 48. This approach maximized the impacts of the Sale 48 emissions. In the cumulative modeling runs, the fuel oil option for the Vaca Tar Sands facility was assumed.

2. Regional Results - Model runs were made in each of the four main areas of interest for the 100% tankering emissions case:

(1) Santa Barbara (SB1)
(2) Ventura (V2, V3)
(3) Los Angeles (LA1)
(4) San Diego (SD1)

Two different model runs were made in Ventura, since this was the region of the maximum air quality impacts of the normal tankering Sale 48 emissions. In addition, one run was made north of Point Conception (SM 1) and south of the Mexican border (SD3'). The model results for 0_3 and $N0_2$ are summarized in Table VII-7. The complete model results, showing all concentrations as a function of time along the trajectory, are presented in Appendix D.

TABLE VII-7. Regional impacts - 100% tankering emissions.

Run	Case	O_3 (ppm)	NO_2 (ppm)
SB1	without Sale 48 with Sale 48	0.157 0.158	0.047 0.048
V2	without Sale 48 with Sale 48	0.089 0.093	0.029 0.030
V3	without Sale 48 with Sale 48	0.083 0.088	0.054 0.054
LA1	without Sale 48 with Sale 48	0.231 0.234	0.092 0.092
SD1	without Sale 48 with Sale 48	0.140 0.140	0.048 0.049
SM1	without Sale 48 with Sale 48	0.074 0.075	0.044 0.046
SD3'	without Sale 48 with Sale 48	0.124 0,124	0.041 0.041

The 100% tankering impacts of Sale 48 on photochemical air quality were very small, as shown in Table VII-7. The greatest calculated impact was in the V3 trajectory, ending in the Simi Valley, with an 0_3 increase of 0.005 ppm, or roughly a 6% increase in the predicted 0_3 level. In general, the 0_3 and NO_2 air. quality impacts of Sale 48 emissions were slightly higher in the 100% tankering emissions case than in the normal tankering emissions case.

3. Cumulative Results - Four model runs were made to determine the cumulative air quality impact of 100% tankering emissions and other proposed major emission sources:

(1) LNG facility at Point Conception (SM 1)
(2) LNG facility at Oxnard and Vaca Tar Sands facility (Cl)
(3) Elk Hills facility (C2)
(4) SOHIO project (C3)

The model results for O_3 and NO_2 are summarized in Table VII-8. The complete model results, showing all concentrations as a function of time along the trajectory, are presented in Appendix D.

Again, the impacts of Sale 48 100% tankering emissions were very small, as shown in Table VII-8. The greatest calculated impact was in the C 1 trajectory, ending in the Simi Valley, with an 0_3 increase of 0.005 ppm, or roughly a 5% increase in the predicted 0_3 level. It should again be noted that the results in Table VII-8 show the air quality impacts of Sale 48 emissions when superimposed on the base of air quality including the impacts of the individual proposed emission sources.

F. Simulation Results (1986) - Accidents

1. Assumptions - Model runs were made assuming four different types of accident scenarios.

(1) 140 barrels oil spilll
(2) 10,000 barrel oil spill
(3) 1,000 barrel/day blowout
(4) 1,000 barrel/day blowout with fire

TABLE VII-8. Cumulative impacts - 100% tankering emissions.

Run	Case	O_3 (ppm)	NO_2 (ppm)
SM1	without Sale 48	0.074	0.044
	with Sale 48	0.075	0.046
Cl	without Sale 48	0,095	0.035
	with Sale 48	0.100	0.035
C2	without Sale 48	0.094	0.030
	with Sale 48	0.098	0.031
C3	without Sale 48	0,247	0.090
	with Sale 48	0,250	0.089

The assumptions used in calculating emissions from these accidents are detailed in Section V and emissions are listed in Appendix A. For the modeling runs, a 140 barrel oil spill and a 1,000 barrel/day "blowout have identical maximum emission rates (only hydrocarbons), and thus only one model run was necessary to determine the impact of both types of accidents. For the 1,000 barrel/day blowout with fire, it was assumed in the modeling that the hot gases did not "penetrate the mixing layer, i.e., all emissions were trapped below the mixing layer.

Simulations were made for a base case (without Sale 48 emissions) and with Sale 48 emissions and the different accident emissions. Model trajectories were chosen which passed directly over the accident sites, thus simulating the maximum air quality impacts of the accidents. For the' "oil spills,, emissions during the first hour of evaporation were used in the modeling runs.

2. Inert Contaminants

0 Regional Impacts

Sale 48 will not have significant inert pollutant impact on areas south of the U. S.-Mexico border.

o Impacts of Specific Sources

The maximum concentrations during normal operation will be insignificant by the time the plume has traveled south of the U.S.-Mexico border.

For the accident case of blowout with fire, the concentration in Mexico will be over a factor of 10 less than the peak centerline impact discussed for Santa Barbara County. Thus, the concentrations of the contaminants will be within both U.S. and California standards by the time they are carried to Mexico.

3. Results - REM2 model runs were made to assess the impact of accidents on air quality in the following areas:

(1) Santa Barbara (accident site in Santa Barbara Channel - SB3' trajectory)

(2) Los Angeles (accident site off San Pedro - LA1 trajectory)
(3) San Diego (accident site off San Diego - SD3' trajectory)
(4) Ventura (accident site in Santa Barbara Channel - V 1 trajectory)
(5) Mexico (accident site in Tanner/Cortez Banks - TC trajectory)

For the Ventura and Mexico impacts, only the 10,OOO barrel oil spill accident was modeled. The model results for O_3 and NO_2 are summarized in Table VII-9. The complete model results, showing all concentrations as a function of time along the trajectory, are presented in Appendix D.

As shown in Table VII-9, the predicted air quality impacts were relatively minor for three types of accidents - the 140 barrel oil spill, the 1,000 barrel/day blowout, and the 1,000 barrel/day blowout with fire. However, the large 10,000 barrel oil spill produced significant effects. Increases in maximum 0_3 levels resulting for the worst hour of emissionsdue to a 10,000 barrel oil spill ranged from 0.069 ppm in Santa Barbara to 0.149 ppm in Los Angeles (Upland). Later concentrations would have less impact. Since the Federal one-hour averaged standard for 0_3 is 0.08 ppm, a 10,000 barrel oil spill was predicted to cause increases in 0_3 levels which exceeded the Federal standard in Los Angeles, San Diego, and Ventura.

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TABLE VII-9. Regional impacts - accidents.

Run	Case	O_3 (ppm)	NO_2 (ppm)
SB3 '	base case (without Sale 48)	0.115	0,051
	1,000 bbl/day blowout with fire	0.115	0.053
	140 bbl spill or 1,000 bbl/day blowout	0.118	0.052
	10,000 bbl spill	0.184	0.038
LA1	base case (without Sale 48)	0.232	0.091
	1,000 bbl /day blowout with fire	0,235	0.093
	140 bbl spill or 1,000 bbl/day blowout	0.239	0.091
	10,000 bbl spill	0.381	0.055
SD3 '	base case (without Sale 48)	0.123	0.041
	1,000 bbl/day blowout with fire	0.124	0.041
	140 bbl spill or 1,000 bbl/day blowout	0.126	0.041
	10,000 bbl spill	0.203	0.028
V1	base case (without Sale 48)	0.064	0,024
	10,000 bbl spill	0.152	0.009
TC	base case (without Sale 48)	0.064	0.011
	10,000 bbl spill	0.141	0.004

VIII. MITIGATING MEASURES

Measures for mitigating the adverse impacts of the proposed OCS projects on air quality can be categorized as follows:

- Measures for reducing pollutant emissions at the source.
- Measures for changing the spatial or temporal relationships of individual sources to minimize the aggregate impact,
- Measures for reducing the populations exposed to the impact – for example, relocations of proposed project elements.

Most realistic, committed and enforceable measures for the mitigation of adverse air quality impacts fall into the first of the above categories – they reduce emissions at the source. Such measures are the main subject of the discussion which follows. The remaining two categories will be discussed briefly.

Best Available Control Technology (BACT) has not been defined for offshore facilities. This section presents the BACT associated with onshore facilities with a discussion of its applicability to offshore facilities.

A. Reduction of Emissions at the Source

1. Accidents - Accidents produce larger air quality impacts than any normal oil production activity. It is of extreme importance to minimize oil spills and blowouts to the maximum extent possible, because there is very little corrective action that can be taken to reduce the impact on air quality after the accident has occurred. The major hydrocarbon emissions (75%) occur within the first two hours. Accident prevention will be discussed by the BLM in connection with the impact on water quality and will not be discussed here. Even though the impact of accidents on air quality is large, the impact on water quality is still larger.

2. Fugitive Hydrocarbon Losses from Offshore Activities - The first thing that must' be decided is what type of processes and equipment can be expected to be found at the platform. Processes will include pumping oil and gas out of the ground, separating the two and sending it ashore for further processing. Any water used on the platform for washing or cooling will have to be treated to remove oil contamination prior to discharge. Also, to provide for safety during upsets,a flare should be present. Equipment one can expect to find on the plant are pumps, compressors, valves, flanges, blinds, sampling points, horizontal tanks (high pressure bullets probably) for liquid-gas and oil-water separation, and a flare. There are two keys to the control of fugitive emissions-design and maintenance.

a. Several criteria can be incorporated into a platform design which can reduce fugitive emissions.

i. Volume throughputs through platform pumps and compressors' should be high enough so that centrifugal fluid-transport systems can be used. This is desirable because a centrifugal unit can be controlled by a mechanical seal whereas a reciprocating shaft can only be controlled by packing seals. Data have been developed to show that packed seals emit 50 percent more hydrocarbons than mechanical seals (Rosebrook, 1977).

When considering the types of mechanical seals to use on compressors, there are two recommended types: the labyrinth seal for gas service, and the oil-film seal for liquid service.

Labyrinth seal - This seal consists of a number of restrictions and openings through which the escaping gas must flow. The labyrinth seal is usually vented at some midpoint and bled back to a lower pressure stage or to the compressor suction.

Oil film seal - An oil film seal is a successful modification of the mechanical seal. It is constructed like a mechanical seal but the wearing faces are held apart while the machine is running. The reason there is no wear is that the oil pumped between sealing faces does the actual sealing. One estimate of emissions from this type of compressor and seal is 50 scfm/compressor through the drain pipe.

If it is necessary to use reciprocating pumps or compressors, packing will have to be used. Newer forms of packing termed “vent packing” consists of a relatively firm packing housing which encases the shaft and can be connected to a vapor blowdown and collection system with the final destination being the flare. This leads into the second major design criteria change, increased use of the flare.

ii. Wherever possible, process vents should be routed to the flare. Due to the physical closeness of all equipment on a platform, the logistics of employing such a system should not be difficult. This practice would tie in pressure relief valves, compressors, covered oil/water separators, and all other feasible potential leak points.

The flare should be sized large enough to handle upset conditions and be equipped with a smokeless tip. The tip functions by injecting steam into the gas flame to improve combustion and reduce visible emissions. The most desirable type uses automatic steam injection with manual override.

iii. The third major design condition which should be employed is the generous use of in-line spares. In the operation of a prouction facility, it is extremely important that processes operate as much of the time as possible. In order to minimize down-time caused by equipment malfunctions, the major streams should have spares. The lack of a spare on an important streamline could cause operation to continue during a leakage condition resulting in more hydrocarbon emissions than would result if this pump had an in-line spare. Existence of this spare would allow switching of the product line with minimal disturbance to the process operations while the normal pump can be taken off-line making a leaking seal readily accesible for repair or replacement.

iv. Several minor design aspects should also be employed. It occasionally becomes necessary to utilize blinds. A blind is a flat solid piece of steel which can be inserted in a flange to form a solid seal in a line. The presence of a blind in a line at times of repair eliminates the danger of an injury, contamination, or spillage due to an inadvertent opening of a valve.

Normal blind changing consists of disconnecting bolts, splitting with a flange chisel and inserting the blind. This process uses manpower and can result in needless hydrocarbon emissions. Probably 13 ACT would be a permannetly installed quick-change blind such as the Hamer unit, which can' be changed almost instantaneously without loss. This valve has an integral handwheel to release the pressure on a rubber-gasketed double spectacle blind. One side is solid and the other is ring-shaped for use during normal operations. When the pressure is released, the blind is merely slid across to the other position and the pressure reapplied by the hand-wheel. Due to their expense, 'these blinds are usually restricted to applications which require frequent changes.

Valves can be controlled by the new vent packing, if possible. Relief valves can have bursting discs with maintenance or vent to the flare.

b. The second major emission "reduction procedure is maintenance. This includes both repair and preventive maintenance.

During scheduled turnarounds, the facility has a number of opportunities to reduce fugitive emissions easily and inexpensively: (1) replace seals (mechanical for packing if possible); (2) replace packing in valves; (3) replace gaskets (for valves and flanges); (4) clean and reseat pressure-relief devices and tie them into the flare system; (5) cover drains; and (6) install more modern equipment.

Routine maintenance can be much less complicated than that performed during a turnaround. Valve leaks can usually be reduced or eliminated simply by tightening the nuts on the packing gland. That valve can then be marked for close inspection during the turnaround. Leaks are easily detected with a hydrocarbon monitor, and, with experience, their magnitude can be estimated quite accurately (Rosebrook, 1977).

Fixed roof storage tanks with no vapor recovery systems were assumed for 'offshore processing facilities. Installation of some sort of emission control system 'should be possible. Techniques currently available for onshore facilities such as bottom loading and the tying of vents to flares or vapor recovery equipment, should be applicable for off-shore installations although it has not actually been done yet. Additional safety requirements im'posed by the Coast Guard could complicate the process.

3. Offshore Power Generation - The power for drilling and oil processing on offshore platforms was assumed to be supplied by diesel fired internal combustion engines. Table VIII- 1 shows the reduction in combustion emissions which would result from the substitution of sweet natural gas for diesel as a fuel.

4. Tanker Operations - Substantial hydrocarbon emissions occur during loading and ballasting of tankers, and much lesser emissions occur during unloading and transit. In the scenarios under consideration in this report, tanker loading occurs as part of the lightering operation in 1975 and at single buoy moors in 1986. Barges are also loaded at single buoy moors and at port in Ventura in the 1986 scenarios. The entire lightering operation is expected to be phased out by 1986, so this in itself constitutes a measure for mitigation of lightering emissions. Loading emissions from tankers and barges at single buoy moors and at Ventura could presumably be reduced substantially by installation of vapor balance recovery systems similar to those used at onshore truck loading facilities. This has not been demonstrated, and is complicated by Coast Guard safety regulations that do not apply onshore and also by the extremely high flow rates that are sometimes used during tanker loading.

Emissions were calculated on the assumption that tankers burn 2.5% sulfur fuel at sea and 0.5% or 1.0% sulfur fuel in port. Tugs and barge pumps were assumed to be powered with diesel fuel (0.2% sulfur). Emissions of sulfur oxides could be reduced by switching to lower sulfur fuels; however, the fuels burned in port are already assumed to be low sulfur. Additional reductions could be achieved at sea by switching to low sulfur fuel, but the improvement in air quality over populated areas would be very small and might not be justified in view of the severely limited quantities of low sulfur fuel that are available.

Hydrocarbon losses during transport can be minimized by the use of gas blanketing systems utilizing combustion gases passed through a seawater scrubber, in conjunction with pressure-vacuum vents. These systems are now used on a few large tankers and could probably be adapted to the smaller (400,000 bbl) tankers proposed for the 1986 OCS scenarios. Emissions in Appendix A were computed under the assumption that these systems would not be used, so further reductions are possible. A non-self-propelled barge does not have the resources for such a gas blanketing system, but installation of pressure-vacuum vents (without the blanketing system) should aid in reducing transit losses.

TABLE VIII-1. Natural gas and diesel emission rates

Contaminant	Natural Gas Emission Rate ($lbs/10^6$ BTU)*	Diesel Emission Rate ($lb/10^6$ BTU)**
Particulate	0.01	0.24
SO_2	Neg.	0.22
NO_2	0.39	3.35
HC (total)	0.04	0.27
CO	0.11	0.73

*AP-42, Table 3.3.1-2 Composite Emission Factors for 1971 Population of Electric Utility Turbines. Assumed natural gas to have heat content of 1050 BTU/CF

**AP-42, Table 3.3.3-1 Emission Factors for Gasoline and Diesel-Powered Industrial Equipment. Assumed diesel to have heat content of 140,000 BTU/gal.

Transit losses from tankers and barges are small compared to loading losses and fuel combustion emissions, so the overall change in air quality resulting from control of these emissions would be very small.

5. General-As was discussed in Chapter III, offshore facilities do not fall within the jurisdiction of local air pollution control agencies and are not actually subject to the local air pollution control requirements. Emissions offshore can be reduced by requiring that all equipment and processes conform to the applicable regulations for onshore facilities.

B. Changes in Scheduling of Operations

1. Cargo tank purging - Occasionally the cargo tanks on a tanker may be purged by sweeping them out with air so that it is possible to enter the hold to accomplish repair work. This process results in very large emissions of hydrocarbons. Purging was not considered in the modeling studies described in this report because it occurs infrequently and is not usually done in port. Purging is not expressly forbidden in port, however, and some legal prohibition of this activity could be considered as a precautionary measure.

2. Ballasting - When ballast water is drawn into tanks that have previously held crude oil, large amounts of hydrocarbons are emitted into the atmosphere. These emissions can be prevented in two ways: (1) by using segregated ballast tanks which are never used for crude oil, and (2) without segregated ballast tanks by keeping ballasting to an absolute minimum when in port. Segregated ballast tanks are in use now, on larger tankers, so no technological developments are required; it is merely necessary to see that the tanks are provided on the smaller (400,000 bbl) tankers and used according to the design specifications.

c. Reducing the Population-at-Risk

In general, onshore activities have more impact on the population than the corresponding activities conducted offshore. The additional emissions associated with transporting personnel and supplies to offshore locations are negligible compared to the emissions from the production and processing operations themselves. Therefore, the farther away from populated areas the offshore production and processing facilities are, the less will be the impact of impaired air quality on the population.

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IX. ASSESSMENT' OF IMPACTS

This chapter presents an assessment of the impacts of Sale 48. The impacts are discussed, in order, for Santa Barbara and Ventura Counties, Los Angeles and Orange Counties, San Diego County, and other affected areas for each scenario analyzed. Inert and photochemical contaminants analyses results are summarized and compared to standards. The state and federal ambient air quality standards are set to protect public health and welfare. The impacts are too small to quantify any health impacts. Major emission sources are identified.

It should be emphasized that impacts were determined 1) for the peak production year of 1986 when emissions should be greatest and 2) when meteorological conditions should maximize impacts. Thus, other years and other times during 1986 will have smaller impacts than those discussed below.

A. Santa Barbara and Ventura Counties

1. Photochemical Reactive Contaminants

a. Regional Impacts

The model results indicate that the emissions resulting from the addition of Sale 48 would increase the peak 0_3 concentration by 0.001 ppm or less, for all trajectories analyzed for Santa Barbara County, for both normal and 100% tankering scenarios. The increase is 0.005 ppm or less for the Ventura County trajectories for both normal and 100% tankering scenarios. The peak 0_3 concentrations predicted by the model are above the 1-hour Federal oxidant standard of 0.08 ppm for trajectories into Santa Barbara and Ventura Counties and slightly below the standard for the Santa Maria trajectory into northern Santa Barbara County for both tankering scenarios. In general, the impacts are slightly higher for the 100% tankering scenario then for the normal tankering scenario.

Although the exceedance of the 0_3 standard would have occurred without Sale 48, Sale 48 does increase the resulting peak 0_3 concentrations and could delay the attainment of the Federal standards, although this effect may not be measurable in Santa Barbara County. There were no emissions offset identified by the BLM and none were modeled.

b. Cumulative Impacts With Other Major Projects

The model results indicate that Sale 48 increases peak 0_3 concentrations by 0.002 ppm or less for normal tankering and by 0.005 ppm or less for 100% tankering over the values which would occur if all other proposed projects took place. The peak 0_3 concentrations are close to and above the Federal l-hour standard of 0.08 ppm. Thus, although the increase is small, Sale 48 could slightly delay the attainment of the Federal standard.

c. Accident Impacts

The model results indicate a significant peak 0_3 concentration impact potential from the accidents analyzed. The smaller spill and blowouts would cause less than .003 ppm increase. The larger 10,000 bbl spill could cause a 0.07 to 0.09 ppm increase in 0_3 concentration at worst, resulting in peak l-hour values varying from 0.18 ppm to 0.15 ppm depending on the trajectory. These values are over the Federal l-hour standard.

2. Inert Contaminants

a. Regional Impacts

The regional impacts of Sale 48 are generally insignificant and the maximum impacts are located greater than 3 miles from shore except for the impacts of the gas and oil processing facilities onshore in Ventura. The analysis assumes that all oil and gas processing associated with both Sale 35 and Sale 48 with normal tankering is done at a single location. The modeling of the emissions from this processing predicts exceedances of the $N0_2$ l-hour California standard of 0.25 ppm and the Federal $N0_2$ annual average standard of 0.05 ppm in the Ventura area. The maximum 1-hour $N0_2$ concentration predicted by the regional model was 0.66 ppm. When 100% tankering is assumed, and thus no processing is done in Ventura, the impact of Sale 48 is very small and located beyond 3 miles from shore. The scenario which includes Sale 48 with 100% tankering plus the other major projects results in exceed antes of the $N0_2$ l-hour standards, but the contribution from Sale 48 activities at the location of the maximum is insignificant (<0.01 ppm).

The regional CO, TSP, and $S0_2$ impacts of the normal operation of Sale 48 are insignificant (less than 10% of the inspection standards) and occur beyond 3 miles from shore; the 100% tankering scenario has slightly larger impacts than the normal tankering. The scenarios with the other major projects show significant $S0_2$ impacts onshore, but the impacts are from the other major projects (mainly Vaca Tar Sands and Elk Hills projects) and not associated with Sale 48. The Sale 48 activities have an insignificant additional impact with either normal or 100% tankering.

Accidents result in TSP and H_2S impacts located beyond 3 miles from shore.

b. Impacts of Specific Sources

The maximum downwind impacts from the various sources associated with Sale 48 in Santa Barbara and Ventura Counties were analyzed. There were significant impacts of NO_2 and H_2S from the gas and oil processing facilities in Ventura. The model indicated that the plume centerline $N0_2$ impact at the surface would be above the l-hour standard over a broad range from 5 to 35 km downwind. Plume centerline H_2S concentrations, peak at 0.15 ppm, decrease very rapidly and are within standards by 2 km from the source. These results are very conservative (i.e., very high) because of the assumption that all oil and gas processing is done at a single location in Ventura and that all NO_x emissions are $N0_2$. In addition, the SBM's in the Santa Barbara Channel will also result in levels of TSP and $N0_2$ over the standards close to the emission source. However, the concentrations decrease very rapidly with distance so that by 2 km downwind the concentrations of the pollutants are all within standards. Thus, the impacts on the populated areas onshore are insignificant.

Accidents result in significant impacts for TSP, $N0_2$, $S0_2$ and H_2S. A blowout with fire results in peak l-hour concentrations, excluding background, of TSP, $N0_2$ and $S0_2$ of 1380 $\mu g/m^3$, 0.25 ppm and 1.64 ppm respectively. The $N0_2$ and $S0_2$ values are at and above l-hour standards and the TSP level will lead to exceedance of the 24-hour standard of 100 $\mu g/m^3$. The blowout without fire results in a l-hour peak H_2S concentration of 0.11 ppm – well over the standard of 0.03 ppm. These accident impacts are valid for all regions.

B. Los Angeles and Orange Counties

1. Photochemically Reactive Contaminants

a. Regional Impacts

The modeling results indicate that the emissions resulting from the addition of Sale 48 will increase peak 0_3 concentrations by 0.001 ppm or less for normal tankering and 0.003 ppm for 100% tankering. The peak 0_3 concentrations are 0.187 ppm to about 0.233 ppm, significantly above the Federal l-hour standard of 0.08 ppm. with or without Sale 48. Both scenarios have a small but adverse impact, which may not be measurable on attaining the Federal l-hour standard. There were no emissions offset identified by the BLM and none were modeled.

b. Cumulative Impacts With Other Major Projects

The model results indicate that Sale 48 would increase peak 0_3 concentrations by 0.003 ppm. The peak 0_3 concentration is about 0.25 ppm with or without Sale 48, but Sale 48 will have a small adverse impact on attainment of the Federal l-hour standard. This delay may not be measurable since Sale 48 causes less than 1 % of the O_3 concentration which would have occurred without Sale 48.

c. Accident Impacts

The modeling predicts a significant impact potential on peak 0_3 concentrations for the accidents analyzed. The blowout and smaller spills analyzed result in about 1% increase to about 0.24 ppm in peak O_3 concentrations. The larger 10,000 bbl spill can cause a significant increase in peak 0_3 concentration from 0.23 ppm without the accident to 0.38 ppm with the accident, which results in a change from a stage I (0.2 ppm) episode to a stage 11 (0.35 ppm) episode as defined by the California Air Resources Board. (SCAQMD, 1977)

2. Inert ‘Pollutants

a. Regional Impacts

Maximum background concentrations for TSP and $N0_2$ exceed standards throughout the shore area, as well as offshore for TSP. Thus any impact from Sale 48 will be to increase the degree of standard exceedance for these pollutants. For TSP, all maximum impact locations from Sale 48 are located beyond 3 miles from shore. The maximum 24-

hour background concentration (without Sale 48) is predicted to be greater than the standard, with the impact of Sale 48 increasing the 24-hour average exceedanceby 2 to 3 µg/m^3 - well offshore. The impact of Sale 48 TSP emissions at onshore locations is very small.

Under the normal tankering scenario, gas processing activities onshore would increase 1-hour nitorgen dioxide concentrations by 0.01 ppm, from 0.30 ppm to 0.31 ppm, in the regional scale. Exceedance of the annual standard is not anticipated, however. The impact from Sale 48 on CO and $S0_2$ concentrations is insignificant.

b. Impacts of Specific Sources

The platforms and SBM's are well offshore and their impacts peak within 2 km of the source. All pollutant maximums for platforms and SBM's are well under applicable standards.

The gas and oil processing facility in Los Angeles County would cause maximum $N0_2$ impacts approaching the l-hour standard without Sale 48 or background included. Sale 48 increases the $N0_2$ maximum by 0.02 ppm. Sale 48 increases the maximum l-hour TSP concentration by 5 µg/m^3, from 48 µg/m^3 to 53 µg/m^3, without background included.

Maximum concentrations of pollutants from a blowout with fire, which is a worst case for inert pollutants, are the same as for Santa Barbara and Ventura Counties.

c. Visibility

The visual range will decrease in the area of maximum impact from a normal range of 18 km offshore to a visual range of 17.4 km for normal tankering and to 17.1 km for 100% tankering. In the Tanner/Cortez field, the visual range will decrease from a normal value of 34 km to 32.9 km with normal tankering and to 29.4 km with 100% tankering. Sale 48 should have an insignificant impact on the maintenance of the state visiblity standard.

C. San Diego County

1. Photochemically Reactive Contaminants

a. Regional Impacts

Emissions resulting from Sale 48 increase peak O_3 concentrations by 0.001 ppm or less for both normal and 100% tankering scenarios. The peak O_3 concentrations are expected to be about 0.14 ppm with or without Sale 48, which is above the Federal l-hour standard.

b. Cumulative Impacts With Other Major Projects

Since the additional other major projects included in the cumulative impact analysis are all located well outside of San Diego County, there is no difference between the regional impacts above and the cumulative impacts.

c. Accident Impacts

The model results indicate a significant impact potential on peak O_3 concentration from the accidents analyzed. The blowouts and smaller spills analyzed result in about 0.003 ppm or 3% increase in peak O_3 concentrations. The larger 10,000' bbl spills can cause a significant increase in the' peak O_3 concentration, from 0.12 ppm without the spill to 0.20 ppm with the spill.

2. Inert Contaminants

a. Regional Impacts

Sale 48 impacts in San Diego County are located more than 3 miles offshore, where background concentrations of contaminants are below standards. The regional impacts are generally small and are within Federal and state standards. The emissions of Sale 48 have an insignificant impact on the shore in the San Diego area.

b. Impacts of Specific Sources

The platforms and SBM's are well offshore and their impacts peak within 2 km of the source. All pollutant maximum concentrations from platforms and SBM's are well under applicable standards.

The peak concentration from blowout with fire, which is the worst-case condition for inert pollutants, is the same as for Santa Barbara and Ventura Counties.

c. Visibility

The visual range offshore will decrease from a normal value of 18 km in the area of maximum Sale 48 impact to a value of 17.4 km for normal tankering and to 17.1 km for 100% tankering. Sale 48 should have an insignificant impact on the maintenance of the state visibility standard.

D. Other Affected Areas

The other affected area is the part of the study area south of the U.S.-Mexico border. The area north of Point Conception was discussed as part of Santa Barbara County.

1. Photochemically Reactive Contaminants

a. Regional Impacts

The model results indicate that the emissions from Sale 48 with either tankering scenario will increase the peak 0_3 concentration just south of the border by less than 0.001 ppm from the level (O. 124 ppm) it would be without Sale 48, which represents an unmeasurable impact.

b. Cumulative Impact with Other Major Projects

The other major projects are all located far enough north not to have any impact south of the border.

c* Accident Impacts

The model results indicate a significant impact potential on peak 0_3 concentrations south of the border from the accidents analyzed. The large 10,000 bbl spill can cause a significant increase in peak O_3 concentrations if the contaminants are carried south of the border. The impact results in an increase in peak O_3 concentration from 0.06 ppm to 0.14 ppm, which is over the U.S. standard of 0,08 ppm.

2. Inert Contaminants

a. Regional Impacts

Sale 48 will not have significant inert pollutant impact on areas south of the U. S.-Mexico border.

b. Impacts of Specific Sources

The maximum concentrations during normal operation will be insignificant by the time the plume has traveled south of the U.S.-Mexico border.

The the accident case of blowout with fire, the concentration in Mexico will be over a ‘factor of 10 less than the peak centerline impact discussed for Santa Barbara County. Thus, the concentrations of the contaminants will be within both U.S. and California standards by the! time they are carried to Mexico.

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X. MASTER BIBLIOGRAPHY

All references cited and reviewed in this report are listed in the master bibliography. The chapter or appendix in which the reference is cited appears following the reference. A list of chapters by number, and appendix by letter, and subject follows:

I - INTRODUCTION
11 - DESCRIPTION OF OIL AND GAS DEVELOPMENT IN THE SOUTHERN CALIFORNIA BIGHT
m - AIR QUALITY REGULATIONS APPLYING TO OCS OIL AND GAS DEVELOPMENT
Iv - DESCRIPTION OF THE EXISTING ENVIRONMENT
V - AIR EMISSIONS FROM OCS OIL AND GAS DEVELOPMENT AND OTHER PROPOSED PROJECTS
VI - MODELING OF INERT POLLUTANTS
VII - MODELING OF PHOTOCHEMICALLY REACTIVE POLLUTANTS
VIII - MITIGATING MEASURES
Ix - ASSESSMENT OF IMPACTS

A - EMISSION SOURCE RATES AND LOCATIONS

B - INERT POLLUTANT MODELING INPUT DESCRIPTION

C - DESCRIPTION OF REM2

D - PHOTOCHEMICAL MODELING INPUTS AND OUTPUTS

E - HYDROCARBON LOSSES FROM PETROLEUM STORAGE TANKS AT PROPOSED LNG FACILITIES

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APPENDIX A

EMISSION SOURCE RATES AND LOCATIONS

A

Table A-1. EMISSION RATES FROM ONSHORE OIL AND GAS PRODUCTION ACTIVITIES, 1975

These were taken from the sources referenced in Chapter VII as follows:

Los Angeles County from **Nordsieck** (1974)
Ventura County from **Barberio** (1977)
Santa Barbara County from **Eschenroeder** (1976)

There are no onshore oil and gas production facilities in San Diego County.

Table A-2. EMISSION RATES FROM PLATFORMS AND LIGHTENING, 1975

Platforms and Lightening Operations	UTM ordinates, km		EMISSIONS, kg/hr						
			THC		NOx		CO	CO_2	TSP
	E	N	Fugitive	Diesels	Gas Turbines	Diesels	Diesels	Diesels	Diesels
Non OCS - Tidelands									
South Elwood	232	3808	0.33	0.99	O"	1.43	1.13	0.52	0.52
Summerland	263	3808	0.07	0.21	3.68	0.29	0.24	0.11	0.11
Carpinteria	268	3805	0.35	1.04	2.25	1.65	1.19	0.55	0.55
Other (1)	187	3812	0.07	0.22	5.04	0.36	0.26	0.12	0.12
Other (2)	192	3815	0.07	0.22	5.04	0.36	0.26	0.12	0.12
Belmont Offshore	420	3723	0.56	1.67	1.11	2.64	1.9	0.88	0.88
Huntington Beach	396	3731	3.4	10.4	3.9	16.4	11.8	5.52	5.52
Wilmington	392	3735	9.7	29.1	14.7	46.1	33.2	15.4	15.4
Other	368	3745	0.16	0.48	1.70	0.70	0.55	0.25	0.25
OCS - Santa Barbara Channel									
Carpinteria (Henry)	266	3803	0.45	1.36	2.49	1.96	1.55	0.72	0.72
Dos Cuadras	260	3803	3.1	9.5	11.7	13.7	10.8	5.04	5.04
Lightening									
Chevron (at sea	387	3673							
El Segundo	367	3755	See	Table A-3	'or emission	rates as	inction of	quential	urs.
Shell (at sea)	410	3652							
Wilmington	388	3735							

Table A-3. EFUSS1ON RATES FROM LIGHTERING OPERATIONS, 1975

ACTIVITY	wows	UTM E	UTM N	Emissions. Kg/hr THC	NO_x	co	SO_2	TSP
CHEVRON								
Arrival of VLC	00	387	3673	2.4	37	1.5	304	18
Preparation	0-4	387	3673	1.4	21	0.9	131	10
Lightening	4-24	387	3673	424	31	1.3	209	14
Preparation	24-2a	387	3673	1.4	21	0.9	131	10
Lightening	28-48	387	3673	548	21	0.9	209	14
Preparation	48-52	387	3673	1.4	21	0.9	131	10
Lightening	52-72	387	3673	548	21	0.9	209	14
Preparation	72-76	387	3673	1.4	21	0.9	131	10
Lightening	76-96	387	3673	548	21	0.9	209	14
Preparation	96-100	387	3673	0.8	12	0.5	101	5.9
Departure of VLC	100	387	3673	2.4	37	1.5	304	18
Lighter vessel inbound	24-32	Between		1.6	25	1.0	83	12.2
	96-104	387	3673	1.6	25	1.0	83	12.2
Lighter vessel outbound	128-134 and O-2	and		1.6	25	1.0	83	12.2
	66-74	367	3755	1.6	25	1.0	83	12.2
Unload lighter vessel	34-58	367	3755	68	14	0.6	48	6.8
	106-126	367	3755	68	14	0.6	48	6.8
Tug assistance in port	32-34	367	3755	3.7	19	4.5	51	8.6
	58-60	367	3755	3.7	19	4.5	51	8.6
	104-106	367	3755	3.7	19	4.5	51	8.6
	126-128	367	3755	3.7	19	4.5	51	8.6
SHELL								
Arrival of VLC	00	410	3652	2.3	35		289	18
Preparation	0-4	410	3652	1.4	21		131	10
Lightening	4-24	410	3652	390	29		198	14
Waiting and preparation	24-64	410	3652	0.8	12		101	6
Lightening	64-84	410	3652	390	29		198	14
Waiting and preparation	84-124	410	3652	0.8	12		101	6
Lightening	124-144	410	3652	390	29		198	14
Waiting and preparation	144-184	410	3652	0.8	12		101	6
Lightening	184-204	410	3652	390	29		198	14
Preparation	204-208	410	3652	0.8	12		101	6
Departure of VLC	208	410	3652	2.3	35		289	18
Lighter vessel inbound	24-32	Between		1.6	25		83	12.2
	84-92	410	3652	1.6	25		83	12.2
Lighter vessel outbound	56-64	and		1.6	25		83	12.2
	116-124	388	3735	1.6	25		83	12.2
Unload lighter vessel	34-54	388	3735	0.9	14		45	6.8
	94-114	388	3735	0.9	14		45	6.8
Tug assistance in port	32-34	388	3735	3.7	18		48	8.6
	54-56	388	3735	3.7	18		48	8.6
	92-94	388	3735	3.7	18		48	8.6
	114-116	388	3735	3.7	18		48	8.6

Table A-4. EMISSION RATES FROM OIL SPILLS AND BLOWOUTS (Kg/hr)

AREA	UTM Coordinates		140 Barrel Spill		10,000 Barrel Spill		1000 b/d Blowout No Fire		1000 Barrel /day blowout + fire				
	East	North	1st hr. THC	2nd hr. THC	1st hr. THC	2nd hr. THC	THC	H_2S	THC	NO_x	CO	SO_2	TSP
Santa Barbara Channel	208*	3803*	3600	1800	260,000	130,000	3600	15	300	20	300	180	60
Tanner/Cortez Banks	291	3629	2100	1050	150,000	75,000	2100	.01	300	20	300	180	60
San Pedro	396	3715	2100	1050	150,000	75,000	2100	.01	300	20	300	180	60
San Diego/Dana Point	457	3623	2100	1050	150,000	75,000	2100	.01	300	20	300	180	60

*Extended UTM Zone 11

Table A-5. ASSUMED LOCATIONS FOR OCS PLATFORMS AND SBMS

LOCATIONS	Sale 35 UTM E	Sale 35 UTM N	Sale 48 UTM E	Sale 48 UTM N
SANTA BARBARA CHANNEL PLATFORMS				
Hueneme	288	3776		
Santa Clara North	278	3184		
Santa Clara (South)	279	3778		
Santa Ynez Hondo)	208*	3804*		
Santa Ynez Secata Pescado)	192*	3806*		
Platform No. 1			162*	809*
Platform No. 2			184*	3794*
Platform No. 3			213*	3782*
Platform No. 4			219*	3795*
Platform No. 5			258	3796
Platform No. 6			270	3777
Platform No. 7			272	3792
SANTA ROSA ISLAND PLATFORMS				
Platform No. 1	224	3748	219*	3739*
Platform No. 2	235	3733		
SANTA BARBARA ISLAND PLATFORMS				
Platform No. 1	298	3714	308	3722
Platform No. 2	298	3710		
Platform No. 3	298	3705		
TANNER/CORTEZ PLATFORMS				
Platform No. 1	273	3644	263	3652
Platform No. 2	276	3643	279	3640
Platform No. 3	278	3644	289	3643
Platform No. 4	284	3543	278	3623
Platform No. S	276	3640	293	3621
Platform No. 6	284	3639	309	3620
Platform No. 7	288	3539	285	3612
Platform No. 8	276	3635	322	3612
Platform No. 9	284	3635	300	3600
Platform No. 10	288	3635		
Platform No. 11	290	3629		
Platform No. 12	295	3630		
Platform No. 13	292	3627		
Platform No. 14	288	3626		
Platform No. 15	295	3626		
Platform No. 16	302	3625		
Platform No. 17	298	3621		
Platform No. 18	284	3621		
Platform No. 19	294	3616		
Platform No. 20	294	3612		
Platform No. 21	298	3612		
Platform No. 22	302	3612		
Platform No. 23	302	3616		
Platform No. 24	316	3616		
Platform No. 25	288	3605		

LOCATIONS	Sale 35 UTM E	Sale 35 UTM N	Sale 48 UTM E	Sale 48 UTM N
SAN PEDRO PLATFORMS				
Platform No, 1	394	3723	384	3715
Platform No, 2	391	3719	394	3705
Platform No. 3	404	3715	411	3707
Platform No. 4	394	3714		
Platform No. 6	398	3710		
Platform No. 6	389	3709		
Platform No. 7	404	3704		
Platform No. 8	405	3699		
SAN DIEGO/DANA POINT PLATFORMS				
Platform No. 1			432	3694
Platform No. 2			443	3681
Platform No. 3			455	3623
SANTA BARBARA CHANNEL SBMs				
SBM No. 1	185*	3791*	163*	3808*
SBM No. 2	209*	3803*	221*	3795*
SBM No. 3	259	3789		
SANTA ROSA ISLAND SBM	237	3733	219*	3738*
SANTA BARBARA ISLAND SBM	298	3710	308	3721
TANNER/CORTEZ SBMs				
SBM No. 1	274	3643	302	3598.
SBM No. 2	291	3629		
SBM No. 3	316	3617		
SAN PEDRO SBM	396	3715	401	3706
SAN DIEGO/DANA POINT SBM			466	3623

* Extended UTM zone 11

Table A-6. EMISSION RATES FROM ONSHORE OIL AND GAS PRODUCTION ACTIVITIES, 1986. NORMAL TANKERING

Production Activity	UTM		EMISSIONS, Kg/hr							
			THC	NO_x		CO	SO_2		TSP	H_2S
	E	N	Fugitive	Process Stacks	Gas Turbines		Process stacks	Flare Stacks		Fugitive
NON OCS - TIDDEANDS										
South Elwood	235	3812	32.3	6.0	24.4	0	0.1	1.75	0	0.80
Summerland	267	3808	7.9	0..6	6.3	0	0	0.46	0	0.21
Carpenteria/Dos Cuadras	277	3804	19.3'	18.1.	2.8	0	0.70	0.20	0	0.09
Other (1)	182	3818	0.12	0.23	0	0	cl	0	0	0
Other (2)	204	3818	12.4	0.3	10.2	0	0	0.73	0	0
Belmont-gas	391	3745	1.3	0	1.1	0	0	0.1	0	0
Belmont-oil	397	3735	0.7	1.3	0	0	0	0	0	0
Huntington Beach	409	3723	16.8	14.8	7.5	0	0	0.5	0	0
Wilmington	388	3736	36.3	26.6	18.6	0	0	1.3	0	0
OCS ACTIVITIES, NON SALE 48										
Ventura-gas	286	3796	1412	0	1180	0	0	85.2	0	0.02
Ventura-oil	287	3795	1052	199.4	0	0	0	0	0	0
Ventura-loading Dos Cuadras	287	3795	1477	199.5	0	0	0	0.1*	0.1*	0
Ventura-loading Wilmington	287	3795	620	199.5	0	0	0	0.1*	0.1*	0
Ventura-loading both crudes	287	3795	1992	199.6	0	0.1*	0	0.3*	0.1*	0
Wilmington-gas	388	3736	105.5	0	88.2	0	0	6.4	0	0
San Pedro-unloading ? barge	388	3736	.4-. 9**	.05-.10*	4.3-11.5**	0.9-2.5**	.25-.69**	.06-.13*	.33-.89	0
San Pedro-storage	388	3736	16.2		0	0	0	0	0	0
OCS ACTIVITIES, SALE 48										
Ventura-gas	286	3796	763		638	0	0	46	0	0.84
Ventura-oil	287	3795	61.3	116.2	0	0	0	0	0	0
Ventura-loading	287	3795	Same as for non Sale 48. Frequency increases but not max. rate							
Wilmington-oil and gas	388	3736	76.8	55.4	19.6	0	2.6	1.4		0
San Pedro-unloading 1 barge	388	3736	.4-. 9**	.05-.10*	4.3-11.5**	0.9-2.5**	.25-.69**	.06-.13*	.33:.89	0
San Pedro-storage	388	3736	9.1	0	0	0	0	0	0	0

*Tug stacks **Barge pumps

Table A-7. EMISSION RATES FROM OFFSHORE PLATFORMS, 1986. NORMAL TANKERING

LOCATION	UTM		EMISSIONS, kg/hr per platform						
			THC		NO_x		CO	SO_2	TSP
	E	N	Fugitive	Diesels	Gas Turbines	Diesels	Diesels	Diesels	Diesels
NON OCS - TIDELINES									
South Elwood	232	3808	0.7	2.0	8.4	3.0	2.4	1.1	1.1
Summerland	263	3808	0.1	0.2	2.2	0.3	0.2	0.1	0.1
Carpentaria	268	3805	0.1	0.4	0.9	0.5	0.4	0.2	0.2
Other (1)	187	3812	0	0.1	1.75	0.1	0.1	0.05	0.05
Other (2)	192	3815	0	0.1	1.75	0.1	0.1	0.05	0.05
OCS ACTIVITIES - NON SALE 48									
Carpentaria (Henry)	266	3803	0.2	0.5	1.4	0.8	0.6	0.3	0.7
Heuneme	288	3776	0.3	0.8	0	1.2	0.97	0.45	0.45
Dos Cuadras	260	3803	0.7	1.9	1.9	2.9	2.3	1.05	1.05
Santa Clara (N)	278	3784	2.2	6.5	26.7	9.4	7.4	3.5	3.5
Santa Clara (S)	279	3778	2.7	7.9	42.9	11.4	9.0	4.2	4.2
Santa Ynez (Hondo)	208	3804	9.0	26.8	81.1	38.9	30.7	14.3	14.3
'Santa Ynez Secata Pescado)	192	3806	4.2	12.2	35.9	18.1	13.6	6.3	6.3
Santa Rosa Island (#1 and #2)	See Table A-5 for location of each platform		0.1	0.3	1.6	0.4	0.35	0.15	0.15
Santa Barbara Island (#1, 2 and 3)			0.11	0.32	0.9	0.4	0.37	0.17	0.17
Tanner/Cortez (#1 through 25)			0.57	1.71	8.7	2.4	1.95	0.91	0.91
San Pedro (#1 through 8)			0.47	1.40	3.8	2.0	1.6	0.75	0.75
OCS ACTIVITIES - SALE 48									
Santa Barbara Channel (#1 through 7)	See Table A-6 for location of each platform		1.6	4.8	12.6	22.3	7.9	3.0	3.2
Santa Rosa Island (#1)			0.8	2.5	6.7	19,0	5.3	1.8	2.0
Santa Barbara Island (#1)			0.6	1.9	1.9	18.2	4.7	1.5	1.7
Tanner/Cortez (#1 through 9)			1.3	3.8	13.9	21.0	6.9	2.5	2.7
San Pedro (#1 through 3)			1.1	3.3	6.4	20.2	6.3	2.2	2.4
San Diego/Dana Point (#1 through 3)			3.9	11.7	14.9	18.1	4.6	2.2	1.6

Table A-8. EMISSION RATES FROM SBMs, 1986. NORMAL TANKERING

LOCATION	UTM		Activity	EMISSIONS, Kg/hr per SBM						
				THC		NO_x		CO	SO_2	TSP
	E	N		Fugitive	Ships*	Process Stocks	Ships*	Ships*	Ships*	Ships*
OCS ACTIVITIES, NON SALE 48										
Santa Barbara Channel (#2, 3)	See table A-5 for location of each SBM		Storage	%.3	0	‘40.9	o	0	0	0
			Tanker loading	630	0.6	40.9	9.2	0.36	76.0	4.4
Santa Barbara Island	298	3710	Storage	4.1	o	2.8	0	0	0	0
	298	3710	Barge loading	173	0.2	2.8	0.1	0.02	0.06	0.08
OCS ACTIVITIES, SALE 48										
Santa Barbara Channel	221	3795	Storage	88.9	0	37.6	O	0	0	0
	-221	3795	Tanker loading	538.5	0.6	37.6	9.2	0.36	0.76	4.4
Santa Barbara Island	308	3721	Storage	3.1	O	2.45	O	0	0	0
	308	3721	Barge loading	169.5	0.02	2.45	0.05	0.02	0.06	0.03
San Diego/Dana Point	456	3623	Storage	8.32	O	6.54	o	0	0	0
	456	3623	Barge loading	166.5	0.02	6.54	0.06	0.02	0.06	0.03

*From tanker stacks during tanker loading and tug stacks during barge loading

Table A-9. **EMISSION** RATES FROM ONSHORE OIL AND GAS PRODUCTION ACTIVITIES, 1986. 100% TANKERING

Production Activity	UTM		Emissions Kg/hr							
			THC	NO_x		CO	SO_2		TSP	H_2S
	E	N	Fugitive	Gas Turbines	Process Stocks		Gas Turbines	Flare Stocks		
Non OCS - Tidelands										
South Elwood	235	3812	32.3	24.4	6.0	0	0.01	0.73	0	0.33
Summerland	267	3808	7.9	6.3	0.3	0	0	0.46	0	0.21
Carpinteria / Dos Cuadras	277	3804	19.3	2.8	16.5	0	0.70	0.20	0	0.09
Other (1)	182	3818	0.12	0	0.23	0	0	0	0	
Other (2)	204	3818	12.4	10.2	0.3	0	0.01	0.73	0	0.00
Belmont (gas)	391	3745	1.3	1.1	0	0	0	0.1	0	0.00
Belmont (oil)	397	3735	0.7	0	1.7	0	0	0	0	
Los Angeles & Tidelands + Non Sale 48 OCS										
Huntington Beach - loading and processing	409	3723	16.8	7.5	14.8	0	0	0.5	0	0.00
Wilmington - loading and processing	388	3736	141.8	106.8	26.6	0	0	7.7	0	0.00
San Pedro - storage only	388	3736	16.2	0	0	0	0	0	0	0
San Pedro - unloading 3 large and 1 small barges	388		14.5+ 3.1**	5+ 38.8**	0.4*	8.4**	2.3**	0.5*	3.0	0
Los Angeles Tidelands + All OCS Sales										
Huntington Beach	409	3723	16.8	7.5	14.8	0	0	0.5	0	0
Wilmington	388;	3736	141.8	106.8	26.6	0	0	7.7	0	0
San Pedro - storage only	388	3736	25.3	0	0	0	0	0	0	0
San Pedro - unloading 3 large and 2 small barges	388	3736	22.7+ 3.5**	43.2**	0.4*	9.3**	2.6**	0.5*	3.3	0

* Tug stacks

** Barge pumps

Table A-10. EMISSION RATES FROM NON-48 SALE PLATFORMS -- 1986, 100% TANKERING

LOCATION	UTM		Emissions, Kg/hr per platform						
			THC		NO_x		CO	SO_2	TSP
	E	N	Fugitive	Diesels	Gas Turbines	Diesels	Diesels	Diesels	Diesels
on OCS - Tidelands									
South Elwood	232	3808	0.7	2.0	8.4	3.0	2.4	1.1	1.1
Summerland	263	3808	0.1	0.2	2.2	0.3	0.2	0.1	0.1
Carpenteria	268	3,805	0.1	0.4	0.9	0.5	0.4	0.2	0.2
Other (1)	1.87	3812	0.03	0.07	1.75	0.1	0.1	0.05	0.05
Other (2)	192	3815	0.03	0.07	1.75	0.1	0.1	0.05	0.05
Belmont Offshore	420	3723	0.15	0.45	0.4	0.6	0.5	0.2	0.2
Huntington Beach	39.6	3731	1.7	5.1	2.6	7.4	5.8	2.7	2.7
Wilmington	392	3735	3.0	9.1	5.8	13.1	10.4	4.8	4.8
Other	368	3745	0.05	0.15	0.6	0.2	0.2	0.1	0.1
CS Activities - Non Sale 48									
Carpenteria (Henry)	266	3803	0.2	0.5	-0-	0.8	0.6	0.3	0.3
Hueneme	288	3776	0.3	0.8	-0-	1.2	1.0	0.45	0.45
Dos Cuadras	260	3803	0.7	1.9	-0-	6.3	5.0	2.3	2.3
Santa Clara (N)	278	3784	2.2	6.5	-0-	9.4	7.4	3.5	3.5
Santa Clara (S)	279	3778	2.7	7.9	-0-	11.4	9.0	4.2	4.2
Santa Ynez (Hondo)	208	3804	9.1	26.7	-0-	38.9	30.7	14.3	14.3
Santa Ynez Secata Pescado)	192	3806	4.2	12.4	-0-	17.2	13.6	6.3	6.3
Santa Rosa Island (#1 and 2)	*	*	0.1	0.3	-0-	0.45	0.35	0.15	0.15
Santa Barbara	*	*	0.11	0.3	-0-	0.47	0.37	0.17	0.17
Tanner/Cortez Island (#1, 2,&	*	*	0.6	1.7	-0-	2.5	2.0	0.9	0.9
San Pedro (#1 (#1 thru 25) 3) thru 8)	*	•	0.48	1.4	-0-	2.0	1.6	0.8	0.8
CS Activities - Sale 48									
Santa Barbara Channel (#1 thru 7	*	*	1.3	5.1	-0-	22.4	7.9	3.0	3.2
Santa Rosa Island (# 1)	219	3739	0.5	2.8	-0-	19.0	5.3	1.8	2.0
Santa Barbara Island (# 1)	308	3722	0.3	2.2	-0-	18.2	4.7	1.5	1.7
Tanner/Cortez (#1 thru 9)	*	*	1.0	4.1	-0-	21.0	6.9	2.5	2.7
San Pedro (#1,2, and 3)	*	*	0.8	3.6	-0-	20.2	6.3	2.2	2.4
San Diego / Dana Pt (#1 thru 3)	*	*	0.3	2.1	-0-	18.1	4.6	1.4	1.6

* See Table A-5 for locations of individual platforms.

Table A-11. EMISSION RATES FROM SBMs, 1986. 100% TANKERING

Location	UTM		Activity	Emissions, Kg/hr per BM						
				THC		NO$_x$		CO	SO$_2$	TSP
	E	N		Fugitive	Ships*	Process Stocks	Ships*	Ships*	Ships*	Ships*
OCS Activities, Non Sale 8										
Santa Barbara Channelt #l, 2 and 3)	**	**	Storage	126.3	o	54.4	o	0		
	**	**	Tanker loading	635.	0.6	54.4	9.2	0.36	?6.0°	4.4°
	**	***	Barge loading	1,397.	0.01	54.4	0.1	0.02	0.13	0.07
Santa Rosa Island	219	3738	Storage	3.9	0	1.8	0	0		0
	219	3738	Barge loading***	515.	0.01	1.8	0.1	0.02	0.1:	0.07
Santa Barbara Island	298	3710	Storage	3.6	0	2.8	0	0		
	298	3710	Barge loading***	172.	0.01	2.8	0.05	0.01	0.06	0.0!
Tanner/Cortez (#1, 2 and 3)	**	**	Storage	84.6	0	41.1	0	0		0
	**	**	Tanker loading	248.	0.6	41.1	9.2	0.36	76.0°	4.4
	**	**	Barge loading	533	0.01	41.1	0.1	0.02	0.13	0.07
San Pedro	396	3715	Storage	40.2	0	32.4	0	o		0
	396	3715	Barge loading	554.	0.01	32.4	0.1	0.02	0.1!	0.07
OCS Activities, Non Sale 48 and Sale 48										
Santa Barbara Channel (al 1 5)	**	**	Storage	110.1	0	47.7	0			0
	**	**	Tanker loading	632	0.6	47.7	9.2	0.3:	?6.0°	4.4
	**	**	Barge loading	1,394.	0.01	47.7	0.1	0.02	0.13	0.07
Santa Rosa Island	219	3738	Storage	7.7	0	5.9		0	0	0
	219	3738	Barge loading***	522.	0.01	5.9	0.1°	0.02	0.13	0.07
Santa Barbara Island	298	3710	Storage	6.7	0	5.2	0	0	0	0
	298	3710	Barge loading***	178	0.01	5.2	0.1	0.02	0.13	0.07
Tanner/Cortez (all 4)	**	**	Storage	60.4	0	48.8	0	0	0	0
	**	**	Tanker loading	289	0.6	48.8	9.2	0.36	76.0	4.4
	**	**	Barge loading	574.	0.01	48.8	0.1	0.02	0.13	0.07
San Pedro (#1 Sale 35)	396	3715	Storage	40.2	0	32.4	0		0	0
	396	3715	Barge loading	554.	0.01	32.4	0.1	0.0;	0.13	0.07
San Pedro (#1 Sale 48)	401	3705	Storage	25.0	0	19.6	0		0	0
	401	3705	Barge loading	539	0.01	19.6	0.1	0.02	o.13	0.07
San Diego / Dana Point	456	3623	Storage	8.3	0	6.5	0		0	0
	456	3623	Barge loading	179.3	0.01	6.5	0.05	0.0?	0.06	0.03

* Fran Tanker stacks during tanker loading and tug stacks during barge loading.
** See Table A-5 for locations of individual SBMs.
*** Barges not loaded simultaneously at Santa Rosa and Santa Barbara Islands.

Table A-1 2. LOCATIONS FOR OTHER PROPOSED PROJECTS

Proposed Project	UTM E	 N
SOHIO-port location	388	3734
ELK Hills terminal	295	3781
LNG Unloading-Oxnard	294	3784
LNG Unloading-Pt. Conception	182	3817
Vaca Tar Sands	304	3786
Space Shuttle	172	3847

APPENDIX B

Inert Pollutant Modeling Input Description

B

APPENDIX B

INTRODUCTION

The purpose of this appendixes to present the meteorology and background methodology and, for all scenarios presented, the emission source inputs used by the modeling along with their respective UTM coordinates (modified). The model run results are too voluminous to present here, but are available upon request.

The remainder of this appendix will proceed as follows:

L Meteorology
II. Background
111. Emission inputs

B.I. METEOROLOGY

The sources were grouped into three regions as shown in Figure B-1, and the meteorological data used were defined separately for each region. For the short term average (1-3 hours), wind directions were taken to be directly onshore for Regions I and II. This would allow maxim urn pollution impact inland. However, because of the distance from land, sources in region 111 would have no significant contribution even with a direct onshore flow. Therefore, wind direction in this region was taken to be north-westerly, which is typical in that area (U.S. Dept. of Commerce, 1965).

Mixing height for the general area had to be selected with additional care. It should be kept in mind that the worst mixing height is a function of the final plume rise of the emissions sources, and that no single height is worst for every source. Therefore, the mixing height should be high enough such that it would not be easily penetrated by most sources and should be low enough to permit minimal vertical mixing. It was determined that an average mixing height for the area would produce a combined worst-case situation for all sources.

Other met eorological parameters were determined through the use of EPA's computer PTMAX model. The results are tabulated in Table B-1. The 3-hour worst meteoro-

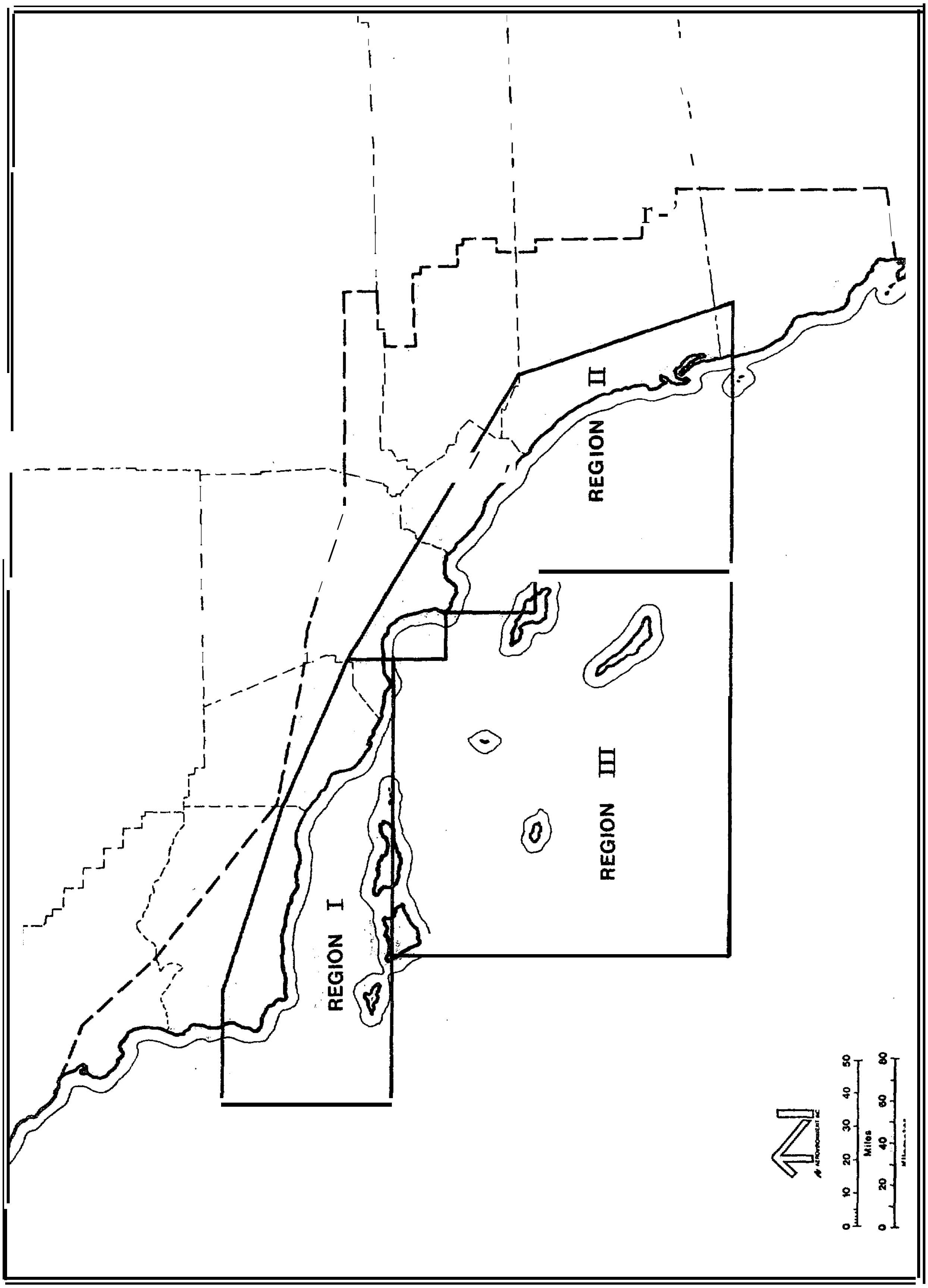

FIGURE B-1. Map showing region delineation for regional analysis.

TABLE B-1. One-hour worst meteorology for three subregions of the study area.

	WD	WS (m/sec)	Stability class *	Mixing Ht. (m)
Region I	210	0.5	4	580
Region II	215	0.6	4	580
Region III	300	0.5	4	580

* Defined by **Pasquill-Gifford** stability class designations (Turner, 1970).

logical data were just extensions of the worst l-hour meteorological data into a longer period with very slight variation. The data are tabulated in Table B-2.

The worst 24-hour meteorology was selected as having offshore flow for 8 hours and onshore flow for 16 hours with an average wind speed of 2 m/s (Kauper, 1977). A synoptic situation that could produce this airflow condition would be following a Santa Ana condition. Santa Ana conditions occur during the fall, winter and spring months and are dry northeasterly winds flowing from” the desert regions to the coastal area (Rosenthal, 1972). The inversion is very low and strong at this time (Koutwik, 1968).

A study done by the California Air Resources Board (1975) determined the percent of time specific airflow patterns occurred in the South Coast Air Basin. The Santa Ana condition was found to occur 1% of the total annual time.

The 24-hour meteorology is presented in Table B-3.

B. II. BACKGROUND CONCENTRATIONS

Worst-case background concentrations of CO, NO_2, SO_2, and total suspended particulate (TSP) were estimated for 1976 in order to determine compliance with Federal Ambient Air Quality Standards. This was done using a proportional technique in which peak concentration is assumed proportional to emissions in an air basin:

$$\frac{X_{P,1986}}{X_{P,1975}} = \frac{Q_{P,1986}}{Q_{P,1975}},$$

where:

$X_{P,1986}$ = Maximum concentration of pollutant P in 1986.

$X_{P,1975}$ = Maximum concentration of pollutant P in 1975.

‘P, 1986 = Emissions of pollutant P in 1986.,

$Q_{P,1975}$ = Emissions of pollutant P in 1975.

TABLE B-2. Three-hour worst meteorological data.

WD	WS (m/sec)	Stability Class *	Mixing Ht. (m)
Region I			
210.0	0.5	4	580.0
200.0	0.8	4	580.0
220.0	0.6	4	580.0
Region II			
210.0	0.5	4	580.00
230.0	0.8	4	580.00
215.0	0.6	4	580.00
Region III			
300.0	0.5	4	580.0
310.0	0.8	4	580.0
290.0	0.6	4	580.0

* Defined by Pasquill-Gifford stability class designations (Turner, 1970).

TABLE B-3. Worst 24-hour meteorology data.

Hour	Wind Direction	Wind Speed (m/s)	Stability Class	Mixing Height (m)
Region I				
000.0	45.0	0.5	5	400.0
01	15.0	1.0	6	400.0
02	30.0	1.0	6	400.0
03	15.0	0.5	6	400.0
04	30.0	0.5	6	400.0
05	45.0	1.5	5	500.0
06	30.0	1.0	5	500.0
07	45.0	0.5	4	580.0
08	180.0	0.3	4	580.0
09	210.0	0.5	4	580.0
10	200.0	0.8	4	580.0
11	220.0	0.6	4	580.0
12	220.0	1.0	4	580.0
13	230.0	2.5	4	580.0
14	210.0	2.0	4	580.0
15	210.0	2.0	4	580.0
16	210.0	1.5	4	580.0
17	200.0	2.0	4	580.0
18	.180.0	1.0	4	580.0
19	180.0	2.0	4	580.0
20	200.0	2.5	4	580.0
21	200.0	0.8	4	580.0
22	210.0	0.5	4	400.0
23	180.0	0.5	5	400.0

TABLE B-3. (continued)

Hour	Wind Direction	Wind Speed (m/s)	Stability Class	Mixing Height (m)
Region 11				
0000	60.0	0.5	6	400.0
01	35.0	1.0	6	400.0
02	45.0	1.0	6	400.0
03	30.0	0.5	6	400.0
04	45.0	0.5	6	400.0
05	60.0	1.5	5	500.0
06	45.0	1.0	5	500.0
07	60.0	0.5	4	580.0
08	210.0	0.5	4	580.0
09	230.0	0.8	4	580.0
10	215.0	0.6	4	580.0
11	230.0	1.5	4	580.0
12	240.0	1.0	4	580.0
13	240.0	1.5	4	580.0
14	230.0	1.5	4	580.0
15	230.0	1.0	4	580.0
16	230.0	1.5	4	580.0
17	220.0	2.0	4	580.0
18	200.0	2.5	4	580.0
19	205.0	2.5	4	580.0
20	230.0	1.0	4	580.0
21	210.0	0.5	4	580.0
22	200.0	0.5	5	500.0
23	180.0	0.5	5	500.0

Thus, maximum concentrations of pollutants of concern in 1986 were scaled from 1975 values using the ratio of 1986 to 1975 emissions. Scaling factors were derived separately for Santa Barbara County, Ventura County, Los Angeles-Orange-Riverside-San Bernardino Counties, and San Diego County. Stationary and area source emissions and vehicle miles travelled (VMT) were assumed to grow at the same rate as population. Motor vehicle emissions were determined by multiplying projected VMT by a composite emission factor. Population growth factors from 1975 to 1986 are as follows:

Los Angeles County: 1.22 (Nordsieck, 1974)
San Diego County: 1.31 (San Diego Air Quality Planning Team, 1976)
Santa Barbara County: 1.14 (Eschenroeder, et al, 1976)
Ventura County: 1.34 (Berberio, 1977)

Composite motor vehicle emission factors, derived from AP-42 (U.S. EPA, 1976), are shown in Table B-4.

Total emissions were determined for 1986 and compared to 1975 emissions to derive the worst-case background correction factor. These factors are shown in Table B-5 and were applied to 1975 maximum l-hour averages of CO, NO_2, and SO_2 and to maximum 24-hour averages of TSP. These 1986 worst-case background levels are represented spatially in Figures B-2 through B-5. These factors were also used to determine the annual average background concentrations for NO_2, SO_2, and TSP.

B.III. EMISSION INPUTS

Stack characteristics are presented in Table B-6. Values for the stack characteristics were obtained from Stout (1977), Burklin (1977), Exxon (1977), and PES (1977).

Table B-7 contains a listing of the emission source inputs for all pollutants for non-Sale 48 (existing in 1986 including Sale 35) and Sale 48 for both normal and 100% tankering, other proposed major projects, and proposed worst-case accidents, broken down for all three analysis regions. Included in the listing are the emission rates for. the pollutants NO_2, TSP, SO_2, CO, and H_2S, the particular stack characteristics, and the source location in UTM coordinates (modified).

TABLE B-4. Composite motor vehicle emission factors (g/mile).

Pollutant	Emission Factor			
	1975		1986	
	San Diego/ Ventura Cnty.	Other Counties	San Diego/ Ventura Cntys.	Other Counties
CO	34.37	33.00	8.50	8.55
NO_x	4.67	5.14	2.50	2.46
TSP	0.58	0.58	0.36	0.36
SO_x	0.30	0.30	0.32	0.32

TABLE B-5. Multiplicative factors used to determine 1986 worst-case background from 1975 levels.

Location	Pollutant			
	NO_x	CO	TSP	SO_x
LA-OR-SB-RIV Co.*	0.755	0.408	1.021	1.233
Ventura County	1.045	0.532	1.248	1.347
Santa Barbara Co.	0.614	0.351	1.025	1.180
San Diego Co.	0.853	0.403	1.294	1.318

* Los Angeles-Orange-San Bernardino-Riverside Counties

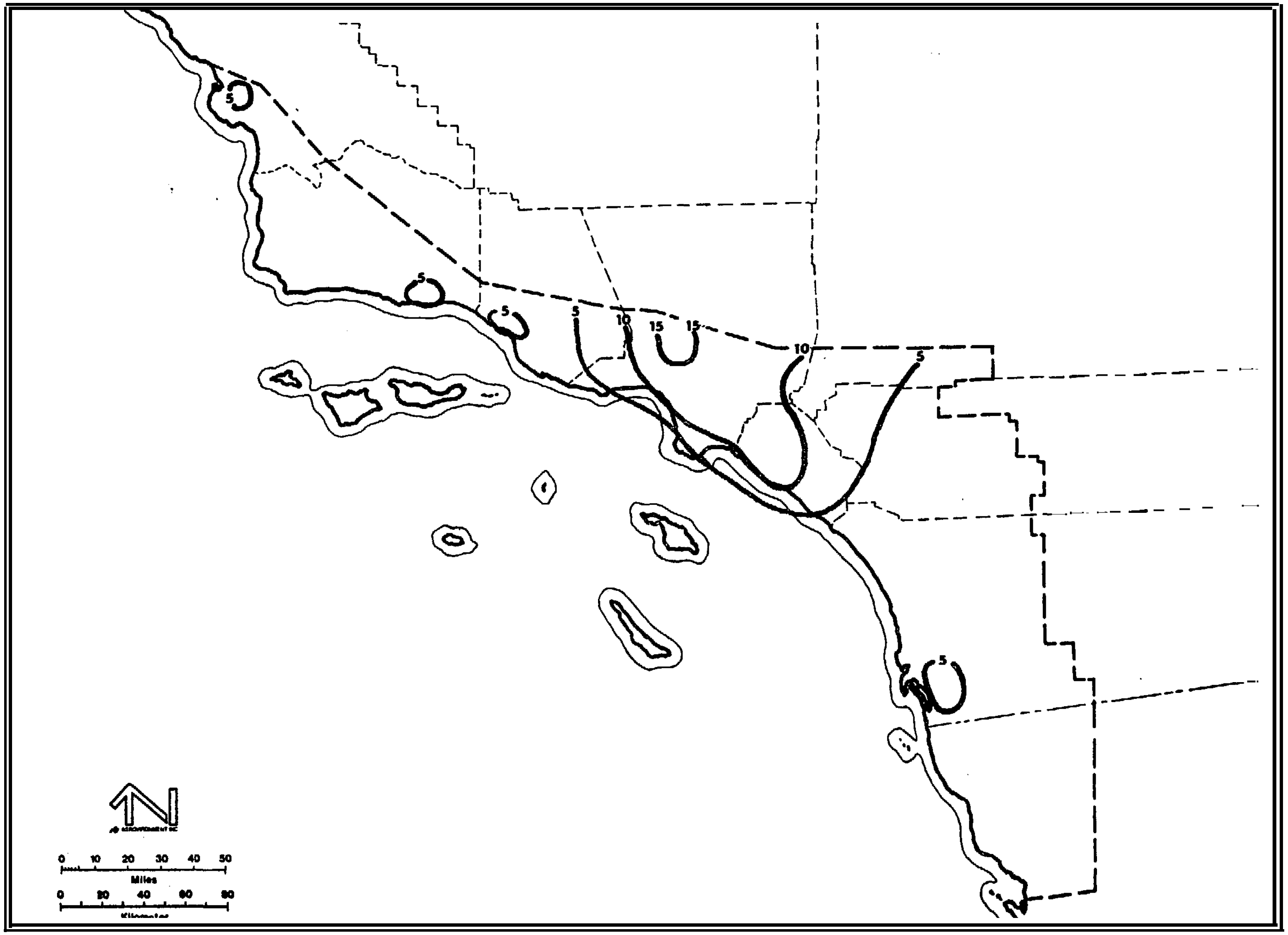

FIGURE B-2. Isopleth of worst-case one-hour average CO background in 1986 (ppm).

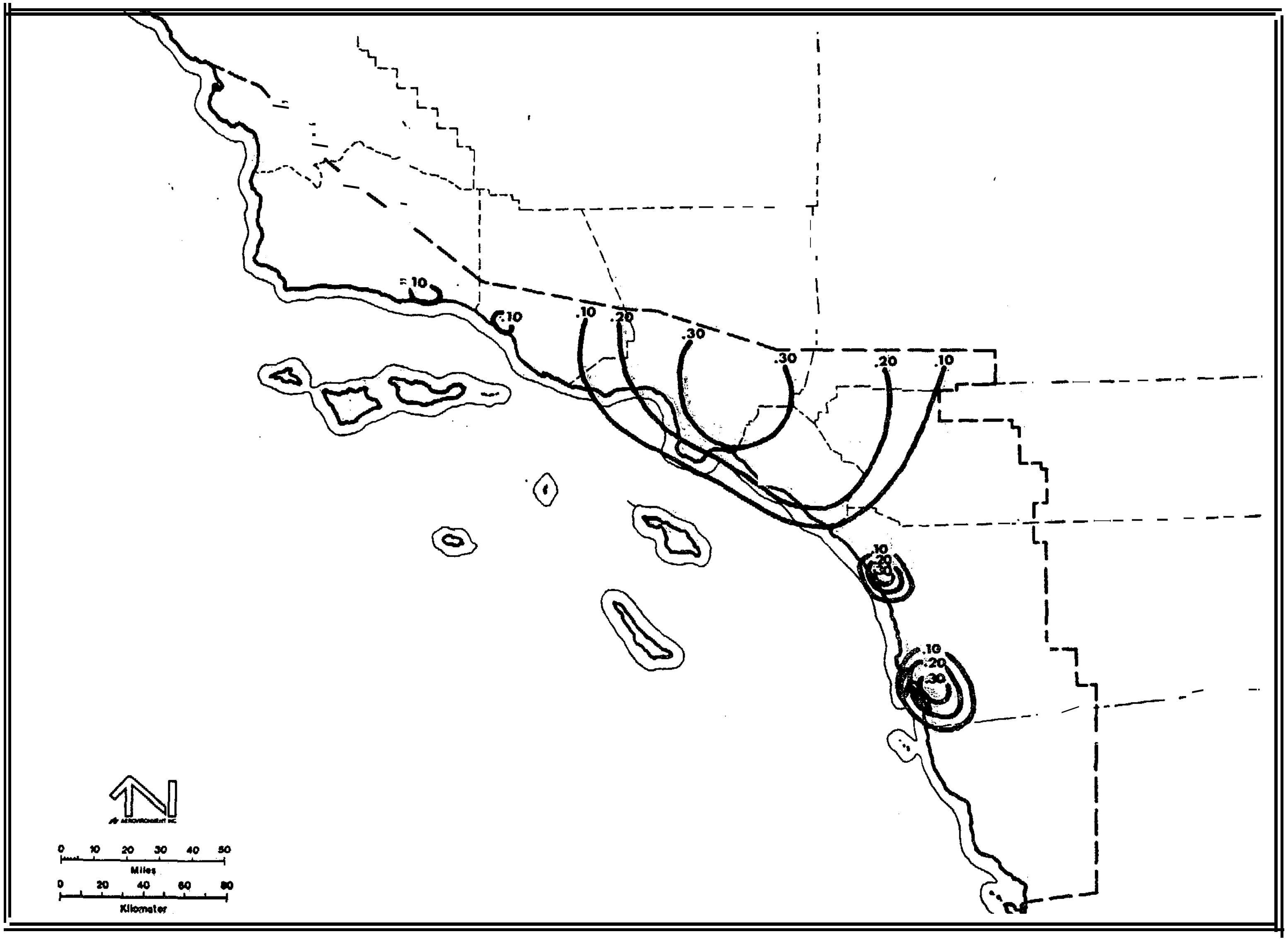

FIGURE B-3. Isopleths of worst-case one-hour NO_2 background in 1986 (ppm).

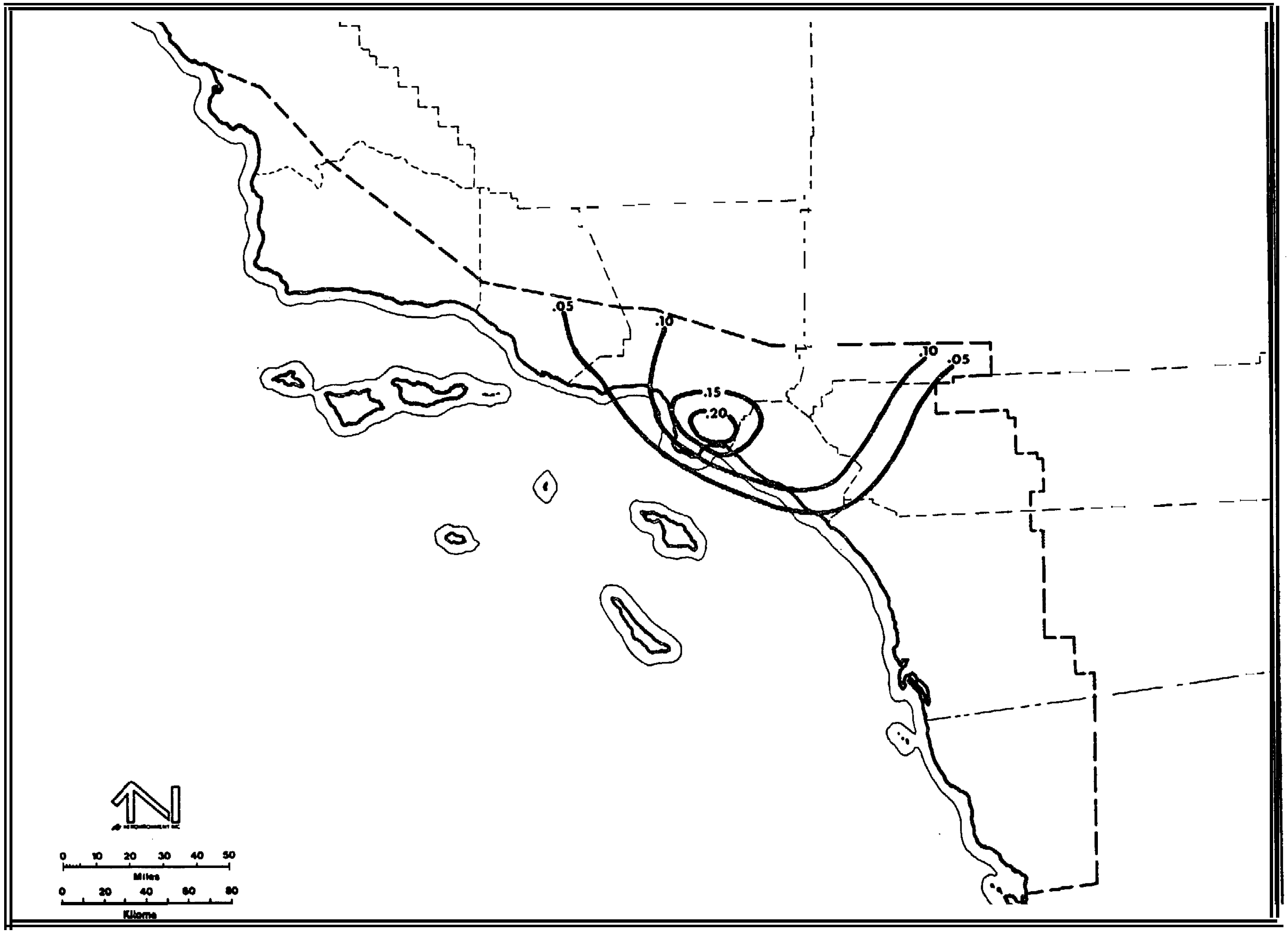

FIGURE B-4. Isopleths of worst-case one-hour SO_2 background in 1986 (ppm).

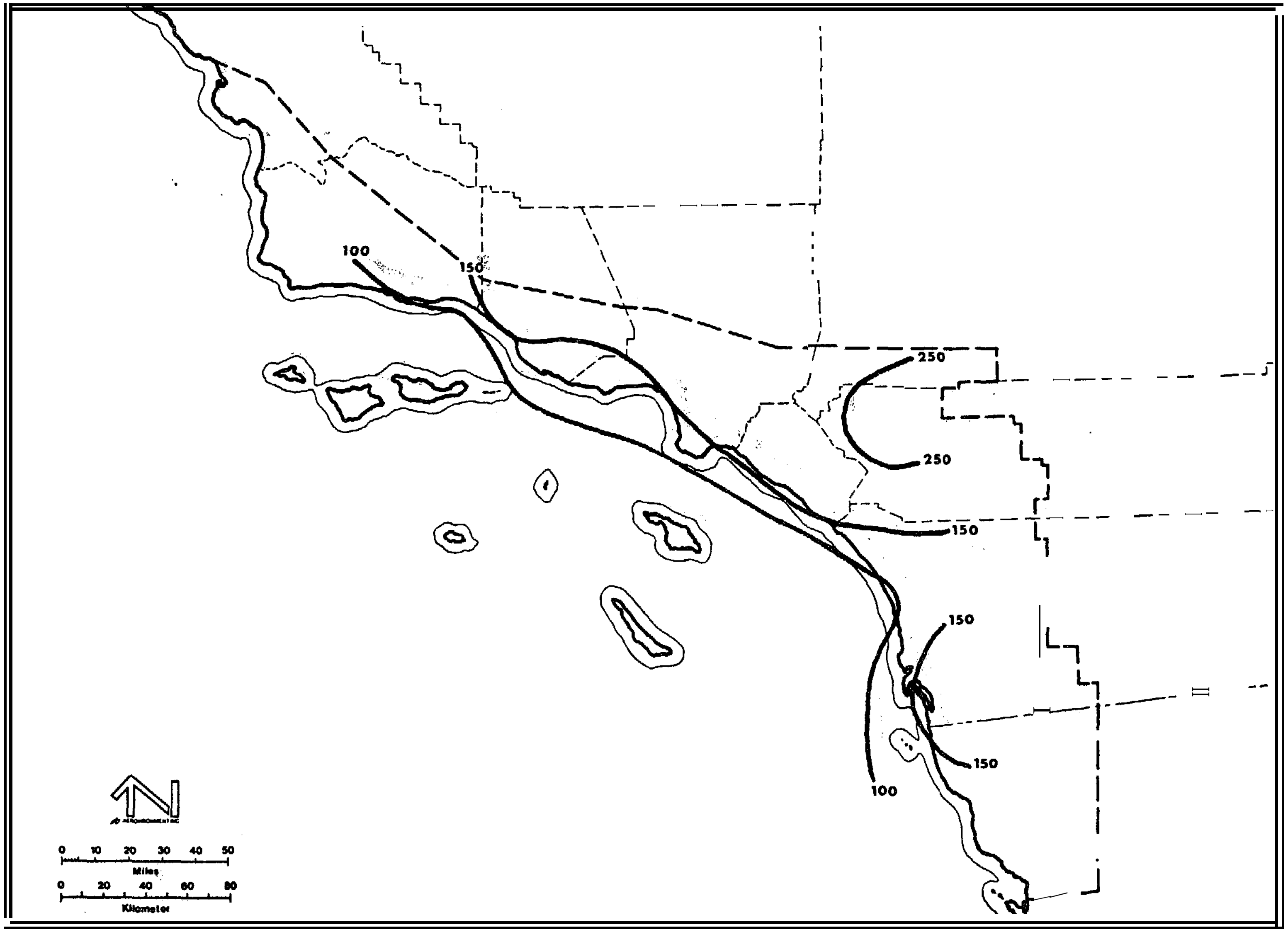

FIGURE B-5. Isopleths of worst-case 24-hour total suspended particulate background in 1986 ($\mu g/m^3$).

TABLE B-6. Source stack characteristics.

Stack Type	HP **(Stack Ht.)** m	TS **(Stack Temp.)** ‘K	Vs **(Emission Vel.)** m/s	D (Stack Diam.) m
Diesel Engine	50.0	741.0	25.0	0.1
Gas Turbine	50.0	770.0	50.0	0.3
Flare Stack	60.0	1240.0	60.0	0.61
Loading Tanker Stack	25.0	433.0	7.7	1.0
Loading Barge or tugboat stack	7.0	433.0	2.0	0.3
Ship Engine	50.0	741.0	25.0	0.1
Process Stack	100.0	700.0	5.0	0.6
Trim Heater	10.0	644.0	22.9	0.75/l .24*
Peaking Vaporizer	10.0	330.0	22.9	1.87
Sea Water Heater	10.0	644.0	22.9	4.39
Steam Generator	12.2”	333.0	5.8	1.2
Single Buoy Moor	10.0	700.0	5.0	0.6
Electric Generator	75.0	756.0	22.9	0.3

* .78 for LNG terminal at Oxnard and 1.24 at Point Conception.

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TABLE B-7. Listing of the emission source inputs.

POLLUTANT NOX

NON 48 SOURCES

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
0.125	50.	741.	25	0.15	224.	3748.
0.125	50.	741.	25.	0.15	235.	3733.
0.128	50.	741.	25	0.15	298.	3714.
0.128	50.	741.	25	0.15	298.	3710.
0.128	50.	741.	25	0.15	298.	3705.
0.681	50.	741.	25	0.15	273.	3644.
0.681	50.	741.	25	0.15	276.	3643.
0.681	50.	741.	25	0.15	278.	3644.
0.681	50.	741.	25	0.15	284.	3643.
0.681	50.	741.	25	0.15	276.	3640.
0.681	50.	741.	25	0.15	284.	3639.
0.681	50.	741.	25.	0.15	288.	3639.
0.681	50.	741.	25	0.15	276.	3635.
0.681	50.	741.	25.	0.15	284.	3635.
0.681	50.	741.	25	0.15	288.	3635.
0.681	50.	741.	25.	0.15	290.	3629.
0.681	50.	741.	25	0.15	295.	3630.
0.681	50.	741.	25.	0.15	292.	3627.
0.681	50.	741.	25	0.15	288.	3626.
0.681	50.	741.	25.	0.15	295.	3626.
0.681	50.	741.	25.	.15	302.	3625.
0.681	50.	741.	25.	0.15	302.	3625.
0.681	50.	741.	25.	0.15	298.	3621.
0.681	50.	741.	25.	0.15	284.	3621.
0.681	50.	741.	25.	0.15	294.	3616.
0.681	50.	741.	25.	0.15	294.	3612.
0.681	50.	741.	25.	0.15	298.	3612.
0.681	50.	741.	25.	0.15	302.	3612.
0.681	50.	741.	25.	0.15	302.	3619.
0.681	50.	741.	25.	0.15	316.	3619.
0.681	50.	741.	25.	0.15	288.	3605.
0.431	50.	770.	50.	0.3	224.	3748.
0.431	50.	770.	50.	0.3	235.	3733.
0.242	50.	770.	50.	0.3	298.	3714.
0.242	50.	770.	50.	0.3	298.	3710.
0.242	50.	770.	50.	0.3	298.	3705.
2.403	50.	770.	50.	0.3	273.	3644.
2.403	50.	770.	50.	0.3	276.	3643.
2.403	50.	770.	50.	0.3	278.	3644.
2.403	50.	770.	50.	0.3	284.	3643.
2.403	50.	770.	50.	0.3	276.	3640.
2.403	50.	770.	50.	0.3	284.	3639.
2.403	50.	770.	50.	0.3	288.	3639.
2.403	50.	770.	50.	0.3	276.	3635.
2.403	50.	770.	50.	0.3	284.	3635.
2.403	50.	770.	50.	0.3	288.	3635.
2.403	50.	770.	50.	0.3	290.	3629.
2.403	50.	770.	50.	0.3	295.	3630.
2.403	50.	770.	50.	0.3	292.	3627.
2.403	50.	770.	50.	0.3	288.	3626.
2.403	50.	770.	50.	0.3	295.	3626.
2.403	50.	770.	50.	0.3	302.	3625.
2.403	50.	770.	50.	0.3	298.	3621.
2.403	50.	770.	50.	0.3	284.	3621.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	y
2.403	50.	770.	50.	0.3	294.	3616.
2.403	50.	770.	50.	0.3	294.	3612.
2.403	50.	770.	50.	0.3	298.	3612.
2.403	50.	770.	50.	0.3	302.	3612.
2.403	50.	770.	50.	0.3	302.	3619.
2.403	50.	770.	50.	0.3	316.	3619.
2.403	50.	770.	50.	0.3	288.	3605.
0.767	100.	700.	5.	0.6	298.	3710.
	48 SOURCES					
0.014	7.	433.	2.	.3	308.	3721.
5.833	50.	741.	25.	0.15	263.	3652.
5.833	50.	741.	25.	0.15	279.	3640.
5.833	50.	741.	25.	0.15	289.	3643.
5.833	50.	741.	25.	0.15	278.	3623.
5.833	50.	741.	25.	0.15	293.	3621.
5.833	50.	741.	25.	0.15	309.	3620.
5.833	50.	741.	25.	0.15	285.	3612.
5.833	50.	741.	25.	0.15	322.	3612.
5.833	50.	741.	25.	0.15	300.	3600.
5.278	50.	741.	25.	0.15	219.	3739.
5.056	50.	741.	25.	.15	308.	3722.
0.661	15.	700.	5.	0.6	308.	3721.
3.861	50.	770.	50.	0.3	263.	3652.
3.861	50.	770.	50.	0.3	279.	3640.
3.861	50.	770.	50.	0.3	289.	3643.
3.861	50.	770.	50.	0.3	278.	3623.
3.861	50.	770.	50.	0.3	293.	3621.
3.861	50.	770.	50.	0.3	309.	3620.
3.861	50.	770.	50.	0.3	285.	3612.
3.861	50.	770.	50.	0.3	322.	3612.
3.861	50.	770.	50.	0.3	300.	3600.
1.651	50.	770.	50.	0.3	219.	3739.
0.528	50.	770.	50.	0.3	308.	3722.
	NON 48 100% TANKERING SOURCES					
0.694	50.	741.	25.	0.1	273.	3644.
0.694	50.	741.	25.	0.1	276.	3643.
0.694	50.	741.	25.	0.1	278.	3644.
0.694	50.	741.	25.	0.1	284.	3643.
0.694	50.	741.	25.	0.1	276.	3640.
0.694	50.	741.	25.	0.1	284.	3639.
0.694	50.	741.	25.	0.1	288.	3639.
0.694	50.	741.	25.	0.1	276.	3635.
0.694	50.	741.	25.	0.1	284.	3635.
0.694	50.	741.	25.	0.1	288.	3635.
0.694	50.	741.	25.	0.1	290.	3629.
0.694	50.	741.	25.	0.1	295.	3630.
0.694	50.	741.	25.	0.1	292.	3627.
0.694	50.	741.	25.	0.1	288.	3626.
0.694	50.	741.	25.	0.1	295.	3626.
0.694	50.	741.	25.	0.1	302.	3625.
0.694	50.	741.	25.	0.1	298.	3621.
0.694	50.	741.	25.	0.1	284.	3621.
0.694	50.	741.	25.	0.1	294.	3616.
0.694	50.	741.	25.	0.1	294.	3612.

TABLE B-7. (Continued)

Emission Rate (gm/see)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) Y
0.694	50.	741.	25.	0.1	298.	3612.
0.694	50.	741.	25.	001	302.	3612.
0.694	50.	741.	25.	0.1	302,	3619.
0.694	50.	741.	25.	0.1	316.	3619.
0.694	50.	741.	25*	0.1	288*	3606.
11.417	100*"	700.	5.0	0.6	274,	3643.
11.417	100.	700;	5.0	006	291.	3629.
11.417	100.	700.	5,0	006	316.	3617.
	48 100% TANKERING SOURCES					
5.833	50.	741.	25.	0.1	263.	3652.
5.833	50.	741.	25,	001	279.	3640.
5.833	50*	741.	25.	0.1	289.	3643.
5.833	50.	741.	25.	0.1	278,	3623,
5.833	50.	741.	25.	0.1	293.	3621.
5.833	50.	741.	25.	0.1	304.	3620.
5.833	50.	741.	25.	0.1	285.	3612.
5.833	50.	741.	25.	0*1	322.	3612.
5.833	50.	741.	25.	0,1	300*	3600.
13.556	100.	700.	5.0	0,6	274.	3643.
1.5,550	100.	700.	5.0	0,6.	291.	3629.
13.556	100.	700.	5.0	0.6	316,	3617.
13.556	100.	700.	5.0	0.6	302.	3599*
2.556	7.	433.	"2.	.3	291o	3629.
0.028	7.	433.	2.	.3	302*	3599.
	ACCIDENT SOURCES					
5.5	50,	1000.	0.0	10.	291.	3629.
			POLLUTANT CO			
	NON 48 SOURCES					
0.097	50.	741.	25.	0.15	224.	3748.
0.097	50J*"	741.	25.	0.15	235.	3733.
0.103	50.	741.	25.	0.15	298.	3714.
0.103	50.	741.	25.	O*15	298.	3710.
0.103	50.	741.	25.	0.15	298.	37050
0.542	50.	741.	25.	0.15	273.	3644.
0.542	50.	741.	25.	0.15	276,	3643.
0.542	50,	74A.	25.	0.15	278.	3644.
0.542	50.	741.	25.	O*15	284.	3643.
0.542	50.	741.	25*	0.15	276,	3640.
0.542	50.	741.	25.	0.15	284.	3659.
0.542	50,	741.	25.	0015	288,	3639.
0.542	50.	741.	25.	0.15	276.	3635.
0.542	50.	741.	25.	0.15	284.	3635.
0.542	50.	741.	25.	0.15	288.	3635.
0.542	50.	741.	25.	0.15	290.	3629.
0.542	50.	741.	25.	O*15	295.	3630.
0.542	50.	741.	25.	0.15	292.	3627.
0.542	50.	741.	25.	0015	288.	3626.
0.542	50,	741.	25.	0.15	295.	3626.
0.542	50.	741.	25.	0.15	302.	3625.
0.542	50.	741.	25.	0.15	298.	3621.
0.542	50.	741.	25.	0015	284.	3621.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
0.542	50.	741.	25.	0.15	294.	3616.
0.542	50.	741.	25.	0.15	294.	3612.
0.542	50.	741.	25.	0.15	298.	3612.
0.542	50.	741.	25.	0.15	302.	3612.
0.542	50.	741.	25.	0.15	302.	3619.
0.542	50.	741.	25.	0.15	316.	3619.
0.542	50.	741.	25.	0.15	288.	3605.
	48 SOURCES					
0.006	7.	700.	5.	.6	308.	3712.
1.917	50.	741.	25.	0.15	263.	3652.
1.917	50.	741.	25.	0.15	279.	3640.
1.917	50.	741.	25.	0.15	289.	3643.
1.917	50.	741.	25.	0.15	278.	3623.
1.917	50.	741.	25.	0.15	293.	3621.
1.917	50.	741.	25.	0.15	309.	3620.
1.917	50.	741.	25.	0.15	285.	3612.
1.917	50.	741.	25.	0.15	322.	3612.
1.917	50.	741.	25.	.15	300.	3600.
1.472	50.	741.	25.	.15	219.	3739.
1.306	50.	741.	25.	0.15	308.	3722.
	NON 48 100% TANKERING SOURCES					
0.556	50.	741.	25.	0.1	273.	3644.
0.556	50.	741.	25.	0.1	276.	3643.
0.556	50.	741.	25.	0.1	278.	3644.
0.556	50.	741.	25.	0.1	284.	3643.
0.556	50.	741.	25.	0.1	276.	3640.
0.556	50.	741.	25.	0.1	284.	3639.
0.556	50.	741.	25.	0.1	288.	3639.
0.556	50.	741.	25.	0.1	276.	3635.
0.556	50.	741.	25.	0.1	284.	3635.
0.556	50.	741.	25.	0.1	288.	3635.
0.556	50.	741.	25.	0.1	290.	3629.
0.556	50.	741.	25.	0.1	295.	3630.
0.556	50.	741.	25.	0.1	292.	3627.
0.556	50.	741.	25.	0.1	288.	3626.
0.556	50.	741.	25.	0.1	295.	3626.
0.556	50.	741.	25.	0.1	302.	3625.
0.556	50.	741.	25.	0.1	298.	3621.
0.556	50.	741.	25.	0.1	284.	3621.
0.556	50.	741.	25.	0.1	294.	3616.
0.556	50.	741.	25.	0.1	294.	3612.
0.556	50.	741.	25.	0.1	298.	3612.
0.556	50.	741.	25.	0.1	302.	3612.
0.556	50.	741.	25.	0.1	302.	3619.
0.556	50.	741.	25.	0.1	316.	3619.
0.556	50.	741.	25.	0.1	288.	3606.
	48 100% TANKERING SOURCES					
1.917	50.	741.	25	0.1	263.	3652.
1.917	50.	741.	25	0.1	279.	3640.
1.917	50.	741.	25	0.1	289.	3643.
1.917	50.	741.	25	0.1	278.	3623.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
1.917	50.	741.	25.	0.1	293.	3621.
1.917	50.	741.	25.	0.1	304.	3620.
1.917	50.	741.	25.	0.1	285.	3612.
1.917	50.	741.	25.	0.1	322.	3612.
1.917	50.	741.	25.	0.1	300.	3600.
0.100	7.	433.	2.	.3	291.	3629.
0.006	7.	433.	2.	.3	302.	3599.

ACCIDENT SOURCES

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
83.5	50.	1000.	0.0	10.	291.	3629.

POLLUTANT TSP

NON 48 SOURCES

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
0.042	50.	741.	25.	.15	224.	3748.
0.042	50.	741.	25.	.15	235.	3733.
0.047	50.	741.	25.	.15	298.	3714.
0.047	50.	741.	25.	.15	298.	3710.
0.047	50.	741.	25.	.15	298.	3705.
0.253	50.	741.	25.	.15	273.	3644.
0.253	50.	741.	25.	.15	276.	3643.
0.253	50.	741.	25.	.15	278.	3644.
0.253	50.	741.	25.	.15	284.	3643.
0.253	50.	741.	25.	.15	276.	3640.
0.253	50.	741.	25.	.15	284.	3639.
0.253	50.	741.	25.	.15	288.	3639.
0.253	50.	741.	25.	.15	276.	3635.
0.253	50.	741.	25.	.15	284.	3635.
0.253	50.	741.	25.	.15	288.	3635.
0.253	50.	741.	25.	.15	290.	3629.
0.253	50.	741.	25.	.15	295.	3630.
0.253	50.	741.	25.	.15	292.	3627.
0.253	50.	741.	25.	.15	288.	3626.
0.253	50.	741.	25.	.15	295.	3626.
0.253	50.	741.	25.	.15	302.	3625.
0.253	50.	741.	25.	.15	298.	3621.
0.253	50.	741.	25.	.15	284.	3621.
0.253	50.	741.	25.	.15	294.	3616.
0.253	50.	741.	25.	.15	294.	3612.
0.253	50.	741.	25.	.15	298.	3612.
0.253	50.	741.	25.	.15	302.	3610.
0.253	50.	741.	25.	.15	302.	3619.
0.253	50.	741.	25.	.15	316.	3619.
0.253	50.	741.	25.	.15	288.	3605.

48 SOURCES

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
0.556	50.0	741.0	25.0	0.15	219.	3739.
0.472	50.0	741.0	25.0	0.15	308.	3722.
0.750	50.0	741.0	25.0	0.15	263.	3652.
0.750	50.0	741.0	25.0	0.15	279.	3640.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) Y
0.750	50.0	741.0	25.0	0.15	289.	3643.
0.750	50.0	741.0	25.0	0.15	27a.	3623.
0.750	50.0	741.0	25.0	0.15	293.	.3621.
0.750	50.0	741.0	25*O	0.15	309.	3620.
0.750	50.0	741.0	25. 0	0.15	2850	3612.
0.750	50.0	741.0	25.0	0.15	322.	3612.
0.750	50.0	741.0	25.0	0.15	3000	3600.
0.008	7.0	433.	2.	.3	308.	3721.
	NON48100% TANKERING SOURCES					
0.667	50.	741.	25.	0.1	384.	3715.
0.667	50.	741.	25.	0.1	394.	3704.
0.667	50.	74A.	25.	0.1	411.	3707.
0.444	50.	741.	25.	0.1	432.	3694.
0.444	50.	741.	250	0.1	4430	3681.
0.444	50,	741.	25.	0.1	455*	3623*
0.019	7.	433.	2.	.3	396.	37150
0.008	7.	433.	2.	.3	456.	3623.
0.075	7.	433.	2.	.3	388,	3736.
0.833	50.	741.	25.	0.1	388.	3736.
	48 100% TANKERING SOURCES					
0.750	50.	741,	25.	0.1	263.	3652.
0.750	50.	741.	25.	0.1	279.	3640.
0.750	50.	74A.	25.	0.1	289.	3643.
0.750	50.	741.	25.	0.1	278.	3623.
0.750	50.	741.	25.	0.1	293.	3621.
0.750	50.	741.	25.	0.1	304.	3620.
0.750	50.	741.	25.	0.1	285.	3612.
0.750	50.	741.	25.	0.1	322.	3612.
0.750	50.	741.	25.	0.1	3000	3600.
1.222	7.	433.	2.	.3	291.	3629.
0.019	7.	433.	2.	.3	302,	3599.
	ACCIDENT SOURCES					
16.	50.	1000*	0.0:	1o..	291.	3629.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) Y
	OTHER MAJOR PROPOSED SOURCES					
0.044	7.	433.	2.	.3	368.	3734.
0.128	7.	433.	2.	.3	388.	37*4*
	ACCIDENT SOURCES					
83.3	50.	1000.	0.0!	10,	457*	3623.
83.3	5(J.	1000.	0.0	10.	396.	3715.
			POLLUTANT TSP			
	NON 46 SOURCES					
0.056	50.	741.	25.	0.1	420.	3723.
0.750	50.	741.	25.	0,1	396.	3731*
1.333	50.	741.	25.	0.1	392.	3735.
0.028	50.	741.	25.	0.1	368.	3745.
0.208	50.	741.	25.	0.1	394.	3723.
0.208	50.	741.	25.	0.1	391.	3719*
0.208	50.	741.	25.	0.1	404.	3715.
0.208	50.	741.	25.	0.1	394*	3714.
0.208	50.	741.	25.	0.1	398.	3710.
0.208	50.	741,	25.	0.1	389*	3709.
0.208	50.	741.	25.	0.1	404.	3704.
0.208	50.	741.	25.	0.1	405.	3699.
	46 SOURCES					
0.667	50.0	741.0	25.0	0.15	384.	3715.
0.667	50.0	741.0	25.0	0.15	394.	3704.
0.667	50.0	741.0	25.0	0.15	411.	3707.
0.444	50.0	741.0	25.0	0.15	432.	3694.
0.444	50.0	741.0	25.0	0.15	443.	3681.
0.444	50.0	741.0	25.0	0.15	455.	3623.
0.003	7.0	433.	2.	.3	456.	3623.
	NON 46 100% TANKERING SOURCES					
0.056	50.	741.	25.	0.1	420.	3723.
0.750	50.	741.	25.	0.1	396.	3731.
1.333	50.	741.	25.	0.1	392.	3735.
0.028	50.	741.	25.	0.1	368.	3745.
0.222	50.	741.	25.	0.1	394.	3723.
0.222	50.	741.	25.	0.1	391.	3719
0.222	50.	741.	25.	001	404.	3715.
0.222	50.	741.	25.	0.1	394*	37140
0.222	50.	741.	25.	0.1	398.	5710.
0.222	50.	741.	25.	O*1	389*	3709.
0.222	50.	741.	25.	0.1	404.	3704.
0.222	50.	741 *	25.	0.1	405.	3699.
	46 100% TANKERING SOURCES					

TABLE B-7. (Continued)

Emission Rate g se	Stack Height (m)	Stack Temp (°K)	Emission Velocity (m/net)	Stack Diameter (m)	Location UTM (m) X	Location UTM (m) Y
0.667	50,	741.	25.	0.1	384.	3715.
0.667	50.	741.	25.	0.1	394.	3704.
0.667	50.	741.	25,	001	4119	3707.
0.444	50.	741*	25.	0.1	432*	3694.
0.444	50.	741,	25.	0.1	443.	3681.
0.444	50.	741.	25.	001	455*	3623.
0.019	7.	433.	2.	.3	396.	3715.
0.008	7*	433.	2.	.3	456.	3623.
0.075	"?,0	433.	2.	.3	388.	3736.
0.833	50.	741.	25.	0.1	388.	3736.
	OTHER MAJOR PROPOSED SOURCES					
0.544	7.	433.	2.	.3	388.	3734.
0.039	7.	433.	2.	.3	388.	3734.
0.639	75.	756.	22.9	0.3	388.	3734.
	ACCIDENT SOURCES					
16.	50.	1000,	0.0	10.	457.	3623.
16.	50.	1000.	0.0	10.	396,	3715.
				REGION III		
				POLLUTANT SO2		
	NON 48 SOURCES					
0.042	50.	741.	25.	.15	224.	3748.
0.042	50.	741.	25.	.15	235.	3753.
0.047	50.	741.	25.	.15	29a.	3714.
0.047	50.	741.	25.	.15	298.	3710*
0.047	50.	741.	25.	.15	298.	37059
0.253	50.	741.	25.	.15	273.	3644.
0.253	50.	741.	25.	.15	276.	3643.
0.253	50.	741.	25.	.15	278.	3644.
0.253	50.	741.	25.	.15	284.	3643.
0.253	50.	741,	.25.	.15	276.	3640.
0.253	50,	741.	25.	.15	284.	3639.
0.253	50.	741.	25.	.15	288.	36.59.
0.253	50.	741.	25.	015	276.	3635.
0.253	50.	741.	25.	.15	284.	3635.
0.253	50.	'?41.	25.	.15	288.	3635.
0.253	50.	741.	25.	.15	2900	3629.
0.253	50.	741.	25.	.15	295.	3630.
0.253	50.	741.	25.	.15	292.	3627.
0.253	50.	741.	25.	.15	288.	3626e
0.253	50.	741.	25.	.15	295.	3626.
0.253	50.	741.	25.	.15	302.	3625.
0.253	50.	741.	25.	.15	298.	3621.
0.253	50.	741.	25.	.15	284.	3621.
0.253	50.	741.	25.	.15	294.	3616.
0.253	50.	741.	25.	.15	294.	3612.
0.253	50.	741.	25.	.15	298m	3612.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	y
0.253	50.	741.	25.	.15	302.	3612.
0.253	50.	741.	25.	.15	302.	3619.
0.253	50.	741.	25.	.15	316.	3619.
0.253	50.	741.	25.	.15	288.	3605.
	48 SOURCES					
0.017	7.	433.	2.	.3	308.	3721.
0.094	50.	741.	25.	0.15	263.	3652.
0.094	50.	741.	25.	0.15	279.	3640.
0.094	50.	741.	25.	0.15	289.	3643.
0.094	50.	741.	25.	0.15	278.	3623.
0.094	50.	741.	25.	0.15	293.	3621.
0.094	50.	741.	25.	0.15	309.	3620.
0.094	50.	741.	25.	0.15	285.	3612.
0.094	50.	741.	25.	0.15	322.	3612.
0.094	50.	741.	25.	0.15	300.	3600.
0.500	50.	741.	25.	.15	219.	3739.
0.417	50.	741.	25.	0.15	308.	3722.
	NON 48 100% TANKERING SOURCES					
0.250	50.	741.	25.	0.1	273.	3644.
0.250	50.	741.	25.	0.1	276.	3643.
0.250	50.	741.	25.	0.1	278.	3644.
0.250	50.	741.	25.	0.1	284.	3643.
0.250	50.	741.	25.	0.1	276.	3640.
0.250	50.	741.	25.	0.1	284.	3639.
0.250	50.	741.	25.	0.1	288.	3639.
0.250	50.	741.	25.	0.1	276.	3635.
0.250	50.	741.	25.	0.1	284.	3635.
0.250	50.	741.	25.	0.1	288.	3635.
0.250	50.	741.	25.	0.1	290.	3629.
0.250	50.	741.	25.	0.1	295.	3630.
0.250	50.	741.	25.	0.1	292.	3627.
0.250	50.	741.	25.	0.1	288.	3626.
0.250	50.	741.	25.	0.1	295.	3626.
0.250	50.	741.	25.	0.1	302.	3625.
0.250	50.	741.	25.	0.1	298.	3621.
0.250	50.	741.	25.	0.1	284.	3621.
0.250	50.	741.	25.	0.1	294.	3616.
0.250	50.	741.	25.	0.1	294.	3612.
0.250	50.	741.	25.	0.1	298.	3612.
0.250	50.	741.	25.	0.1	302.	3612.
0.250	50.	741.	25.	0.1	302.	3619.
0.250	50.	741.	25.	0.1	316.	3619.
0.250	50.	741.	25.	0.1	288.	3606.
	48 100% TANKERING SOURCES					
0.750	50.	741.	25.	0.1	263.	3652.
0.750	50.	741.	25.	0.1	279.	3640.
0.750	50.	741.	25.	0.1	289.	3643.
0.750	50.	741.	25.	0.1	278.	3623.
0.750	50.	741.	25	0.1	293.	3621.
0.750	50.	741.	25.	0.1	304.	3620.
0.750	50.	741.	25.	0.1	285.	3612.

TABLE B-7. (Continued)

Emission Rate (gm/see)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/see)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) Y
0.750	50.	741.	25.	0.1	32'2.	3612.
0.750	50.	741.	25.	0.1	300.	3600.
1.222	7.	433.	2,	0.3	291.	3629.
0.019	7.	433.	2.	0.3	302.	35998

ACCIDENT SOURCES

50.	50.	1000.	0.0	10.	291.	3629.

TABLE -7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	y
			PoLLuTANT Co			
	NON 48 SOURCES					
0.139	50.	741.	25.	O*1	420.	3723.
1.611	50.	741.	25.	0.1	396.	3731.
2.889	50.	741.	25.	0.1	3920	3735.
0.056	50,	741.	25.	0.1	368.	3745.
0.722	50.	741.	25.	0.1	394.	3723.
0.722	50.	741.	25.	061	391.	3719.
0.722	50.	741*	25.	O*1	4048	3715.
0.722	50.	741.	25.	0.1	394.	37149
0.722	'Jo.	741.	25.	O*1	398.	3710.
0.722	50.	741.	25,	0.1	389.	3709.
0.722	50.	741.	25.	091	404.	37(14*
0. 722	50.	741*	25.	0.1	405,	3699.
	48 SOURCES					
1.750	50,	741.	25.	0.1	384.	37159
1.750	50.	74A.	25.	0.1	394,	3704.
1.750	50.	741.	25.	0.1	411.	3707.
1.278	50.	741,	25.	0.1	432.	3694.
1.278	50.	741.	25.	0.1	443s	3681.
1.278	50.	741.	25.	0.1	455*	3623.
0.006	7.	433.	2.	.3	456.	3623.
	NON 48 100% TANKERING SOURCES					
0.139	50.	741.	'25.	0,1	420,	3723.
1.611	50.	741.	25.	0.1	396.	3731.
2.889	50.	741.	25.	0.1	392.	3735,
0.056	50.	741.	25.	0.1	368.	3745*
0.444	50.	741.	25.	0.1	394.	5723.
0.444	50.	741.	25.	0.1	391.	3719.
0.444	50.	741.	25.	0.1	404.	3715.
0.444	50.	741.	25.	0.1	394.	3714.
0.444	50.	741.	25.	0.1	398.	371O*
1.1*444	50.	741.	25.	0.1	389.	3709.
0.444	50.	741.	25.	0.1	404.	3704.
0.444	.50.	741.	25.	O*1	405.	3699.
	48 100% TANKERING SOURCES					
1.750	50.	741.	25.	0.1	384.	3715.
1.750	50,	741.	25.	0.1	394.	3704.
1.750	50,	741.	25.	0.1	411.	37117.
1.278	50.	741.	25.	i l l	432.	3694.
1.278	50.	741.	25.	0.1	4430	3681.
1.278	50.	741.	25.	0.1	455.	3623.
0.022	r.	433.	2.	.3	388.	3736.
2.556	50'	741.	25.	0.1	388.	3736.
0.006	7.	433.	2.	.3	396.	3715.
0.003	7.	433.	2.	.3	456.	3623.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m)	
					X	Y
			POLLUTANT TSP			
	NON 48 SOURCES					
0.306	50.0	741.0	25.0	0.15	232.	3808.
0.028	50.0	741.0	25.0	0.15	2630	3808*8
0.056	50.0	741.0	25.0	0.15	268,	3805.
0.014	50.0	741.0	25.0	0.15	187.	3812*
0.014	50.0	741.0	25.0	0.15	192.	3815.
0.194	50.0	741.0	25*U	0.15	266.	3803.
0.292	50.0	741.0	25*U	0,15	260.	3803.
0.125	50.0	741.0	25.0	0.15	288.	3776.
0.972	50.0	741.0	25.0	0.15	278.	3784.
1.167	50.0	741.0	25.0	0.15	279,	3778.
3.972	50.0	741.0	25.0	0.15	208.	3804.
1.75	50.0	741.0	25.0	0.15	192.	38060
0.028	50.0	741,0	25. (J	0015	287.	3795.
	48 SOURCES					
0.889	50.0	741.0	25.0	0.15	162.	3809.
0.889	50.0	741. (J	25.0	0.15	184.	37949
0.889	50.0	741.0	25. (J	0.15	213.	3782.
0.889	50.0	741.0	25.0	0.15	219.	37959
0.889	50.0	741.0	25.0	0.1s	258.	3796.
0.889	50.0	-/*Aolj	25*O	0.15	270.	3777.
0.889	50.0	741.0	25.0	0.15	272.	3792.
1.222	25.	433.	7.7	1.	221*	3795.
	NON 48 100% TANKERING SOURCES					
0.306	50.	741.	25.0	0.1	232.	3808.
0.028	50.	741.	25.0	0.1	263.	3808.
0.056	'ah.	741.	25.0	0.1	268.	3805.
0.014	50,	741.	25*U	0.1	187,	3812.
0.014	50.	741,	25*U	0.1	192.	3815.
0.063	50.	-/41.	25.0	0,1	266.	3803.
0.125	50.	741.	25.0	0.1	288.	3776.
0.659	50.	741.	25.0	U*1	260.	3803.
0.972	50,	741.	25.0	0.1	278.	3784.
1.167	50.	741.	25.0	0.1	279.	3778.
3.972	50.	741.	25.0	001	208.	3809.
1.750	50.	741.	25.0	0.1	192.	3806.
0.042	50.	741.	25.0	0.1	224.	3748.
0.042	50.	74A.	25. (J	0.1	235.	3733.
0.047	50.	741.	25.0	0.1	298.	3714.
0.047	50.	741.	25.0	0.1	298.	3710.
0.047	50.	"/41.	25.0	0.1	298.	3705.
	48 100% TANKERING SOURCES					
0.8896	50.	741.	25.	0.1	162,	3809.
0.8896	50.	741.	25.	0.1	184.	3794.
0.8896	50.	741.	25.	0.1	2130	3782.
0.8896	50.	741.	25.	0.1	219.	37'35.
0.8896	50.	741.	25.	0.1	258.	3796.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) X	Location UTM (m) Y
0.8896	50	741.	25.	0.1	270.	3777.
0.8896	50.	741.	25.	0.1	272.	3792.
0.5566	50,	741.	25.	0.1	219.	3739.
0.4726	50.	741.	25.	0.1	308.	3722.
0.019	7.	433.	2.	.3	209.	3803.
0.008	7.	433.	2.	.3	298.	3710.
1.222	25,	433.	7.7	1.	259.	3789.
OTHER MAJOR PROPOSED SOURCES						
0.083	7.	433.	2.	.3	295.	3781.
0.264	7	433.	2.	.3	295.	3781.
0.639	75.	756.	22.9	0.3	295.	3781.
39.444	12.2	333.	5.8	1.2	3040	3786.
ACCIDENT SOURCES						
16.	50.	1000.	0.0	10.	208.	3803.

REGION II

POLLUTANT SO2

NON 48 SOURCES						
0.056	50,	741.	25.	0.1	420.	3723.
0.750	50.	741.	25.	0.1	396.	3751.
0.333	50.	741.	25.	0,1	392.	3735.
0.028	50.	741.	25.	0.1	368.	3745.
0.208	50.	741.	25.	0.1	394.	3723.
0.208	50.	741.	25.	0.1	391.	3719.
0.208	50.	741.	25.	0,1	404.	3715.
0.208	50.	741.	25.	0.1	394,	3714.
0.208	50.	741.	25.	0.1	398.	3710.
0.208	50,	741.	25.	0.1	389.	3709.
0.208	50.	741.	25.	0.1	404.	3704.
0.208	50,	741.	25.	0.1	405.	3699.
0.028	60,	1240.	60.	0.61	391.	3745.
2.139	60.	1240.	60.	0.61	388.	3736.
0.139	60,	1240.	60.	0.61	409.	3723.
48 SOURCES						
0.611	50,	741.	25.	0,1	364.	3715.
0.611	50.	741.	25.	0.1	394.	3704.
0.611	50.	741.	25.	0.1	411,	3707.
0.611	50.	741.	25.	0.1	432.	.36940
0.611	50.	741.	25.	0.1	443.	3681.
0.611	50.	741.	25.	0.1	455,	3623.
0.017	7.0	433.	2.	.3	456.	3623.
0.339	60,	1240.	60.	0.61	388.	3736.
0.722	50.	741.	25.	0.1	388.	3736.

NON 48 100% TANKERING SOURCES

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
0.056	50.	741.	25.	0.1	420.	3723.
0.750	50.	741.	25.	0.1	396.	3731.
1.333	50.	741.	25.	0.1	392.	3735.
0.028	50.	741.	25.	0.1	368.	3745.
0.222	50.	741.	25.	0.1	394.	3723.
0.222	50.	741.	25.	0.1	391.	3719
0.222	50.	741.	25.	0.1	404.	3715.
0.222	50.	741.	25.	0.1	394.	3714.
0.222	50.	741.	25.	0.1	398.	3710.
0.222	50.	741.	25.	0.1	389.	3709.
0.222	50.	741.	25.	0.1	404.	3704.
0.222	50.	741.	25.	0.1	405.	3699.
0.028	60.	1240.	60.	0.61	391.	3745.
0.139	60.	1240.	60.	0.61	409.	3723.
2.139	60.	1240.	60.	0.61	388.	3736.
	46 100% TANKERING SOURCES					
0.011	50.	741.	25.	0.1	384.	3715.
0.011	50.	741.	25.	0.1	394.	3704.
0.011	50.	741.	25.	0.1	411.	3707.
0.389	50.	741.	25.	0.1	432.	3694.
0.389	50.	741.	25.	0.1	443.	3681.
0.389	50.	741.	25.	0.1	455.	3623.
0.036	7.	433.	2.	.3	396.	3715.
0.017	7.	433.	2.	.3	456.	3623.
0.142	7.	433.	2.	.3	388.	3736.
0.722	50.	741.	25.	0.1	388.	3736.
	OTHER MAJOR PROPOSED SOURCES					
5.972	7.	433.	2.	.3	388.	3734.
0.056	7.	433.	2.	.3	388.	3734.
66.526	75.	756.	22.9	0.3	388.	3734.
	ACCIDENT SOURCES					
50	50.	1000.	0.0	10.	396.	3715.
50.*	50.	1000.	0.0	10.	457.	3623.
			POLLUTANT NOX			
	NON 46 SOURCES					
0.167	50.	741.	25.	0.1	420.	3723.
2.056	50	741.	25.	0.1	396.	3731.
3.639	50	741.	25.	0.1	392.	3735.
0.056	10.	741.	25.	0.1	368.	3745.
0.567	50	741.	25.	0.1	394.	3723.
0.567	50*.	741.	25.	0.1	391.	3719.
0.567	50*	741.	25.	0.1	404.	3715.
0.567	50*.	741.	25.	0.1	394.	3714.
0.567	50	741.	25.	0.1	398.	3710.
0.567	50.	741.	25.	0.1	389.	3709.

TABLE B-7. (Continued)

Emission Rate (gm/see)	stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Y
0,567	50.	741.	25.	O*1	404.	3704.
0.567	50.	741.	25.	0.1	4050	3699.
0.111	50.	7700	50.	0,3	420.	3723,
0.722	50.	770.	50,	0.3	396.	3731.
1.611	50,	770,	50.	0,3	392.	3735.
0.167	50.	770.	50.	0.3	368.	3745.
1.053	50.	77(J.	50,	O*3	394*	3723.
1.053	50.	770.	50,	0.3	391,	3719*
1.053	50.	770.	50,	003	404.	3715.
1.053	50.	770.	50.	003	394.	3714.
1.053	50,	770.	50.	0.3	398,	3710.
1.053	50.	770.	50.	0.3	389,	3709.
1.053	50,	77U ,	50.	0.3	404.	3704.
1.053	50.	770.	50. ,	0.3	405,	3699.
0.306	50.	77U.	50.	003	391*	3745.
29,667	50.	770.	50.	0.3	388.	3736.
2. 083	50.	770.	50.	0,3	409.	3723.
0.361	100.	700.	5*	0.6	397.	3735.
7.389.	10U.	700.	5 ,	0.6	388.	3?36.
4.111	100.	700,	5*	0.6	409.	3723.
	48 SOURCES					
1077U	50 ,	770.	50.	0.3	384.	3715.
1.778	50.	770.	50.	0.3	394.	3704.
1.778	50,	770.	50.	0.3	4119	3707.
4.139	50,	770.	50.	0.3	432.	3694.
4.139	50.	770.	50.	O*3	443.	3681.
4.139	50.	770.	50.	0.3	455.	3623.
1.817	15.	700.	5.	.6	456.	3623.
5.444	50.	770.	50.	0.3	388.	3736.
15.389	100.	700.	5.	0.6	388.	3736.
5.611	50.	741.	25.	0.1	384.	3715*
5.611	50.	741.	25.	0,1	394.	37U4 .
5.611	50.	741.	25.	0.1	411*	3707.
5.028	50.	741.	25.	0.1	432.	3694.
5.028	50.	741.	25.	0.1	4439	3681.
5.028	50.	741.	25.	0.1	455.	3623.
0.017	7.	433*	2.	.3	456.	3623.
	NON 48 100% TANKERING SOURCES					
0.167	50.	741.	25.	0.1	420.	3723.
2.056	50,	741.	25.	0.1	396.	3751.
3.639	50.	741.	25.	O*1	392.	3755*
0.056	50.	741.	25.	0.1	368,	3745*
0.556	50.	741.	25.	0.1	394.	3723.
0.556	50,	741.	25.	0.1	3910	3719.
0.556	50.	741.	25.	0.1	404.	3715.
0.556	50.	741.	25.	0.1	394.	3714.
0.556	50.	741.	25.	0.1	398.	3710.
0.556	50.	741.	25.	0.1	369.	3709.
0.556	50.	741.	25.	0.1	404.	3704.
0.556	50.	741.	25.	0.1	405.	3699.
0.111	50.	770.	50.	0.3	420.	3723.
0.722	50,	77U.	50.	()*3	396.	3731.
1.611	50.	77U.	50.	0.3	392.	3755*
0.167	50.	77U.	50.	0.3	368.	3745.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/see)	Stack Diameter (m)	Location UTM (m) X	Location UTM (m) Y
0.306	50.	770.	50.	0.3	3919	3745.
2.033	50.	770.	50.	0.3	409.	3723.
29.667	50.	770.	50*	0.3	388.	3736.
0.472	100.	700.	5.	0.6	387.	3735.
4.111	100.	770,	.50	003	409,	3723.
7.389	100.	700.	5.	0.6	388.	3736.
	46 100% TANKERING SOURCES					
5.011	50.	741.	25.	0.1	384.	3715.
5.011	50.	741.	25.	0.1	394.	37U4.
5.011	50.	74A.	25.	0.1	411.	37(17*
5.028	50.	741.	25.	0.1	432.	3694.
5.028	50.	741.	25.	0.1	443,	3681.
5.026	50.	741.	25.	0.1	4550	3623.
0.028	7.	433,	2.	.3	396.	3715.
0.014	7.0	433.	29	.3	456.	3623.
0.111	7.	433.	2.	.3	388.	3736.
12.000	50.	741.	25.	0.1	388.	3736.
9.000	100.	700.	5.0	0.6	396.	3715.
5.444	100.	700.	5.0	0.6	4010	3705.
1.806	100.	700.	5.0	0.6	456.	3623.
	OTHER MAJOR PROPOSED SOURCES					
3.139	7.	433.	2.	.3	388.	37.34.
0.861	7.	433.	2.	.3	388.	3734.
63.111	75.	750.	22.9	0.3	388.	3734.
	ACCIDENT SOURCES					
5.5	50.	1000.	0.0	10.	457.	3623.
5.5	50.	1000.	0.0	10.	396.	3715.

TABLE B-=. (Continued)

REGION I
POLLUTANT SO2

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
NON 48 SOURCES						
0.305	50.0	741.	25	0.15	232.	3808.
0.028	50.0	741.	25	0.15	263.	3808.
0.056	50.0	741.	25.	0.15	268.	3805.
0.014	50.0	741.	25.	0.15	187.	3812.
0.014	50.0	741.	25	0.15	192.	3815.
0.083	50.0	741.	25.	0.15	266.	3803.
0.292	50.0	741.	25.	0.15	260.	3803.
0.125	50.0	741.	25.	0.15	288.	3776.
0.972	50.0	741.	25.	0.15	278.	3784.
1.167	50.0	741.	25.	0.15	279.	3778.
3.972	50.0	741.	25.	0.15	208.	3804.
1.750	50.0	741.	25.	0.15	192.	3806.
0.003	100.0	700.	5.	0.6	204.	3818.
0.003	10 .0	700.	5.	0.6	235.	3812.
0.194	100.0	700.	5.	0.6	277.	3804.
23.667	60.00	1240.	60.	0.61	286.	3796.
0.203	60.00	1240.	60.	0.61	204.	3818.
0.486	60.00	1240.	60.	0.61	235.	3812.
0.128	60.00	1240.	60.	0.61	267.	3808.
0.056	60.00	1240.	60.	0.61	277.	3804.
12.778	60.00	1240.	60	0.61	286.	3796.
0.083	50.0	741.	25.	0.15	287.	3795.
48 SOURCES						
0.833	50.0	741.	25.	0.15	162.	3809.
0.833	50.0	741.	25.	0.15	184.	3794.
0.833	50.0	741.	25.	0.15	213.	3782.
0.833	50.0	741.	25.	0.15	219.	3795.
0.833	50.0	741.	25.	0.15	258.	3796.
0.833	50.0	741.	25.	0.15	270.	3777.
0.833	50.0	741.	25.	0.15	272.	3792.
21.11	25.	433.	7.7	1.	221.	3795.
NON 48 100% TANKERING SOURCES						
0.306	50.	741.	25.0	0.1	232.	3808.
0.028	50.	741.	25.0	0.1	263.	3808.
0.056	50.	741.	25.0	0.1	268.	3805.
0.014	50.	741.	25.0	0.1	187.	3812.
0.014	50.	741.	25.0	0.1	192.	3815.
0.083	50.	741.	25.0	0.1	266.	3803.
0.125	50.	741.	25.0	0.1	288.	3776.
0.039	50.	741.	25.0	0.1	260.	3803.
0.972	50.	741.	25.0	0.1	278.	3784.
1.167	50.	741.	25.0	0.1	279.	3778.
3.972	50.	741.	25.0	0.1	208.	3809.
1.750	50.	741.	25.0	0.1	192.	3806.
0.042	50.	741.	25.0	0.1	224.	3748.
0.042	50.	741.	25.0	0.1	235.	3733.
0.047	50.	741.	25.0	0.1	298.	3714.
0.047	50.	741.	25.0	0.1	293.	3710.
0.047	50.	741.	25.0	0.1	293.	3705.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) x	Location UTM (m) y
0.003	50.	770.	50.	0.3	235.	3812.
0.194	50.	770.	50.	0.3	277.	3804.
0.003	50.	770.	50.	0.3	204.	3818.
0.203	60.0	1240.	60.	0.61	235.	3812.
0.128	60.0	1240.	60.	0.61	267.	3808.
0.036	60.0	1240.	60.	0.61	277.	3804.
0.203	60.0	1240.	60.	0.61	204.	3818.
	40 100% TANKERING SOURCES					
0.833	50.	741.	25.	0.1	162.	3809.
0.833	50.	741.	25.	0.1	184.	3794.
0.833	50.	741.	25.	0.1	213.	3782.
0.833	50.	741.	25.	0.1	219.	3795.
0.833	50.	741.	25.	0.1	258.	3796.
0.833	50.	741.	25.	0.1	270.	3777.
0.833	50.	741.	25.	0.1	272.	3792.
0.500	50.	741.	25.	0.1	219.	3739.
0.417	50.	741.	25.	0.1	308.	3722.
0.036	7.	433.	2.	.3	209.	3803.
0.017	7.	433.	2.	.3	298.	3710.
21.111	25.	433.	7.7	1.	258.	3789.
	OTHER MAJOR PROPOSED SOURCES					
0.778	7.	433.	2.	.3	295.	3781.
0.333	7.	433.	2.	.3	295.	3781.
06.056	75.	756.	22.9	0.3	295.	3781.
0.036	10.	644.	22.9	0.78	294.	3784.
0.500	10.	330.	22.9	1.87	294.	3784.
0.325	10.	644.	22.9	4.39	294.	3784.
0.250	10.	644.	22.9	1.24	182.	3817.
0.500	10.	330.	22.9	1.87	182.	3817.
136.11	12.2	333.	5.8	1.2	304.	3786.
	ACCIDENT SOURCES					
50.0	50.	#000.	0.0	10.	208.	3803.
			POLLUTANT NOX			
	NON 40 SOURCES					
0.833	50.0	741.0	25.0	0.1	232.	3806.
0.063	50.0	741.0	25.0	0.1	263.	3808.
0.139	50.0	741.0	25.0	0.1	268.	3805.
0.028	50.0	741.0	25.0	0.1	187.	3812.
0.028	50.0	741.0	25.0	0.1	192.	3815.
0.222	50.0	741.0	25.0	0.1	266.	3803.
1.75	50.0	741.0	25.0	0.1	260.	3803.
0.333	50.0	741.0	25.0	0.1	288.	3776.
2.611	50.0	741.0	25.0	0.1	278.	3784.
3.167	50.0	741.0	25.0	0.1	279.	3778.
10.606	50.0	741.0	25.0	0.1	208.	3804.
4.778	50.0	741.0	25.0	0.1	192.	3806.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m)	
					X	Y
0.639	50.0	741.0	25,0	0.1	1820	3818.
0.083	50.o	741.0	25.0	0.1	204.	3818.
1.667	50,0	741.0	25.0	0.1	235.	3812.
0.167	50.0	741.0	25,0	001	267.	3808.
5.028	50.0	741.0	25.0	O*1	277.	3804.
2.333	50.0	770.0	50.0	0.3	232.	3808.
0.611	50,0	770.0	50.0	O*3	263.	3808,
0.250	50.0	770.0	50.0	0.3	268,	3805.
0.486	50,0	770.0	50,0	0,3	187,	3812.
0.486	50.0	770,0	50.0	O*3	192.	3815*
0.389	50.0	770.0	50.0	0.3	266.	3803.
0.528	50.0	770.0	5000	0,3	260.	38030
7.417	50.0	770.0	50.0	0.3	278.	3784.
11.917	50.0	770.0	50.0	0.3	279.	3778.
22.528	50.0	770.0	50.0	0.3	2080	3804.
10.222	50.0	770.0	5000	0.3	192.	3806.
11.361	100.0	700.0	5.0	0.6	209.	3803.
11.361	100.0	700.0	5.0	0.6	259.	3789.
2.833	50.0	770.0	50.0	0.3	2040	3818.
6.778	50.0	770.0	50.0	0.3	235.	3812.
1.75	50.0	770.0	50.0	0,3	267.	3808.
0.778	50.0	770.0	50.0	0.3	277.	3804.
327.778	50.0	770.0	50.0	0.3	286.	3796.
55.389	100. U	700.0	5.0	0.6	287.	37950
0.056	50.0	741.0	25*O	U*1	287,	3795.
	48 SOURCES					
1.721	50.0	741.0	25.0	0.1	162.	38090
1.721	50.0	741.0	25.0	0.1	184.	5794.
1.721	50.0	741.0	25.0	0.1	213,	5762.
1.721	50.0	741.0	25.0	001	219.	3795.
1.721	50.0	741.0	25.0	0.1	258.	3796.
1.721	50.0	741.0	25.0	0.1	270.	3777*
1.721	50.0	741.0	25*U	0.1	2720	3792.
2.556	25.	433.	“?.7	1.	2210	5795*
3.499	50.0	770.0	50.0	0.3	162,	3809.
3.499	50.0	770.0	50.0	0.3	184.	3794.
3.499	50.0	770.0	50.0	0.3	213.	37820
3.499	50.0	770.0	50.0	U.3	219*	3795.
3.499	50.0	770.0	boon	0,3	258.	3796.
3.499	50.0	770.0	50.0	O*3	270,	3777.
3.499	50.0	770.0	50.0	0.3	272,	3792.
10.444	15.0	700.0	5.0	0.6	221.	3795.
177.139	50.0	“17(J.O	50.0	0.3	286.	3796.
32.278	100.0	700.0	5.0	0.6	287.	3795.
	NON48 100% TANKERING SOURCES					
2.3331	50.0	77U.	50.	0.3	232.	3808.
0.6111	50.0	770.	50.	0.3	263,	3808.
0.2501	50.0	77U ,	50.	0.3	268.	3805.
0.4861	50.0	770.	50.	O*3	187.	3812.
0.4861	50.0	770	50.	0.3	192.	3815.
6.7781	50.0	770.	50.	0.3	235.	3812.
1.7501	50.0	77U.	50.	0.3	267.	3808.
0.7781	50.0	770.	50.	0.3	277.	3804.
2.8331	50.0	770.	50.	0.3	204.	3818.

TABLE B-7. (Continued)

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) X	Location UTM (m) Y
1.667	100.	700.	5.	0.6	235.	3812.
0.083	100.	700.	5.	0. 6	267.	3808.
4.583	100.	700.	5.	0.6	277.	3804.
0.064	100.	700.	5.	0 . 6	182*	3816
0.083	10U,	700."	5.	0.6	204.	3818.
0.778	100.	700.	5.	0.6	298.	3710.
0.833	50*	7 * 1 .	25.	0.1	232.	3808.
0.083	50.	741.	25.	0.1	263.	3808.
0.139	50.	741.	25.	0.1	268.	3805.
0.028	50,	741.	25.	0.1	187.	3812.
0.028	50.	741.	25.	0.1	1920	3815.
0.222	50.	741.	25.	0.1	266.	3803.
0.333	50.	741.	25.	0.1	288.	3776.
1.750	50.	741,	25.	0.1	260.	3803.
2.611	50.	741.	25.	0.1	278.	3784.
3.167	50.	741.	25.	0.1	279.	3778*
10.806	50.	741.	25.	0.1	208.	3804.
4.7786	50.	741.	25.	0.1	1920	3806.
0.1256	50.	741.	25.	001	224.	3748.
0.1256	50.	741.	25.	0.1	235.	3733.
0.1316	50.	741.	25.	0.1	298.	3714.
0.1316	50.	741.	25.	0.1	298.	3710*
0.1316	50.	741.	25.	0.1	298.	3705.
15.111	100.	700.	5.	006	185.	3791.
15.111	100.	700.	5.	0.6	2090	3803.
15.111	100.	700.	5.	006	259.	3789.
0.500	100.	700.	5.	0,6	219.	3738.

46 100% TANKERING SOURCES

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) X	Location UTM (m) Y
6.222	50.	741.	25.	0.1	162.	3809.
6.222	50.	741.	25.	0.1	184.	3794.
6.222	50.	741.	25.	0.1	213.	3782.
6.222	50.	741.	25.	0.1	219.	3795.
6.222	50.	741.	25.	0.1	258.	3796.
6.222	50.	741.	25.	0.1	270.	3777.
6.222	50.	741.	25.	0.1	272.	3792.
5.278	50,	741.	25.	0.1	219.	3739.
5.056	50.	741.	25.	0.1	308.	3722.
0.028	7.	433.	2.	.3	209.	3803.
0.014	7.	433.	2.	.3	298.	3710.
2.556	25.	433.	7.7	1.	2599	3789.
13.250	.15	700.	5.	0.6	185.	3791.
13.250	.15	700.	5.	0.6	209.	3803.
13.250	.15	700.	5.	0.6	259.	3789.
13.250	.15	700.	5.	0.6	163.	3808.
13.250	.15	700.	5.	006	2210	3795.
1.639	100.	700.	5.	0.6	219.	3738.
1.444	100.	700.	5.	0.6	298.	3710.

OTHER MAJOR PROPOSED SOURCES

Emission Rate (gm/sec)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) X	Location UTM (m) Y
0.139	7.	433.	2.	.3	295.	3781,
8.056	75.	756.	22.9	0.3	295.	3781.
2.889	10.	644.	22.9	0.78	294.	3784.
12.611	10.	330.	22.9	1.87	294.	3784.
8.806	10.	644.	22.9	4*39	294.	3784.
7.550	10.	644.	22,9	1.24	182*	3817.

TABLE B-7. (Continued)

Emission Rate {gr"/see)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m) X	Location UTM (m) Y
12.600	10.	330.	22.9	1.87	182.	3817.
102.76	12.2	333.	5.8	1.2	304.	3786.
	ACCIDENT SOURCES					
5.5	50.	1000.	0.0	10.	208.	3803.
			POLLUTANT CO			
	NON 48 SOURCES					
0.667	50.0	741.0	25.0	0.15	232.	3808.
0.056	50.0	741.0	25.0	0.15	263.	3808.
0.111	50.0	741.0	25.0	0.15	268.	3805.
0.028	50.0	741.0	25.0	0.15	187.	3812.
0.028	50.0	741.0	25.0	0.15	192.	3815.
0.167	50.0	741.0	25.0	0.15	266.	3803.
0.639	50.0	741.0	25.0	0.15	260.	3803.
2.056	50.0	741.0	25.0	0.15	278.	3784.
2.500	50.0	741.0	25.0	0.15	279.	3778.
0.269	50.	741.	25.	0.15	268.	2773.
8.528	50.0	741.0	25.0	0.15	208.	3804.
3.778	50.0	741.0	25.0	0.15	192.	3803.
	48 SOURCES					
2.194	50.0	741.0	25.0	0.15	162.	3809.
2.194	50.0	741.0	25.0	0.15	184.	3794.
2.194	50.0	741.0	25.0	0.15	213.	3782.
2.194	50.0	741.0	25.0	0.15	219.	3795.
2.194	50.0	741.0	25.0	0.15	258.	3?96.
2.194	50.0	741.0	25.0	0.15	270.	3777.
2.194	50.0	741.0	25.0	0.15	272.	3792.
0.100	25.	433.	7.7	1.	221.	3795.
0.025	50.0	741.0	25.0	0.15	287.	3795.
	NON 48 100% TANKERING SOURCES					
0.667	50.0	741.0	25.0	0.1	232.0	3808.
0.056	50.0	741.0	25.0	0.1	263.	3808.
00.111	50.0	741.0	25.0	0.1	268.	3805.
0.0281	50.0	741.0	25.0	0.1	187.	3812.
0.0281	50.0	741.0	25.0	0.1	192.	3815.
0.1671	50.0	741.0	25.0	0.1	266.	3803.
0.2781	50.0	741.0	25.0	0.1	288.	3776.
1.3891	50.0	741.0	25.0	0.1	260.	3803.
2.0561	50.0	741.0	25.0	0.1	278.	3784.
2.5001	50.0	741.0	25.0	0.1	279.	3778.
8.5281	50.0	741.0	25.0	0.1	208.	3804.
3.7781	50.0	741.0	25.0	0.1	192.	3806.
0.0971	50.0	741.0	25.0	0.1	224.	3748.
0.0971	50.0	741.0	25.0	0.1	235.	3733.
0.1031	50.0	741.0	25.0	0.1	298.	3714.
0.1031	50.0	741.0	25.0	0.1	298.	3710.
0.1031	50.0	741.0	25.0	0.1	298.	3705.

TABLE B-7. (Continued)

Emission Rate (gm/see)	Stack Height (m)	Stack Temp. (°K)	Emission Velocity (m/sec)	Stack Diameter (m)	Location UTM (m)	
					x	y
	46 100% TANKERING SOURCES					
2.194	50.	741.	25.	0.1	162.	3809.
2.194	50.	741.	25.	0.1	184.	3794.
2.194	50.	741.	25.	0.1	213.	3782.
2.194	50.	-741.	25.	0.1	219.	3795*
2.194	50.	741.	25.	0.1	258.	3796.
2.194	50.	741.	25.	0.1	270.	3777*
2.194	50*	741.	25.	0.1	272.	3792.
1.472	50.	741.	25.	0.1	219.	3739.
1.306	50.	741.	25.	0.1	308.	3722.
0.006	7.	433.	2.	.3	209.	3803.
0.003	7.	433.	2*	.3	298.	3710.
0.100	25.	433.	7.7	1.	259.	3789.
	OTHER MAJOR PROPOSED SOURCES					
1.369	7.	453.	2.	.3	295.	3781.
6.801	12.2	333.	5.8	1.2	304.	3786.
	ACCIDENT SOURCES					
63.3	50.	1000.	0.0	10.	208.	3803.
	POLLUTANT H2S					
	NOT 46 SOURCES					
00.222	5.	293.	0*0	0.1	235.	3812.
0.058	5.	293.	0.0	0.1	267*	3808.
0.025	5.	293.	0.0	0.1	277.	3804.
	46 SOURCES					
0.233	5.	293.	0.0	0.1	286.	3796.
	NOT 46 100% TANKERING SOURCES					
0.092	5.	293.	000	0.1	235*	3812.
0.056	5.	293.	0*0	0.1	267.	3808.
0.025	5.	293.	0*0	0.1	277.	3804.
	ACCIDENT SOURCES					
4.157	50.	1000.	0*0	10.	208.	3803.

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APPENDIX C

DESCRIPTION OF REM2
PHOTOCHEMICAL AIR QUALITY SIMULATION MODEL

C.1 Introduction

Pacific Environmental Services, Inc. (PES) originally developed, with funding from the Environmental Protection Agency, an efficient photochemical air quality simulation model, REM (Reactive Environmental Model). REM was a Lagrangian model which was designed for the prediction of photochemical contaminant levels specifically in the Los Angeles basin (Wayne et al., 1971). REM was tested by comparing its predictions with the actual measurements observed by the extensive air monitoring network in the Los Angeles Basin. Results of this validation study have been published by the EPA (Wayne et al., 1973; Kokin et al., 1973); they showed that REM yielded good predictions for typical smog situations in Los Angeles.

The current photochemical model, REM2, is an improved version of the original model, and it can be easily used in any location. The improvements have been in both simulation accuracy (e.g., horizontal diffusion) and user-oriented adaptability (e.g., variable grid size). The improved photochemical model, REM2, is described in detail in this appendix. Some recent REM2 validation results are summarized in Section C.5 of this appendix.

C.2 Principles of Simulation

REM2 is a regional photochemical air quality model which simulates a 34-reaction photochemical mechanism in a Lagrangian (moving coordinate) frame of reference. The basis of the model is a moving parcel of air, which is bounded by a stable layer (inversion base) above and the ground below. Figure C-l illustrates the dynamics of the model. Pollutants enter the moving air parcel from sources located relative to a Cartesian emissions grid, and can diffuse in and out of the moving air parcel by horizontal diffusion.

The location of the base of the moving column at successive moments generates the path or trajectory of the air parcel across the region. Both forward and reverse trajectories can be computed by special routines using wind velocity and direction information, given in the data base as a function of time of day and location; alternatively, arbitrarily chosen trajectories can be utilized. The moving parcel of air is assumed to remain vertical and to be well-mixed vertically between ground level and the inversion base. Plume rise is not explicitly treated in the model due to the assumption of instantaneous vertical mixing of all emissions. Both the ground terrain level and the inversion base height can be entered as functions of location and time of day; thus the model can accommodate varying ground terrain and varying inversion heights.

Because of the Lagrangian formulation which follows an air parcel in a moving-coordinate frame of reference, the basic equation is simply that of conservation of mass in the air parcel for each pollutant of interest:

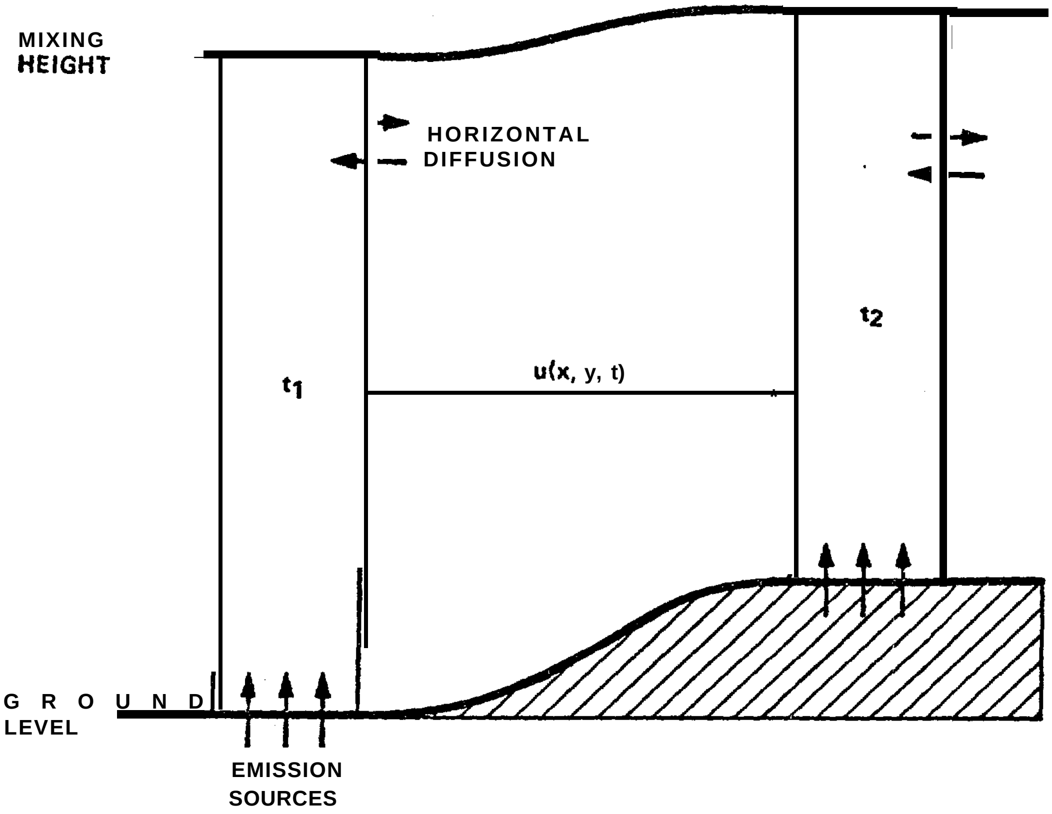

Figure C-1. REM2 MODEL DYNAMICS

$$\left[\frac{dc_i}{dt}\right]_{\text{Total}} = \left[\frac{\partial c_i}{\partial t}\right]_{\text{reaction}} + \left[\frac{\partial c_i}{\partial t}\right]_{\substack{\text{horizontal}\\ \text{diffusion}}} + \left[\frac{\partial c_i}{\partial t}\right]_{\substack{\text{volume}\\ \text{change}}} + \left[\frac{\partial c_i}{\partial t}\right]_{\substack{\text{emissions}\\ \text{input}}} \qquad \text{(C-1)}$$

The reaction term is handled in the conventional manner,

$$\left[\frac{\partial c_i}{\partial t}\right]_{\text{reaction}} = \sum k_{ij}\, c_i c_j \qquad \text{(c-2)}$$

where k_{ij} is the reaction rate constant. The horizontal diffusion term involves the use of the semi-empirical turbulent diffusion equation or K-theory,

$$\left[\frac{\partial c_i}{\partial t}\right]_{\substack{\text{horizontal}\\ \text{diffusion}}} = K_y \frac{\partial^2 c_i}{\partial y^2} \qquad \text{(c-3)}$$

where K_y is the horizontal diffusion coefficient and y is the direction perpendicular to the trajectory direction. Diffusion is simulated between adjoining air parcels on each side of the main air parcel. In the program operation, gradients are calculated from concentrations on each side of the air parcel, assumed proportional to the total emissions one grid length away perpendicular to the trajectory direction.

The REM2 computer program is modular in design, with separate modules linked to form a complete atmospheric simulation system. Modules presently in the system determine the necessary meteorological parameters, the rate of absorption of ultraviolet light by NO_2, emissions due to traffic and area sources, and solution of the conservation-of-mass equations. The ultraviolet absorption module calculates a diurnal ultraviolet irradiance function based on measurement of cloud cover, latitude, and local calendar time (Leighton, 1961).

The source emissions module calculates the pollutant inputs to the column of air as it passes over vehicular, stationary, and area emission sources. The emissions from freeway traffic, street traffic, and area sources are represented by a square grid system, whose size is adjustable. Currently, three types of pollutant emissions are considered: nitric oxide (NO), carbon monoxide (CO), and non-methane hydrocarbons (NMHC). The NMHC emissions are divided into two reactivity classes. Separate emission factors and diurnal distributions for freeway and street traffic are input into the model. Emissions from point sources are attributed (as area emissions) to the grid squares in which they are located.

The source emissions module calculates the pollutant inputs to the column of air as it passes over vehicular, stationary, and area emission sources. The emissions from freeway traffic, street traffic, and area sources are represented by a square grid system, whose size is adjustable. Currently, three types of pollutant emissions are considered: nitric oxide (NO), carbon monoxide (CO), and non-methane hydrocarbons (NMHC). The NMHC emissions are divided into two reactivity classes. Separate emission factors and diurnal distributions for freeway and street traffic are input into the model. Emissions from point sources are attributed (as area emissions} to the grid squares in which they are located.

C.3 Photochemical Mechanism

The chemical mechanism in REM2 simulates the elementary photochemical reactions occurring in the moving parcel of air. The model utilizes a 34-reaction mechanism, shown in Table C-1, which contains mainly stoichiometrically consistent elementary reactions (Wayne *et al.*, 1973). Twenty-four different chemical species are considered; of these, twelve are free radicals.

Non-methane hydrocarbons are grouped into two reactivity classes-more reactive hydrocarbons and less reactive hydrocarbons. Methane is assumed non-reactive and is not included in the reaction scheme. The types of compounds assigned to the REM2 reactivity classes are given in Table C-2.

The conservation-of-mass equations, which include the chemical kinetics expressions, are solved by an efficient numerical integration routine (Gear, 1971); this routine has found widespread use in photochemical kinetics simulations. It should be noted that the chemical mechanism can be easily replaced by a future more accurate mechanism, with only minor changes in the affected program algorithms.

Table C-1. REM2 34- REACTION PHOTOCHEMICAL MECHANISM

REACTION			RATE CONSTANT (25°C)
1.	NO_2 + hν	→ NO + O	Depends on light intensity
2.	O_2 + O + M	→ O_3 + M	6.7 x 10^{-6} ppm^{-2} min^{-1}
3.	NO + O_3	→ NO_2 + O_2	4,0x 10^{1} ppm^{-1} min^{-1}
4.	NO_2 + O_3	→ NO_3 + O_2	1.0 x 10^{-3} ppm^{-1} min^{-1}
5.	NO + NO_3	→ 2NO_2	2.5 x 10^{4} ppm^{-1} min^{-1}
6.	NO_2 + NO_3 + H_2O	→ 2HNO_3	1.0 ppm^{-2} min^{-1}
7.	NO_2 + OH	→ HNO_3	1.0 x 10^{4} ppm^{-1} min^{-1}
8.	NO + HO_2	→ NO_2 + OH	1.0 x 10^{3} ppm^{-1} min^{-1}
9.	O_2 + H + M	→ HO_2 + M	4.8 x 10^{-6} ppm^{-2} min^{-1}
10.	O_3 + OH	→ HO_2 + O_2	1.0 x 10^{3} ppm^{-1} min^{-1}
11.	CO + OH	→ CO_2 + H	3.0 x 10^{2} ppm^{-1} min^{-1}
12.	HCHO + hν	→ CO + 2H	1/133 k_1
13.	C_3H_6 + O	→ CH_3 + C_2H_3O	3.5 x 10^{3} ppm^{-1} min^{-1}
14.	C_3H_6* + O	→ CH_3 + C_2H_3O	7.0 x 10^{2} ppm^{-1} min^{-1}
15.	C_3H_6 + O_3	→ HCHO + $C_2H_4O_2$	5.0 x 10^{-3} ppm^{-1} min^{-1}
16.	C_3H_6 + OH	→ CH_3CHO + CH_3	1.5 x 10^{5} ppm^{-1} min^{-1}
17.	C_3H_6 + HO_2	→ CH_3O + CH_3CHO	1.0 x 10^{2} ppm^{-1} min^{-1}
18.	C_3H_6 + CH_3O_2	→ CH_3 + CH_3O + C_2H_3O	1.0 ppm^{-1} min^{-1}
19.	C_3H_6* + O_2 + O	→ HCHO + $C_2H_4O_2$	8,3x 10^{-3} ppm^{-2} min^{-1}
20.	C_2H_3O + M	→ CO + CH_3 + M	1,0 x 10^{-5} ppm^{-1} min^{-1}
21.	CH_3O + O_2	→ HCHO + HO_2	9,5 x 10^{-4} ppm^{-1} min^{-1}
22.	CH_3 + O_2 + M	→ CH_3O_2 + M	6.7 x 10^{-6} ppm^{-2} min^{-1}
23.	C_2H_3O + O_2	→ $C_2H_3O_3$	4,8 x 10^{-1} ppm^{-1} min^{-1}
24.	$C_2H_3O_3$ + O_2	→ $C_2H_3O_2$ + O_3	9,5 x 10^{-5} ppm^{-1} min^{-1}
25.	$C_2H_4O_2$ + O_2	→ $C_2H_3O_3$ + OH	1,4 x 10^{-3} ppm^{-1} min^{-1}
26.	CH_3O_2 + NO	→ CH_3O + NO_2	2,0x 10^{2} ppm^{-1} min^{-1}
27.	CH_3O + NO + O_2	→ CH_3O_2 + NO_2	4.8x 10^{-3} ppm^{-2} min^{-1}
28.	$C_2H_3O_2$ + NO	→ C_2H_3O + NO_2	2.0 x 10^{3} ppm^{-1} min^{-1}
29.	$C_2H_3O_3$ + NO	→ $C_2H_3O_2$ + NO_2	2.5x10^{2} ppm^{-1} min^{-1}
30.	$C_2H_4O_2$ + NO	→ CH_3CHO + NO_2	1.0 x 10^{4} ppm^{-1} min^{-1}
31.	CH_3O + NO_2	→ CH_3ONO_2	I.0x10^{2} ppm^{-1} min^{-1}
32.	$C_2H_3O_3$ + NO_2	→ $C_2H_3O_3NO_2$	2.0 x 10^{1} ppm^{-1} min^{-1}
33.	NO + Radical	→ Products	5.0 ppm^{-1} min^{-1}
34.	Radical + Radical	→ Products	1.0 x 10^{4} ppm^{-1} min^{-1}

*Less reactive hydrocarbon

Table C-2
REM2 HYDROCARBON REACTIVITY CLASSES

Unreactive	Less Reactive	More Reactive
methane	paraffins (other than methane)	olefins
	acetylene	aldehydes
	benzene	cycloparaffins
	acetone	aromatics (other than benzene)
	methanol	ketones (other than acetone)
		alcohols (other than methanol)

C.4 Model Assumptions

As with all models, the REM2 model is 'based upon certain assumptions. Basic assumptions regarding atmospheric motions are:

1. A minimum effective mixing depth exists which may be assumed operative in instances of surface inversions.
2. Effects of wind shear are unimportant and may be neglected.
3. Effects of lag. in vertical mixing within the mixing layer are unimportant on a regional scale and may be neglected.

Assumptions regarding photochemical contaminants and their chemical behavior are:

1. Only contaminants.emitted into, or produced chemically within, the mixing layer are involved in the photochemical reactions.
2. Effects of temperature changes on the rate of photochemical reactions are unimportant and may be neglected.
3. The non-methane hydrocarbons involved in photochemical reactions can be adequately simulated in terms of two reactivity classes.
4. Due to the assumption of no lag in vertical mixing, vertical. contaminant concentration profiles are uniform within the mixing layer.

C.5 Summary of REM2 Validation Results

In three recent modeling applications, REM2 was validated in three very different locations:

(1) a high-density urban area - Los Angeles, California
(2) a medium-density urban area -. Phoenix, Arizona
(3) a low-density rural area - Goleta, California.

Four validation runs were made in the Los Angeles area, four runs were made in the Phoenix area, and two runs were made in the Goleta area. The validation procedure involved running reverse trajectories to specific air monitoring locations, and comparing the predicted concentrations with measured pollutant levels at the air monitoring stations.

The validation results are summarized in Table C-3. The average absolute error is the average difference between predicted and measured values; the linear correlation coefficient (Bevington, 1969) describes the goodness of fit of a linear relationship between predicted and measured values. Model agreement with measured concentrations was excellent for ozone (03), nitrogen dioxide (NO_2) and carbon monoxide (CO), with respective linear correlation coefficients of 0.94, 0.89, and 0.84. Agreement was reasonable for non-methane hydrocarbons (NMHC); limited measured data for nitric oxide (NO) prevented an adequate validation except at very low NO levels.

The REM2 model was always used in a “hands-off” fashion. The model was not changed and there were no model parameters which were “calibrated” for any of the validation runs in the three different locations. These validation results verify the REM2 model dynamics and kinetics assumptions as appropriate for regional photochemical air quality simulation modeling.

Table C-3

SUMMARY OF REM2 VALIDATION RESULTS

pollutant	Number of Validation Runs	Correlation Coefficient	Ave. Absolute Error (ppm)
O_3	10	0.94	0.02
NO_2	7	0.89	0.02
NMHC	7	0.67	0.3
CO	10	0.84	1

REFERENCES

Bevington, Philip R. **(1969)** Data Reduction and Error Analysis for the Physical Sciences. **McGraw-Hill Book Company,** New York, p. 121.

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Kokin, A., **L.G.** Wayne, and M. **Weisburd** (1973) Controlled Evaluation of the Reactive Environmental Simulation **Model** (REM), **Volume II:** User's Guide. **Pacific Environmental** Services, **Inc.,** Santa Monica, **California,** EPANo. **R4-73-013** b, NTIS No. PB 220457/6.

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Wayne, L.G., A. Kokin, and **M.I. Weisburd (1973)** Controlled Evaluation of the Reactive Environmental Simulation Model (REM), Volume I: **Final** Report. Pacific Environmental Services, Inc. Santa Monica, California, EPA **R4-73-013a,** NTIS No. PB 220 456/8.

APPENDIX D

Photochemical Modeling
Inputs and Outputs

D

Photochemical Modeling
Inputs and Outputs

Appendix D presents the meteorological data used as inputs for the trajectories as well as the detailed outputs for each run. other input data were discussed in Chapter VII.

The trajectory inputs include the coordinates of the location of the trajectory at the beginning of each hour in UTM (Universal Transverse Mercator) coordinates (except in the Santa Barbara area where extended UTM Region 11 coordinates were used rather than UTM Region 10). The inputs also include meteorological data such as temperature, relative humidity and mixing heights.

The procedure used in determining the trajectory locations and their corresponding meteorological characteristics was as follows. Initially, a number of days were selected to be analysed. The selection of days was limited to the year 1975 for which air quality and meteorological data were readily at hand. Since the trajectories were to be used for photochemical modeling, emphasis was placed on the summer smog season when photochemical air pollution problems in Southern California are most pronounced. In addition, two winter days were analysed. The first day, January 25, was analysed at the specific request of the San Diego County APCD and the second was a day when it was believed that Los Angeles area smog was transported north to San Luis Obispo County, so it was used to portray a northward transport day. The meteorology for this day was based on an analysis of conditions on February 28 and March 1.

The days selected then, were days which showed relatively high concentrations of ozone at the different Southern California areas when there was a flow going from offshore to onshore areas. It was felt that conditions during these days would be most likely to indicate the worst impact of the offshore development under meteorological conditions that were not only possible but had actually occurred.

After the days had been selected, surface wind data (wind speed and direction) were plotted on hourly maps at many of the observation stations in the southern California area, including all available offshore data. The result was a series of maps, each one showing the air flow at that particular time. Each map was subjected to streamline analysis, so that the air flow between the observation stations could be approximated.

The trajectory, or movement, of an air parcel was carried out by moving the parcel along the wind, as given by the streamlines, and locating the parcel from one hourly map to another, in succession. The movement of such parcels in each case represented an average of the movement indicated by two hourly maps. Temperature, dew point temperature and mixing height were also approximated for each hour, from data at nearby observation stations.

Two kinds of trajectories were constructed – one going backward in time, and the other, forward. In the first situation, an air parcel containing the ozone maximum for the day could be tracked back to its point of origin, while for the latter case, an air parcel representing a slug of emissions could be carried along with the winds, its trajectory indicating where its effect would be felt. The first type of trajectory was used for validation of the model, while the second was used to assess the impacts of the proposed lease development.

In some.. cases, various air pollution control agencies in the study area specified certain trajectories they particularly wished to see included in the analysis. If specific days were not also indicated, then professional experience with air flow and meteorological patterns in Southern California was employed to determine likely conditions associated with the specified trajectories.

It should be borne in mind that the derived trajectories, involving as they do transport over the ocean area off shore, are based in sparse wind data. W bile every effort was made to insure that the analyzed wind fields were truly representative of the actual situation, of necessity, a great deal of interpolation was required.

In addition, the trajectories all are based on surface wind reports. As such there are questions as to their representativeness of the total air mass flow in certain instances.

This appendix also presents the outputs of the trajectory model. The outputs list the pollutant concentrations in a given air parcel along the trajectory for each location at the time the trajectory passes over it. Concentrations are given for each quarter hour along the trajectory. The coordinates are not given in UTM's, but correspond to the emissions grid. Some outputs are presented in two parts because of the transfer from different emissions grid systems (i.e., offshore grids to onshore girds).

The appendix is divided into four sections: (1) validation data, (2) 1986 without and with Sale 48 impact data (both normal and 100% tankering scenarios), (3) cumulative impact data (both normal and 100% tankering scenarios), and (4) accidents. Each section gives the trajectories used in the section, a figure showing the locations of the trajectories used and the output from the model runs. Concentrations of O_3 and NO_2 in parts per hundred million (pphm), CO and NO in parts per million (ppm) and NMHC in parts per million corrected for methane (ppmc) are shown.

REFERENCES

Kauper, E.K. 1977. Discussion of air trajectory analysis for the Southern California Federal Off-shore oil lease EIS. (Report to AeroVironment).

Validation Results

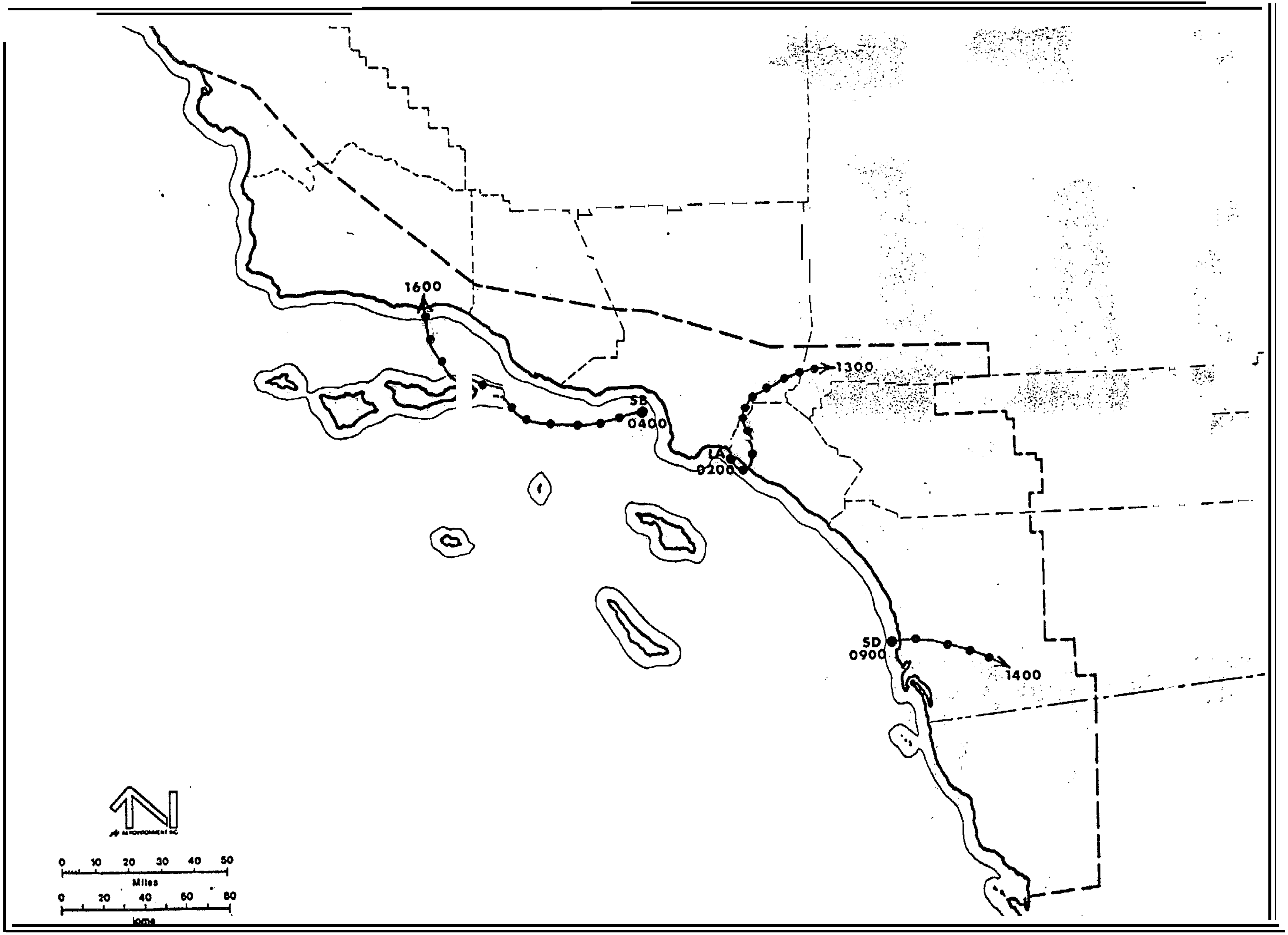

FIGURE D-1. Validation analysis.

Hour	x(km)	y(km)	Temp °C	Relative Humidity(%)	Mixing Height (m AGL*)
SANTA BARBARA VALIDATION TRAJECTORY 9/25/75					
0400	348	3758	18	73	30
0500	339	3755	18	73	30
0600	329	3753	18	73	30
0700	318	3752	19	68	30
0800	306	3753	21	60	30
0900	295	3752	22	56	30
1000	286	3758	24	50	30
1100	281	3768	25	47	60
1200	265	3773	27	41	90
1300	251	3782	27	36	90
1400	249	3793	27	34	90
1500	249	3803	27	32	90
1600	248	3808	27	28	90
LOS ANGELES VALIDATION TRAJECTORY 7/25/75					
0200	390	3732	18	88	520
0300	398	3729	18	88	520
0400	401	3738	18	88	520
0500	399	3745	18	88	520
0600	399	3751	18	88	520
0700	400	3757	19	83	520
0800	403	3765	19	83	550
0900	409	3769	23	69	610
1000	418	3772	27	57	670
1100	424	3773	28	55	700
1200	432	3773	29	52	760
1300	438	3773	31	46	790
San Diego Validation Trajectory 9/3/75					
0900	468	3649	22	68	425
1000	479	3648	22	68	455
1100	491	3646	26	47	550
1200	502	3643	29	38	670
1300	512	3639	31	33	700
1400	521	3634	32	31	730

* meters above ground level

PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL (4/1/77)

OCS - 1975 VALIDATION RUN - 9/25/75
SANTABARBARA TRAJECTORY - PART 1 - 11 HR OCEAN GRID
START AT 0400, END AT 1500
EMISSIONS GRID: OCDATA75

TIME	POSITION(X,Y)	O3(PPHM)	NO2(PPHM)	NO(PPHM)	NMHC(PPMC)	CO(PPM)
4.00	198.0,208.0	1.00	5.00	4.00	2.00	2.00
4.25	196.7,207.9	0.00	6.03	2.96	2.00	2.00
4.50	194.8,207.4	0.00	6.03	2.94	1.99	1.99
4.75	192.2,206.4	0.00	6.03	2.94	1.99	1.99
5.00	189.0,205.0	0.00	6.02	2.93	1.99	1.99
5.25	185.7.2.03.6	0.00	6.01	2.93	1.99	1.99
5.50	182.9,202.9	0.00	6.00	2.92	1.98	1.98
5.75	180.7,202.6	0.00	5.99	2.92	1.98	1.90
6.00	179.0,203.0	0.00	5.99	2.91	1.98	1.98
6.25	177.2,203.4	0.00	5.98	2.91	1.97	1.97
6.50	174.8,203.4	0.08	5.92	2.96	1.97	1.97
6.75	171.7,202.9	0.25	5.85	3.01	1.97	1.97
7.00	168.0,202.0	O*U1	5.91	2.93	1.96	1.97
7.25	164.2,201.2	0.66	6.04	2.78	1.96	1.96
7.50	160.9,2.01.1	O*63	6.42	2.37	1.95	1.96
7.75	158.2,201.7	1.23	6.70	2.04	1.94	1.96
8.00	756.0,203.0	1.83	6.93	1.77	1.93	1.96
8.25	153.8,204.2	2.57	7.13	1.52	1.91	1.95
8.50	151.3,204.4	3.39	7.29	1.29	1.90	1.95
8.75	148. 3,203.6	4.29	7.39	1.11	1.88	1.95
9.00	145.0,202.0	5. 24	7.08	0.95	1.86	1.95
9.25	141.7,200.8	6.26	7*U9	0.85	1.83	1.94
9.50	139.2,201.4	7.29	7.47	0.78	1.81	1.94
9*75	137. 3,203.8	8.31	7.43	0.72	1.78	1.94
10.00	136.0,208.0	9.30	7.39	0.66	1.75	1.94
10.25	135.0,212.5	9.68	7.34	0.65	1.74	1.94
10.50	133.8,215.6	10.03	7.30	0.63	1.72	1.94
10.75	132.5,217.5	10.30	7.26	0.62	1.71	1.94
11.00	131.0,218.0	10.69	7.21	0.61	1.70	1.95
11.25	128.8,216.2	10.2U	7.19	0.64	1.70	1.95
1?.50	125.4,219.1	9.99	7.17	0.66	1.71	1.95
11.75	120.8,220.7	9.88	7.15	0.67	1.71	1.96
12.00	114.9,223.0	9.87	7.13	0.68	1.70	1.96
12.25	109.2,225.5	10.81	7.08	0.61	1.68	1.96
12.50	105.0,227.9	11.70	7.00	0.56	1.65	1.96
12.75	102.2,230.0	12.51	6.92	0.51	1.63	1.96
13.00	101.0,232.0	13.26	6.81	0.47	1.61	1.95
13.25	100.4,23U.2	13.94	6.69	0.43	1.59	1.95
13.50	99.9,237.1	14.57	6.56	0.40	1.58	1.95
13.75	99.4,240.7	15.15	6.42	0.37	1.56	1.95
14.00	99.0,245.0	15.67	6.26	0.34	1.55	1.95
14.25	98.7,2*8.9	16.18	6.13	0.31	1.55	1.95
14.50	98.5,251.6	16.67	5.98	0.29	1.55	1.96
14.75	98.7,252.9	17.12	5.84	0.27	1.55	1.96
15.00	99.0,253.0	17.51	5.72	0.23	1.55	1.97

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                                                  PACIFICENVIRONMENTAL SERVICES
                                                REM2 PHOTOCHEMICAL MODEL  (4/1/77)


          OCS  -  1975 VALIDATION RUN - 9/25/75
          SANTABARBARA Trajectory - PART 1 - 1 HR - SANTA BARBARA GRID
          START AT 1500, END AT 1600
          EMISSIONS GRID: SBDATA75


    TIME     POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

   15.'30    20.0, 12*C'        17*5O        5.72        0*24         1.55         1.97
   15.09     19.9, 12.4         17.61        5.67        0.23         1*55         1.97
   15.17     19.8, 12.8         17.70        5.63        0822         1.55         1.97
   15,25     19.7, 13.2         17.80        5.58        0022         1.55         1.97
   15.34     19.6, 13.6         17.90        5*54        0.21         1.55         1.97
   15.42     19.5, 14.0         17.99        5.50        0.20         1.55         1.97
   15.50     19.4, 14.4         18.07        5.46        0*20         1*55         1.97
   15.58     19.3, 14.8         18.15        5.42        0.19         1.55         1.97
   15.67     19.3, 15.3         18.23        5.38        0.18         1055         1.97
   15.75     19.2, 15.7         18.29        5035        0.17         1.55         1.97
   15.84     19.1, 16.1         18.36        5.31        0.16         1.55         1..97
   15.92     19.1, 16.5         18.43        5.27        0.16         1. 55        1.97
   16.00     19.0, 16.9         18.49        5.24        0.16         1055         1.97


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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL  (4/1/77)

        OCS  -   1975  VALIDATION RUN -   7125175
        LOS ANGELES TRAJECTORY - 11 HR - ENDING  A T  UPLAND
        START  AT  0200,END  AT  1300
        EMISSIONS GRID: LACATA75


  TIME     POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

  2.00     28.6, 14.3           1.00          4.00          3.00         2*OC        3.00
  2.25     29.6, 14.8           0.00          5.06          2.07         2.0C        3.00
  2.50     30.5, 15.3           0*00          5.06          3.21         2.01        3.00
  2.75     31.4, 15.8           0.00          5.05          5.16         2.02        2.99
  3*OO     3?.3, 16.2           0.00          5*O4          6.35         2.03        2.99
  3.25     33.1, 16.6           0.00          5.02          6.81         2.03        2.99
  3.50     33.5, 17.3           0.00          5.00          6.83         2.04        2.99
  3.75     33.7, 18.2           0.00          4.97          6.82         2.04        2.99
  4.00     33.6, 19.3           0.00          4.95          6.81         2.05        2.99
  4.25     33.2, 20.3           0.00          4.93          6.80         2.06        2.99
  4.50     32.7, 20.9           0.00          4.91          6.80         2.06        2.99
  4.75     31.9, 21.2           0.00          4.09          6.80         2.01        2.99
  5.00     31.1, ?1.1           0.01          4.86          6.82         2.08        3.00
  5.25     30.4, 21.1           0.01          4.85          6.84         2.09        3.00
  5.50     30.4, 21.7           0.04          4.85          6.89         2*1C        3.01
  5.75     31.1. 22.7           0.08          4.89          6.94         2.11        3.02
  6.00     32.3. 24.3           0.13          5.04          6.90         2.12        3.03
  6.25     33.6, 25.9           0.20          5.28          6.85         2.14        3.05
  6.50     34.1, ?7.0           0.29          5.68          6.72         2.15        3.06
  6.75     33.9, 27.7           0.36          6.33          6.29         2.17        3.07
  7.00     32.9, 28.0           0.50          7.16          5.78         2.18        3.10
  7.25     32.1, 28.3           0.76          8.09          5.18         2.19        3.14
  7.50     32.1, 29.3           1.15          9* 14         4.47         2.19        3.19
  7.75     33.0, 30.8           1.75         10.16          3.64         2.19        3.23
  8.00     34.8, 33.0           2.62         10.98          2.89         2.17        3.25
  8.25     36.7, 34.9           3.59         11.58          2.40         2.16        3.29
  8.50     38.0. 36.0           4.61         12.09          1.94         2.14        3.32
  8*75     38.6, 36.2           5.93         12.24          1.63         2.11        3.33
  9.00     38.5* 35.4           7.26         12.30          1.42         2.08        3.34
  9.25     38.6.*- 34.7         8.52         12.34          1.27         2.05        3.36
  9.50     39.6, .34.7          9.75         12.32          1.14         2.02        3.37
  9.75     41.4, 35.6          10098         12.21          1.05         1.99        3.38
 10.00     44.2, 37.3          12.18         12.05          0.96         1.96        3.39
 10.25     46.7, 38.9          13.49         11.89          0.87         1.93        3.39
 10.50     48.2, 39.6          14.77         11.66          0.80         1.91        3.39
 10.75     48.6, 39.2          16.07         11.41          0.73         1.90        3.39
 11.00     47.8, 37.9          17.29         11.15          0.66         2.02        3.38
 11.25     47.?, 36.6          18.28         10.85          0.62         2.11        3.38
 11.50     47.8, 36.1          19.22         10.58          0.57         2.25        3.37
 11.75     49.7, 36.6          20.16         10.32          0.53         2.8C        3.37
 12.00     52.9, 37.9          21.07         10* 07         0.50         2.86        3.37
 12.25     55.9, 39.3          22.10          9.86          0.47         2.81        3.37
 12.50     57.5, 39.7          23.04          9.62          0.44         2.77        3.37
 12.75     57.7, 39.3          23.89          9.37          0.40         2.74        3.37
 13.00     56.6, 37.9          24.64          9.12          0.39         2.71        3.37
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                                                      PACIFIC ENVIRONMENTAL SERVICES
                                                     REM2 PHOTOCHEMICAL MODEL (4/1/77)

          OCS  -  1975 VALIDATION RUN  -  9/3/75
          SAN DIEGO TRAJECTORY --5 HR -  ENDING AT ALPINE
          START AT 0900, END AT 1400
          EMISSIONS GRID: SDDATA75

   TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

   9.00     28.0,  59.0        3.00        6.00         2.00        1.50        1.00
   9.17     29.9,  59.0        3.10        6.35         1.63        1.50        1.00
   9.33     31.7,  58.9        3.58        6.46         1.50        1.49        1.00
   9.50     33.5,  56.7        4.09        6.61         1.34        1.49        1.00
   9.67     35.3,  58.6        u.67        6.72         1.25        1.09        1.01
   9.s3     37.2,  58.3        5.19        6.87         1.16        1.49        1.02
  10.00     39.0,  58.0        5.77        6.95         1.09        1.48        1.03
  10.17     40.9,  57.7        6.28        7.00         1.01        1.47        1.03
  10.34     42.8,  57.3        6.03        7.01         0.96        1.46        1.03
  10.50     44.8,  57.0        7.34        -?.02        0.89        1.45        1.03
  10.67     46.8,  56.7        7.85        7.02         0.86        1.44        1.03
  10.84     48.9,  56.3        8.35        7.01         0.82        1.43        1.03
  11.00     51.0,  56.0        8.81        7.03         0.79        1.42        1.03
  11.17     53.1,  55.6        9.18        7.05         0.76        1.41        1.04
  11.34     55.1,  55.2        9.56        7.03         0.73        1.40        1.04
  11.50     57.0.  54.7        9.94        7.01         0.70        1.39        1.04
  11.67     58.8,  54.2       10'.30       6.98         0.68        1.38        1.03
  11.84     60.5,  53.6       10.65        6.95         0.65        1.37        1.03
  12.00     62.0,  53.0       10.98        6.92         0.63        1.36        1.03
  12.17     63.5,  52.3       11.50        6.89         0.60        1.35        1.03
  12.34     65.1,  51.7       11.99        6.87         0.57        1.33        1.04
  12.50     66.8,  51.0       12.46        6.83         0.55        1.32        1.04
  12.67     68.5,  50.3       12.89        6.79         0.53        1.31        1.04
  12.83     70.2.  49.7       13.32        6.74         0.51        1.30        1.04
  13.00     72.0,  49.0       13.72        6.69         0.48        1.29        1.04
  13.17     73.8,  48.3       14.10        6.64         0.47        1.28        1.04
  13.33     75.5,  47.5       14.44        6.58         0.45        1.27        1.04
  13.50     77.0,  46.7       14.77        6.53         0.43        1.26        1.04
  13.67     78.5,  45.9       15.07        6.47         0.41        1.26        1.04
  13.84     79.8,  44.9       15.34        6.42         0.40        1.25        1.05
  14.00     81.0,  44.0       15.58        6.36         0.38        1.24        1.05


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'"1986 Impact Results

Norma! and 100% Tankering Transportation Scenarios

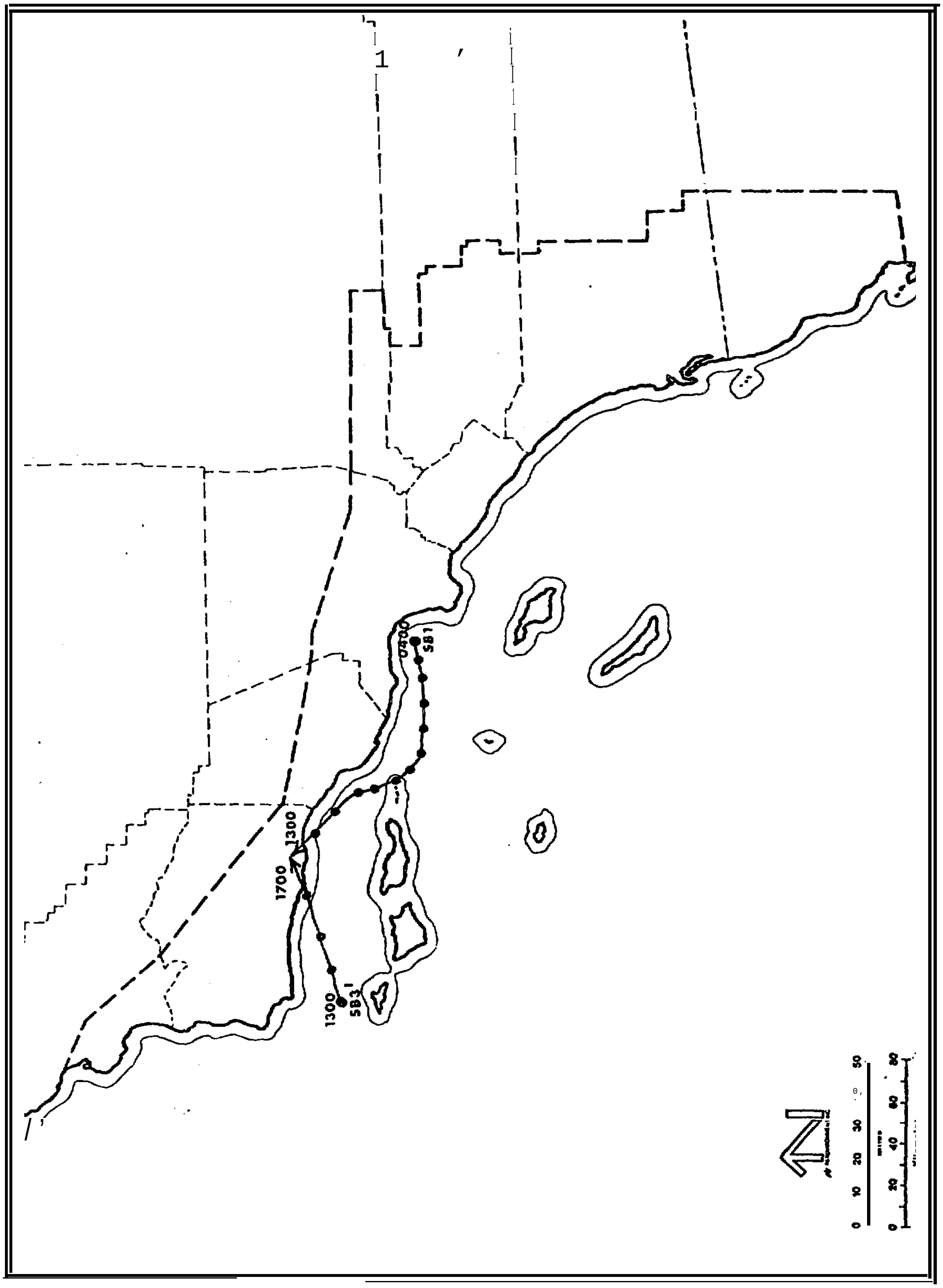

FIGURE D-2. Trajectories (SB3 and SB1) for regional analysis.

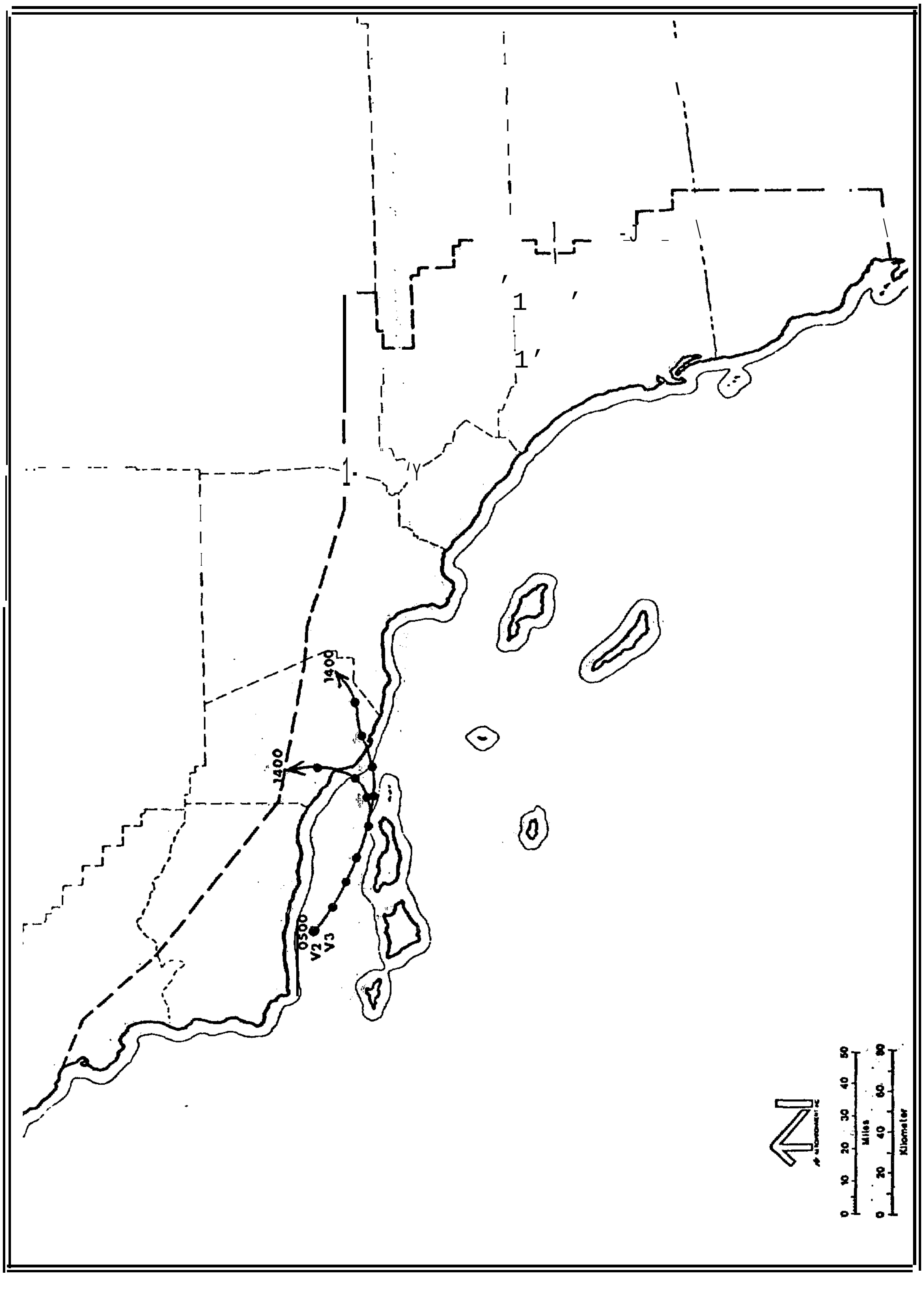

FIGURE D-3. Trajectories (V2 and V3) for regional analysis.

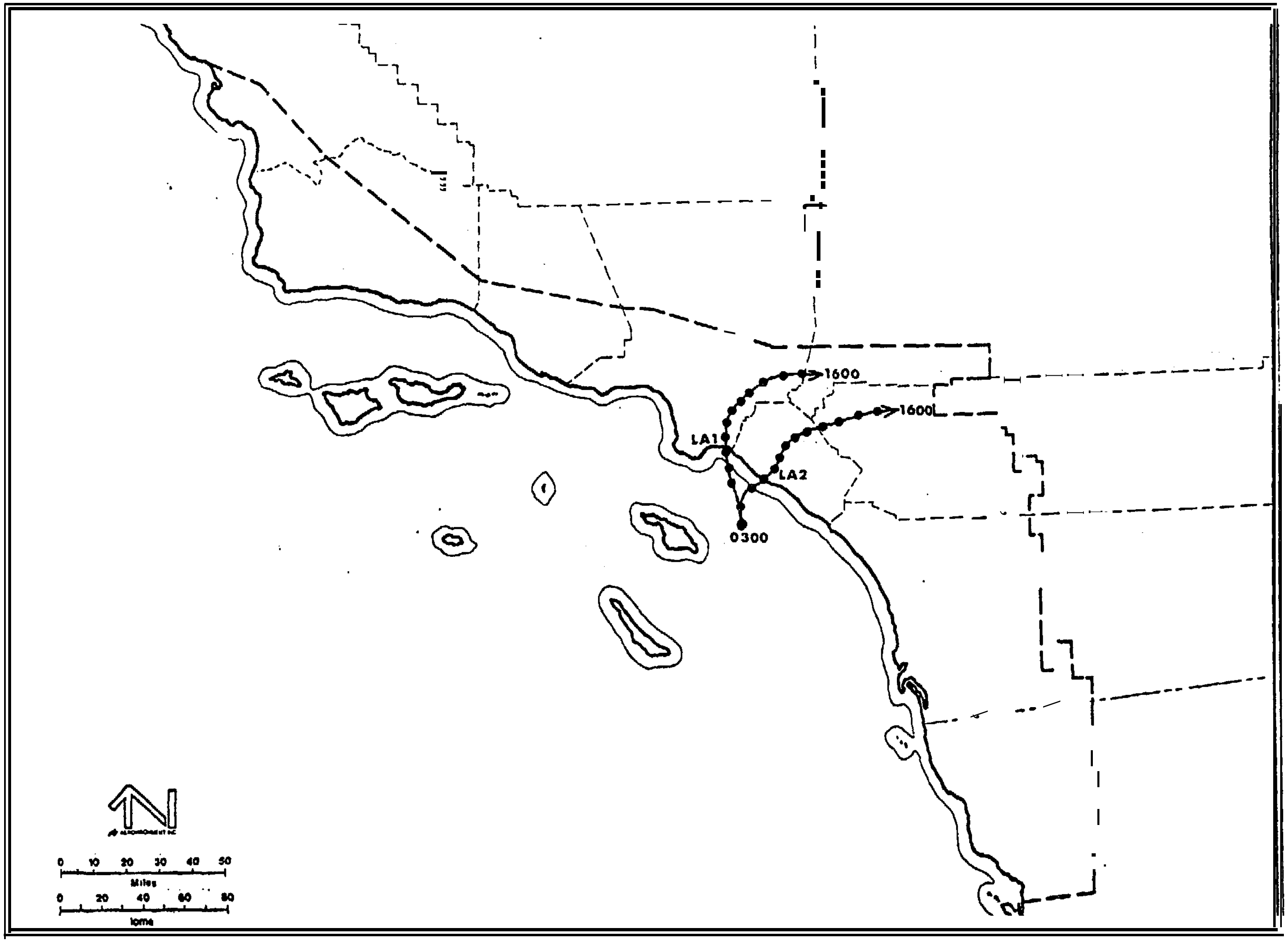

FIGURE D-4. Trajectories (LA1 and LA2) for regional analysis.

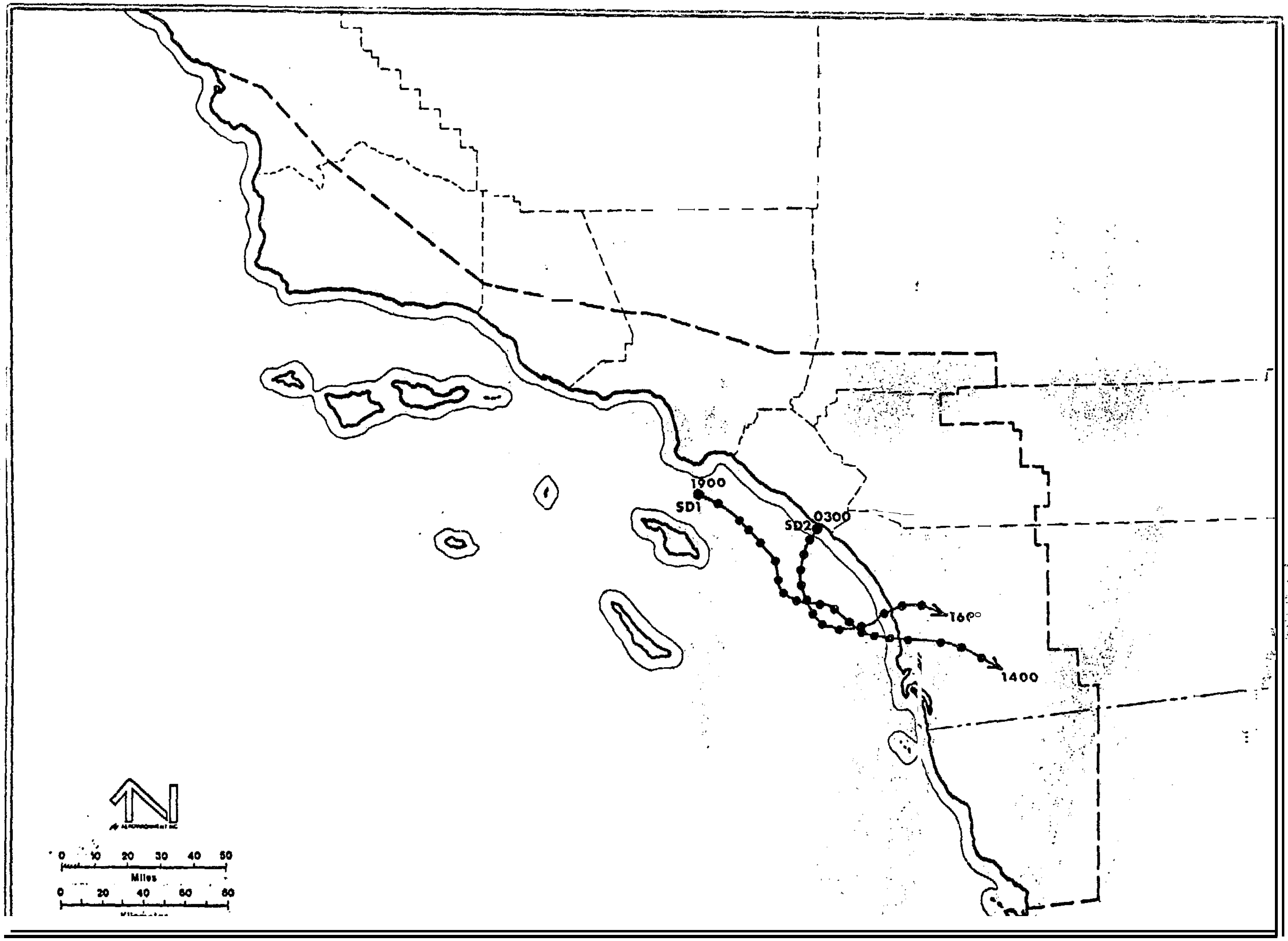

FIGURE D-5. Trajectories (SD1 and SD2) for regional analysis.

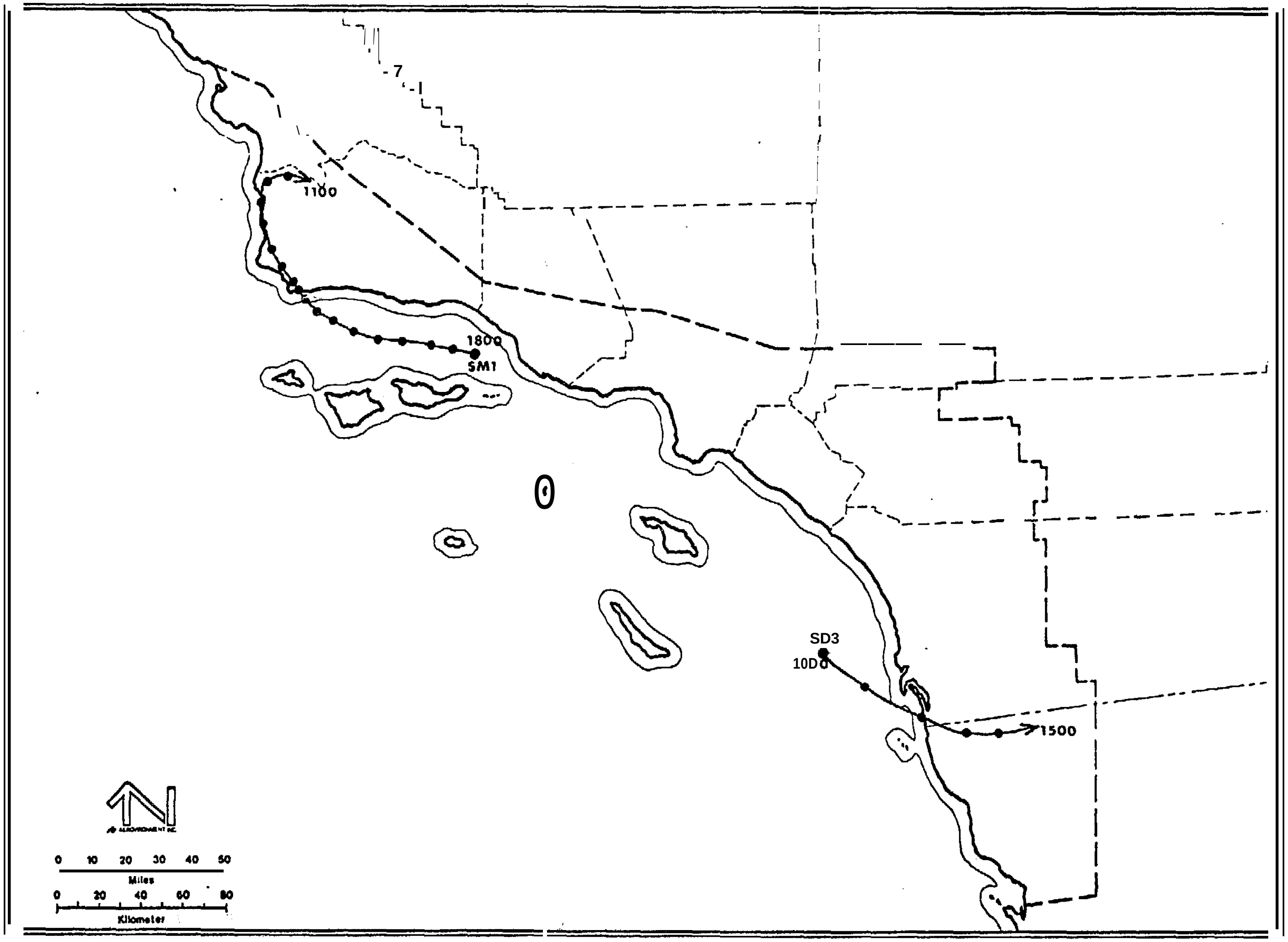

FIGURE D-6. Trajectories (SM 1 and SD3) **for regional analysis.**

Hour	x (km)	y (km)	Temp°C	Relative Humidity %	Mixing Height (m AGL) *
SANTA BARBARA 1 (SB 1) TRAJECTORY					
0400	348	3758	18	73	30
0500	339	3755	18	73	30
0600	329	3753	18	73	30
0700	318	3752	19	68	30
0800	306	3753	21	60	30
0900	295	3752	22	56	30
1000	286	37”58	24	50	30
1100	281	3768	25	47	60
1200	278	3780	27	41	90
1300	267	3787	27	36	90
1400	258	3796	27	34	90
1500	253	3803	27	32	90
1600	248	3813	27	28	90
SANTA BARBARA 3' -(SB 3') TRAJECTORY					
1300	177	3794	29	24	120
1400	193	3797	29	21	120
1500	208	3803	29	19	120
1600	228	3809	29	18	120
1700	248	3813	29	18	120

*meters above ground level

Hour	x (km)	y (km)	Temp°C	Relative Humidity %	Mixing Height (m AGL) *
VENTURA2 (V2) TRAJECTORY					
0500	207	3803	17	77	150
0600	220	3795	18	73	150
0700	231	3788	19	68	150
0800	244	3782	21	60	150
0900	259	3779	22	56	150
1000	272	3778	24	50	150
1100	281	3785	25	44	185
1200	283	3795	27	34	215
1300	286	3803	29	25	290
1400	287	3813	32	17	365
VENTURA 3 (V3) TRAJECTORY					
0500	207	3803	17	77	150
0600	220	3795	18	73	150
0700	231	3788	19	68	150
0800	244	3782	21	60	150
0900	259	3779	22	56	150
1000	272	3777	24	50	150
1100	289	3777	25	44	185
1200	302	3780	27	34	215
1300	316	3783	29	25	240
1400	330	3790	32	17	365

* meters above ground level

Hour	x(km)	y(km)	Temp °C	Relative Humidity(%)	Mixing Height (m AGL*)
LOS ANGELES 1 (LA1) TRAJECTORY					
0300	394	3706	16	82	150
0400	395	3715	17	77	150
0500	389	3722	17	77	150
0600	388	3730	18	73	150
0700	387	3739	21	36	150
0800	387	3747	24	41	150
0900	388	3752	25	39	185
1000	392	3758	27	34	215
1100	396	3764	28	29	260
1200	400	3768	29	25	305
1300	406	3773	31	21	380
1400	416	3777	33	17	455
1500	424	3778	35	16	455
1600	433	3776	35	16	455
LOS ANGELES 2 (LA2) TRAJECTORY					
0300	394	3706	16	82	150
0400	395	3715	17	77	150
0500	399	3721	17	77	150
0600	403	3726	18	73	150
0700	411	3731	21	56	150
0800	415	3736	24	41	150
0900	419	3741	25	39	185
1000	425	3745	27	34	215
1100	429	3748	28	29	260
1200	437	3751	29	25	305
1300	445	3754	31	21	380
1400	453	3757	33	17	455
1500	460	3758	35	16	455
1600	469	3759	35	16	455

*** meters above ground level**

Hour	x(km)	y(km)	Temp°C	Relative Humidity(%)	Mixing Height (m AGL*)
SAN DIEGO 1 (SD1) TRAJECTORY					
1900	372	3719	16	100	305
2000	384	3715	16	100	305
2100	394	3704	16	100	305
2200	399	3702	16	100	305
2300	408	3694	16	100	305
9000	411	3685	16	100	305
0100	412	3675	16	100	305
0200	417	3670	16	100	305
0300	427	3669	16	100	305
0400	436	3666	16	100	305
0500	442	3662	16	100	305
0600	448	3656	16	100	305
0700	452	3652	18	88	365
0800	461	3649	21	73	425
0900	468	3649	22	68	425
1000	479	3648	22	68	455
1100	491	3646	26	47	550
1200	502	3643	29	38	670
1300	512	3639	31	33	700
1400	521	3634	32	31	730
SAN DIEGO 2 (SD2) TRAJECTORY					
0300	437	3704	10	100	30
0400	433	3697	10	100	30
0500	430	3690	10	100	30
0600	428	3684	10	100	30
0700	427	3677	10	100	30
0800	428	3667	10	100	30
0900	432	3661	11	94	90
1000	438	3656	13	82	150
1100	446	3654	14	77	185
1200	456	3656	16	67	215
1300	464	3660	18	60	260
1400	473	3666	20	53	305
1500	484	3667	21	49	305
1600	495	3666	21	49	305

* meters above ground level

Hour	x (km)	y (km)	Temp°C	Relative Humidity %	Mixing Height (m AGL)*
SANTA MARIA 1 (SM 1) TRAJECTORY					
1800	264	3788	11	94	305
1900	253	3789	11	94	305
2000	242	3791	11	94	305
2100	230	3793	11	94	305
2200	219	3795	11	94	305
2300	208	3797	11	94	305
0000	199	3802	11	94	305
0100	192	3806	11	94	305
0200	186	3813	11	94	305
0300	182	3817	11	94	305
0400	177	3824	11	94	305
0500	173	3831	11	94	305
0600	168	3840	11	94	305
0700	166	3850	11	94	305
0800	165	3861	11	94	305
0900	167	3872	12	76	335
1000	177	3875	13	67	365
1100	187	3873	13	63	365
MEXICAN IM PACT (SD 3') TRAJECTORY					
1000	434	3640	27	34	150
1100	457	3623	27	34	150
1200	482	3609	27	34	150
1300	505	3602	27	34	150
1400	520	360.2	28	33	150
1500	535	3605	28	33	150

* meters above ground level

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                                                        PACIFIC ENvIRONMENTAL SERVICES
                                                      REM2 PHOTOCHEMICAL MODEL (4/1/77)

        OCS  -   1986  IMPACT wITHOUT SALE-48 - 9/25
        SANTA BARBARA 1 TRAJECTORY - PART 1 - 11 HRS
        START AT 0400, END AT 1500
        EMISSIONS GRID:OCDATA86.SALE35


  TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

  4.00    198.0s208.0        1.00       4*OO        3.00        1.50        2.00
  4.25    193.4s208.6        0.00       5.04        1.96        1.50        2.00
  4.50    190.4,208.3        0.00       5.06        1.94        1.50        2.00
  4.75    188.9,207.1        0.00       5*O7        1.93        1.50        2.00
  5.00    189.0,204.9        0.00       5.07        1093        1850        2.00
  5.25    189.0s202.9        0.00       5*O7   .    1.93        1.50        2.00
  5*5O    187.3s201.9        0*OO       5.07        1.93        1.50        2.00
  5.75    184.0,201.9        0.00       5.07        1.93        1050        2*00
  6.00    178.9s203.0        0900       5.07        1.93        1.50        2.00
  6.25    173.9s204.1        0.00       5*O7        A*93        1.50        2.00
  60S0    170.4s204.4        0.09       5.00        2000        1.50        2.00
  6075    168.5s203.6        0.29       4.88        2.11        1*5O        2.00
  7.00    168.0,202.0        0.48       4.88        2.11        1*5O        2.00
  ?.25    167.5,200.5        0.69       4.95        2.03        1.49        2.00
  7*5O    165.3s200.1        0.90       5.16        1.81        1.49        2.00
  7*75    161.5s201.0        1.27       5.33        1.63        1*49        2.00
  8.00    156.0,203.0        1.78       5.45        1.48        1.48        2.00
  8.25    150.5s204.9        2.36       5.58        1,32        1047        2.90
  8.50    146.9,205.4        2099       5.73        1,14        1.46        2.00
  8.75    145.1s204.4        3.68       5.85        0.98        1*45        2.40
  9.00    145.0,201.9        4.46       S*89        O*S9        1.44        2.00
  9.25    145.1,200.0        5.27       5.92        0.81        1.42        2000
  9.50    143.5,200.4        6.08       5.93        O*75        1.40        2.00
  9*75    140.5,203.1        6.90       5.93        0.70        1.39        2.00
 10.00    135.9,208.1        7.69       5.93        0.63        1*37        2*OO
 10.25    131.7,213.3        8.03       5*9O        0.62        1.36        2090
 10.50    129.4s216.6        8.34       5.87        0.61        1035        2.00
 10* 75   129.2,218.2        8.60       5.85        0.60        1.33        2.00
 11.00    131.0,218.0        8.88       5.83        O*59        1.32        2.00
 11.25    133.0,217.9        8.56       5.80        0.62        1.32        2.00
 11.50    133.1s219.9        8.39       5.78        0.64        1.32        2.00
 11.75    131.4,224.0        8.32' ' ' ' 5.77       0.64        1.32        2.01
 12.00    127.9s230,1        8.32       5.77        0.65        1.32        2.91
 12.25    124.0s23S.8        9.05       5.79        0.60        1.30        2.01'
 12.s0    120.9,238.9        9*75       5.78        0955        1.28        2.00
 12.75    118.5,239.3       10040       5*73        0.51        1.27        2.00
 13.00    117.0s236.9       11.04       5.60        0.47        1.25        2.00
 13,25    115.5,234.8       11.64       S.60        0.43        1.24        2.00
 13.s0    113.5,235.7       12.21       S.52        0.40        1023        2090
 13.75    111.0,239.4       12. ?3      5.44        0.38        1022        2.00
 14.00    10?.9,246.1       13.22       5.34        0.35        1.22        2.00
 14.25    105.1,252.6       13.67       5.24        0.32        1.21        2.00
 14.50    103.4025509       14.09       5013        0.29        1.21        2.40
 14.75    102.7,256.0       14.48       5.02        0.26        1*2I        2.00
 15.00    103.0,253.0       14.81       4.92        0.24        1.21        2.00
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL (4/1/77)

      OCS  -  1986 IMPACT WITHOUT SALE-48 - 9/25
      SANTA BARBARA 1 TRAJECTORY -"<PART 2 - 1 HR
      START AT 1500, END AT 1600
      EMISSIONS GRID: SBDATA86


   TIME    POSITION(X, Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  15.00     36. 0,12.0        14.80        4.92         0.24        1.21        2.00
  15.09     36.2, 10.6        14.90        4.88         0.23        1.21        2.00
  15.17     36.3,  9.7        14.99        4.85         0.23        1.21        2.00
  1S.25     36.3,  9.2        15.08        4.81         0.22        1.21        2*OO
  15.34     36.2,  9.0        15.16        4.79         0.21        1.21        2.00
  15.4?     35*9*  9*3        15.24        4.75         0.21        1.21        2.00
  15.50     39.6,  9.9        15.31        4. 72       "0.20        1.21        2*00
  15.58     35.1, 11.0        15.39        4.69         0.19        1.21        2.00
  15.67     34.5* 12.4        15.45        4.67         0.18        1.21        2.00
  15*75     33.8* 14.3        15.52        4.64         0.17        1.21        2.00
  15.84     33.0, 16.5        15.58        4. 61        0.17        1.21        2.00
  15.92     32.0, 19.1        15.67        4.62         0.17        1.22        2.01
  16.00     31.0, 22.1        15059        4.80         0.18        1.23        2.03


 KFLAG =    1
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PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL(4/1/77)

OCS - 1986 IMPACT WITH SALE-48 - 9/25
SANTA BARBARA 1 TRAJECTORY - PART 1 - 11 HRS
START AT 0400, END AT 1500
EMISSIONS GRID: OCDATA86.SALE48

TIME	POSITION(X,Y)	O3(PPHM)	NO2(PPHM)	NO(PPHM)	NMHC(PPMC)	CO(PPM)
4.00	198.0,208.0	1.00	4900	3.00	1.50	2.00
4.25	193.4,208.6	0*00	5.04	1.96	1.50	2.00
4.50	190.4,208.3	0800	5.06	1.94	1.50	2.00
4.75	188.9,207.1	0900	5.07	1.93	1050	2.00
5*00	189.0s204.9	0*00	5.07	1.93	1.50	2.00
5.25	189.0,202.9	0*00	5.07	1.93	1.50	2.00
5.50	187.3,201.9	0.00	5.07	1.93	1.50	2.00
5.75	184.00201.9	0.00	5.07	1*93	1.50	2.00
6.00	178.9,203.0	0*00	5.07	1.93	1.50	2.00
6.25	173.9,204.1	0.00	5.07	1093	1950	2.00
6.50	170.4,204.4	O*O9	5.00	2.00	1.50	2.00
6.75	168.5s203.6	0.29	4.88	2.11	1.50	2.00
7.00	168.0,202.0	0.48	4.$8	2.11	1050	2.00
7*25	167.5,200.5	0.69	4.95	2.03	1.49	2.00
7.50	165.3,200.1	0.90	5.16	1081	1.49	2*OO
7*75	161.5,201.0	1.27	5.33	1.63	1049	2.00
8.00	156.0,203.0	1.78	5.45	1.48	1.48	2.00
8.25	150.5s204.9	2.36	5.58	“1.32	1.47	2.00
8.50	146.9s205,4	2.99	5.73	1.14	1.46	2.00
8.75	145.1s204.4	3.68	5.85	0.98	1.45	2.00
9.00	145.0,201.9	4.46	5089	0.89	1.44	2.00
9.25	145.1s200.0	5.27	5.92	0.01	1.42	2.00
9.50	143.5s200.4	6*O8	5*93	O*75	1.40	2*OO
9.75	140.5,203.1	6.90	5*93	0.70	1.39	2.00
IO*00	135.9s208.1	7.69	5.93	0.63	1.37	2.00
10.25	131.7?213.3	8003	5.90	0.62	1.36	2.00
10.50	129.4,216.7	8.33	5.87	0.61	1.35	2*DO
10.75	129.2,218.2	8.59	5.86	0.60	1*33	2.00
11.00	131.0,218.0	8.87	5.86	0.59	1.32	2.00
11.25	133.0s21?.9	8.54	5.83	0.62	1.32	2.90
11.50	133.1s219.9	8.37	5.81	0.64	1.32	2.00
11.75	131.4,224.0	8.31	5.$0	0.65	1.32	2.00
12.00	127.9,230.1	8.29	5.02	0.66	1.32	2..00
12.25	124.0,235.8	9.02	5.83	0.61	1.30	2.00
12.50	120.9,238.9	9.71	5.83	0.56	1028	2.00
12.75	118.5s239.2	10038	5*8O	0.52	1.27	2.00
13.00	117.0,237.0	11.01	5.75	0.48	1.25	2.00
13.25	115.59234.8	11.62	5.68	O*44	1.24	2.00
13.50	113.5s235.7	12.20	5.59	0041	1.23	2.00
13.75	111.0,239.4	12.72	5.51	0.38	1.22	2.00
14.00	107.9,246.1	13* 20	5.44	O*35	1022	2.01
14.25	105.19252.6	13.63	5.35	O*33	1.22	2.01
14.50	103.4s255.9	14.05	5.24	O*3O	1.21	2.01
14.75	102.7,256.0	14.43	5*13	0928	1.21	2.01
15.00	103.0,253.0	14.75	5.03	0.25	1021	2.01

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                                                          PACIFIC ENVIRONMENTAL SERVICES
                                                        REM2 PHOTOCHEMICAL MODEL (4/1/77)

        OCS  -  1986  IMPACT WITH SALE-48 - 9/25
        SANTA BARBARA 1 TRAJECTORY - PART 2 - 1 HR
        START AT 1500, END AT 1600
        EMISSIONS GRID: SBDATA86


  TIME    POSITION(X,Y)      O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  15.00    36.0, 12.0         14.80        5.03         0.25        1.21        2.01
  15.09    36.2, 10.6         14.89        5.00         0.24        1.21        2.01
  15.17    36.3,  9.7         14.98        4.96         0.23        1.21        2.01
  15.25    36.3,  9.2         15.08        4.93         0.23        1.21        2.01
  15.34    36.2,  9.0         15.16        4.90         0.22        1.21        2.01
  15.42    35.9,  9.3         15.25        4.06         0.21        1.21        2.01
  15.50    35.6, 10.0         15.32        4.83         0.20        1.21        2.01
  15.58    35.1, 11.0         15.39        4.80         0.19        1.21        2.01
  15.67    34.5, 12.5         15.46        4.77         0.19        1.21        2.01
  15.75    33.8, 14.2         15.52        4.75         0.18        1.21        2.01
  15.83    33.0, 16.5         15.59        4.72         0.18        1.21        2.01
  15.92    32.0, 19.2         15.69        4.73         0.17        1.21        2.02
  16.00    31.0, 22.1         15.61        4.90         0.19        1.23        2.04


 KFLAG  =  1
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                                                      PACIFIC ENVIRONMENTAL SERVICES
                                                     REM2 PHOTOCHEMICAL MODEL(4/1/77)

          OCS  -  1986  IMPACT WITHOUT SALE-48 - 9/24
          SANTA BARBARA 3'TRAJECTORY-PART1 - 3 HRS
          START AT 1300, END AT 1600
          EMISSIONS GRID:OCDATA86.SALE35


  TIME    POSITION(X,Y)     O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 13.00     27.0,2'34.0        5.00       4.00        1.00       1.00        1*OO
 13.17     29.7,294.9         5*14       4.23        O*75       1.00        1.00
 13.34     32.4,295.6         5.54       4.27        0.70       0.99        1.00
 13.50     35.0,296.2         5.95       4.30        0.65       0.99        1.00
 13.67     37.7.296.6         6.34       4.33        0.61       0.98        1.00
 13.83     40.3,296.9         6.73       4.34        0.57       O*98        1.00
 14.00     43.0,297.0         7.11       4.37        O*53       0.97        1.00
 14.17     45.7,297.2         7.52       4.39        0.50       0.97        1.00
 14.33     48.2,297.7         7.87       4.42        0.47       0.96        1.00
 14.50     50.7,298.6         8.20       4.46        0.44       0.96        1*OO
 14.67     53.2.299.7         8.52       4.49        0.43       0.95        1.01
 14.84     55.7,301.2         8.78       4.55        0.40       0.95        1.01
 15.00     58.0,303.0         9.01       4.62        0.38       0.94        1.01
 15.17     60.5,304.8         9.26       4.66        0.37       0.94        1.01
 15.33     63.3,306.3         9.51       4.68        0.34       0.93        1.01
 15.50     66.S,307.5         9.76       4.68        0.31       0.92        1.00
 15.67     70.0,308.3        10.00       4.68        0.29       0.91        1.00
 15.84     73.9,308.8        10.21       4.67        0.26       0.91        1*00
 16.00     ?8.1,309.0        10.43       4.64        0.26       0.90        1.00


KFLAG =    1
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                                                          PACIFICENVIRONMENTAL SERVICES
                                                         REM2 PHOTOCHEMICAL MODEL  (4/1/77)

          OCS  -  1986 IMPACT WITHOUT ,=SI@Ey48"- 9/24
          SANTA BARBARA 3'TRAJECTORY - PART 2 - 1 HR
          START AT 1600, END AT 1700
          EMISSIONS GRID:SBDATA86


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  16.00    11.0. 18.0        10.40        4.64         0.26         0.90         1.00
  16.09   '13.2,  18.0       10*49        4.65         0.24         0.90         1.00
  16.17    15.2,  18.1       10.61        4.66         0.24         0.90         1.00
  16.25    17.2.  18.3       10.72        4.69         0.21         0.90         1.00
  16.34    19.0,  18.5       10.B5        4.69         O*2O         0.90         1.0.0
  16.42    20.9,  18.8       10.99        4.70         0.20         0.90         1.01
  16.50    22.6.  19.1       11.09.       4.74         0.18         0.91         1.01
  16.59    24.2*  19.4       11.20        4.77         0.18         0.91         1.02
  16.67    25.7,  19.8       11.30,       4.81         0.16         0.91         1.03
  lb. 75   27.2,  20.3       11.42        4.82         0.16         0.92         1.03
  16.83    28.,5, 20.8       11.51        4.86         0.14         0.92         1.04
  16.92    29.8,  21.4       11.5'9       4.91         O*14         0,93         1.05
  17.00    31.0,  22.0       11.49        5.12         0.12         0.94         1*O7


  KFLAG =   1
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                                                        PACIFIC ENVIRONMENTAL SERVICES
                                                      REM2  PHOTOCHEMICAL MODEL  (u/1/77)


       Ocs   -  1986 IMPACT WITH SALE-48 - 9/24
       SANTA BARBARA 3' TRAJECTORY - PART 1 - 3 HRS
       START AT 1300, END AT 1600
       EMISSIONS GRID: OCDATA86.SALE48


  TIRE     POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    co (PPM)

 13.00     27.0,294.0         5.00        4.00        1.00        1.00         1.00
 13.17     29.7,294.9         5.14        4.24        0.75        1.00         1.00
 13.34     32.4,295.6         5.52        4.29        0.70        0.99         1.00
 13".50    35.0.296.2         5.92        4.33        0.66        0.99         1.00
 13.67     37.7.296.6         6.29        4.38        0.62        0.98         1.00
 13.03     40.3,296.9         6.69        4.41        0.59        0.98         1.00
 14.00     43.0,297.0         7.06        4.44        0.54        0.97         1.00
 14.17     45.6,297.2         7.45        4.45        0.52        0.97         1.00
 14.34     48.3,297.7         7.81        4.48        0.48        0.96         1.00
 14.50     50-8.298<6         8.14        4.51        0.45        0.96         1.00
 14.67     53.2,299.7         8.46        4.54        0.43        0.95         1.00
 14.83     55.6,301.2         8.72'       4.61        0.40        0.95         1.00
 15.00     58.0,303.0         8.97        4.68        0.38        0.94         1.00
 15.17     60.5,304.8         9.21        4.74        0.36        0.94         1.00
 15.34     63.3,306.3         9.49        4.74        0.35        0.93         1.00
 15.50     66.5,307.5         9.75        4.75        0.32        0.92         1.00
 15.67     70.0,308.3        10.00        4.75        0.29        0.92         1.00
 15.84     73.9,308.8        10.23        U.75        0.27        0.91         1.00
 16.00     78.1,309.0        10.46        4.73        0.26        0.91         1.00



 KFLAG =    1
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                                                       PACIFIC ENVIRONMENTAL SERVICES
                                                      PEM2 PHOTOCHEMICAL MODEL (4/1/77)


          OCS  -  1986 IMPACT WITH SALE-48 - 9/24
          SANTA BARBARA 3' TRAJECTORY - PART 2 - 1 HR
          START AT 160 C,' END AT 1700
          EMISSIONS GRID: SBDATA86


   TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  16.00    11.0, 18.0        19.50        4.73         0.26        0.91        1.00
  16.08    13.2, 18.0        10.58        4.74         0.24        0.9C        1*JO
  15.17    15.2, 18.1        10.71        4.75         0.24        0.91        1.00
  16.25    17.1, 18.3        10.82        4.78         0.21        0.91        1.00
  16.34    19.1, 18.5        10.96        4.7d         0.21        0.91        1.00
  16.42    20.8, 19.7        11.07        4.82         0.18        0.91        1.01
  16.50    22.5, 19.1        11.20        4.84         0.10        0.91        1.01
  16.59    24*?*  19.4       11.30        4.87         0.17        0.92        1.02
  16.67    25.7, 19.8        11.41        4990         0.17        0.92        1.03
  16.75    27.1, .20.3       11.53        4.91         0.16        0.92        1.03
  16.83    28.5, 20.8 "      11.62        4.96         0.13        0.93        1.04
  16.92    29.8. 21.4        11.70        5.01         0.14        0.93        1.05
  17.00    31.0, 22.0        11.61        5.?2         0.12        0.95        1.07



KFLAG =   1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL  (4/1/77)


                OCS  -  1986 IMPACT WITHOUT SALE-48 - 7/10
                VENTURA 2 TRAJECTORY - PART 1 - 6 HRS
                START AT 0500, ENO AT 1100
                EMISSIONS GRID: OCDATA86.SALE35


  TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  5.00     57.0,253.0        1.00        2000         1.00         1.00         0.50
  5,25     60.3,251.0        0.32        2.75         0.31         1.00         0.50
  5*5O     63.6,249.1        G*53        2.64         0.44         1.00         0.50
  5*75     66.8,247.0        0.75        2.56         0.52         1.00         0.50
  6.00     70.0,245.0        1*OC        2.50         0.57         0.99         0.50
  6.25     73.0,243.0        1.18        2.56         0.51         0.99         0.50
  6.50     7'S.9,241.2       1.53        2.50         0.55         O*9Q         0.50
  6,75     78.5,239.5        1.84        2.50         0.54         O*9R         C*5)
  7.00     81.0,238.0        2.21        2.48         O*54         C.98         0.49
  7.25     83.6,236.5        2.58        2.48         0.54         0.97         0.49
  7.50     86.6,235.1        2.93        2.52         0.48         0.96         0.49
  7.75     90.1,233.5        3.33        2.52         0.47         0.95         0.49
  8.00     94.0,232.0        3.75        2.51         0.46         0.95         0.49
  8.25     98.1,230.6        4.16        2.51         0.45         0.94         0.49
  8.50    101.9,229.7        4.57        2.51         0.44         0.93         0.49
  8.75    105.5,229.1        4.97        2.53         O*4I         0.92         0.49
  9.00    109.0,229.0        5.40        2.52         0.40         0.91         0.49
  9.25    112.3,229.0        5.81        2.52         0.39         0.89         0.49
  9.50    115.6s228.8        6.22        2.51         0.37         0.88         0.49
  9.75    118.8,228.5        6.62        2,50         0.36         0.87         0.49
 10.00    122.0s228.0        6.99        2,51         0.34         0.86         0.49
 10.25    124.9,228.0        7.03        2.51         O*35         0.85         0.49
 10.50    127.4,229.2        1.09        2.51         0.36         0.85         0.49
 10.75    129.4s231.5        7.17        2.50         0.36         0.84         0.49
 11900    131.0,235.0        7.26        2.49         0.36         0.84         0.5j



KFLAG =    1
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                                          PACIFIC ENVIRONMENTAL SERVICES
                                          REM2PHOTOCHEMICAL MODEL  (4/1/77)

    OCS  -  1986IMPACTWITHOUT SALE-48 - 7/10
    VENTURA 2 TRAJECTORY - PART 2 - 3 HRS
    START AT 1100, END AT 1400
    EMISSIONS GRID: V2DATA86.SALF35


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

 11.00     11.0, 19.0         7.26        2.49         0.36        0.84        0.50
 11.17     11.8, 21.6         7.50        2.48         0.34        0.83        0.50
 11.33     12.4, 23.7         7.74        2.47         0.33        0.82        0.50
 11.50     12.8, 25.6         7.97        2.45         0.32        0.82        0.50
 11.67     13.1* 27.1         8.18        2.43         0.31        0.81        0.50
 11.83     13.1, 28.2         8.42        2.44         0.31        0.82        0.50
 12.00     13.0, 79.0         8.67        2.46         0.30        0.82        0.51
 12.17     12.9. 29.7         8.06        2.47         0.30        0.82        0.51
 12.34     13.0, 30.7         8.98        2.53         0*30        0.83        0.52
 12.50     13.4, 31.9         9.03        2.59         0.30        0.83        0.52
 12.67     14.0, 33.4         9.16        2.61         0.30        0.84        0.52
 12.83     14.9* 35.1         8.86        3.07         0.39        0.84        0.52
 13.00     16.0, 37.0         8.65        3.45         0.42        0.85        0.52
 13.17     17.1* 39.0         8.89        3.40         0.40        0.85        0.52
 13.33     17.8, 40.8         9.10        3.35         0.38        0.86        0.51
 13.50     18.1, 42.6         9.32        3.30         0.36        0.86        0.51
 13.67     18.1, 44.2         9.52        3.25         0.35        0.87        0.51
 13.83     17.7, 45.6         9.69        3.20         0.33        0.81        0.51
 14.00     17.0, 47.0         9.87        3.14         0.32        0.88        0.51


KFLAG =   1
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OCS  -  1986 IMPACT WITH SALE-48 - 7/10
VENTURA 2 TRAJECTORY - PART  1  - 6 HRS
START AT 0500, END AT 1100
l? MISSIONS GRID: OCDATA86. SALE48


 TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO (PPM)

 5.00     57.0,253.0         1.00         2.00          1.00         1.00         0.50
 5.25     60.3,251.0         0.32         2.75          0.31         1.00         0.50
 5.50     63.6,249.1         0.52         2.65          0.45         1.00         0.50
 5.75     66.8,247.0         0.73         2.58          0.5U         1.00         0.50
 6.00     70.0,205.0         0* 97        2.54          0.60         1.00         0.50
 6.25     73.0,243.0         1.13         2.62          0.55         1.01         0.50
 6.50     75.9,241.2         1.46         2.59          0.60         1.01         0.50
 6.75     78.5,239.5         1.76         2.61          o.5e         1.02         0.50
 7.00     81.0,238.0         2*1U         2.60          0.59         1.02         0.50
 7.25     83.6,236.5         2.52         2.60          0.58         1.01         0.49
 7.50     86.6,235. 1        2.89         2.64          0.51         1.00         0.49
 7.75     90.1,233.5         3.32         2.65          0.50         0.99         0.49
 8.00     94.0,232.0         3.75         2.64          0.48         0.99         0*U9
 8.25     98.0,230.6         4.19         2.64          0.47         0.98         0.49
 8.50    301.9,229.7         4.63         2. 6U         0.46         0.97         0.49
 e. 75   105.6,229.1         5.05         2.66          0.42         0.95         0.49
 9.00    109.0,229.0         5.50         2.66          0.41         0.94         0.49
 9.25    112.3,229.0         5.94         2.65          0.40         0.93         0.49
 9.50    115.6,228.8         6.37         2.64          0.30         0.92         0.49
 9.75    118.8,228.5         6.79         2.64          0.37         0.90         0.49
10.00    122.0,228.0         7.16         2.65          0.36         0.89         0.49
10.25    124.9,228.0         7.20         2.66          0.37         0.88         0.49
10.50    127.4,229.2         7.26         2.67          0.37         0.80         0.49
10.75    129.4,231.5         7.35         2.66          0.37         0.87         0.50
11.00    131.2,235.0         7. 45        2.64          0.37         0.07         0.50



KFLAG  =  1
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                                                  PACIFICENVIRONMENTAL SERVICES
                                                REM2 PHOTOCHEMICAL MODEL (4/1/77)

      OCS  -  19 86 IMPACT WITH SALE-48 - 7 / 10
      VENTURA 2 TRAJECTORY - PART 2 - 3 HRS
      START AT 1100, END AT 1400
      EMISSIONS GRID: V2DATA86.SALE48


   TIME   POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  11.00    11.0, 19.0        7.45        2.64         0.37        0.87         0.50
  11.17    11.8, 21.5        70'70       2.63         O*35        0.86         0.50
  11034    12.4, 23.7        7.96        2.61         0.34        0.85         O*5O
  11.50    12.8, 25.6        8.19        2.60         0.33        0.85         0.50
  11.67    13.1, 27.1        8.41        2.58         0.32        0.84         0.50
  11.83    13.1, 28.2        8.67        2.58         0.31        0.85         0.50
  12.00    13.0, 29.0        8.93        2.60         0031        0.85         0.51
  12.17    12.9, 29.7        9* 12       2,61         0830        0.85         0.51
  12.33    13.0, 3007        9* 25       2.66         0.31        0.86         0.52
  12.50    13.4, 31.9        9.33        2.73         0.31        O*86         0.52
  12.67    14.0, 33.4        9.48        2.-76        0031        0907         0.52
  12.83    14.9, 35*1        9019        3.21         O*39        0.88         0,52
  13000    16.0, 3700        8.97        3.,61        0.42        0.88         0.52
  13017    17.1, 39.0        9.21        3.57         0041        0.89         0.52
  13.33    17.8, 40.8        9943        3.53         O*39        0.89         0..52
  13.50    18.1, 42*6        9.65        3.49         0037        0.89         O*51
  13.67    18.19 44.2        9.86        3.45         0.36        0.90         0.51
  13083    17.7, 45*7        10.05       3.41         0.34        0.90         0051
  14.00    17.0, 47*0        10.25       3.36         0.33        0.91         0.51


 KFLAG =    1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL (4/1/77)

      OCS  -  1956 IMPACT WITHOUT SALE-487/10
      VENTURA 3 TRAJECTORY PART 1 6 HRS
      START AT 0500, END AT 1100
      EMISSIONS GRID: OCDATA86.SALE35


  TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO (PPM)

  5.00     57.0,253.0         1.00          2.00          1.00         1.00         0.50
  5.25     60.3,251.0         0.32          2.75          0.31         1.00         0.50
  5.50     63.6,249.1         0.53          2.64          0.44         1.00         0.50
  5.75     66.8,207.0         0.75          2.56          0.52         1.00         0.50
  6.00     70.0,245.0         1.00          2.50          0.57         0.99         0.50
  6.25     73.0,243.0         1.18          2.56          0.51         0.99         0.50
  6.50     75.9,241.2         1.53          2.50          0.55         0.99         0.50
  6.75     78.5,239.5         1.84          2.50          0.54         0.98         0.50
  7.00     81.0,238.0         2.21          2.48          0.58         0.98         0.49
  7.25     83.6,236.5         2.58          2.48          O*54         0.97         0.49
  7.50     86.6,235.1         2.93          2.52          0.48         0.96         0.49
  7.75     90.1,233,5         3*33          2.52          0.47         0.95         0.49
  8.00     94.0,232.0         3.75          2.51          0.46         0.95         0*49
  8.25     98.1,230.6         4.16          2.51          0.45         0.94         0.49
  8.50    101.9,229.7         u. 57         2.51          0.44         0.93         0.49
  8.75    105.5,229.1         4.97          2.53          0.41         0.92         0.49
  9.00    109.0,229.0         5.00          2.52          0.40         0.91         0.49
  9.25    112.3,228.9         5.81          2.52          0.39         0.89         0.49
  9.50    115.6,228.6         6.22          2.51          0.37         0.88         0.49
  9.15    118.8,227.9         6.62          2.50          0.36         0.87         0.49
 10.00    122.0,227.0         6.99          2.51          0.34         0.86         0.49
 10.25    125.4,226.2         7.03          2.52          0.35         0.85         0.49
 10.50    129.4,225.9         7.09          2.52          0.36         0.85         0.49
 10.75    133.9,226.2         7.18          2.50          0.36         0.84         0.49
 11.00    139.0,227.0         7.27          2.48          0.35         0.84         0.49



 KFLAG =     1
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                                                    PACIFIC ENVIRONMENTALSERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)

            OCS  -  1986  IMPACT WITHOUT SALE-48 7/10
            VENTURA 3 TRAJECTORY - PART 2 3 HRS
            START AT 1100,END AT 1400
            EMISSIONS GRID: V2DATA86.SALE35

   TIME     POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)     CO(PPM)

  11*00     19.0,  11*O          7.27         2.48          O*35         0.84          0.50
  11.17     22.4, 1107           7.51         2.47          O*34         0.83          0.50
  11.33     25.2, 12.3           7.80         2.48          0.33         0.83          0.50
  11.50     27*6’; 12.8          7.96         2.61          O*37         0.83          0.51
  11.67     29.5, 13.3           3.75”        7.03          2.24         0.84          0053
  11.84     31.0, 1307           2 . 9 5      8.27          3*OI         0.84          0.54
  12.00     32.(% 14.0           3.38         8.30          2.62         0.84          0*54
  12.17     33.0, 14.3           3.93         8.09          2*2O         0.83          0.54
  12.34     34.6, 14.7           4.48         7.84          1.87         0.83          0.54
  12.50     36.7,   15.2         5.02         7.56          1.60         0.83          0.53
  12.67     39.3, 15..7          5.52         7.28’         1.40         0082          0.53
  12.84     42.4, 16.3           5*96         7.00          1024         0082          0.53
 .13.00     46.0, 17.0           6.42         6.71          1.10         0.82          0053
  13.17     49.7, 17.8           6.80         6.47          1.00         0.82          0.52
  13.34     52.8, 18.8           ‘7* 14       6.25          0.92         0.81          0*53
  13.50     55.4, 1909           7 . 4 8      6.02          0.83         0m81          0.52
  13.67     57.4, 21*1           7.78         5.82          0.77         0.81          0.52
  13.84     59.0, 22.s           8.05         5.63          0.71         0081          0.52
  14.00     60.0′; 24.1          8.30         5*45          0066         0.81          0.52


KFLAG =    1
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                                                        PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)


           OCS  -  1986 IMPACT WITH SALE-48 - 7/10
           VENTURA 3 TRAJECTORY  -  PART 1-6 HRS
           START AT 0500, END AT 1100
           EMISSIONS GRID: OCDATA86.SALE48


  TIME    POSITION(X,Y)      O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  5.00     57.0,253.0          1.00         2.00        1.00         1.00         0.50
  5.25     60.3.251.0          0.32         2.75        0.31         1.00         0.50
  5.50     63.6,249.1          0.52         2.65        0.45         1.00         0.50
  5.75     66.8,247. 0         0.73         2.58        0.54         1.00         0.50
  6.00     70.0,245.0          0.97         2. 54       0.60         1.00         0.50
  6.25     73.0,243.0          1.13         2.62        0.55         1.01         0.50
  6.50     75.9,241.2          1.46         2.59        0.60         1.01         0.50
  6.15     78.5,239.5          1.76         2.61        0.58         1.02         0.50
  7.00     81.0,238.0          2. 14        2.60        0.59         1.02         0.50
  7.25     83.6,236.5          2.52         2.60        0.58         1.01         0.49
  7.50     86.6,235.1          2.89         2.64        0.51         1.00         0.49
  7.75     90.1,233.5          3.32         2.65        0.50         0.99         0.49
  8.00     94.0,232.0          3.75         2.64        0.48         0.99         0.49
  $.25     98.0,230.6          4.19         2.64        0.47         0.98         0.49
  8.50    101.9.229.7          4.63         2.64        0.46         0.97         O*Q9
  8.75    10S.6,229.1          5.05         2.66        0.42         0.95         0.49
  9.00    109.0,229.0          5.50         2.66        0.41         0.94         0.49
  9.25    112.3,228.9          5.94         2.65        0.40         0.93         0.49
  9.50    115.6,228.6          6.37         2.64        0.38         0.92         0.49
  9.75    118.8,227.9          6.79         2.64        0.37         0.90         0.49
 10.00    122.0.227.0          7.16         2.66        0.36         0.89         0.49
 10.25    125.4,226.2          7.19         2.67        0.37         0.68         0.49
 10.50    129.4,225.9          7.25         2.69        0.37         0.88         0.49
 10.75    133.9,226.2          7.35         2.66        0.37         0.87         0.50
 11.00    139.0.227.0          7. 46        2.63        0.36         0.07         0.50


KFLAG  =  1
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL (4/1/77)

OCS - 1986 IMPACT WITH SALE-48 - 7/10
vENTuRA 3 TRAJECTORY - PART 2 - 3 HRS
START AT 1100, END AT 1400
EMISSIONS GRID: V2DATA86.SALE48


 TIME :  POSITION(X,Y)   O3(PPHM)    NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

11.00' ,"., 19.0,  11"*0   7.46        2.63        0.37        0.87        '0.50
11.17      22.4,  11.7     7.71        2.62        0.35        0.86        0.50
11.33     25.2,  12.3"     8.01        2.62        0.34        0.86        O*5O
11.50     27.6, 12.8       8.-18       2.76        0.38        0.86        0.51
11.67     29.5, 13.3       3.95        7.20        2.18        0.87        0.53
11.83     31.0, 1307       3.10        8.49        2.94        0.87        0.54
12.00     32.0, 14.0       3.55        8.49        2.56        0.87        0.54
12.17     33.09 14.3       4.11        8.27        2.15        0.86        0.54
12.33     34.6,   14.7     4.67        8.01        1.82       0 . 8 6      0.54
12.50     36.6,   1 5 . 2  5,22        7.71        1.57        0.85        0.53
12.67     39.2, 15.7       5.72        7.43        1.37        0.85        O*53
12.83     42.4,   1603  .  6.19        7.13        1.22        0.85        0.53
13.00     46.0, 17.0       6*64        6.04        1.08        0.85        0.53
13*17     49.6, 17.8       7.02        6.59        0.99        0.84        0.53
13*33     52.8, 18.8       7. 36       6.38        0.90        0.84        0.53
13.50     55.3, 19.9       7.71        6.13        0.'83       0.84        0.52
13.67     57.4, 21.1       8.00        5.93        0.76        0.84        0.52
13.84     59.0, 22.5       8.28        5.73        09.71 "     0.84        0.52
14.00     60.0, 24.0       8.53        5855        0.65        0.84       .0.52


KFLAG =    1
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                                                      PACIFIC ENVIRONMENTAL SERVICES
                                                      REM2 PHOTOCHEMICAL MODEL  (4/1/77)

          OCS  -  1986 IMPACT WITHOUT SALE-48  -  7/25
          LOS ANGELES 1 TRAJECTORY - PART 1 - 2 HRS
          START AT 0300, END AT 0500
          EMISSIONS GRID: OCDATA86.SALE35


        TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

        3.00    244.0s206.0         L*OO         4.00        3.00        2.00         2.00
        3.17    244.2,207.5         O*OO         5.05        1.96        2.00         2.00
        3.34    244.5,209.0         0.00         5.09        1*94        2.01         2.01
        3.50    244.6,210.5         0.00         5.11        1.93        2.01         2.01
        3.67    244.8,212.0         0.00         5.12        1.9?        2.01         2*01
        3.84    244.9.213.5         0.00         5.13        1.92        2.01         2.01
        4.00    245.0,215.0         0.00         5.12        1.93        2.01         ?.01
        4.17    244.9,216.5         0.00         5.12        1.94        2.00         2.01
        4.34    244.4,217.8         0.01         5*1I        1.95        2.00         2.00
        4.50    241.6,219.1         0.01         5.11        1.95        2.00         2.00
        4.67    242.4.220.2         0.00         5.12        1.94        2.00         2.00
        4.84    240.8,221.1         0.00         5.11        1.94        2.00         2.00
        5.00    738.9,222.0         0.03         5.08        1.98        2.00         2.00


      KFLAG =    1
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                                                     PACIFICENVIRONMENTAL SERVICES
                                                   REM2 PHOTOCHEMICAL MODEL (4/1/77)

        OCS  -  1986 IMPACT WITHOUT SALE-48  -  7/25
        LOS ANGELES 1 TRAJECTORY - PART 2 - 11 HRS
        START AT 0500,ENDAT 1600
        EMISSIONS GRID:LADATA86.SALE35


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  5000    26.1,  6.2          0.03        5.08         1.98        1099         2.00
  5.25    24.6,  7.1          O*O4        5.08         1.98        1.99         2.00
  5.50    24.0,  8.2          0.17        5,02         2.04        1.99         2.00
  5.75    24.3,  9.6          0.32        5*O5         2.03        2*9O         2.00
  6.00    25.5, 11.2          0.50        5.18         1.99        2.02         2.00
  6.25    26.7, 12.8          0.58        5,56         1.90        2.04         2.00
  6.50    26.9, 14.3          0.89        5,85         1*95        2.07         2.02
  6.75    26.3, 15.6          1*O5        6.44         2.25        2.11         2.04
  7.00    24.9, 16.8          o* 68       7.75         5*41        2.22         2.07
  ?.25    23.4, 17.9          0.59        9037         8.60        2.33         2.10
  7.50    22.9, 19,1          0.84       11.38         8.07        2 . 3 6      2.14
  7.75    23.4, 20.4          1.25       13.50         7013        2.38         2.19
  8.00    24.9, 21.8          1.88       15.66         5.86        2.40         2.21
  8.25    26.4s. 23.0         2.84       16.84         4.46        2.37         2.24
  8.50    27.0, 24.0          3.87       17.76         3.45        2.34         2.28
  8.75    26.7, 24.6          5.24       18.15         2..77       2*30         2.30
  9.00    25.5, 24.9          6.74       18.23         2.28        2.27         2.32
  9.25    24.4, 25.2          8.27       18.09         1.91        2.23         2.33
  9*5O    24.5, 25.9          9.79       17.82         1.65        2.20         2.34
  9*75    25.7, 27.1         11.19       17.52         1*49        2.16         2.35
 10*OO    28.0, 28.6         12.36       17.32         1.36        2.13         2.37
 10.25    30.3, 30.1         13.18       16.95         1027        2.11         2.38
 10050    31.5, 31.2         14,02       16.50         1.18        2.09         2.38
 10.75    31.5, 32.0         14.90       15.99         1.10        2.07         2.38
 11.00    30.4, 32.3         15.65       15.51         1.02        2.04         2.38
 11.25    29.4, 32.6         16.21       15017         O*97        2.02         2.39
 11.50    29.5, 33.1         16.70       14.87         0.92        2.00         2.40
 11.75    30.7, 33.8         17.18       14*55         0.89        1.98         2.41
 12.00    33.0, 34.8         17058       14.25         0.86        1.97         2*A2
 12.25    35.3, 3S.8         17.46       13,86         0.84        1.96         2.42
 12.50    36.7, 36.7         17050       13.40         0.81        1.95         2.42
 12.75    37.2, 37.4         17.68       12.86         0.76        1093         2.41
 13*OO    36.7, 37.9         17.83       12.37         0.71        1.92         2.40
 13.25    36.3, 38.4         17.95       11.94         0.68        1.91         2.40
 13.50    37.2, 39.0         18.06       11.54         0.64        1.89         2.39
 13.75    39.4, 39.6         18.17       11.16         0061        1.88         2.38
 14.00    42.9, 40.4         18.27       10.81         0.57        1.87         2.37
 14.25    46.3, 41.0         19.11       10.64         0.53        1.86         2.38
 14.50    48.2, 41.3         19.91       10.42         0.49        1.85         2.38
 14.75    48.7, 41.3         20.63       10.18         0.44        1.84         2.39
 15.00    47.8, 41.0         21.26        9*94         0.40        1.83         2.39
 15.25    47.0, 40.6         21.84        9..70        0.38        1.82         2.40
 15.50    47.6, 40.2         22.31        9.50         0.34        1.82         2.41
 15.75    49.8, 40.0         22.75        9,31         0.31        1.83         2.41
 16.00    53.4, 39.8         23.21        9,13         0.28        1.84         2.42
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                                              PACIFIC ENVIRONMENTAL SERVICES
                                              REM2 PHOTOCHEMICAL MODEL (4/1/77)

          Ocs  -  1986 IMPACT WITH SALE-49  - 7/25
          LOS ANGELES 1 TRAJECTORY - PART 1 - 2 HRS
          START AT 0300, ENO AT 0500
          EMISSIONS GRID: OCDATA86.SALE48


 TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

 3.00    244.0,206.0        1.00        4.00         3.00         2.00         2.00
 3.17    244.29207.5        0.00        5.04         1.97         2.00         2.00
 3.34    244.5s209.0        0.00        5907         1,95         2.00         2.00
 3.50    244.6s210.5        0000        5.09         1995         2.00         2.00
 3.67    244.8,212.0        0*00        5.10         1.95         2.00         2.00
 3.84    244.9,213.5        0.00        5910         1096         2.00         2,00
 4.00    245.0,215.0        0.00        5011         1.96         2.00         2.00
 6.1?    244.9,216.5        0.00        5.11         1.97         2*9O         2.00
 4.34    244.4,217.8        0.01        5.10         1,99         2000         2.00
 4.50    243.6,219.1        0.01        5.10         2.00         2.00         2.00
 4.67    242.4,220.2        0.00        5.12         1.99         2.00         2.40
 4*84    240.89221.1        0.00        5.12         1,99         2.00         2.00
 5800    238.9,222.0        0.03        5.09         2.03         2.00         2.00



KFLAG  =  1
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                                                          PACIFIC ENVIRONMENTAL SERVICES
                                                      REM2 PHOTOCHEMICAL MODEL '' (4/1/77)

     OCS  -  1 9 8 6 IMPACT WITH SALE-48   7/25
     LOS ANGELES 1 TRAJECTORY - PART 2 - 11 HRS
     START AT 0500, END AT 1 6 0 0
     EMISSIONS GRID: LADATA86.SALE48

  TIME   POSITION(X,Y)     03(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

  5.00    26.1,  6.2        0.03        5.09        2.03        2.00        2.00
  5.25   "24.6,  7.1        0.04        5.09        2.03        2.00        2.00
  5.50    24.0,  8.2        O*17        5*O3        2.08        2.00        2.00
  5.75   '24.3,  9.6        0.31        5.07        2.08        2.01        2.00
  6.00    25.5, 11.2        0.49        5.20        2.04        2.02        2.00
  6.25    26.7, 12.8        0.57        5*57        1.95        2.04        2.00
  6.50    26.9, 14.3        0.87        5.88        2.01        2.08        2.02
  6.75    26.3. 15.6        1.02        6.48        2.34        2.12        2.04
  7.00    24.8, 16.8        0.65        7.81        5.66        2.24        2.07
  7.25    23.4, 17.9        0.58        9.45        8.79        2.35        2.10
  7.50    22.9, 19.1        0.82       11.50        8.21        2.38        2.14
  7.75    23.4, 20.4        1.19       13.74        7.15        2.40        2.19
  8.00    24.9, 21.8        1.83       15.92        5.87        2.42        2.21
  8.25    26.4, 23.0        2.80       17.15        4.41        2.35        2.24
  8*5O    27.0, 24.0        3.95       17.95        3.50        2.36        2.28
  8*75    26.7, 24.6        5.32       18.35        2.81        2.32        2.30
  9.00    25.5, 24.9        6.80       18.42        2.32        2.28        2.32
  9.25    24.4, 25.2        8.35       18.28        1.94        2.25        2.33
  9.50    24.5, 25.9        9.87       18.01        1.66        2.21        2.34
  9.75    25.7, 27.1       11.25       17.73        1.48        2.18        2.35
 10.00   '28.0, 28.6       12.43       17.51        1.37        2.15        2.36
 10.25    30.3, 30.1       13.24       17.13        1.28        2.13        ?.37
 10.50    31.5, 31.2       14.10       16.67        1.18        2*11        2.3$3
 10.75    31.5, 32.0       14.97       16.15        1.10        2.08        2.38
 11.00    30.4, 32.3       15.73       15.66        1.03        2.06        2.38
 11.25    29.4, 32.6       16.30       15.32        0.97        2.04        2.39
 11.50    29.5, 33.1       16.79       15.00        0.93        2.02        2.40
 11.75    30.7, 33.8       17.26       14.67        0.90        2.00        2.41
 12.00    33.0. 34.8       17.65       14.38        0.86        1.98        2.4.?
 12.25    35.3, 35.8       17.54       13.98        0.85        1.97        2.42
 12.50    36.7, 36.7       17.57       13.52        0.80        1.96        2.42
 12.75    37.2, 37.4       17.76       12.96        0.76        1.94        2.41
 13.00    36.7, 37.9       17.92       12.47        0.72        1.93        2.40
 13.25    36.3, 38.4       18.04       12.04        0.69        1.92        2.39
 13.50    37.2, 39.0       18.16       11.62        0.66        1.91        2.39
 13.75    39.4. 39.6       18.25       11.26        0.61        1.90        2.38
 14.00    42.9, 40.4       18.35       10.89        0.58        1.89        2.37
 14.25    46.3, 41.0       19.20       10.72        0.54        1.87        2.38
 14.50    48.2, 41.3       19.99       10.50        0.49        1.66        2.38
 14.75    48.7* 41.3       20.73       10.25        0.45        1.85        Z.39
 15.00    47.8. 41.0       21.36       10.02        0.41        1.84        2.39
 15.25    47.0, 40.6       21.91        9.79        0.37        1.84        2.40
 15.50    47.6, 40.2       22.40        9.58        0.34        1.84        ?.40
 15.75    49.8, 40.0       22 .86       9.38        0.31        1.84        2.41
 16.00    53.4, 39.8       23.29        9.21        0.28        1.65        2.41
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                                        PACIFIC ENVIRONMENTAL. SERVICES
                                     REM2   PHOTOCHEMICAL MODEL (4/1/77)

      OCS -   1986 IMPACT WITHOUT SALE-48 -   7/25
      LOS ANGELES 2 TRAJECTORY - PART 1 - 2 HRS
      START AT 0300,END AT 0500
      EMISSIONS GRID:OCDATA86.SALE35

   TIME   POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

   3.00   244.0,206.0       1000       4*OO        3.90       2.00         2.00
   3017   244.2,207.5       0.00       5,05        1.96       2*9O         2.00
   3034   244.5,209.0       0.00       5*O9        1.94       2.01         2.01
   30s0   244.6s210.5       0*80       5.11        1.93       Zeal         2.01'
   3*67   244.8,212.0       0.00       5.12        1.92       2091         2.01
   3.84   244.9,213.5       0*DO       5013        1.92       2*O1         2.01
   4.00   245.0,215.0       0000       5.12        1..93      2.01         2.01
   4.17   245.2,216.5       0.00       5.12        1*94       2.00         2.01
   4.34   245.5,217.7       0001       5011        1.95       2*OO         2.00
   4.s0   246.1s218..8      0.01       5.11        1095       2.00         2.00
   4067   246.9,219.7       0*00       5.12        1.95       2*SO         2.00
   4.84   247.9s226.4       0.00       5.11        1*95       2.00         2.00
   5.00   249.0,221.0       0.03       5.08        1.98       2.00         2.00


 KFLAG = 1
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PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL (4/1/77)

OCS - 1986 IMPACT WITHOUT SALE-48 - 7/25
LOS ANGELES 2 TRAJECTORY - PART 2 - 11HRS
START AT 0500, END AT 1600
EMISSIONS GRID: LADATA86.SALE35

TIME	POSITION(X,Y)	O3(PPHM)	NO2(PPHM)	NO(PPHM)	NMHC(PPMC)	CO(PPM)
5.00	32.3, 5.6	0.03	5.08	1.98	1.99	2.00
5.25	33.3, 6.1	0.04	5.08	1.98	1.99	2.00
5.50	34.1, 6.8	0.17	5.02	2.04	1.99	2.00
5.75	34.6, 7.7	0.32	5.07	2.03	2.01	2.01
6.00	34.8, 8.7	0.51	5.20	1.96	2.02	2.03
6.25	35.2, 9.8	0.64	5.52	1.71	2.04	2.04
6.50	36.1, 10.6	1.02	5.71	1.64	2.05	2.05
6.75	37.6, 11.3	1.43	5.99	1.50	2.06	2.06
7.00	39.8, 11.8	1.69	6.34	1.52	2.08	2.08
7.25	41.8, 12.4	2.46	6.69	1.45	2.08	2.10
7.50	42.8, 13.1	3.03	7.17	1.27	2.08	2.13
7.75	43.0, 13.9	3.73	7.61	1.24	2.03	2.16
8.00	42.2, 14.9	4.41	8.15	1.26	2.08	2.20
8.25	41.5, 16.0	4.96	8.54	1.26	2.01	2.22
8.50	41.7, 16.8	5.70	8.76	1.20	2.05	2.24
8.75	42.8, 17.5	6.41	9.01	1.16	2.04	2.26
9.00	44.8, 16.0	7.12	9.27	1.08	2.02	2.27
9.25	46.8, 18.5	7.97	9.40	1.03	2.00	2.28
9.50	48.1, 19.1	8.85	9.45	0.96	1.98	2.28
9.75	48.7, 19.8	9.82	9.36	0.90	1.96	2.28
10.00	48.5, 20.5	10.67	9.34	0.85	1.93	2.28
10.25	48.2, 21.2	11.23	9.26	0.81	1.92	2.28
10.50	48.5, 21.8	11.79	9.17	0.77	1.90	2.27
10.75	49.5, 22.2	12.36	9.03	0.74	1.88	2.27
11.00	51.0, 22.4	12.95	8.84	0.70	1.86	2.26
11.25	52.6, 22.6	13.50	8.62	0.66	1.84	2.26
11.50	54.0, 23.0	14.01	8.40	0.62	1.82	2.25
11.75	55.1, 23.5	14.45	8.20	0.59	1.81	2.25
12.00	55.9, 24.3	14.84	8.01	0.57	1.80	2.24
12.25	56.8, 25.0	14.84	7.80	0.55	1.79	2.23
12.50	57.9, 25.5	14.86	7.60	0.54	1.78	2.23
12.75	59.3, 25.5	14.91	7.41	0.52	1.78	2.22
13.00	60.9, 26.1	14.97	7.24	0.50	1.77	2.21
13.25	62.6, 26.4	15.01	7.10	0.48	1.77	2.21
13.50	64.0, 26.7	15.04	6.98	0.47	1.76	2.20
13.75	65.1, 27.3	15.08	6.86	0.45	1.76	2.20
14.00	65.9, 28.0	15.13	6.75	0.43	1.75	2.20
14.25	66.7, 28.6	15.82	6.66	0.40	1.74	2.20
14.50	67.7, 29.0	16.44	6.56	0.37	1.73	2.20
14.75	68.9, 29.0	16.97	6.47	0.34	1.73	2.21
15.00	70.2, 28.6	17.45	6.40	0.32	1.72	2.22
15.25	71.7, 28.3	17.88	6.33	0.30	1.72	2.22
15.50	73.1, 28.3	18.19	6.32	0.28	1.72	2.23
15.75	74.5, 28.6	18.45	6.32	0.26	1.72	2.24
16.00	75.8, 29.2	18.68	6.32	0.24	1.72	2.25

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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)

      OCS  -  1986 IMPACT WITH SALE-48 -  7/25
      LOS ANGELES 2 TRAJECTORY - PART 1-2 HRS
      START AT 0300, END AT 0500
      EMISSIONS GRID:OCDATA86.SALE48


    TIME   POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

    3*00   244.0,206.0        1.00       4.00        3*00       2.00        2.00
    3*17   244.2,207.5        0.00       5.04        1.97       2.00        2.00
    3.34   244.5s209.0        0.00       5.07        1.95       2890        2.00
    3.50   Z44.6VZ1O.5        0,00       5.09        1.95       2.00        2.00
    3.67   244.8,212.0        0.00       5.10        1*95       2.00        2.00
    3,84   244.9s213.5        0.00       5.10        1.96       2.00        2.00
    4000   245.0s215.0        0.00       5.11        1.96       2.00        2.00
    4*17   245.2,216.5        0.00       5.11        1.97       2.00        2.0o
    4,34   245.5,217.7        0001       5.10        1*99       2.00        2.00
    4.50   246.1s218.8        0.01       5.10        1.99       2.00        2.00
    4.67   246.9,219.7        0.00       5.12        1.99       2.00        2.00
    4.84   247*9*220.4        0.00       5.12        1.99       2*4O        2.00
    5.00   249.0,221.0        0,03       5.09        2.03       2.00        2.00


   KFLAG  =  1
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                                                PACIFICENVIRONMENTAL SERVICES
                                               REM2 PHOTOCHEMICAL MODEL (4/1/77)

     Ocs - 1986 IMPACT WITH SALE-48  7?25
     LOS  ANGELES 2 TRAJECTORY -PART 2 - 11HRS
     START AT 0500,END AT 1600
     EMISSIONS GRID:LADATA86.SALE48


 TIME   POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 5.00    32.3,  5.6       0.03        5.09        2.03        2.00        2.00
 5.25    33.3,  6.1       0.04        5.09        2.03        2.00        2,00
 5*5O    34.1,  6.8       0.17        5.03        2.08        2.00        2.00
 5.75    34.6,  7.7       0.31        5.08        2*O8        2.01        2.01
 6000    34.8,  8.7       O*5O        5.21        2.01        2*O3        2.03
 6.25    35.2,  9.8       0.62        5*54        1*75        2.04        2.04
 6050    36.1, 10.6       1.00        5*74        1.68        2.06        2.45
 6.?5    37.6* 11.3       1.40        6.02        1*54        2.07        2.06
 7.00    39.8, 11.8       1.86        6.37        1.55        2,08        2.08
 7.25    41.8, 12.4       2.44        6.?3        1.48        2.09        2.10
 7.50    42.8, 13.1       3.00        7.22        1.29        2.09        2.13
 7.75    43.0, 1389       3*71        7.65        1.25        2.09        2.16
 8.00    42.2, 14.9       4.39        8.20        1.27        2.09        2.20
 8.25    41.5, 1600 ,     4. 9s       8.59        1.27        2.07        2.22
 8.50    41.79 16.8       5.69        8.81        1021        2.06        2.24
 8.75    42.8, 17.5       6.41        9.06        1.17        2.04        2.26
 9*OO    44.8, 18.0       7*12        9033        1*O9        2.03        2.27
 9.25    46.8, 18.5       7.97        9*45        1.03        2.01        2.28
 9*5O    48.1, 19.1       8.85        9.50        0.97        1099        2.28
 9.75    48.7, 19.8       9.81        9.43        0.90        1.96        2.28
10.00    48.5, 20.5      10.6T        9.39        0,85        1*94        2.28
10.25    48.2, 21.2      11.24        9.32        0.81        1.92        2.28
10.50    48.5, 21.8      11.80        9.22        0.78        1.91        2.27
10.75    49.5, 22.2      12.38        9.08        0.75        1.89        2.27
11.00    51.0, 22.4      12.96        8.89        O*7O        1.87        2.26
11.25    52.6, 22.6      13051        8.67        0066        1.85        2.26
11.50    54.0, 23.0      14002        8.45        0.63        1.83        2.25
11075    55.1, 23.6      14.47        8.25        O*6O        1.81        2.25
12.00    55.9, 24.3      14.86        8.06        O*57        1.80        2.24
12.25    56.8, 25.0      14.86        7.84        O*55        1.80        2.23
12.50    57.9, 25.5      14.88        7.65        0.54        1.79        2.23
12.75    59.3, 2S.9      14093        7.46        0.52        1.78        2,22
13000    60.9, 26.1      14.99        7.28        0.50        1.78        2.21
13.25    62.6, 26.4      15003        7.14        0.48        1.77        2821
13.50    64.0, 26.7      15.06        7.02        0.47        1.77        2.20
13*75    65.1, 27.3      15.10        6.91        O*45        1.76        2.20
14.00    65.9, 28.0      15.16        6.79        0.44        1.76        2.20
14.25    66.7, 28.6      15,85        6.70        0.41        1.75        2.20
14.50    67.7, 29.0      16.47        6.60        0937        1074        2020
14.75    68.9, 29.0      17.01        6.51        0.34        1.73        2*21
15.00    70.2, 28.6      17.49        6.43        0.32        1.13        2.22
15.25    71.7, 28.3      17.91        6.37        0.30        1.73        2.22
15.50    73.1, 28.3      18.22        6.36        0.28        1.73        2.23
15.75    74.5s 28.6      18.49        6.36        0.26        1.73        2.24
16.00    75.8, 29.2      18.71        6.36        0,24        1.73        2*25
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Ocs   -  1986 IMPACT WITHOUT SALE-48 - 9/3
SAN DIEGO 1 TRAJECTORY - PART 1 - 11 HRS
START AT 1900, END AT 0600
EMISSIONS GRID:  OcDATA86.SALE35


 TIME    POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     no(PPHM)    NMHC(PPMC)    co(PPM)

 19.00   222.0,219.0          1.00         5.00          2.00         1.50         1.00
 19.25   225.1,217.9          0.00         6.04          0.95         1.50         1.00
 19.50   226.1,216.9          0.00         6.07          0.93         1.50         1..00
 19.75   231.1,215.9          0.00         6.07          0.92         1.50         1.00
 20.00   234.0,215.0          0.00         6.08          0.92         1.50         1.00
 20.25   236.9.213.6          0.00         6.08          0.92         1.50         1.00
 20.50   239.5,211.3          0.00         6.08          0.92         1.50         1.00
 20.75   241.9,208.1          0.00         6.08          0.92         1.50         1.00
 21.00   244.0,204.0          0.00         6.08          0.92         1.50         1.00
 21.25   245.8,200.4          0.00         6.08          0.92         1.50         1.00
 21.50   247.3,198.9          0.00         6.08          0.92         1.50         1.00
 21.75   248.3,199.4          0.00         6.08          0.92         1.50         1.00
 22.00   249.0,202.0          0.00         6.08          0.92         1.50         1.00
 22.25   249.9,204.2          0.00         b.08          0.93         1.50         1.00
 22.50   251.7,203.6          0.00         6.08          0.93         1.50         1.00
 22.75   254.4,200.2          0.00         6.08          0.93         1.50         1.00
 23.00   258.0,193.9          0.00         6.08          0.93         1.50         1.00
 23.25   261.2,187.7          0.00         6.08          0.93         1.50         1.00
 23.50   262.8, 184.1         0.00         6.08          0.93         1.50         9.00
 23.75   262.7,183.2          0.00         6.08          0.93         1.50         1.00
 24.00   261.0, 185.0         0.00         6.08          0.93         1.50         1.00
 24.25   259.1,186.7          0.00         6.08          0.93         1.50         1.00
 24.50   258.7,185.6          0.00         6.08          0.93         1.50         1.00
 24.75   259.7,181.7          0.00         6.08          0.93         1.s0         1.00
 25.00   262.0,175.0          0.00         6.08          0.93         1.50         1.00
 25.25   264.6,168.6          0.00         6.08          0.93         1.50         1.00
 25.50   266.3, 165.6         0.00         6.08          0.93         1.50         1.00
 25.75   267.1,166.1          0.00         6.08          0.93         1.50         1.00
 26.00   267.0, 170.1         0.00         6.08          0.93         1.50         1.00
 26.25   267.2,174.2          0.00         6.08          0.93         1.50         1.00
 26.50   269.0, 175.4         0.00         6.08          0.93         1.50         1.00
 26.75   272.3,173.6          0.00         6.08          0.93         1.50         1.00
 27.00   277.1, 169.0         0.00         6.08          0.93         1.50         1.00
 27.25   281.8,16%2           0.00         6.08          0.93         1.50         1.00
 27.50   264.8,162.1          0.00         6.08          0.93         1.50         1.00
 27.75   286.2, 162.7         0.00         6.08          0.93         1.50         1.00
 28.00   286.0, 166.0         0.00         6.08          0.93         1.50         1.00
 28.25   285.6,169.2          0.00         6.08          0.93         1.50         1.00
 28.50   286.5, 169.6         0.00         6.08          0.93         1.50         1.00
 28.75   288.6,167.2          0.00         6.08          0.93         1.50         1.00
 29.00   292.0, 161.9         0.00         6.08          0.93         1.50         I*OO
 29.25   295.4,156.6          0.02         6.06          0.95         1.50         1.00
 29.50   297.6,153.9          0.15         5.95          1.06         1.50         1.00
 29.75   298.1$,153.7         0.28         5.87          1.14         1.50         1.00
 30.00   296.0,156.0          0.33         5.93          1.07         1.50         1.00
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                                                            PACIFIC ENVIRONMENTAL SERVICES
                                                            REM2 PHOTOCHEMICAL MODEL  (4/1/77)

     OCS  -  1986  IMPACT wITHOUT SALE-48-9/3
     SANDIEGO1 TRAJECTORY - PART 2 - 8 HRS
     START AT 0600. END AT 1400
     EMISSIONS GRID: SDDATA86


  TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  6.00      8.0, 66.0        O*33        5.93         1.07        1.50          1.00
  6.25      7.5, 68.5        0.52        5.85         1.14        1.50          1.00
  6.50      8.0, 68.6        0.84        5* 77        1.21        1.49          1.00
  6.75      9.5, 66.4        1.23        5.71         1.26        1.49          1.00
  7.00     12.0, 62.0        1.65        5.70         1.25        1.49          1.00
  7.25     14.9, 57.6        1.99        5.86         1.07        1.48          1.00
  7.50     17.3, 55.7        2.48        5.91         1.00        1.48          1.00
  7.75     19.4, 56.1        3.0?        5.91         0.98        1.47          1.00
  8.00     21.0, 59.1        3.65        5.93         0.93        1.46          1.00
  8.25     22.5, 62.1        4.3a        5.94         0.87        1.45          1.00
  8.50     24.2, 63.1        5.09        6.01         0.76        1.43          1.00
  8.75     26.0, 62.1        5.89        6.01         0.71        1.42          1.00
  9.00     28.0, 59.0        6.70        5.99         0.68        1.40          1.00
  9.25     30.2, 55.8        7.40        5.97         0.65        1.39          1900
  9*5O     32.8, 54.6        8.08        5.94         0.62        1.37          1.00
  9.75     35.'7, 55.4       8.73        5.90         0.59        1.36          I*OO
 10*OO     39.0, 58.0        9.29        5.91         0.57        1.35          1.00
 10.25     42.4, 60.6        9.60        5.85         0.56        1.34          1.00
 10.50     45.5, 61.1        9.92        5.80         O*55        1.33          1*OO
 10.75     48.4, 59.5       10.23        5.75         0.54        1.32          1.00
 11.00     51.0, 55.9       10.50        5.71         O*54        1.31          1.00
 11.25     53.6, 52.3       10.62        5.67         0.53        1.30          1.00
 11.50     56.4, 50.6       10.77        5.61         0.52        1.29          1.00
 11.75     59.1, 50.9       10.93        5.55"        0.51        1.29          1.00
 12.00     62.1, 53.0       11.08        5.50         0.50        1.28          0.99
 12.25     64.9, 55.1       11.57        5.42         O*47        1.27          0.99
 12.50     67.5, 55.1       12.03        5.34         0.45        1.26          0.99
 12.75     69.9, 53.0       12.45        5.25         0.42        1.25          0.99
 13.00     72.0, 49.0       12.82        5.16         0.40        1.25          0.99
 13.25     74.2, 44.8       13.14        5.06         0.38        1.24          0.99
 13.50     76.3, 42.6       13".43       4.97         0.36        1.24          0.99
 13.75     78.6, 42.4       13<69        4.87         0.33        1.23          0.98
 14.00     81.0, 44.0       13.92        4.78         0.32        1.23          0.98


KFLAG  =  1
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PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL (4/1/77)

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OCS  -  1986 IMPACT WITH SALE-48 - 9/3
SANDIEGO 1 TRAJECTORY - PART 1- 11 HRS
START AT 1900, END AT  0 6 0 0
EMISSIONS GRID: OCDATA86.SALE48

 TIME    POSITION[X,YI      O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 19.00   222.0,219.0          1.00        5.00        2.00        1.50        1.00
 19.25   225.1,217.9          0.00        6.04        0.95        1.50        1.00
 19.50   228.1,216.9          0.00        6.07        0.93        1.50        1.00
 19.75   231.1,215.9          0.00        6.07        0.93        1.50        1.00
 20.00   234.0,215.0          0.00        6.08        0.93        1.50        1.00
 20.25   236.9,213.6          0.00        6.08        0.94        1.50        1.00
 20.50   239.5,211.3          0.00        6.08        0.95        1.50        1.00
 20.75   241.9,208.1          0.00        6.08        0.96        1.50        1.00
 21.00   244.0,204.0          0.00        6.08        0.97        1.50        1.00
 21.25   245.8,200.4          0.00        6.08        0.98        1.50        1.00
 21.50   247.3, 1'58.9        0.00        6.08        0.99        1.50        1.00
 21.75   248.3,199.4          0.00        6.08        0.99        1.50        1.00
 22.00   249.0,202.0          0.00        6.08        0.99        1.50        1.00
 72.25   249.9.204.2          0.00        6.08        1.00        1.50        1.00
 22.50   251.7,203.6          0.00        6.08        1.01        1.50        1.00
 22.75   254.4,200.2          0.00        6.08        I*O1        1.50        1.00
 23.00   258.0,194.0          0.00        6.08        1.01        1.50        1*OO
 23.25   261.2,187.7          0.00        6.08        1.01        1.50        1.00
 23.50   262.8,184.1          0.00        6.08        1.01        1.50        1.00
 23.75   262.7, 183.2         O*OO        6.08        1.01        1.50        1.00
 24.00   261.0.185.0          0.00        6.08        1.01        1.50        1.00
 24.25   259.1,186.7          0.00        6.08        1.01        1.50        1.00
 24.50   258.7.185.6          O*OO        6.08        1.01        1.50        1.00
 24.75   259.7.181.7          0.00        6.08        1.01        1.50        1.00
 25.00   262.0,175.0          0.00        6.08        1.01        1.50        1.00
 25.25   264.6,168.6          0.00        6.08        1.01        1.50        1.00
 25.50   266.3,165.6          0.00        6.08        1*O1        1.50        1.00
 25.75   267.1,166.1          0.00        6.08        1.01        1.50        1.00
 26.00   267.0,170.1          0.00        6.08        1.01        1.50        1.00
 26.75   267.2,174.2          0.00        6.08        1.01        1.50        1.00
 26.50   269.0,175.4          0.00        6.08        1.01        1.50        1.00
 26.75   272.3,173.6          0.00        6.08        1.01        1.50        1.00
 27.00   277.1,169.0          0.00        6.08        1.01        1.50        1.00
 27.25   281.8.164.2          0.00        6.08        1.01        1.50        1.00
 27.50   284.8,162.1          0.00        6.08        1.01        1.50        1.00
 27.75   286.?.162.?          0.00        6.08        L*O1        1.50        1.00
 28.00   286.0,166.0          0.00        6.08        1.01        1.50        1.00
 28.25   285.6,169.2          0.00        6.08        1.01        1.50        Loo
 28.50   286.5,169.6          0.00        6.08        1.01        1.50        1.00
 28.75   288.6, 167.2         0.00        6.08        1.01        1.50        1.00
 29.00   292.0.161.9          0.00        b. 08       1.01        1.50        1.00
 29.25   295.4,156.6          0.02        6.06        1003        1.50        1.00
 29.50   297.6,153.9          0.14        5.96        1.14        1.50        1.00
 ?9. 75  298.4.153.7          0.27        5.88        1.21        1.s0        1.00
 30.00   298.0.156.0          0.32        5.94        1*14        1.50        1.00
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                                                            PACIFIC ENVIRONMENTAL SERVICES
                                                            REM2 PHOTOCHEMICAL MODEL (4/1/77)

   OCS  -  1996 IMPACT WITH SALE 48 - 9/3
   SAN DIEGO , TRAJECTORY - PART 2 - 8 HRS
   START AT 0600, END AT 1400
   EMISSIONSG RID: SDDATA86


 TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

 6.00      8.0, 66.0         0.32         5.94         1.14        1.50         1*JO
 6.25      7.5; 68.5         0.50         5.87         1.21        19.50        1.00
 6.50      8.0, 68.6         0.80         5.79         1.27        1.49         1.00
 6.75      9.5, 66,4         1.18         5*74         1.31        1.49         1.00
 7.00     12.0, 62.0         1.60         5.74         1930        1.49         1.00
 7.25     14.9, 57.6         1.94         5.89         1.13        1.48         1.00
 7.350    17*3B 55*7         2.42         5.96         1.03        1.48         1.00
 7.75     19.4, 56.1         3.00         5.96         1.00        1.47         1.00
 8,00     21.0, 59.1         3.59         5.99         0*95        1.46         1.00
 8.25     22.5, 62.1         4933         6.01         0.89        1.45         1.00
 8050     24.2, 63.1         5.08-        6.94         008'1       1.43         1.00
 8.75     26.0, 62.1         5.85         6.07         0,73        1.42         1.00
 9.00     28.0, 5990         6.6'6        6.06         0.69        1*4O         1.$0
 9.25     30.3, 55.8         7.37         6.03         0 ●&6       1.39         1.00
 9.50     32.8, 54.6         8.05         6.00         0.63        1.37         1.00
 9.75     35.8, 55.4         8.71         5.97         0.60        1.36         1.00
10.00     39.0, 58.0         9.28         5.98         0.58        1.35         1.00
10.25     42.4, 60.6         9.60         5.93         0*S7        1.34         1.00
10.50     45.5, 6101         9 . 9 3      5.88         0.56        1*.33        1.00
10.75     48.4, 5905        10.24         5.82         0.55        1.32         1.00
11*00     51.0, 56.0        10.51         5.79         0.54        1.31         1.00
11.25     53.6, 52.3        10.64         5.75         0054        1.30         1.00
11*50     56.3, 50.6        10080         5.69         0.53        1.30         1.00
11.75     59.1, 50.9        10.96         5.63         0,52        1.29         1.00
12.00     62.1, 53.0        11*12         5.58         0.50        1.29         1.00
12.25     64.9, 55.1        11.62         5.50         0.48        1.28         1.00
12.50     67.5, 55.1        12.09         5.42         0.45        1.27         0.s9
12.75     69.9, 53.0        12.52         5.33         0.42        1.26         0.99
13.00     72.0, 49.0        12.90         5.24         0.40        1.25         0.99
13.25     74.2, 44.8        13.23         5.15         0.38        1.25         00.99
13.50     76.3, 42.6        13.53         5.05         0.36        1.24         O.*99
13.75     78.6, 42.4        13.80         4.95         0.34        1.24         0.99
14.00     81.1, 44.0        14.04         4.86         0.32        1.24         0..99



KFLAG =    1
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PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL (4/1/77)

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OCS - 1986 IMPACT WITHOUT SALE-48 - 9/3
SAN DIEGO 2 TRAJECTORY PART 1 10 HRS
START AT 0300, END AT 1300
EMISSIONS GRID: OCDATA86.SALE35

TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

3.00    287.0,154.0      1.09       3.00        2900       1*00         1000
3.25    285.8,152.4      0.00       4.03        0.97       1.00         1.00
3.50    284.8,150.8      0.00       4.05        O*94       1000         1.00
3.75    283.8,148.9      0.00       4.06        O*94       1.00         1.00
4,00    283.0,147.0      0.00       4.07        0.93       1.00         1000
4.25    282.2,145.0      0.00       4.07        0.93       1.00         1.00
4.50    281.5,1,43.2     0.00       4*O7        0.93       1000         1*00
4.75    280.7,141.5      0.00       4.07        0.93       1000         1*00
5*OO    280.0,140.0      0*0C       4.07        0.93       1*00         1*00
5.25    279.3,138.5      0*00       4*O7        0.93       1800         1*00
5.50    278.8,137.0      0.08       4.00        1.00       1.00         1*00
5.75    278.3,135.5      0.19       3,92        1.08       1*OO         1.00
6.00    279.0,134.0      0.30       3.87        1.13       1*OO         1.00
6.25    277.7,132.4      0*35       3,92        1.07       1.00         1*00
6.50    277.5,130.7      0.54       3.89        1.10       1.00         1*00
6.7S    277.2,128.9      0.84       3.81        1.18       1.00         1.00
7.00    277.0,127.0      1.16       3.78        1.19       0.99         1.00
7.25    276.9,1,24.9     1.45       3.86        1*11       0.99         1.00
7.50    277.0,122.5      1.74       3.99        0.96       0999         1.00
7.75    277.4,119.8      2.20       4.01        O*93       0.98         1.00
8.00    278.0,117.0      2.66       4.04        0.87       0997         1*00
8.25    278.8,114.3      2.72       3.97        0895       0.97         1.00
8.50    279.7,112.4      2.02       3.93        0.98       0.97         1.00
0.75    280.8,111.3      2.96       3.96        0.94       0.97         I*00
9.00    282.0,111.0      3.22       3.95        0.94       0.96         1.00
9.25    283.3,110.7      3.39       3.93        0.95       0.96         1*00
9.50    284.8,109.8      3.59       3.93        0.94       0.96         1.00
9.75    286.4,108.2      3.82       3.94        0.91       O*95         1.00
10*00   288.0,106.0      4.07       3.97        0.87       0095         1.00
10.25   289.8,104.0      4.51       4.00        0.82       O*94         1.00
10.50   291.8,103.0      4.94       4.02        O*7?       0,93         1*00
10.75   293.8,103.0      5*35       4.03        0.73       0.92         1*00
11.00   296.0,104.0      5.74       4.05        0.69       O*91         1.00
11.25   298.4,105.3      6.13       4.05        0.65       0.90         1*00
11.50   300.8,110600     6.49       4905        0.62       0.89         1.00
11.75   303.4,106.?      6.84       4.04        0.59       O*89         1.00
12.00   306.0,106.0      7.16       4.03        0.57       0.88         1001
12.25   308.6,105.9      793?       4.01        0.55       0.87         1.01
12.50   310.8s106.5      7.50       4*00        O*54       0.87         1.01
12.75   312.6s107.9      7.66       3.98        0.52       0.86         1.01
13.00   314.00110,0      7.82       3*97        O*5O       0.86         1*01
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                                              PACIFIC ENVIRONMENTAL SERVICES
                                             REM2 PHOTOCHEMICAL MODEL (4/1/77)


        OCS - 1986 IMPACT WITHOUT SALE-48 - 9/3
        SAN DIEGO 2 TRAJECTORY - PART 2 - 3 HRS
        START AT 1300, END AT 1600
        EMISSIONS GRID: SDDATA86


   TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO (PPM)

   13.00    24.0, 70.3        7.82        3.97         0.51        0.86          1.01
   13.17    25.0, 71.6        8.12        3.96         0.48        0.85          1.01
   13.33    26.1, 72.9        8.41        3.94         0.46        0.85          1.01
   13.50    27.5, 74.0        8.67        3.92         0.43        0.84          1.01
   13.67    29.1, 74.9        8.86        3.92         0.43        0.83          1.01
   13.83    31.0, 75.6        9.00        4.03         0.42        0.83          1.01
   14.00    33.0, 76.0        9.23        4.07         0.41        0.82          1.02
   14.17    35.1, 76.3        9.45        4.09         0.39        0.82          1.02
   14.34    37.1, 76.5        9.69        4.09         0.38        0.81          1.02
   14.50    39.0, 76.7        9.91        4.10         0.37        0.81          1.03
   14.67    40.8, 76.9       10.12        4.11         0.35        0.81          1.03
   14.83    42.5, 76.9       10.28        4.15         0.34        0.81          1.04
   15.00    44.1, 77.0       10.37        4.20         0.34        0.83          1.04
   15.17    45.6, 77.0       10.44        4.24         0.33        0.83          1.04
   15.34    47.3, 76.9       10.50        4.28         0.31        0.82          1.04
   15.50    49.1, 76.7       10.57        4.29         0.30        0.82          1.04
   15.67    51.0, 76.5       10.62        4.31         0.28        0.82          1.04
   15.84    53.0, 76.3       10.64        4.36         0.27        0.82          1.05
   16.00    55.0, 76.0       10.65        4.40         0.27        0.82          1.05



 KFLAG =    1
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                                                      PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL  (4/1/77)


           OCS  -  1986 IMPACT WITH SALE-48 - 9/3
           SAN DIEGO 2 TRAJECTORY - PART 1 - 10 HRS
           START AT 0300, END AT 1300
           EMISSIONS GRID: OCDATA86.SALE48


   TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

   3.00    287.0,154.0        1.00        3.00         2.00        1.00          1.00
   3.25    285.9,152.4        0.00        4.03         0.97        1900          1.00
   3.50    284.9,150.9        Cc?         4.05         0.97        1.00          1.00
   3.75    283.8,148.9        0.00        4.06         1.00        1000          1.00
   4.00    283.0,147.9        0.00        4.07         1*O5        1*00          1.00
   4.25    282.2,145.0        0.00        4.07         1.12        1900          1*OO
   4.50    281.5,143.2        0.00        4.07         10AR        1.00          1*OO
   4.75    280.7,141.5        0.00        4.07         1*22        1.00          1*OO
   5.00    280.0,140.0        0.00        4.07         1.25        1.00          1.00
   5.25    279.3,138.5        0.00        4907         1.27        1.00          1.00
   5.50    278.9,137.0        0.06        4001         1.33        1.00          1.00
   5.75    278.3,135.5        0.15        3.96         1.40        1.00          1*OO
   6.00    278.0,134.0        0.25        3.91         1.44        1*00          1.00
   6.25    277.7,132.4        0.27        3.97         1.38        1.00          1.00
   6.50    277.5,130.7        0.43        3.96         1.39        1000          1.00
   6.75    277.2,128.9        0.70        3.90         1.44        1*00          1*OO
   7.00    277.0,127.0        0.99        3.90         1.43        1.00          1.00
   7.25    276.9,124.9        1.26        4.00         1.33        1*00          1.00
   7.50    277.0,122.5        1.51        4.16         1.15        0*99          1*OO
   7.75    277.4,119.9        1.95        4.20         1.09        0* 99         1*OO
   8.00    278.0,117.0        2.41        4.26         1.61        0.98          1.00
   8.25    278.9*114*3        2.54        4.15         1005        0.98          1.00
   8.50    279.7,112.4        2.69        4.08         1.07        0.98          1*OO
   8.75    280.8,111.3        2.86        4.10         1.01        0.97          1.00
   9.00    282.0,111.0        3* 14       4.08         0.98        0.97          1.00
   9.25    283.3,110.7        3.33        4.05         0.99        0.96          1.00
   9.50    284.8,109.7        3.56        4.03         0.97        0.96          1.00
   9.75    286.3,108.2        3.81        4.03         C*94        0.95          1.00
  10.00    288.0,106.0        4.06        4.06         0.69        0995          1.00
  10.25    289.8,104.0        4.51        4008         0.63        0.94          1*OO
  10.50    291.7,103.0        4.94        4.10         0.7P        0.93          1000
  10.75    293.8,103.0        5.37        4.11         0.74        0.92          1.00
  11.00    296.0B104.C        5.76        4.12         0.69        0*91          1.00
  11.25    29R.4,105.3        6.15        4.12         0,66        0.90          1*OO
  11.50    300.8,106.0        6.52        4.11         0.63        0.89          I*OO
  11.75    303.4,106.3        6.87        4.10         0.60        0.89          1.00
  12.00    306.0*106*C        7.19        4.09         0.57        0088          1.01
  12.25    308.6,105.9        7.37        4,0?         0.56        0.87          1.01
  12.50    31C.7J106.5        7.54        4.05         0.54        0.87          1.01
  12.75    312.6s107.9        7.71        4.03         0.52        0.86          1.01
  13000    314.0s110.0        7.86        4.01         0051        0.86          1.01
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                                         PACIFIC ENVIRONMENTAL SERVICES
                                        RPM2 PHOTOCHEMICAL MODEL   (4/1/77)

     OCS  -  1986 IMPACT WITH SALE-48  - 9/3
     SANDIEGO 2  TRAJECTORY  -  PART 2 - 3 HRS
     START AT 1300, END AT 16.00
     EMISSIONS GRID: SDDATA86


  TIME    POSITION(X,Y)     O3(PPHM)  NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  13.00    24.0, 70.0        7.86      4.01         0.51        0.86        1.01
  13.17    25.0, 71.6        8.16      4.00         0.48        0.85        1.01
  13.34    26.2, 72.9        8.46      3.98         0.46        0.85        1.01
  13.50    27.5, 74.0        8.71      3.96         0.44        0.84        1.01
  13.67    29.1, 74.9        8.90      3.96         0.43        0.83        1.01
  13.84    31.0, 75.6        9.04      4.06         0.43        0.83        1.01
  14.00    33.0, 76.0        9.24      4.11         0.41        0.83        1.02
  14.17    35.1, 76.3        9.48      4.12         0.40        0.82        1.02
  14.33    37.1, 76.5        9.72      4.13         0.38        0.82        1.02
  14.50    39.0, 76.7        9.95      4.13         0.37        0.81        1.03
  14.67    40.8, 76.9       10.15      4.15         0.35        0.81        1.03
  14.84    42.5, 76.9       10.31      4.18         0.34        0.81        1.03
  15.00    44.1, 77.0       10.39      4.24         0.33        0.83        1.04
  15.17    45.6, 77.0       10.47      4.28         0.33        0.83        1.04
  15.34    47.3, 76.9       10.53      4.31         0.32        0.83        1.04
  15.50    49.1, 76.7       10.60      4.32         0.30        0.82        1.04
  15.67    50.9, 76.5       10.66      4.34         0.29        0.82        1.04
  15.83    52.9. 76.3       10.67      4.39         0.27        0.82        1.05
  16.00    55.1, 76,0       10.68      4.44         0.26        0.82        1.05



 KFLAG  =  1
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                                                     PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL  (4/1/77)

     OCS  -  1986 IMPACT WITHOUT SALE48 2/28
     SANTA MARIA1 TRAJECTORY - NORTH - PART 1 - 11 HRS
     START AT 1800. END AT 0500
     EMISSIONS GRID:OCDATA86.SALE35


  TIME     POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

  18.00    114.0,288.0        1.00          4.00          1.00         1.00         1.00
  18.25    111.2,288.1        0.17          4.88          0.12         1.00         1.00
  18.50    108.4,288.3        0.11          4.94          0.05         1*OC         1.00
  18.75    105.7,288.6        0.10          4.97          0.03         1.00         1.00
  19*OO    103.0,289.0        0.09          4.98          0.02         1.00         1.09
  19,25    100.3,289.5        0.08          4.9a          0.02         0.99         1.00
  19.50     97.5,290.0        0.07          4.98          0.01         0.9$         1.00
  19.75     94.8,290.5        0.07          4.98          0.01         0.9s         1.00
  20.00     92.0,291.0        0.07          4.98          O*OO         0.9s         1.00
  20.25     89.1,291.5        0.07          4.97          0.00         0.99         1.00
  20.50     86.2,292.0        0.07          4.96          0.00         0.99         1.00
  20.75     83.1,252.5        0.07          4.96          0.00         0.98         1.00
  21.00     80.0.293.0        0.07          4.95          0.00         0.98         1.00
  21.25     76.9,2S3.5        0*07          4.94          0.00         0.98         1.00
  21.50     74.0,294.0        0.07          4.94          0.00         0.98         1.00
  21.75     71.4,294.5        0.07          4.93          0.00         0.98         1.00
  22.00     69.0,295.0        0.07          4.97          0.00         0.98         1.00
  22.25     66.6,2S5.5        0.07          4.91          0.00         0.98         1.00
  22.50     64.0,296.0        0.07          4.91          0.00         0.97         1.00
  22.75     61.1,296.5        0.07          4.90          0.00         0.97         1.00
  23.00     58.0,297.0        0.07          4.90          O*OL         0.97         1.03
  23.25     55.09297.7        0.06          4.90          0.01         0.97         1.00
  23.50     52.5,298.8        0.06          4.90          0.02         0.97         1.00
  23.75     50.5,300.2        0.06          4.91          0.02         O*97         1.01
  24.00     49.0,302.0        0.05          4.92          0.04         0.97         1.01
  24.25     47.6,303.8        0.04          4.93          0.05         0.97         1.01
  24.50     46.0,305.0        0.03          4.95          0.06         0.97         1.01
  24.75     44.1,305.8        0.02          4.96          0.07         0.96         1.01
  25.00     42.0,306.0        0.02          4.97          0.08         0.96         1.01
  25.25     40.0,306.5        0.01          4.97          0.08         0.96         1*O1
  25.50     38.3,307.8        0.01          4.98          0.08         0.96         1.00
  25.75     37.O*31O.O        0.01          4.98          0.07         0.96         1.00
  26.00     36.0,313.0        0.01          4.98          0.07         0.96         1.00
  26.25     35.2,315.9        0.01          4.98          0.06         0.96         1.00
  26.50     34.2,317.5        0.01          4.98          0.06         0.96         1.00
  26.75     33.2,317.9        0.01          4.97          0.06         0.56         1.00
  27.00     32.0,317.0        0.01          4.97          0.05         0.96         1.00
  27.25     30.8,316.3        0.01          4.97          0.05         0.95         1.0'3
  27.50     29.6,317.3        0.01          4.97          0.05         0.95         0.99
  27.75     28.3,319.9        0.01          4* 97         0.05         0.95         0.99
  28.00     27.0,324.1        0.01          4.96          0.04         0.95         0.99
  28.25     25.8,328.3        0.01          4.96          0.04         0.95         0.99
  28.50     24.7,330.8        0.01          4.96          0.04         O*95         0.99
  28.75     23.8,331.7        0.01          4.95          0.03         0.95         0.99
  29.00     23.0,331.1        0.01          4.95          0.03         0.95         0.99
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                                                            PACIFIC ENVIRONMENTAL SERVICES
                                                          REM2 PHOTOCHEMICAL MODEL  (4/1/77)


    OCS  -  1986 IMPACT WITHOUT SALE-%8 - 2/28
    SANTA MARIA 1 TRAJECTORY - NORTH - PART 2 -  6  HRs
    START AT 0500, END AT 1100
    EMISSIONS GRID: OCDATA86.SALE35


  TIME   POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  5.00   23.0,334.0        0.01        4.95         0.03        0.95        O*99
  5.25   22.2,330.4        0.00        4.95 “       0.03        0.95        0.99
  5.50   21.0,331.8        0.00        4; 95        0.03        0.95        O*99
  5.75   19.7,335.0        0.01        4.95         0.03        O*95        O*99
  6.00   18.0,340.0        0.01        4.96         0.02        0.95        0.99
  6.25   16.5,345.1        0.01        4.96         0.02        0.95        0.99
  6.50   15.7,348.5        0.32        4.66         0.32        0.95        0.99
  6.75   15.5,350.1       0 . 5 8      4.’47         0.51        0.95        0.99
  7.00   16.0,350.0        0076        4.40         0.57        0.95        O*99
  7.25   16.6,350.0        0.92        4.41         0.55        0.94        0.99
  7.50   16.8,351.8        1.21        4.33         0.62        0994        0.99
  7.75   16.6,355.5        1.60        4.21         0.73        0.94        0.99
  8.00   16.0,361.1        1.98        4.16         0.77        0.94        0.99
  8.25   15.5,3,$6.6       2.30        4.18         0.74        0.93        0.99
  8.50   15.5,370.3        2.”61       4.23         0.67        0.93        0.99
  8.75   16.0,372.1        3.02        4.21         0.68        0.92        0.99
  9.00   17.0,372.0        3.44        4.19         0.68        0.92        0.99
  9.25   18.6,371.4        3.85        4.’19        0.66        0.91        0.99
  9.50   20.9,371.8        4.26        4.19         0.64        0.90        0.99
  9.75   23.7,373.0        4.66        4.21         0.59        0.89        0.99
 10*OO   27.1,375.0        5.09        4.19         0.58        0.89        0.99
 10.25   30.5,376.8        5.60        4.19         0.55        0.88        0.99
 10.50   33.3,3$71.0       6.10        4.18         0.53        0.87        0.99
 10.75   35.5,375.7        6.58        4.17         0.50        0.86        0.99
 11.00   37.0,372.9        7.04        4.16         0.4’6       0.85        O*99



 KFLAG  =  1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL  [illegible]


          OCS  -   1986 IMPACT WITH SALE-48 - 2/28
          SANTA MARIA 1 TRAJECTORY  - NORTH - PART 1 - 11HRS
          START AT 1800, END AT 0500
          EMISSIONS GRID: OCDATA86.SALE48


   TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

  18.00    114.0,288.0        1.00         4.00          1.00         1.00         1.00
  18.25    111.2,288.1        0.17         4.88          0.12         1.00         1.00
  18.50    108.4,288.3        0.11         4.95          0.05         1.00         1.00
  18.75    105.7,288.6        0.09         4.97          0.03         1.00         1.00
  19.00    103.0s289.0        0.08         4.98          0.03         1.00         1.00
  19.25    100.3.289.5        0.07         4.99          0.02         0.99         1.00
  19.50     97.5,290.0        0.07         4.99          0.02         0.99         1*00
  19.75     94.8,290.5        0.06         4.99          0.01         0.99         1*00
  20.00     92.0,291.0        0.06         4.99          0.01         0.99         1.00
  20.25     89.1,291.5        0.06         4.99          0.00         0.99         1*00
  70.50     86.2,292.0        0.06         4.98          0.00         0.99         L*00
  20.75     83.1,292.5        0.06         4.98          0.00         0.99         1.00
  21.00     80.0,293.0        0.06         4.97          0.01         0.99         1.01
  21.25     76.9.293.5        0.06         4.97          0.01         0.99         1.01
  ?1.50     74.0,294.0        0.05         4.97          0.02         1.00         1.01
  21.75     71.4,294.5        0.05         4.97          0.03         1.00         1.01
  ?2.00     69.0,295.0        0.04         4.98          0.04         1.00         1.01
  22.2'3    66.6,295.5        0.04         4.98          0.04         1.00         1.01
  22.50     64.0.296.0        0.03         4.99          0.04         1.00         1.01
  22.75     61.1,296.5        0.03         4. w          0.05         1.00         1.00
  23.00     58.0,297.0        0.02         4.99          O*O5         1.00         1.00
  23.25     55.0,297.7        0.02         4.99          0.05         1.00         1.00
  23.50     52.5,298.8        0.02         5.00          0.05         1.00         1.00
  23.75     50.5,300.2        0.01         5.00          0.07         1.00         1.00
  ?4.00     49.0,302.0        0.01         5.00          0.09         1.00         1.00
  74.25     47.6,303.8        0.01         5.00          0.10         0.99         1.00
  24.50     46.0?305.0        0.01         5.01          0.12         0.99         1.00
  24.75     44.1,305.8        0.00         5.01          0.14         0.99         1.00
  25.00     42.0,306.0        0.00         5.01          0.15         0.99         1.00
  25.25     40.0,306.5        0.00         5.00          0.16         0.99         1.00
  25.50     38.3,307.8        0.00         5.00          0.16         0.99         1*00
  25.75     37.0,310.0        O*OO         5.00          0.17         0.99         1.00
  26.00     36.0,313.0        O*OO         4.99          0.17         0.99         1.00
  26.25     35.2,315.9        0.00         4.99          0.17         0.98         1.00
  26.50     34.2,317.5        0.00         4.99          0.16         0.98         1.00
  ?6. 75    33.2,317.9        0.00         4.98          0.16         0.98         0.99
  ?7.00     32.0,317.0        0.00         4.98          0.16         0.98         0.99
  27.25     30.8,316.3        0.00         4.97          0.16         0.98         ().99
  27.50     29.6.317.3        0.00         4.96          0.16         0.98         0.99
  27.75     28.3,319.9        O*OO         4.96          0.16         0.98         0.99
  28.00     27.0,324.1        0.00         4.95          0.16         0.9?         0.99
  28.25     25.8,328.3        0.00         4.95          0.16         0.97         0.99
  28.50     24.7,330.8        0.00         4.94          0.16         0.97         0.99
  29.75     23.8,331.7        0.00         4.94          0.16         0.97         0.99
  29.00     23.0,331.1        0.00         4.93          0.16         0.97         0.99
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                                                          PACIFIC ENVIRONMENTAL SERVICES
                                                        REM2 PHOTOCHEMICAL MODEL (4/1/77)

     Ocs -  1986 IMPACT WITH SALE-48 - 2/28
     SANTA MARIA 1 TRAJECTORY - NORTH - PART “2 -’6 HRS
     START AT 0500, END AT 1100
     EMISSIONS GRID: OCDATA86.SALE48


  TIME    POSITION(X,Y)      03 (PPHM)     NO2 (PPHM)     NO (PPHM)    NMHC (PPMC)    CO (PPM)

  5.00     23.0,331.0          0.00          4.93          0.16          0.91          0.99
  5.25     22.2,330.4          0.00          4.93          0.16          0.97          0.99
  5.50     21.0,331.8          0.00          4.93          0.16          0.97          0.99
  5.75     19.7,334.9          0.’00         4.93          0.16          0.97          0.99
  6.00     18.0,340.0          0.00          4.93          0.16          0.97          0.99
  6.25     16.5,345.1          0.00          4.93          0.16          0.97          0.99
  6.50     15.7,3411.5         0.26          4.68          0.41          0.97          0.99
  6.75     15.5,350.1          0.51          4.50          0.59          0.97          0.99
  -9.00    16,0,350.0          0.68          4.44          0.64          0.97          0.9’9
  7.25     16.6,349.9          0. 83         4.’4’6        0.62          0.97          0.99
  7.50     16.8,351.8          1.12″         4.38          0.68          0.9’6         0.99
  7.15     16.6,355.5          1.50          4.27          0.79          0.96          0.99
  8.00     16.0,361.1          1.88          4.22          0.83          0.96          0.99
  8.25     15.5,966.6”         2.2.0         4.25          0.78          0.95          0.99
  8.50     15.5,370.3          2.51          4.3’1         0.71          0.95          0.99
  8.75     16.0,372.1          2.93          4.28          0.72          0.94          0.99
  9.00     17-0,.?372.0        3.35          4.27          0.71          0.94          0.99
  9.25     18.6,371.4          3.78          4.27          0.68          0.93          0.99
  9.50     20.8,371.8          4.20          4.28          0.66          0.92          0.99
  9.75     23.7,’372.9         4.62          4.30          0.61          0.92          0.99
 10.00     27.1,-375.0         5.’06         4.29          0.6’0         0.91          0.99
 10.25     30.4,376.7          5.58          4.28          0.57          0.90          0.99
 10.50     33.3,377.0          6.09          4.28          0.54          0.89          0.99
 10.75     35.5.375.7          6.58          4.28          0.50          0.88          0.99
 11.00     37.0.372.9          7.07          4.26          0.47          0.87          0.99


KFLAG =    1
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL  (4/1/77)

          (ICS  -  1986 IMPACT WITHOUT SALE-48 9/3
          SAN DIEGO 3“ SPILL TRAJECTORY - BASE CASE - PART 1 - 1.5 HRS
          START AT 1000, ENO AT 1130
          EMISSIONS GRID:OCDATA86.SALE35


  TIME   POSITION(X,Y)     O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 10900   284.0,140.0        3*OO        3.00        1.00       1000        09s0
 10*1?   288.1,137.5        3*14        3*O9        0.91       1.00        00s0
 10.33   292.1,134.9        3*47        3*.I3       0.85       0.99        O*SO
 10.50   296.0.132..1       3.83        3.19        0.79       0.99        0.s0
 10.67   299.8,129.2        4.21        3022        0.74       0.99        0.50
 10.84   303.5,126.2        4.59        3.26        0.69       0.98        0.50
 11.00   307.0,123.0        4*9B        3029        0.65       0.98        0.50
 11.17   310079119..9       5.36        3.31        0.61       0997        09s0
 11.34   314,5s117.1        5075        3.33        00S8       0.97        0.60
 11*5O   318.6,114.6        6.13        3*35        0.54       0.96        0.50



 KFLAG  =  1
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                   REM2 PHOTOCHEMICAL MODEL (4/1/77)


        OCS - 1986 IMPACT WITHOUT SALE-48 - 9/3
        SAN DIEGO 3' SPILL TRAJECTORY - BASECASE - PART 2 - 3.5 HRS
        START AT 1130, END AT 1500
        EMISSIONS GRID: SDDATA86


   TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

   11.50    28.6, 24.6        6.13       3.35       0.54        0.96        0.50
   11.75    35.1, 21.5        6.63       3.36       0.51        0.95        0.50
   12.00    42.1, 19.0        7.17       3.37       0.47        0.94        0.50
   12.25    49.0, 17.0        7.75       3.41       0.44        0.93        0.51
   12.50    55.1, 15.1        8.10       3.67       0.46        0.95        0.53
   12.75    60.5, 13.5        8.55       3.80       0.44        0.94        0.54
   13.00    65.1, 12.0        9.05       3.87       0.42        0.93        0.54
   13.25    69.3, 10.9        9.55       3.92       0.40        0.92        0.55
   13.50    73.1, 10.6       10.04       3.95       0.38        0.91        0.55
   13.75    76.7, 11.0       10.50       3.98       0.36        0.90        0.55
   14.00    80.1, 12.0       10.92       4.00       0.34        0.89        0.56
   14.25    83.4, 13.3       11.32       4.02       0.33        0.88        0.56
   14.50    87.1, 14.2       11.68       4.04       0.30        0.87        0.56
   14.75    91.0, 14.7       12.01       4.04       0.29        0.87        0.57
   15.00    95.1, 15.0       12.32       4.05       0.27        0.86        0.57


 KFLAG =    1
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                                                  PACIFIC  ENVIRONMENTAL.  SERVICES
                                                REM2 PHOTOCHEMICAL  MODEL (4/1/77)

       OCS  -  1986 IMPACT WITH SALE-46 - 9/3
       SAN DIEGO 3' TRAJECTORY  -  PART 1 - 1,5 HRS
       START  AT 1000,END AT 1130
       EMISSIONS GRID: OCDATA86.SALE48

   TIME    POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)   NMHC(PPMC)    CO(PPM)

   10.00   284.0,140.0         3.00          3.00          1.00        1.00         0.50
   10.17   288.1,137.5         3.14          3.09          0.91        1.00         0.50
   10.33   292.1,134.9         3.47          3.13          0.8S        0.99         0.50
   10.50   296.0,13?.1         3.83          3.19          0.79        0.99         0.50
   10.67   299.8,129.2         4.21          3.22          0*74        0.99         0.50
   10.84   303.5,126.2         4.58          3.27          0.69        0.99         O*5O
   11.00   307.0,123.0         4.95          3.32          0.66        0.98         O*5O
   11.17   310.7,119.9         5.33          3.35          0.62        0.98         0.50
   11.34   314.5,117.1         5.72          3.37          0.59        0.97         0.50
   11.50   318.6,114.6         6.10          3.39          0.55        0.97         0.50


 KFLAG  =  1
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                                                    PACIFIC ENVIRONMENTAL "SERVICES
                                                  RPM2 PHOTOCHEMICAL MODEL  (4/1/77)

        OCS -  1986 IMPACT WITH SALE-48 - 9/3
        SAN DIEGO 3' TRAJECTORY  PART 2 3.5 HRS
        START AT 1130, END AT 1,500"
        EMISSIONS GRID: SDDATA86


    TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO (PPM)

    11.50    28.6, 24.6       6.10        3.39         0.55        0.97          0.50
    11.75    35.1, 21.5       6.61        3.40         0.51        0.96          0.50
    12.00    42.1, 19.0       7.16        3.41         0.48        0.95          0.50
    12.25    09.0, 17.0       7.74        3.45         0.45        0.94          0.51
    ?2.50    55.1, 15.2       8.10        3.71         0.46        0.96          0.53
    12.75    60.5, 13.5       8.57        3.85         0.45        0.95          0.54
    13.00    65.1, 12.0       9.07        3.92         0.43        0.94          0.54
    ?3.25    69.2, 11.0       9.5?        3.96         0.41        0.93          0.55
    ?3.50    73.1, 10.6      10.07        4.00         0.38        0.92          0.55
    13.75    76.7, 11.0      10.54        4.03         0.36        0.91          0.55
    14.00    80.1, 12.0      10.97        4.05         0.34        0.90          0.56
    14.25    83.4, 13.3      11.37        4.07         0.32        0.89          0.56
    14.50    87.1. 14.2      11.75        4.08         0.30        0.88          0.56
    14.75    91.0, 14.8      12.09        4.09         0.29        0.88          0.57
    15.00    95.1, 15.0      12.40        4.10         0.27        0.87          0.57



   KFLAG =    1
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                                                            PACIFIC ENVIRONMENTAL SERVICES
                                                          BEM2 PHOTOCHEMICAL MODEL (U/1/77}

          OCS  -  1986 IMPACT WITHOUT SALE-48  -  100% TANKERING  -  9/2 5
          SANTA BARBARA 1 TRAJECTORY.- PART 1 - 11 HRS
          START AT 0400, END AT 1500
          EMISSIONS GRID: OCDATA86.SALE35T


  TIME   POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO (PPM)

  4.00   198.0,258.0        1.00        4.00         3.00         1.50          2.00
  4.25   193.4,258.6        0.00        5.04         1.96         1.50          2.00
  U.50   190.4,258.3        0.00        5.06         1.94         1.50          2.00
  4.75   188.9,257.1        0.00        5.07         1.93         1.50          2.00
  5.00   189.0,254.9        0.00        5.07         1.93         1.50          2.00
  5.25   189.0,252.9        0.00        5.07         1.93         1.50          2.00
  5.50   187.3,251.9        0.00        5.07         1.93         1.50          2.00
  5.75   104.0,251.9        0.00        5.07         1.93         1.50          2.00
  6.00   178.9,253.0        0.00        5.07         1.93         1.50          2.00
  b.25   173.9,254.1        0.00        5.07         1.93         1.50          2.00
  6.50   170.4,254.4        0.09        5.00         2.00         1.50          2.00
  6.75   168.5,253.6        0.29        4.88         2.11         1.50          2.00
  7.00   168.0,252.0        0.48        4.88         2.11         1.50          2.00
  7.25   167.5,250.5        0.69        4.95         2 . 0 3      1.49          2.00
  7.50   165.3,250.1        0.90        5.16         1.81         1.49          2.00
  7.15   161.5,251.0        1.27        5.33         1.63         1.49          2.00
  8.00   156.0,253.0        1.78        5.45         1.48         1.48          2.00
  8.25   150.5,254.9        2.36        5.58         1.32         1.47          2.00
  8.50   146.9,255.4        2  .  9   9 5.73         I*1U         1.46          2.00
  8.75   145.1,254.4        3.68        5.85         0.98         1.45          2.00
  9.00   145.0,251.9        4. 46       5.89         0.89         1.44          2.00
  9.25   145.1,250.0        5.27        5.92         0.81         1.42          2.00
  9.50   143.5,2S0.4        6.08        5.93         0.75         1.40          2.00
  9.75   140.5,253.1        6.90        5.93         0.70         1.39          2.00
 10.00   135.9,258.1        7.69        5.93         0.63         1.37          2.00
 10.25   131.7,263.3        8.03        5.90         0.62         1.36          2.00
 10.50   129.4,266.6        8.34        5.87         0.61         1.35          2.00
 10.-?5  129.2,268.2        8.62        5.83         0060         1.33          2.00
 11.00   131.1,268.0        8.92,       5.80         0.s9         1.32          2.00
 11.25   133.0,267.9        8.60        5.77         0.61         1.32          2*OO
 11.50   133.1.269.9        8.43        5.75         0.63         1.32          2.00
 11.75   131.4,274.0        8.37        5.73         0.64         1.32          2.01
 12.00   128.0,280.1        8.38        5.72         0.64         1.32          2.01
 12.25   124.0,285.8        9.13        5.70         0.58         1.30          2.01
 12.50   120.9.288.9        9.84        5.67         0.54         1.28          2.00
 12.75   118.5,289.3       10.51        5.62         0.49         1.27          2.00
 13.00   117.0,286.9       11.13        5.56         0.46         1.25          2.00
 13.25   115.5,284.8       11.73        5.49         0.42         1.24          2.00
 13.50   113.5,285.7       12.30        5.41         0.39         1.23          2.00
 13.75   111.0,289.4       12.83        5. 33        0.37         1.23          2.00
 14.00   107.9,296.1       13.31        5.25         0.34         1.22          2.00
 14.25   105.1,302.6       13.77        5.15         0.31         1.22          2.00
 14.50   103.4,305.9       14.18        5.06         0.29         1.22          2.00
 14.75   102.7,306.0       14.56        4.95         0.26         1.22          2.00
 15.00   103.0,303.0       14.90        4.8b         0.23         1.22          2.00
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                                                     PACIFIC ENVIRONMENTAL SERVICES
                                                     REM2 PHOTOCHEMICAL MODEL (4/1/77)

     OCS - 1986 IMPACT WITHOUT SALE-48 - 100% TANKERING        9/25
     SANTA BARBARA 1 TRAJECTORY - PART 2 - 1 HR
     START AT 1500, END AT 1600
     EMISSIONS GRID = SBDATT86


   TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

   15.00    36.0, 12.0        14*9O        4.86         0.23        1922          2.00
   15.09    36.2, 10.6        15.00        4.82         0.23        1.22          2.00
   15.17    36.3,  9.7        15.08        4.79         0.22        1.22          2*OO
   15.25    36.3,  9.2        15.17        4.75         0.22        1*22          2*OO
   15.34    36.2,  9.0        15.26        4*73         O*21        1821          2.00
   15.42    35.9,  9.3        -15*34"      4.69         0.20        1.21          2.00
   15.50    35.6,  909        15.41        4.66         0.19        1.21          2*OO
   15.58    35.1, 1100        15.48        4*63         0.19        1021          2.00
   15.67    34.5, 12*4        15.55        4.61         0.18        1*21          2.00
   15.75    33.8, 14.3        15.61        4.58         0.17        1.21          2.00
   15.83    33.0, 16.5        15.6?        4*55         0.17        1.21          2.00
   15.92    32.0, 19.2        15.77        4.57         0.17        1022          2.01
   16.00    3,100$. 22.1      15.70        4.74         0.18        1,24          2.03


 KFLAG =   1
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                                              PACIFIC ENVIRONMENTAL SERVICES
                                              REM2 PHOTOCHEMICAL MODEL (U/1/77)

        OCS  -  1986 IMPACT WITH SALE-48  -  100% TANKERING -   9/25
        SANTA BARBARA 1 TRAJECTORY - PART 1 - 11 HRS
        START AT 0400, END AT 1500
        EMISSIONS GRID: OCDATA86.SALE48T


TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

 4.00   198.0,258.0        1.00        4.00         3.00        1.50         2.00
 4.25   193.4,258.6        0.00        5.04         1.96        1.50         2.00
 4.50   190.4,258.3        0.00        5.06         1.94        1.50         2.00
 4.75   168.9,257.1        0.00        5.07         1.93        1.50         2.00
 5.00   189.0,254.9        0* 00       5.07         1.93        1.50         2.00
 5.25   189.0.252.9        0.00        5.07         1.93        1.50         2.00
 5.50   187.3,251.9        0.00        5.07         1.93        1.50         2.00
 5.75   184.0,251.9        0.00        5.07         1.93        1.50         2.00
 6.00   178.9,253.0        0.00        5.07         1.93        1.50         2.00
 6.25   173.9,254.1        0.00        5.07         1.93        1.50         2.00
 6.50   170.4,254.4        0.09        5.00         2.00        1.50         2.00
 6.75   169.5,253.6        0.29        4.88         2.11        1.50         2.00
 7.00   168.0,252.0        0.48        4.88         2.11        1.50         2.00
 7.25   167.5,250.5        0.69        4.95         2.03        1.49         2.00
 7.50   165.3,250.1        0.90        5.16         1.81        1.49         2.00
 7.75   161.5,251.0        1.27        5.33         1.63        1.49         2.00
 8.00   156.0,253.0        1.78        5.45         1.48        1.48         2.00
 8.25   150.5,254.9        2.36        5.58         1.32        1.47         2.00
 8.50   146.9,255.4        2.99        5.73         1.14        1.46         2.00
 8.75   145.1,254.4        3.68        5.85         0.98        1.45         2.00
 9.00   145.0,251.9        4.46        5.89         0.89        1.44         2.00
 9.25   145.1,250.0        5.27        5.92         0.81        1.42         2.00
 9.50   143.5,250. 4       6.08        5.93         0.75        1.40         2.00
 9.75   140.5,253.1        6.90        5.93         0.70        1.39         2.00
10.00   135.9,258.1        7.69       5.93          0.63        1.37         2.00
10.25   131.7,263.3        8.03        5.90         0.62        1.36         2.00
10.50   129.4,266.6        8.34        5.87         0.61        1.35         2.00
10.75   129.2,268.2        8.60        S.84         0.60        1.33         2.00
11.00   131.0,268.0        8.91        5.82         0.59        1.32         2.00
11.25   133.0,267.9        8.58        5.79         0.61        1.32         2.00
11.50   133. 1,269.9       8.41        5.76         0.63        1.32         2.00
11.75   131.4,274.0        8.34        5.75         0.64        1.32         2.00
12.00   127.9,280.1        8.35        5.74         0.64        1.32         2.00
12.25   124.0,285.8        9.10        5.73         0.59        1.30         2.00
12.50   120.9.286.9        9.80        5.70         0.54        1.28         2.00
12.75   118.5,289.3       10.47        5.66         0.50        1.27         2.00
13.00   117.0,287.0       11.10        5.61         0.46        1.25         2.00
13.25   115.5,284.8       11.73        5.54         0.43        1.24         2.00
13.50   113.5,285.7       12.31        5.46         0.39        1.24         2.01
13.75   111.0,289.0       12.84        5.39         0.3-)       1.23         2.01
14.00   108.0,296.1       13.32        5.33         0.34        1.23         2.01
14.25   105.1,302.6       13.78        5.24         0.32        1.23         2.01
14.50   103.4.305.9       14.21        5.13         0.29        1.23         2.01
14.75   102.7,306.0       14.61        5.03         0.27        1.23         2.01
15.00   103.0,303.0       14.96        4.93         0.24        1.23         2.01
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL (4/1/77)


      OCS  -  1986  IMPACT WITH SALE-48 - 100% TANKERING -  9/25
      SANTA BARBARA 1TRAJECTORY - PART 2 - 1HR
      START AT 1500, END AT 1600
      EMISSIONS GRID: SBDATT86


   TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  15.00     36.0, 12.0       15.00        4.93        0.24         1.23         2.01
  15.08     36.2, 10.7       15.04        4.89        0.23         1.23         2.01
  15.17     36.3,  9.7       15.18        4.86        0.22         1.23         2.01
  15.25     36.3,  9.2       15.28        4.82        0.22         1.23         2.01
  15.33     36.2,  9.0       15.36        4.80        0.21         1.23         2.01
  15.42     35.9,  9.3       15.44        4.76        0.21         1.23         2.01
  15.50     35.6,  9.9       15.51        4.73        0.20         1.23         2.01
  15.58     35.1, 11.0       15.59        4.71        0.19         1.23         2.01
  15.67     34.5, 12.4       15.66        4.68        0.18         1.23         2.01
  15.75     33.8, 14.2       15.72        4.65        0.17         1.23         2.01
  15.83     33.0, 16.5       15.78        4.62        0.17         1.23         2.01
  15.92     32.0, 19.2       15.88        4.63        0.17         1.24         2.02
  16.00     31.09 22.1       15.80        4.81        0.17         1.25         2.04



  KFLAG  =  1
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL  (4/1/77)


          OCS  -  1986 IMPACT WITHOUT SALE-48 -  100% TANKERING  - 7/10
          VENTURA 2 TRAJECTORY - PART 1 - 6 HRS
          START AT 0500, END AT 1100
          EMISSIONS GRID: OCDATA86.SALE35T


  TIME   POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)    CO (PPM)

  5.00    57.0,303.0        1.00        2.00         1.00        1.00        0.50
  5.25    60.3,301.0        0.33        2.74         0.29        1.00        0.50
  5.50    63.6,299.1        0.55        2.62         0.42        1.00        0.50
  5.75    66.8,297.0        0.77        2.54         0.50        1.00        0.50
  6.00    70.0,295.0        1.02        2.48         0.55        0.99        0.50
  6.25    73.0,293.0        1.21        2.53         0.49        0.99        0.50
  6.50    75.9,291.2        1.55        2.48         0.53        0.99        0.50
  6.75    78.5,289.5        1.86        2.48         0.52        0.98        0.50
  7.00    81.0,288.0        2.23        2.45         0.53        0.98        0.49
  7.25    83.6,286.5        2.60        2.45         0.53        0.97        0.49
  7.50    86.6,285.1        2.94        2.49         0.47        0.96        0.49
  7.75    90.1,283.5        3.34        2.48         0.46        0.95        0.49
  8.00    94.0,282.0        3.76        2.47         0.45        0.95        0.49
  6.25    98.1.280.6        4.17        2.47         0.44        0.94        0.49
  0.50   101.9.279.7        4.57        2.48         0.43        0.93        0.49
  8.75   105.5,279.1        4.96        2.50         0.40        0.92        0.49
  9.00   109.0,279.0        5.39        2.50         0.39        0.91        0.49
  9.25   112.3,279.0        5.80        2.49         0.38        0.89        0.49
  9.50   115.6.278.8        6.21        2.48         0.37        0.88        0.49
  9.75   118.8,278.5        6.61        2.47         0.36        0.87        0.49
 10.00   122.0,278.0        6.99        2.47         0.34        0.86        0.49
 10.25   124.9,278.0        7.05        2.45         0.34        0.85        0.49
 10.50   127.4,279.2        7.13        2.43         0.34        0.85        0.49
 10.75   129.4.281.5        7.21        2.41         0.34        0.84        0.49
 11.00   131.0,285.0        7.29        2.39         0.34        0.84        0.50



KFLAG  =  1
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                                        PACIFIC ENVIRONMENTAL SERVICES
                                        REM2 PHOTOCHEMICAL MODEL  (4/1/77)

     Ocs - 1986 IMPACT WITHOUT SALE48 100% TANKERING        7/la
     VENTUR4 2 TRAJECTORY - PART 2 - 3 HRS
     START AT 1100, END AT 1400
     EMISSIONS GRID: V2DATA86.[redacted]T


  TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 11.00    11.0, 19.0        7.29       2.39        0.34       0.84        0.50
 11.17    11.8, 21.6        7.52       2.38        0.33       0.83        0.50
 11.34    12.4, 23.6        7.76       2.37        0.32       0.83        0.50
 11.50    12.8, 25.6        7.98       2.35        0.31       0.82        0.50
 11.67    13.1, 27.1        8.19       2.34        0.30       0.82        0.50
 11.84    13.1, 28.2        8.39       2.33        0.29       0.82        0.50
 12.00    13.0, 29.0        8.64       2.35        0.29       0.82        0.51
 12.17    12.9, 29.7        8.82       2.36        0.28       0.82        0.51
 12.34    13.0? 30.7        8.92       2.41        0.29       0.83        0.52
 12.50    13*4* 31.9        8.94       2.45        0.29       0.82        0.52
 12.67    14.0, 33.4        8.98       2.45        0.29       0.82        0.52
 12.83    14.9, 35.1        8.58       2.88        0.38       0.82        0.52
 13.00    16.0, 37.0        8.28       3.24        0.41       0.81        0.52
 13.17    17.1, 39*0        8.4X       3.17        0.39       O*B1        0.51
 13.33    17.8, 40.8        8.53       3.11        0.38       0.80        0.51
 13.50    18.1, 42.6        8.64       3*05        0.36       0.80        0.51
 13.67    18.1, 44.2        8*74       2.99        O*35       0.80        0.51
 13.83    17.7* 45.7        8.83       2.93        0.33       0.79        0.51
 14.00    17*0* 47.0        8.93       2*86        0.32       0.79        0.51



KFLAG .   1
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                                                      PACIFIC ENVIRONMENTAL SERVICES
                                                      REM2 PHOTOCHEMICAL MODEL (4/1/77)

   OCS  -  1966  IMPACT WITH  SALE-48  -  100%TANKERING-7/10
   VENTURA 2 TRAJECTORY - PART 1-6 HRS
   START AT 0500, END AT 1100
   EMISSIONS GRID: OCDATA86.SALE48T


 TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)    CO(PPM)

 5*OO     57.09303.0         1.00        2.00         1.00        1.00         0.50
 5.25     60.3,301.0         0.33        2.74         0.29        1.00         0.50
 5.50     63.6,299.1         0.54        2.63         0.42        1.00         0.50
 5.75     66.8,297.0         0.76        2.55         0.51        1.00         0.50
 6.00     70.0,295.0         1*OO        2.50         0.57        1.00         0.50
 6.25     73.0,293.0         1.16        2.58         0.52        1.01         0.50
 6.50     75.9,291.2         1.49        2.55         0.58        1.02         0.50
 6.75     78.5,289.5         1.79        2.57         0.57        1.02         0.50
 7.00     81.0,288.0         2.16        2.56         0.57        1.02         0.50
 7.?5     83.6,286.5         2.55        2.56         0.56        1.01         0.49
 7.50     86.6,285.1         2.91        2.61         0.50        1.00         0.49
 7.75     90.1,283.5         3.33        2.61         0.49        1.00         0.49
 8.00     94.0.282.0         3.77        2.60         0.48        0.95         0.49
 8.25     98.1.280.6         4.20        2.60         0.46        0.98         0.49
 0.50    101.9,279.7         4.63        2.60         0.45        0.98         0.49
 8.75    105.5.279.1         5.05        2.63         0.42        0.98         0.49
 9.00    109.0.279.0         5.50        2.67         0.41        0.98         0.49
 9.25    112.3,279.0         5.95        2.62         0.39        0.97         0049
 9.50    115.6,278.8         6.39        2.61         0.38        0.96         0.49
 9.75    118.8,278.5         6.82        2.60         0.36        0.94         0.49
10.00    122.0,278.0         7.22        2.60         0*34        0.93         0.49
10.25    124.9,278.0         7.29        2.58         0.35        0.92         0.49
10.50    127.4,279.2         7.37        2057         0.35        0.91         0.49
10.75    129.4,281.5         7.46        2.S5         0.35        0.90         0.50
11*OO    131.0,265.1         7.56        2.52         0.34        0.90         0.50


KFLAG =    1
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                                                                PACIFIC ENVIRONMENTAL SERVICES
                                                               REM2 PHOTOCHEMICAL MODEL (4/1/77)

OCS  -  1986  IMPACT WITH SALE-48  -  100% TANKERING  -  7/10
VENTURA 2 TRAJECTORY - PART 2 - 3 HRS
START AT 1100, END AT 1400
EMISSIONS GRID: V2DATA86.T


 TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)     NMHC(PPMC)     CO(PPM)

 11.00    11.0, 19.0        7.56         2.52          0.35          0.90          0.50
 11.17    11.8, 21.5        ?.81         2.51          O*33          0.89          0.50
 11.33    12.4, 23.7        8.06         2.49          0.32          0.88          0.50
 11.50    12.8, 25.6        8.29         2.48          o*31          0.88          0.50
 11.67    13.1, 27.0        8.51         2.46          0.30          0.87          0.50
 11.84    13.1, 28.2        8.73         2.45          O*3O          0.87          0.50
 12.00    13.0, 29.0        8.98         2.46          0.29          0.87          0.51
 12.17    12.9, 29.7        9.18         2.40          0.29          0.88          0.51
 12.34    13.0, 30.7        9.29         2.53          0.29          0.88          C.52
 12.50    13.4, 31.9        9.31         2.56          0,29          0.88          0.52
 12.67    14.0, 33.4        9.36         2.56          0.29          0*87          0.52
 12.84    14.9, 3501        8.96         3*OO          0.38          0.87          0.52
 13.00    16.0, 37.0        8.66         3.35          0.41          0.87          0.52
 13.17    17.1, 39.0        8.80         3.28          0.39          0.86          0.52
 13.34    17.8, 40.9        8.9?         3.22          0.37          0.86          0s52
 13.50    18.1, 42.6        9.03         3.15          0.36          0.86          0.51
 13.67    19.1, 44.2        9.14         3.08          0.35          0.85          0.51
 13.83    17.7, 45*7        9.23         3.02          0.33          0.85          0.51
 14.00    17.0, 47*O        9.32         2.95          0,32          0.84          0.51


KFLAG =    1
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                                                        PACIFIC ENVIRONMENTAL SERVICES
                                                      REM2 PHOTOCHEMICAL MODEL (4/1/77)

            OCS - 1986 IMPACT WITHOUT SALE 48 - 100% TANKERING - 7/10
            VENTURA 3 TRAJECTORY - PART 1 - 6 HRS
            START AT 0500, END AT 1100
            EMISSIONS GRID: OCCATA86.SALE35T

   TIME   POS1TION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

   5.00   57.0,303.0         1.00       2.00        1.00        1.00        0.50
   5.25   60.3,301.0         0.33       2.74        0.29        1.00        0.50
   5.50   63.6,299.1         0.55       2.62        0.42        1.00        0.50
   5*75   66.8,297.0         0.77       2.54        0.50        1*OO        0.50
   6.00   70.0,295.0         1.02       2.48        0.55        0.99        0.50
   6.25   73.0,293.0         1.21       2.53        0.49        0.99        0.50
   6.50   75.9.291.2         1.55       2.48        0.53        C*99        0.50
   6.75   78.5,289.5         1.86       2.48        0.52        0.90        0.50
   7.00   81.0,288.0         2.23       2.45        0.53        0.98        0.49
   7.25   83.6,286.5         2.60       2.45        0.53        0.97        0.49
   7.50   86.6.285.1         2.94       2.49        0.47        0.96        0.49
   7.75   90.1,283.5         3.34       2.48        0.46        0.95        0.49
   8.00   94.0,282.0         3.76       2.47        0.45        0095        0.49
  8 . 2 5 98.1,280.6         4.17       2.47        0044        0.94        0.49
   8.50  101.9,27'7.7        4*57       2.48        0.43        0.93        0.49
   8.75  105.50279.1         4.96       2.50        0.40        0.92        0.49
   9.00  109.0,279.0         5.39       2.50        O*39        0.91        0.49
   9.25  112.3.279.9         5.80       2.49        0.38        0.89        0.49
   9.50  115.6,278.6         6.21       2.48        0.37        0.88        0.49
   9.75  118.8,?77.9         6.61       2.47        0.36        0.87        0.49
  10000  122.0,277.0         6.99       2.47        0.34        0.86        0.49
  10.?5  125.4,276.2         7.05       2.45        0.34        0.85        0.49
  10.50  120.4,275.9         7.12       2.43        0.34        0.85        0.49
  10.75  133.9,276.2         7.21       2.41        O*34        0.84        0.49
  11.00  139.0,277.0         7.29       2.39        0.34        0.84        0.49


  KFLAG =    1
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                                             PACIFIC ENVIRONMENTAL SERVICES'
                                           REM2 PHOTOCHEMICAL MODEL (U/1/77)

   OCS  -  1986 IMPACT WITHOUT SALE-48  -  100% TANKERING  -  7/10
   VENTURA 3 TRAJECTORY - PART 2 - 3 HRS
   STARI' AT 1100, END' AT 1400
   EMISSIONS GRID: V2DATA86.T


  TIME   POSITION(X,Y)   O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO (PPM)

 11.00   19.0, 11.0        7.29       2.39        0.34        0.84        0.50
 11.17   22.4, 11.7        7.53       2.38        0.33        0.83        0.50
 11.33   25.2, 12.3        7.81       2.39        0.32        0.83        0.50
 11.50   27.6, 12.8        7.97       2.s1        0.36        0.84        0.51
 11.67   29.5, 13.3        3.75       6.95        2.21        0.85        0.53
 11.84   31.0, 13.7        2.94       8.20        2.99        0.84        0.54
 12.00   32.0, 14.0        3.38       8.22        2.60        0.84        0.54
 12.17   33.0, 14.3        3.93       8.02        2.18        0.83        0.54
 12.34   34.6, 14.7        4.48       7.77        1.85        0.83        0.54
 12.50   36.7.15.2         5.02       7.49        1.59        0.83        0.53
 12.67   39.3, 15.7        5.51       7.21        1.38        0.82        0.53
 12.84   42.4, 16.3        5.98       6.92        1.22        0.82        0.53
 13.00   46.0, 17.0        6.42       6.64        1.08        0.82        0.53
 13.17   49.7, 17.8        6.00       6.39        0.99        0.82        0.52
 13.34   52.8, 18.8        7.13       6.19        0.90        0.82        0.53
 13.50   55.4, 19.9        7.47       5.95        0.82        0.01        0.52
 13.67   57.4, 21.1        7.76       5.75        0.76        0.81        0.52
 13.84   59.0, 22.5        8.04       5.55        0.71        0.81        0.52
 14.00   60.0, 24.1        8:29       5.37        0.65        0.81        0.52


KFLAG =    1
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                                                             PACIFIC ENVIRONMENTAL SERVICES
                                                            REM2PHOTOCHEMICAL MODEL (4/1/77)

     OCS  -  1986 IMPACT WITH SALE-48 -  100%  TANKERING-  7/10
     VENTURA 3 TRAJECTORY - PART 1 - 6 HRS
     START AT 0500,END AT 1100
     EMISSIONS GRID: OCDATA86.SALE48T


   TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

   5.00     57.0,303.0         1.00        2.00         1900       1*OO        0.50
   5.25     60.3,301.0         0.33        2.74         0.29       1.00        0..50
   5.50     63.6,299.1         0.54        2.63         0,42       1.00        O*5O
   5.75     66.8,297.0         0.76        2.55         0851       1000        0..50
   6.00     70.0,295.0         1.00        2.50         0.57       1.00        0.50
   6.25     73.0,293.0         1.16        2.58         0.52       1,01        0.50
   6.50     75.9,291.2         1.49        2,55         0.58       1.02        0.50
   6.75     79.5,289.5         1.79        2.57         0.57       1.02        0.50
   7.00     81.0,288.0         2.16        2.56         0.57       1.02        0.50
   7.25     83.6,286.5         2.55        2.56         0.56       1.01        0..49
   7.50     86.6,285.1         2.91        2.61         0.50       1.00        0.49
   7.75     90.1s283.5         3.33        2.61         0.49       1.00        0..49
   8.00     94.0,282.0         3.77        2.60         0.48       0.99        0.49
   8.25     98.1,280.6         4.20        2.00         0.46       0.98        0.49
   8.50    101.9,279.7         4.63        2.60         0.45       0.90        0.49
   8.75    105.5,279.1         5.05        2.63         0.42       0.98        0.49
   9.00    10%O9279.C          5.50        2.62         0.41       0.98        0.49
   9.25    112.3,278.9         5.95        2.62         0.39       0.97        0.,49
   9.50    115.6,278.5         6.39        2.61         0.38       0.96        0.49
   9.75    119.8,277.9         6,82        2.60         0.36       0.94        0.49
  10.00    122.0,277.0         7.22        2.60         0.34       0.93        0.49
  10.25    125.4,276.2         7.29        2.59         0.35       0.92        0.49
  10.50    129.4,275.9         7*37        2.58         O*35       0.91        0.49
  10.75    133.9,276.2         7.46        2.55         0.35       0.90        0.50
  11.00    139.0,277.0         7*56        2.52         0.34       0.90        0.50


  KFLAG =    1
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                                              PACIFIC ENVIRONMENTAL SERVICES
                                              REM2 PHOTOCHEMICAL MODEL (4/1/771

    OCS - 1986 IMPACT WITH SALE-48 - 100% TANKERING - 7/10
    VENTURA 3 TRAJECTORY - PART 2 3 HRS
    START AT 1100,END AT 1400
    EMISSIONS GRID: V2DATA86.T


  TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 11.00    19.0* 11.0        7.56        2.52        0.35       0.90         0.50
 11.17    22.3, 11.7        7.81        2.51        0.33       0.89         0.50
 11.34    25.2, 12.3        8.12        2.51        0.32       0.89         0.50
 116.50   27.6, 12.8        8.29        2.64        0.36       0.89         0.51
 11.67    29.5, 13.3        4.05        7.11        2.11       0.90         0.53
 11.83    31.0, 13.7        3.18        8.45        2.85       0.90         0.54
 12.00    32.0, 14.0        3.66        8.45        2.46       0.90         0.54
 12.17    33.0, 14.3        4.25        8.22        2.06       0.89         0.54
 12.33    34.6, 14.7        4.84        7.95        1.75       0.89         0.54
 12.50    36.6, 15.2        5.40     ...7.64        1.51       0.88         0.53
 12.67    39.2, 15.7        5.92        7.34        1.31       0.88         0.53
 12.83    42.4, 16.3        6.40        7.04        1.16       0.88         0.53
 13.00    46.0, 17.0        6.85        6.75        1.03       0.88         0.53
 13.17    49,6, 17.8        7.25        6.49        0.94       0.88         0.53
 13.33    52.7, 18.8        7.59        6.27        0.06       0.87         0.53
 13.50    55.3* 19.9        7.94.       6.02        0.79       0.87         0.52
 13.67    57.49 21.1        8.23        5.82        0.72       0.87         0.52
 13.84    59.0, 22.5        8.51        5.62        0.67       0.87         0.52
 14.00    60.0, 24.0        8.77        5.43        0.62       0.87         0.52


KFLAG =    1
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                                                          PACIFIC ENVIRONMENTAL SERVICES
                                                       REM2 PHOTOCHEMICAL MCDEL  (4/1/77)


           OCS  -  1986 IMPACT WITHOUT SALE-48 - 100% TANKERING      7/25
           LOS ANGELES 1 TRAJECTORY - PART 1 2 HRS
           START AT 0300, END AT 0500
           EM1SS1ONS GRID:OCDATA86.SALE35T


   TIMF   POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

   3.00   244.0,206.0         Loo         4.00         3.0C        2.00        2.00
   3.17   244.2,207.5         0.00        5.05         1.96        2.0C        2.00
   3.34   244.5,209.0         0.00        5.07         1.93        2.00        7.01
   3.50   244.6,210.5         0.00        5.09         1.92        2.00        2.01
   3.67   244.8,212.0         0.00        5.09         1.92        2.0C        2.01
   3.84   244.9.213.5         0.00        5.09         1.94        1.99        2.01
   4.00   245.0,215.0         0.00        5.09         1.95        1.99        2.01
   4.17   244.9.216.5         0.00        5.09         1.97        1.99        2.01
   4.34   244.4,217.8         0.01        5.07         2*OC        1.99        2.00
   4.50   243.6,219.1         0.01        5.07         2.01        1.99        2.00
   4.67   242.4,220.2         0.00        5.08         2.00        1.99        2.00
   4.84   240.8,221.1         0.00        5.08         2.0C        1.99        2.00
   5.00   238.9,222.0         0.03        5.04         2.03        1.99        2*OO



 KFLAG =      1
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PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL (4/1/77)

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OCS  -  1986 IMPACT WITHOUT SALE-48 -  100% TANKERING  -  7/25
LOS ANGELES 1 TRAJECTORY - PART 2 - 11HRS
STARTAT 0500, END AT 1600
EMISSIONS GRID: LADATT86.SALE35


 TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)   NMHC(PPMC)   CC(PPM)

 5.00     26.1,   6.2        0.03          5.04          2.03        1.99       2.00
 5.?5     24.6,  7.1         0.04          5.04          2.03        1.99       2.00
 5.50     24.0.  8.2         0.17          4.98          2.08        1.99       2.00
 5. 75    ?4.3,  9.6         0.31          5.02          2.08        1.99       2.00
 6.00     25.5, 11.2         0.49          5.15          2.04        2.01       2.00
 6.25     26.7, 12.8         0.56          5*52          1.95        2.03       ?.00
 6.50     26.9, 14.3         0.86          5.81          2.00        2.05       2.02
 6.75     26.3, 15.6         1.02          6.40          2.30        2.09       2.04
 7.00     74.9, 16.8         0.66          7,68          5.48        2.19       2.07
 7* 25    23.4, 17.9         0.57          9.26          8.70        2.30       2*LO
 7.50     22.9, 19.1         0.82         11.22          8.24        2.33       2.14
 7.75     23.4, 20.4         1.21         13.33          7.30        2.34       2.19
 8.00     24.9, 21.8         1.82         15.51          6.03        2.36       2.21
 8.25     26.4, 23.0         2.65         16. 03         4.50        2.34       2.24
 8.50     27.0.  24.0        3.77         17.67          3.56        2.30       2.26
 8.?5     26.7, 24.6         5.11         18.10          2.85        2.27       2.30
 9.00     25.5, 24.9         6.58         18.20          2.'35       2.23       2.32
 9.25     24.4, 25.2         8.13         18.07          1.96        2.20       2.33
 9.50     24.5,  25.9        9*63         17.82          1.68        2.16       2.34
 9.75     25.7,  27.1       11.01         17.53          1.52        2.13       2.35
10.00     ?8.0, ?8.6        12.17         17.34          1.38        2.10       2.36
10.25     30.3, 30.1        12.98         16. 98         1.29        2.08       2.37
10.50     31.5, 31.2        13.65         16. 5?         1.20        2.07       2.37
10.75     31.5,  32.0       14.69         16.02          1.11        2.04       2.38
11.00     30.4, 32.3        15.46         15.53          1.04        2 . 0 1    2.38
11..?5    ?9.4, 32.6        16.03         15.20          0.99        1.99       2.39
11.50     29.5, 33.1        16.52         14.90          0.94        1.97       2.40
11.75     30.7, 33.8        17*OO         14.58          0.91        1.96       2.41
12.00     33.0,  34.8       17.40         14. 29         0.86        1.94       2.42
12.25     35.3,  35.8       17.30         13.90          0.85        1.93       2.42
12.50     36.7, 36.7        17.35         13.44          0.82        1.92       2.4?
12.75     37.2,  37.4       17.54         12.89          0.77        1*91       2.41
13.00     36.7, 37.9        17.71         12.41          0.72        1.09       2.40
13.25     36.3, 38.4        17.83         11.97          0.70        1.88       2.39
13.50     37.2, 39.0        17.94         11.58          0.66        1.87       2.38
13.75     39.4.  39.6       18.05         11.20          0.62        1.86       ?.38
14.00     4?.9, 40.4        18.15         10.84          0.58        1.85       2.37
14.25     46.3, 41.0        18.99         10.67          0.54        1.84       2.38
14.50     48.2,  41.3       19.79         10.45          0.50        1.82       2.38
14*75     48.7, 41.3        20.50         10.?1          0.45        1.81       2.39
15.00     47.8,  41.0       21.14          9.98          0.41        1.81       2.39
15.25     47.0,  40.6       21.69          9.75          0.38        1.80       2.40
15.50     47.6.  40.2       22.18          9.54          0*35        1.80       2.40
15.75     49.8, 40.0        22.63          9.35          0.31        1.80       2.41
16.00     53.4, 39.8        23.07          9.19          0.27        1.82       2.41
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MCOEL (4/1/77)


       OCS  -  1986 IMPACT WITH SALE-48  - 100%TANKERING-  7/25
       LOS ANGELES 1 TRAJECTORY - PART 1 - 2 HRS
       START AT 0300, ENO AT 0500
       EMISSIONS GRID: OCDATA86.SALE48T


  TIMF   POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

  3.00   244.0,206.0        1.00       4.00        3.00       2.0C         2.00
  3.17   244.2,207.5        0.00       5.04        1.97       2.0C         2.00
  3.34   244.5,209.0        0.00       5.07        1.95       2.0C         2.00
  3.50   244.6,210.5        0.00       5.09        1.95       2.01         2.00
  3.67   244.8,212.0        0.00       5.10        1.96       2.01         2.00
  3.%4   244.9.213.5        0.00       5.10        1.97       2.02         2.00
  4.00   245.0,215.0        0.00       5.11        1.99       2.03         2.00
  4.17   244.9,716.5        0.00       5.11        2.01       2.04         2.00
  4.34   244.4,217.8        0.01       5* 10       2.04       2.05         2000
  4.50   243.6,219.1        0.01       5.10        2.05       2.06         2*OO
  4.67   24?.4,220.2        0.00       5.12        2.05       2.06         2.00
  4.84   240.8,221.1        0.00       5.12        2.05       2.07         2.00
  5.00   236.9.222.0        0.03       5.09        2.09       2.07         2.00


 KFLAG  =  1
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                 RFM2 PHOTOCHEMICAL MODEL (4/1/77)

OCS - 1986 IMPACT WITH SALE-48     100% TANKERING - 7/25
LOS ANGELES 1 TRAJECTORY'-"""#~RT 2 -.11      HRS
START AT 0500. END AT 1600
EMISSIONS GRID: LADATT86.SALE48

TIME   P9S1TION(X,Y)     O3(PPHM)   NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

5.'"00   76.1,  6.2       0.03       5.09         2.09       2.07        2.00
5.25     24.6,  7.1       0.04       5.09         2.09       2.07        2.00
5.50     24.0,  8.2       0.16       5.04         2.14       2.01        2.00
5.75     24.3,  9.6       0.30       5.08         2.12       2.08        2.00
6.00    "25.5, 11.2       0.49       5.22         2.07       2.09        2.00
6.25     26.7, 12.8       0.56       5.61         1.97       2.11        2.00
6.50     26.9, 14.3       0.88       5.92         2.00       2.14        2.02
6.75     26.3, 15.6       1*04       6.52         2.29       2.17        2.04
7.00     24.8, 16.8       0.68       7.86         5.48       2.28        2.07
7.25     23.4, 17.9       0.59       9.51         8.56       2.38        2.10
7.50     22.9, 19.1       0.86      11.57         7.99       2.41        2.14
7.75     23.4, 20.4       1.28      13.71         7.02       2.42        2.19
8.00     24.9, 21.8       1.93      15.85         5.76       2.44        2.21
8.25     26.4, 23.0       2.93      17.02         4.36       2.41        2.24
8.50     27.0, 24.0       3.98      17.91         3.38       2.38        2.28
8.75     26.7, 24.6       5.36      18.27         2.72       2.34        2.30
9.00     25.5, 24.9       6.87:     18.34         2.24       2.30        2.32
9.25     24.4, 25.2       8.43,     18.18         1.80       2.27        2.33
9.50     24.5, 25.9      99,96      17.88         1.66       2.23        2.34
9* 75    25.7, 27.1      11.33      17.60         1.47       2.20        2.35
10.00    28.0, 28.6      12.50      17.40         1.34       2.17        2.37
10.25    30.3, 30.1      13.31      17.02         1.26       2.15        2.37
10.50    31.5, 31.2      14."17     16.56         1.18       2.13        2.38-
10.75    31.5, 32.0      15.02      16.05         1.08       2.11        2.38
11.00    30.4, 32.3      15.78      15.56         1.02       2.08        2.38
11.25    29.4, 32.6      16.34      15.23         0.96       2.06        2.39
11.50    29.5, 33.1      16.85      14.92         0.93       2.04        2.40
11.75    30.7, 33.8      17.32      14.60         0.89       2.02        2.41
12.00    33.0, 34.8      17.72      14.31         0.85       2*O1        2.42
12.25    35.3, 35.8      17.60      13.93         0.83       2.00        2.42
12.50    36.7, 36.7      17.65      13.47         0.80       1.99        2.42
12.75    37.2. 37.4      17.83      12.93         0.75       1.97        2.41
13.00    36.7, 37.9      17.98      12.43         0.71       1.96        ?.40
13.2.5   36.3, 38.4      18.11      12.00         0.68       1.95        2.40
13.50    37.2, 39.0      18.22      11.60         0.64       1.94        2.39
13.75    39.4, 39.6      18.32      11.22         0.61       1.93        2.30
14.00    42.9, 40.4      18.42      10.87         0.57       1.92        2.37
14.25    46.3, 41.0      19.28      10.69         0.53       1.90        2.38
14.50    48.2, 41.3      20.09"     10.47         0.49       1.89        2.39
14.75    48.7, 41.3      20.81      10.23         0.44       1.88        2.39
15.00    47.88 41.0      21.46       9.98         0.41       1.67        2.40
15.25    47.0, 40.6      22.02       9.75         0.38       1.86        2.40
15.50    47.6, 40.2      22.50       9.55         0034       1.86        2.41
15.75    49.8, 40.0      22●9V       9.35         0.31       1.87        2.41
16.00    53.4, 39.8      23.40       9.17         0.28       1.88        2.42
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                                                          PACIFIC ENVIRONMENTAL SERVICES
                                                         REM2 PHOTOCHEMICAL MODEL (4/1/77)

          Ocs  -  1986 IMPACT WITHOUT SALE-48 - 9/3
          SAN DIEGO 1 TRAJECTORY 100% TANKERING PART 1 11 HRS
          START AT 1900, END AT 0600
          EMISSIONS GRID: OCDATA86.SALE35T

  TIME    POSITION(X,Y)      O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

 19.00    222.0,219.0          1.00        5.00         2.00        1.50        1.00
 19.25    225.1,217.9          0.00        6.04         0.95        1.50        1.00
 19.50    228.102L6.9          0.00        6.07         0.93        1.50        1.00
 19.75    231.1s215.9          0.00        6.07         0.92        1.50        1*OO
 20.00    234.0,215.0          0.00        6*O8         0.92        1.50        1*OO
 20.25    236.9,213.6          0.00        6.08         0.92        1.50        1.00
 20.50    239.5,211.3          0.00        6.08         0.92        1.50        1.00
 20.75    241.9,208.1          0.00        6.08         0.93        1.50        1*OO
 21.00    244.0,204.0          0.00        6.08         0.93        1.50        1.00
 21.25    245.8,200.4          0.00        6.08         0.93        1.50        1.00
 21.50    247.3*198.9          0.00        6.08         0.93        1.50        1*OO
 21.75    248.3,199.4          0.00        6.08         O*93        1.50        1*OO
 22.00    249.0,202.0          0.00        6.08         0.93        1.50        1.00
 22.25    249.9,204.2          0.00        6.08         0.93        1.50        1.00
 22.50    251.7,203.6          0.00        6.08         0.93        1.50        1*OO
 22.75    254.4,200.2          0.00        6.08         0.93        1.50        1*OO
 23.00    258.0,193.9          0.00        6.08         0.93        1.50        1.00
 23.25    261.2,167.7          0.00        6.08         0.93        1.50        1900
 23.50    262.8.184.1          O*OO        6.08         0.93        1.50        1*OO
 23.75    262.7. 183.2         0.00        6.08         0.93        1.50        1900
 24.00    261.0,185.0          0.00        6.08         0.93        1.50        1.00
 24.25    259.1.186.7          0.00        6.08         0.93        1.50        1*OO
 24.50    258.7,185.6          0.00        6.08         0.93        1.50        1.00
 24.75    259.7,181.7          0.00        6.08         0.93        1.50        L*OO
 25.00    262.0, 175.0         0.00        6.08         0.93        1.50        1.00
 25.25    264.6,166.6          0.00        4.08         0.93        1.50        1.00
 2S.50    266.3,165.6          0.00        6.08         O*93        1.50        1*OO
 2s.75    267.1,166.1          0.00        6.08         O*93        1.50        1.00
 26.00    267.0,170.1          0.00        6.08         0.93        1.50        1*OO
 26.25    267.2,174.2          0.00        6.08         O*93        1.50        1.00
 26.50    269.0, 175.4         0.00        6.08         0.93        1.50        1.00
 26.75    272.3,173.6          0.00        6.08         0.93        1.50        1.00
 27.00    277.1,169.0          0.00        6.08         0.93        1.50        1*OO
 27.25    281.8,164.2          0.00        6.08         0.93        1.50        1.00
 27.50    284.8,162.1          0.00        6.08         0.93        1.50        1000
 27.75    286.2,162.7          0.00        6.08         O*93        1.50        1.00
 28.00    286.0,166.0          0.00        6.08         0.93        1.50        1*OO
 28.25    285.6.169.2          0.00        6.08         0.93        1*5O        1*OO
 28.50    286.5,169.6          0.00        6.08         0.93        1.50        1.00
 28.75    288.6.167.2          0.00        6.08         0.93        1*5O        1*OO
 29.00    292.0,161.9          0.00        6.08         0.93        1.50        1.00
 29.25    295.4,156.6          0.02        6.06         0.95        1.50        1.00
 29.50    297.6,153.9          0.15    ,-..85. 95       1.06        1.50        1.00        ,.
 29.75    296.4,153.7          0.28        5.87         1*I4        1.50        t     o     o
 30.00    298.0,156.0          0.34        5.93         1.07        1.50        1.00
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                                                PACIFIC ENVIRONMENTAL SERVICES
                                              REM2 PHOTOCHEMICAL MODEL (4/1/77)

 OCS  -  1986 IMPACT WITHOUT SALE-48 - 9/3
 SAN DIEGO 1 TRAJECTORY 100%' TINKERING - PART 2 - 8 HRS
 START AT 0600, END AT 1400
 EMISSIONS GRID:SDDATA86


 TIME   POSITION(X,Y)   O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 6.00    B*O* 66.0        0.34       5.93        1.07       1.50        1*OO
 6.25    7.5, 68.5        0.52       5*85        1.14       1*5O        1*OO
 6.50    8.0, 68.6        0..84      5.77        1.21       1049        1.00
 6.75    9.5, 66.4        1.23       5.72        1.26       1.49        1.00
 7.00   12.0, 62.0        1.65       5.70        1.25       1.49        1.00
 7.25   14.9, 57.6        1.99       5.86        1*O7       1.48        1.00
 7.50   17.3* 55.7        2.48       5.91        1.00       1.48        1.00
 ?.75   19.4, 56.1        3.07       5.91        0.98       1*47        1.00
 8.00   21.0, 59.1        3.65       5.93        0.92       1.46        1.00
 8.25   22.5, 62.1        4.38       5*94        0.87       1.45        1.00
 8.50   24.2, 63.1        5.09       6.01        0.76       1.43        1.00
 8.75   26.0* 62.1        5.89       6.01        0.71       1.42        1.00
 9.00   28.0, 59.0        6.70       5.99        0.68       1.40        1.00
 9.25   30.2, 55.8        7.40       5.97        0.65       1.39        1.00
 9.50   32.8, 54.6        8*O8       5.94        0.62       1.37        1.00
 9.75   35.8, 55.4        8.74       5*90        0.59       1.36        1.00
10.00   39.0, 58.0        9.30       5.91        0.57       1.35        1.00
10.25   42.4, 60.6        9.62       5.86        0.56       1.34        1.00
10.50   45.5, 61.1        9.94       5.81        0.55       1.33        1*OO
10.7s   48.4, 59.5       10.26       5.76        0.54       1.32        1.00
11.00   51.0, 55*9       10.54       5*73        0.54       1.31        1.00
11.25   53..6, 52.3      10.66       5.69        0.53       1.30        1.00
11.50   56.3, 50.6       10.81       5.63        0.52       1.30        1.00
11.75   59.1, 50.9       10.96       5*57        0.51       1.29        1.00
12.00   62.0, 53.0       11.11       5*51        0.50       1.29        1*OO
12.25   64.9, 55.1       11.61       5.44        0.47       1.27        0.99
12.50   67.5, 55.1       12.07       5.35        0.44       1.26        0.99
12.75   69.9, 53.0       12.48       5.26        0.42       1.26        0.99
13.00   72.0, 48.9       12.85       5.17        0.40       1.25        0.99
13.25   74,01, 44.8      13.18       5.08        0.38       1.24        0.99
13.50   76.3, 42.6       13 .4?      4.98        0.36       1.24        0.99
13.75   78.6, 42.4       13.72       4.88        0.34       1.23        0.99
14.00   81.0, 44.0       13.96       4.78        0.32       1.23        0.99


KFLAG  =  1
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                                                     PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL (4/1/77)

      Ocs  -  1986  IMPACT WITH SALE-48 - 9/3
      SAN DIEGO 1 TRAJECTORY - 100? TANKERING - PART 1  11 HRS
      STARTAT 1900, END AT 0600
      EMISSIONS GRID: OCDATA86.SALE48T


 TIME    POSITION(X,Y)      O3(PPHM)     NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

 19.00   227.0,219.0          1.00         5.00         2.00         1.50         1.00
 19.25   225.10217.9          0.00         b.04         0.95         1.50         1.30
 19.50   278.1,216.9          0.00         6.07         0.93         1.50         1.00
 19.?5   231.1,215.9          O*OO         6.07         0.93         1.50         1.00
 20.00   234.0.215.0          0.00         6.08         0.93         L * 5 O      1000
 20.25   236.9,213.6          0.00         6.08         0.94         1.50         1.00
 20.50   239.5,211.3          0.00         6.08         0.95         1.50         1.00
 20.75   241.9,208.1          0.00         6.08         0.96         1.50         1.00
 71.00   244.0,?04.0          0.00         6.08         0.96         1*5O         1.00
 21.25   245.8,200.4          0.00         6.08         0.97         1.50         1.00
 21.50   247.3,198.9          0.00         6.08         0.97         1.5C         1.00
 ?1.75   248.3,199.4          0.00         6.08         0.98         1.50         loo
 22.00   249.0,202.0          0.00         6.08         0.98         1.50         1.00
 22.25   249.9,204.2          0.00         6.08         0.99         1.50         1.00
 22.50   251.7,203.6          0.00         6.08         1000         1.50         1.00
 22.75   254.4,200.2          O*OO         6.08         1.01         1.50         1.00
 23.00   258.0,194.0          0.00         6.08         1*O1         1.50         1.00
 23.25   261.2,187.7          0.00         6.08         1.01         1.50         1.00
 23.50   267.8.184.1          0.00         6.08         1.01         1*5O         1.00
 23.75   262.7.183.2          0.00         6.08         1.01         1.50         1*00
 24.00   261.0,185.0          0.00         6.08         1.01         1*SO         1.00
 24.25   259.1,186.7          0.00         6.08         1.01         1.50         1.00
 24.50   258.7,185.6          0.00         6.08         1.01         1.50         1.00
 24.75   259.7,181.7          0.00         6.08         1*01         1.50         1.00
 25.00   26?.0,175.0          0.00         6.08         1.01         1.50         1.00
 25.25   264.6,168.6          0.00         6.08         1.01         1.50         1.00
 25.50   266.3,165.6          0.00         6.08         1.01         1.50         1.00
 25.75   267.1,166.1          0.00         6.08         I*01         1.50         1.00
 26.00   267.0,170.1          0.00         6.08         1.01         1.50         1.00
 26.25   267.2,174.2          0.00         6.08         1*01         1.50         1.00
 ?6.50   269.0.175.4          O*OO         6.08         1.01         1.50         1.00
 ?5.75   272.3,173.6          0.00         6.08         1.01         1.50         1.00
 27.00   277.1,169.0          0.00         6.08         1*01         1.50         1.00
 ?7.25   261.8,164.2          0.00         6.08         1.01         1.50         1.00
 27.50   284.8.162.1          0.00         6.08         1.01         1.50         1.00
 27.75   286.2,162.7          0.00         6.08         1.01         1.50         1.00
 28.00   286.0.166.0          0.00         6.08         1.01         1.50         1.00
 28.25   285.6,169.2          0.00         6.08         1.01         1.50         1.00
 28.50   286.5.169.6          0.00         6.08         1.01         1.50         1.00
 28.75   288.6, 167.2         0.00         6.08         1.01         1*5O         1..00
 29.00   292.0,161.9          0.00         6.08         1.01         1.50         1.00
 79.25   295.4,156.6          0.02         b.06         1.02         1.50         1.00
 ?9.50   297.6,153.9          0.14         5.96         1.13         1*5O         1.00
 79.75   298.4.153.7          0.27         5.88         1*21         1*5C         1.00
 30.00   298.0,156.0          0.32         5.94         1.14         1.50         1.00
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)


          OCS  -  19S6 IMPACT WITH SALE-48 - 9/3
          SAN DIEGO 1 TRAJECTORY - 100? TANKERING - PART 2 - 8 HRS
          START AT 0600, END AT 1400
          EMISSIONS GRID: SDDATA88


   TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

   6.0(3     8.0, 66.0       0.32        5.94        1.14        1.50        1*00
   6.25      7.5, 68.5       0.50        5.87        1.21        1.50        1*00
   6.50      8.0, 68.6       0.81        5.80        1.27        1.50        1.00
   6.75      9.5, 66.4       1.18        5.74        1.31        1.50        1*00
   7.00     12.0, 62.0       1.60        5.76        1.30        1.49,       1900
   7.25     14.9, 57.6       1.95        5.89        1.12        1.49        1*00
   7.50     17.3, 55.7       2.42        5.96        1.03        1.48        1900
   7.75     19.4, 56.1       3.01        5.96        1.00        1.47        1.00
   8.00     21.0. 59.1       3.60        5.99        0.94        1.46        1.00
   8.25     22.5, 62.1       4.34        6.01        0.89        1.45        1.00
   8.50     24.2, 63.1       5.09        6.04        0.80        1.44        1.00
   8.75     26.0, 62.1       5.86        6.07        0.72        1.42        1.00
   9.00     28.0, 59.0       6.67        6.06        0.68        1.41        1.00
   9.25     30.3, 55.8       7.3a        6.03        0.66        1.39        1*00
   9.50     32.8, 54.6       8.07        6.00        0.63        1.38        1.00
   9.75     35.8, 55.4       8.73        5.97        0.60        1036        1.00
  10.00     39.0, 58.0       9.30        5.98        0.58        1.35        1.00
  10.25     42.4, 60.6       9.62        5.93        0.57        1.34        1*00
  10.50     45.5, 61.1       9.94        5.86        0.56        1.33        1*00
  10.75     48.4, 59.6      10.25        5.82        0.55        1.32        1.00
  11.00     51.0, 55*9      10.53        5.79        0.54        1.31        1.00
  11.25     53.6, 52.3      10.65        5*75        0.53        1.31        too
  11.50     56.3, 50.6      10.81        5.69        0.52        1.30        1.00
  11.75     59.2, 50.9      10.97        5.63        0.51        1.30        1.00
  12*OO     6?.1, 53.0      11.13        5.57        O*5O        1.29        1.00
  12.25     64.9, 55.1      11.63        5.50        0.47        1.28        0.99
  12.50     67.5, 55.1      12.09        5.42        0.45        1.27        0.99
  12* 75    69.9, 53.1      12.51        5.33        0.43        1.26        0.99
  13.00     72.0, 49.0      12.89        5.23        0.40        1.25        0.99
  13.25     74.1, 44.8      13.23        5.14        0.38        1.25        0.99
  13.50     76.4, 42.6      13.52        5.04        0.36        1.24        0.99
  13.75     78.7, 42.4      13●79        4.94        0.34        1.24        0.99
  14.00     81.0, 44.0      14.02        4.85        0.32        1.24        0.99


 KFLAG  =  1
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                                                        PACIFIC ENVIRONMENTAL SERVICES
                                                      REM2 PHOTOCHEMICAL MODEL (4/1/77)


              Ocs  -  1966 IMPACT WITHOUT SALE-48 - 9/3
              SAN DIEGO 3' TRAJECTORY - 100% TANKERING - PART 1 1.5 HRS
              START AT 1000, END AT 1130
              EMISSIONS GRID: OCDATA86.SALE35T


   TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

  10.00   204.0,140.0       3.00       3.00       1.00       1.00        0.50
  10*17   288.1,13?.5       3.14       3.09       0.91       1.00        0.50
  10.33   292.1,134.9       3.47       3.13       0.85       0.99        0.50
  10.50   296.0,132.1       3.03       3.19       0.79       0.99        0.50
  10.67   299.8,129.2       4.21       3.22       0.74       0.99        0.50
  10. 84  303.5,126.2       4.59       3.26       0.69       0.98        0*50
  11.00   307.0,123.0       4.96       3.29       0.65       0.98        0.50
  11.17   310.7,119.9       5.36       3.31       0.61       0.97        0.50
  11.34   31*.5*117.1       5.75       3.33       0.58       0.97        0.50
  11.50   318.6,114.6       6.13       3.35       0.54       0.96        0.50


 KFLAG =    1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                   PEM2 PHOTOCHEMICAL MODEL  (4/1/77)

        Ocs  -  1986 IMPACT WITHOUT SALE-48 9/3
        SAN DIEGO3' TRAJECTORY - 100%TANKERING - PART 2 - 3.5 HRS
        START AT 1130, END AT 1500
        EMISSIONS GRID:SDDATA86

  TIME    POSITION(X,Y)      O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 11.50    28.6, 24.6          6.13       3.35        0.54       0.96        0.50
 11.75    35.1, 21.5          6.63       3.36        0.51       0.95        0.50
 12.00    42.,1, 19.0         7.18       3.37        0.47       0.94        0.5J
 12.25    49.0, 17.0          7.75       .3.41       0.44       0.93        0.51
 12.50    55.1* 15.1          8.11       3.67        0.46       0.55        0.53
 12.75    60.5, 13.5          8.57       3.80        0.44       0.95        0.54
 13.00    65.1, 12.0          9.07       3.87        0.42       0.93        0.54
 13.25    69.3, 10.9          9.58       3.92        0.40       0.92        0.55
 13.50    73.1, 10.6         10.07       3.95        0.38       0091        0.55
 13.75    76.7, 11.0         10.52       3.98        0.36       0.90        0.55
 14.00    80.1, 12.0         10.95       4.00        0.34       0.89        0.56
 14.25    83.4, 13*3         11.35       4.02        0.32       0.89        0.56
 14.50    87.1. 14.2         11.73       4.04        0.30       0.88        0.57
 14.75    91.0, 14.8         12.07       4.04        0.?9       0.87        0.5?
 15.00    95.19 15.0         12.37       4.05        0.27       0.87        0.57


KFLAG  =  1
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                                                    PACIFIC ENvIRONMENTAL SERVICES
                                                   REM2 PHOTOCHEMICAL MODEL  (4/1/77)


     OCS  -  1986  IMPACTWITH SALE-48 - 9/3
     SAN DIEGO3' TRAJECTORY - 100X  TANKERING-  PART 1 - 1.5 HRS
     START AT 1000, END AT 1130
     EUISS1ONS GRID: OCDATA86.SALE48T


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  10.00   284.0,140.0         3.00        3.00         1*OO        1.00        0.50
  10.17   288.1,137.5         3.14        3.09         0.91        1.00        0.50
  10.33   292.10134.9         3.47        3.13         0.85        0.99        0.50
  10.50   296.0.132.1         3.63        3.19         0.79        0.99        0.50
  10.67   299.8,129.2         4.21        3.22         0.74        O*99        0.50
  10.84   303.5,126.2         4.59        3.27         0.69        O*99        0.50
  11.00   307.0,123.0         4.96        3.31         0.66        0.98        0.50
  11.17   31O*7,X19.9         5.34        3.34         0.61        0.98        0.50
  11.34   314.5,117.1         5.73        3.36         0.58        0.97        0.50
  11.50   318.6,114.6         6.11        3.37         0.55        0.97        0.50


 KFLAG =    1
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                                                PACIFIC ENVIRONMENTAL SERVICES
                                              REM2 PHOTOCHEMICAL MODEL  (4/1/771

     OCS  -  1986 IMPACT WITH SALE46 9/3
     SAN DIEGO3' TRAJECTORY - 100% TANKERING - PART 2 - 3.5HRS
     START AT 1130,END AT 1500"
     EMISSIONS GRID: SDDATA86


   TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  11.50    28.6, 24.6         6.11        3*37         0.55         0.97         0*50
  11.75    35.1,  21.5        6.61        3.38         0.51         0.96         0.50
  12.00    42.1, 19.0         7.16        3.39         0.47         0.95         0.5)
  12.25    49.0, 1.7.0        7.74        3.43         0.45         0.94         0.51
  12.50    55.1,  15.2        8.10        3.69         0.46         0.96         0.53
  12.75    60.5,  13.5        8.56        3.83         0.45         0.95         0.54
  13000    65.1, 12.0         9.07        3.90         C*4?         0.94         C*54
  13.25    69.2, 11.0         9.58        3.94         0.40         0.93         0.55
  13*5O    73.1, 10.6        10.07        3* 98        C.38         0.92         0.55
  13.75    76.7,  11.0       10.53        4.01         0.36         0.91         C*55
  14.00    80,.1,  12.0      10.96        4.03         0.34         0.90         0.56
  14.25    83.5,  13.3       11.37        4.04         0.32         0.89         0.56
  14.50    87.1, 14.2        11.74        4*O5         0.31         0.88         0.56
  14.75    91".0. 14.8       12.00        4.07         0.28         0.88         0.57
  15.00    95.1,  15.0       12.38        4.08         0.27         0.81         C*57


 KFLAG  =  1
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Cumulative Project Results

Normal and 100% Tankering Transportation Scenarios

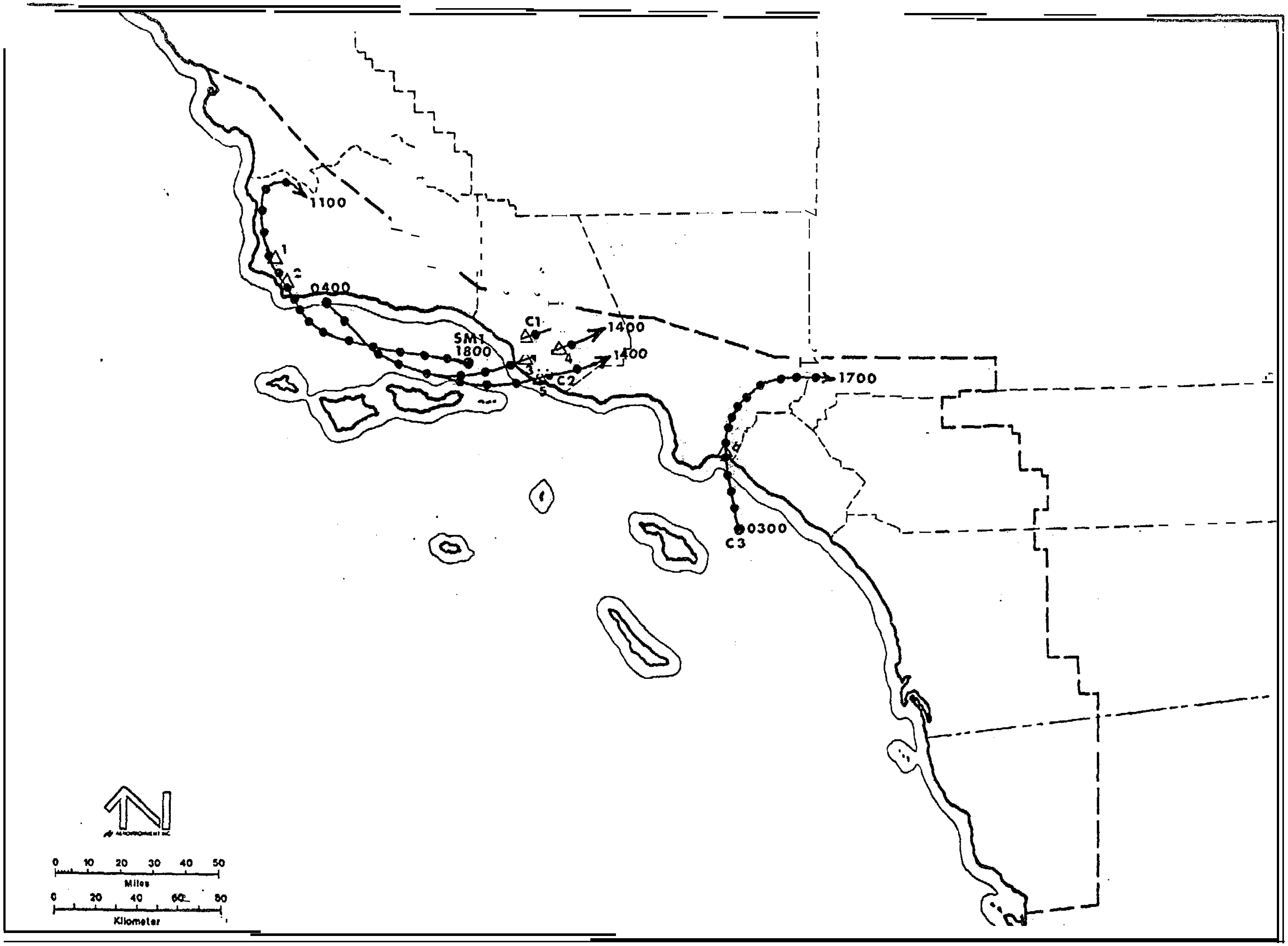

FIGURE D-7. Cumulative analysis.

Hour	x (km)	y (km)	Temp°C	Relative Humidity %	Mixing Height (m AGL)*
SANTA MARIA 1 (SM I) TRAJECTORY					
1800	264	3788	11	94	305
1900	253	3789	11	94	305
2000	242	3791	11	94	305
2100	230	3793	11	94	305
2200	219	3795	11	94	305
2300	208	3797	11	94	305
0000	199	3802	11	94	305
0100	192	3806	11	94	305
0200	186	3813	11	94	305
0300	182	3817	11	94	305
0400	177	3824	11	94	305
0500	173	3831	11	94	305
0600	168	3840	11	94	305
0700	166	3850	11	94	305
0800	165	3861	11	94	305
0900	167	3872	12	76	335
1000	177	3875	13	67	365
1100	187	3873	13	63	365
CUMULATIVE (Cl) TRAJECTORY					
0400	197	3813	17	77	150
0500	207	3803	17	73	150
0600	220	3793	18	73	150
0700	231	3788	19	68	150
0800	244	3782	21	60	150
0900	259	3780	22	56	150
1000	272	3780	24	50	150
1100	287	3781	25	44	185
1200	300	3785	27	34.	215
1300	313	3791	29	25	290
1400	328	3797	32	17	365

*meters agove ground level

Hour	x(km)	y(km)	Temp°C	Relative Humidity(S%)	Mixing Height (m AGL*)
CUMULATIVE 2 (C2) TRAJECTORY					
0400	197	3813	17	77	150
0500	207	3803	17	77	150
0600	220	3793	18	73	150
0700	231	3788	19	68	150
0800	244	3782	21	60	150
0900	259	3779	22	56	150
1000	272	3778	24	50	150
1100	289	3778	25	44	185
1200	302	3782	27	34	215
1300	316	3784	29	25	290
1400	330	3790	32	17	365
CUMULATIVE 3 (C3) TRAJECTORY					
0300	393	3706	16	82	150
0400	395	3715	17	77	150
0500	391	3721	17	77	150
0600	388	3729	18	73	150
0700	388	3738	21	56	150
0800	388	3746	24	41	150
0900	389	3752	25	39	185
1000	393	3758	27	34	215
1100	396	3764	28	29	260
1200	400	3768	29	25	305
1300	406	3773	31	21	380
1400	416	3777	33	17	455
1500	424	3778	35	16	455
1600	433	3776	35	16	453
1700	440	3773	35	16	455

* meters above ground level

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                                                            PACIFIC ENVIRONMENTAL SERVICES
                                                           REM2 PHOTOCHEMICAL MODEL (4/1/77)


          OCS  -  1986  IMPACTWITHOUT SALE-48 7/10
          CUMULATIVE 1 TRAJECTORY - OXNARD LNG AND VACA TAR SANDS PART 1 - 7 HRS
          START AT 0400, END AT 1100
          EMISSIONS GRID: OCDATA86.SALE35


  TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  4.00    47.09?1380         1.00        2.00         1.00        1*00          0*50
  4.25    49.6,310.4         0.16        2.89         0.13        1.00          0*50
  4.50    52.1,307.9         0.10        2.99         0.10        1*00          0*50
  4.75    54.6,305.4         0.08        3.02         O*17        1900          0.50
  5.00    57.0,303.0         0.12        3001         0931        1.00          0.50
  5,25    59978300.5         0.21        2.96         0943        1900          0.50
  5.50    62.7,298.0         0.39        2.88         0.53        1.00          0.50
  5.75    66.2,295.5         0.64        2.76         0.64        1.00          0.50
  6000    70.0,293.0         0.8R        2.70         0.69        O*99          0*50
  6.25    73.7,290.8         1014        2.69         o* 70       0.99          0.50
  6.50    76.8?289.2         1.40        2.73         0.64        0.99          0.49
  6,75    79.2.288,3         1.72        2.74         0.62        0.90          0.49
  7.00    81.0,288.0         2.10        2.73         0.62        O*98          0.49
  7.25    82.9,287.7         2.49      . 2.72         0.61        0.97          0.49
  7.50    85.7,286.5         2.87        2.75         0.56        0.96          0.49
  7.75    89.4,284.6         3.28        2.77         0.52        0.95          0*49
  8.00    94.1,282.0         3*73        2.77         0.51        O*95          0.49
  8,25    98.8,279.6         4.16        2*77         0.49        0.94          0*49
  8.50    102.9,278.4        4.61        2.77         0.48        0.93          0.49
  8.75    106.2*278.6        5*O3        2.79         0.44        0.91          0.49
  9*00    109.OV28O.O        5*49        2.78         O*43        0.90          0.49
  5'.25   1I107J281o5        5.92        2.78         0.42        0.89          0*49
  9.50    114.8s282.0        6.36        2.76         0.40        0.88          0.49
  9975    118.2s281.5        6.79        2.75         0.39        0.87          0.49
 10.00    122.0s280.0        7.18        2.75         0.37        0.85          O*49
 10.25    126.0,278.5        7.23        2.74         0.37        O*85          O*49
 10.50    129.9s278.2        7*30        2.72         0.38        0.85          0.49
 10.75    133.5027901        7.39        2.69         0.37        0.84          0.49
 11.00    137.1,281.0        7.49        2.66         0.37        0.84          0.49



 KFLAG  =  1
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                                                      PACIFIC ENVIRONRENTAL SERVICES
                                                     REM2 PHOTOCHEMICAL MODEL  (4/1/77)


          OCS  -  1986 IMPACTWITHOUT SALE-48  7/10
          CUMULATIVE 1 TRAJECTORY - OXNARD LNG AND VACA TAR SANDS  PART 2 - 3 HRS
          START AT 1100; END AT 1400
          EH1SS1OBS GRID: V2DATA86.SALE35


  TIME    POSITION (X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)    CO (PPM)

  11.00    17.0, 1s.0          7.49        2.66         0.37        0.84         0.49
  11.17    19.3, 16.5          7.74        2.65         0.35        0.83         0.49
  11.33    21.5, 17.7          8.00        2.64         0.35        0.83         0.50
  11.50    23.7, 18.5          8.18        2.70         0.35        0.83         0.50
  11.67    25.9, 19.0          7.81        3.33         0.47        0.83         0.51
  11.83    28.0, 19.2          7.88        3.53         0.48        0.84         0.52
  12.00    30.0, 19.0          8.03        3.64         0.48        0.84         0.53
  12.17    32.1, 18.8          8.19        3.67         0.48        0.85         0.53
  12.34    34.2, 19.2          8.33        3.71         0.48        0.65         0.53
  12.50    36.3, 19.9          8.13        4.06         0.55        0.85         0.54
  12.67    38.5, 21.2          8.18        4.18         0.54        0.85         0.54
  12.83    40.7, 22.9          8.34        4.19         0.53        0.85         0.55
  13.00    43.1, 25.0          8.57        4.11         0.50        0.85         0.55
  13.17    45.4, 27.2          8.79        4.02         0.48        0.84         0.55
  13.33    47.8, 28.8          8.99        3.94         0.45        0.84         0.55
  13.50    50.2, 30.0          9.18        3.85         0.43        0.84         0.54
  13.67    52.8, 30.8          9.35        3.77         0.41        0.84         0.54
  13.83    55.4, 31.1          9.50        3.70         0*39        0.84         0.54
  14.00    58.0, 31.0          9.63        3.63         0.37        0.84         0.54



 KFLAG  =  1
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                                                PACIFIC ENVIRONMENTAL SERVICES
                                              REM2 PHOTOCHEMICAL MODEL  (4/1/77)


          OCS  -  1986 IMPACT WITH SALE-48 - 7/10
          CUMULATIVE 1 TRAJECTORY - OXNARD LNG AND VACA TAR SANDS - PART 1 - 7 HRS
          START AT 0400,END AT 1100
          EMISSIONS GRID: OCDATA86.SALE48


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)    CO(PPM)

  4.00     47.0,-413.0        1.00        2.00         1.00        1.0C        0.50
  4.25     4?.6,310.4         0.16        2.89         0.13        1.0C        0.53
  4.50     52.1,307.9         0.10        2.99         0.10        1*OC        0.5J
  4.75     54.6,305.4         0.08        3.02         0.17        1.0C        ().50
  5.00     57.0,303.0         0.12        3.01         0.31        1.00        0.50
  5.25     59.?,300,5         0.21        2.96         0.43        1.0C        0.50
  5.50     62.7,?98.0         0.38        2.88         0*54        1.00        0.50
  5.75     66.2,295.5         0.62        2.78         0.67        1.00        0..50
  6.00     70.0,293.0         0.85        2.73         C.73        1.0C        0.53
  6.25     73.7,290.8         1.09        2.74         0.74        1.00        0.50
  6.50     76.8,289.2         1.33        2.80         0.69        1.01        0.50
  6.75     79.2,288.3         1.65        2.83         0.66        1.01        0.49'
  7.00     81.0,288.0         2.04        2.82         0.66        I o o       0.49
  7.25     82.9,287.7         2.44        2.83         0.64        1.00        0.49
  7.50     85.7,286.5         2.83        2.86         0.59        0.99        0.49
  7.75     89.4,284.6         3.25        2.89         0.55        0.98        0.49
  8.00     94.1,282.0         3.72        2.88         0.53        0.97        0.49
  8.25     98.8,279.6         4*17        2.88         0.51        0.96        0.49
  8.50    102.9,278.4         4.64        2.88         0.50        0.95        O*49
  8.75    106.2,278.6         5.08        2.90         0.46        0.94        0.49
  9.00    109.0,280.0         5.55        2.90         0.44        0.93        0.49
  9.25    111.7,281.5         6.01        2.89         0.43        0.92        0.49
  9.50    114.8,28?.0         6.46        2.88         0.41        0.90        0.49
  9.75    118.2.281.5         6.90        2.87         0.40        0.89        0.49
 10.00    122.0,280.0         7031        2.88         0.38        0.88        0.49
 10.25    126.0,278.5         7.36        2.87         0.38        0.87        0.49
 10.50    129.8,278.2         7.43        2.85         0.39        0.87        0.49
 10.75    133.5??79.0         7.53        2.82         0.38        0.86        0.49
 11.00    137.0,?81.0         7.63        2.78         0.38        0.86        0.50



 KFLAG  =  1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)


          OCS  -  1986 IMPACT WITH SALE-48  -  7/10
          CUMULATIVE 1 TRAJECTORY  - OXNARD LNG ANO VACA TAR SANDS PAPT 2 - 3 HRS
          STARTAT 1100.. END AT 1400
          EMISSIONS GRID: V2DATA86.SALE48


    TIME     POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)     NMHC(PPMC)     CO(PPM)

   11.00     17.0, 15.0          7.63          2.78          0.38          0.85          O*5O
   11.17     19.3, 16.5          7.09          2.77          0.36          0.85          O*5O
   11.34     21.5, 17.7          8.15          2.75          0*35          0.84          0.50
   11.50     23.7, 18.5          8.34          2.82          0.36          0.85          0.50
   11.67     25.9, 19.0          6.00          3*4+          0.47          0.85          0051
   11.84     28.0, 19.2          8.08          3.65          0.48          0.85          0.52
   12.00     30.0, 19.0          8.23          3.75          0.49          o* 86         O*53
   12.17     32.1, 18.8          8.39          3.78          0.48          0.86          O*53
   12.33     34.2, 19.2          8.'53         3.82          0.48          0.87          0.53
   12.50     36..3, 19.9         8.33          4.17          0055          0. 87         0954
   12.67     38.5, 21.2          8.38          4.29          0.55          0.87          0.54
   12.83     40.7, 22.9          8*54          4.29          0*53          0.87          O*55
   13*00     43.0, 25.0          8.77          4.22          0.50          0.86          0.55
   13.17     45.4, 27.1          8.99          4.13          0.48          0.86          O*55
   13.33     47.8, 28.8          9.19          4004          0.46          O*86          0.55
   13050     50.2, 3000          9.38          3.95          0.43          0.86          0.55
   13.67     52.8, 30.8          9.55          3.87          0*4I          0.86          O*54
   13.84     55.4, 31.1          9.70          3*79          0.40          0.86          0.54
   14000     58.1, 31.0          9.84          3.72          0.38          0.86          0.54



  KFLAG =    1
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                                              PACIFIC ENVIRONMENTAL SEEVICES
                                            REM2 PHOTOCHEMICAL MODEL (4/1/77)

          Ocs  -  19B6 IMPACT WITHOUT SALE-48 - 7/10
          CUMULATIVE 2 TRAJECTORY - ELK HILLS - PART1 7 HRS
          START AT 0400, END AT 1100
          EMISSIONS GRID: OCDATA86.SALE35


  TINE   POSITION(X,Y)   O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO (PPM)

  4.00    47.0,313.0      1.00        2.00        1.00        1.00        0.50
  4.25    49.6,310.U      0. 16       2.89        0.13        1.00        0.50
  4.50    52.1,307.9      0.$0        2.99        0.10        1.00        0.50
  4.75    54.6,305. U     0.08        3.02        0.17        1.00        0.50
  5.00    57.0,303.0      0.12        3.01        0.31        1.00        0.50
  5.25    59.7,300.5      0.21        2.96        0.43        1.00        0.50
  5.50    62.7,298.0      0.39        2.88        0.53        1.00        0.50
  5.75    66.2,295.5      0.64        2.76        0.64        1.00        0.50
  6.00    70.0,293.0      0.88        2.70        0.69        0.99        0.50
  6.25    73.7,290.8      1.14        2.69        0.70        0.99        0.50
  6.50    76.8,289.2      1.40        2.73        0.64        0.99        0.49
  6.75    79.2.288.3      1.72        2.74        0.62        0.98        0.49
  7.00    81.0,288.0      2.10        2.73        0.62        0.98        0.49
  7.25    82.9,287.7      2.49        2.72        0.61        0.97        0.49
  7.50    85.7,286.5      2.87        2.75        0.56        0.96        0.49
  7.75    89.4,284.6      3.28        2.77        0.52        0.95        0.49
  8.00    94.1,282.0      3.73        2.77        0.51        0.95        0.49
  8.25    98.8,279.5      4.16        2.77        0.49        0.94        0.49
  8.50   102.9,278.2      4.61        2.77        0.48        0.93        0.49
  0.75   106.2,278.0      5.03        2.78        0.44        0.91        0.49
  9.00   109.0,279.0      5.48        2.78        0.43        0.90        0.49
  9.25   111.7,280.1      5.93        2.77        0.42        0.89        0.49
  9.50   114.7,280.3      6.36        2.76        0.40        0.88        0.49
  9.75   118.2,279.6      6.79        2.75        0.39        0.87        0.49
 10.00   122.0,278.0      7.18        2.75        0.37        0.85        0.49
 10.25   126.2,276.5      7.22        2.74        0.37        0.85        0.49
 10.50   130.4,276.0      7.29        2.73        0.38        0.05        0.49
 10.75   134.6,276.5      7.39        2.69        0.37        0.84        0.49
 11.00   139.1,278.0      7.49        2.66        0.37        0.84        0.49



KFLAG  =  1
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                REM 2 PHOTOCHEMICAL MODEL   (4/1/77)


   OCS  -  1986 IMPACT WITHOUT SALE-48  7/10
   CUMULATIVE 2 TRAJECTORY - ELKHILLS - PART 2 - 3 HRS
   START AT 1100, END AT 1400
   EMISSIONS GRID: V2DATA86.SALE35


  TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

 11.00     19.0, 17.0         7.49         2.66         0.37        0.84         0.49
 11.17     21.3, 13.3         7.73         2.64         0.36        0.83         0.49
 11.33     24.4, 14.3         7.93         2.66         0.36        0.84         0.50
 11.50     26.7, 15.1         7.90         2.87         0.39        0.92         0.50
 11.67     28.8, 15.6         7.95         3.05         0.41        0.93         0.51
 11.84     30.5$ 15.9         8.08         3.16         0.41        0.92         0.52
 12.00     32.0, 16.0         8.24         3.23         0.42        0.91         0.53
 12.17     33.5, 16.0         8.40         3.24         0.41        0.90         0.53
 12.34     35.4, 16.2         8.58         3.23         0.40        0.88         0.53
 12*50     37.6, 16.5         8.75         3.20         0.39        0.87         0.53
 12.67     40.1, 16.9         8.89         3.18         0.38        0.86         0.54
 12.83     42.9, 17.4         9.02         3.16         0.37        0.85         0.54
 13.00     46.1, 18.0         9.14         3.15         0.36        0.84         0.54
 13.17     49.2, 18.8         9.15         3.22         0.37        0.84         0.55
 13.34     52.0, 19.6         9.23         3.22         0.36        0.83         0.55
 13.50     54.5. 20.6         9.34         3.19         0.35        0.82         0.55
 13.67     56.7, 21.6         9.41         3*18         0.35        0.82         C.55
 13.84     58.5, 22.8         9.47         3.18         0.34        0.81         0.55
 14.00     60.0, 24.0         9.52         3.18         0.33        0.81         0.56



 KFLAG  =  1
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                                                         PACIFIC ENVIRONMENTALSERVICES
                                                      REM2 PHOTOCHEMICAL MODEL  (4/1/77)


     OCS  -  1986IMPACT WITH SALE-48 - 7/10
     CUMULATIVE 2 Trajectory - ELK HILLS-PART 1 - 7 HRS
     STARTAT0400,END AT 1100
     EMISSIONS GRID: OCDATA86.SALE48


  TIME    POSITION(X,Y)      03( PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

  4.00     47.0,313.0         1.00          2* 00         1.00         1.00         0.50
  4.25     49.6,310.4         0.16          2.89          0.13         1.00         0.50
  4.50     52.1,307.9         0.10          2.99          0.10         1.00         0.50
  4.75     54.6,305.4         0.08          3,02          0.17         1.00         0.50
  5.00     57.0,303.0         0.12          3.01          0.31         1.00         0.50
  5.25     59.7,300.5         0.21          2.96          0.43         1.00         0.50
  5.50     62.7,298.0         0.38          2.89          0.54         1.00         0.50
  5.75     66.?,295.5         0.62          2.78          0.67         L*OC         0.50
  6.00     70.0,293.0         0.85          2.73          O*73         1.00         O*5O
  6.25     73.7,290-8         1.09          2.74          0.74         1.00         0.50
  6.50     76.8,289.2         1.33          2.8.0         0.69         1.01         0.50
  6.75     79.2,288.3         1.65          2.83          0.66         1.01         0.49
  7.00     91.0,288.0         2.04          2.82          0.66         1.0C         0.49
  7.25     82.9,?87.7         2.44          2.03          0.64         1.00         0.49
  7.50     85.7,286.5         2.83          2.86          0.59         0.99         0.49
  7.75     89.4,284.6         3.25          2.89          O*55         0.98         0.49
  8.00     94.1,282.0         3.72          2.88          0.53         0.97         0.49
  8.25     98.8,279.5         4.17          2.88          0.51         0.96         0.49
  8.50    102.9,278.2         4.64          2.88          0.50         0.95         0.49
  8.75    106.2,278.0         5.08          2.90          0.46         0.94         0.49
  9.00    109.0,279.0         5.55          2*90          0.44         0.93         0.49
  9.25    111.7,280.1         6.01          2.89          0.43         0.92         0.49
  9.50    114.7,280.3         6.47          2.88          0.41         0.90         0.49
  9*75    118.2,279.6         6.90          2.87          0.40         0.89         0.49
 10.00    122.0,278.0         7.30          2.88          0.38         0.88         0.49
 10.25    126.1s276.5         7.34          2.80          0.39         0.87         0.49
 10.50    130.3,276.0         7.41          2.87          0.39         0.87         0.49
 10.75    134.7,?76.5         7.5?          2.83          0.39         0.66         0.49
 11.00    139.1,278.0         7.63          2.79          0.3s         0.86         0.50


 KFLAG =   1
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL   (4/1/77)


      OCS  -  1986 IMPACT WITH SALE-48 - 7/10
      CUMULATIVE 2 TRAJECTORY - ELK HILLS - PART 2 - 3 HRS
      START AT 1100, END AT 1400
      EMISSIONS GRID:V2DATA86.SALE48


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  11.00    19.0. 12.0        7.63        2.79         0.38        0.85        0.50
  11.17    21.9,  13.3       7.88        2.77         0.36        0.85        0.50
  11.34    24.4,  14.3       8.09        2.79         0.37        0.86        0.50
  11.50    26.7,  15.0       8.07        2.99         0.40        0.94        0.50
  11.67    28.7,  15.6       8.12        3.17         0.41        0.95        0.51
  11.84    30.5,  15.9       8.26        3.,?8        0.42        0.94        0.52
  12.00    32.0,  16.0       8.43        3.35         0.42        0.93        0.53
  12.17    33.5,  16.0       8.59        3.36         C.41        C.91        0.53
  12.33    35.4,  16.?       8.77        3*35         0.40        0.9C        0.53
  12.50    37.6,  16.5       8.94        3.32         0.39        0.89        0.53
  12.67    40.0,  16.8       9.09        3.30         0.38        0.88        0.54
  12.83    42.9,  17.4       9.22        3.28         0.37        0.87        0.54
  13.00    46.0,  18.0       9.33        3.26         0.37        0.86        0.54
  13.17    49.1,  18.7       9.35        3.33         0.37        0.85        0.55
  13.34    52.0,  19.6       9.43        3.34         0.37        0.85        0.55
  13*50    54.5,  20.6       9.53        3.30         0.36        0.84        0.55
  13.67    56.6,  21.6       9.61        3.28         0.35        0.83        0.55
  13.83    58.5,  22.8       9.66        3.28         0.34        0.8?        0.55
  14.00    60.0,  24.0       9.72        3.28         0.34        0.82        0.56



KFLAG =    1
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                                                      PACIFIC ENVIRONMENTAL SERVICES
                                                     REM2 PHOTOCHEMICAL MODEL  (4/1/77)

     OCS  -  1986 IMPACT WITHOUT SALE-48 -  7/25
     CUMULATIVE 3 TRAJECTORY - SOHIO TERMINAL - PART 1 - 3 HRS
     START AT 0300, END AT 0600
     EMISSIONS GRID: OCDATA86.SALE35


  TIME    POSITION(X,Y)      O3(PPHM)      NO2(PPHM)      NO(PPHM)     NMHC(PPMC)     CO (PPM)

  3.00    245.0.206.0          1.00           4.00          3.00          2.00          2.00
  3.25    245.0,208.3          0.00           5.07          1.94          2.01          2.01
  3.50    245.0,210.5          0.00           5.12          1.93          2.01          2.01
  3.75    245.0,212.8          0.00           5.13          1.92          2.01          2.01
  4.00    245.0,215.0          0.00           5.13          1.93          2.01          2.01
  4.25    244.7.217.1          0.00           5.12          1.94          2.01          2.01
  4.50    244.0.218.8          0.01           5.11          1.96          2.00          2.00
  4.75    242.7,220.1          0.00           5.12          1.95          2.00          2.00
  5.00    241.0,221.0          0.03           5.08          1.98          2.00          2.00
  5.25    239.3.222.1          0.03           5.09          1.97          1.99          2.00
  5.50    238.3.223.8          0.12           5.05          2.00          1.99          1.99
  5.75    237.8.226.1          0.29           5.02          2.01          1.99          1.99
  6.00    238.0.229.0          0.48           5.09          1.93          1.98          1.99



 KFLAG  =  1
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PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL (4/1/77)

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Ocs - 1986 IMPACT WITHOUT SALE-48 - 7/25
CUMULATIVE 3 TRAJECTORY - SOHIO TERMINAL - PART 2 - 11 HRS
START AT 0600, END AT 1700
EHXSS1ONS GRID: LADATA86.SALE35

 TIRE   POSITION(X,Y)   O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 6.00    25.5, 10.6      0.48        5.09        1.93        1.98        1.99
 6.25    25.7, 12.5      0.53        5.26        2.08        2.00        2.00
 6.50    25.8, 14.0      0.68        5.60        2.58        2.03        2.02
 6.75    25.7, 15.3      0.80        6.19        2.87        2.07        2.04
 7.00    25.5, 16.2      0.74        7.17        4.57        2.16        2.06
 7.25    25.3, 17.1      0.50        8.80        9.68        2.31        2.10
 7.50    25.2, 18.2      0.51       11.38       13.20        2.44        2.16
 7.75    25.3, 19.6      0.79       14.41       11.93        2.46        2.23
 8.00    25.5, 21.2      1.32       17.60        9.39        2.48        2.26
 8.25    25.8, 22.7      2.18       19.57        6.78        2.45        2.28
 8.50    26.0, 23.8      3.40       20.79        4.90        2.40        2.29
 8.75    26.1. 24.6      4.81       21.44        3.57        2.35        2.31
 9.00    26.1, 24.9      6.46       21.51        2.80        2.31        2.32
 9.25    26.3. 25.3      8.21       21.30        2.34        2.26        2.33
 9.50    26.7, 26.0      9.82       20.99        1.98        2.21        2.34
 9.75    27.5, 27.1     11.28       20.67        1.74        2.17        2.35
10.00    28.6, 28.7     12.64       20.27        1.57        2.14        2.36
10.25    29.7, 30.2     ?3. 61      19.67        1.44        2.11        2.36
10.50    30.3. 31.3     14.47       19.15        1.32        2.09        2.37
10.75    30.6, 32.0     15.39       18.50        1.23        2.06        2.37
11.00    30.5. 32.4     16.22       17.97        1.13        2.03        2.37
11.25    30.4, 32.6     16.98       17.25        1.07        2.01        2.37
11.50    30.6, 33.2     17.68       16.62        0.99        1.98        2.37
11.75    31.6, 33.9     18.27       16.04        0.92        1.95        2.37
12.00    33.0, 34.9     18.65       15.62        0.88        1.94        2.38
12.25    34.4, 35.9     18.53       15.06        0.86        1.93        2.38
12.50    35.4, 36.7     18.54       14.49        0.82        1.92        2.37
12.75    36.2, 37.4     18.62       13.90        0.78        1.90        2.37
13.00    36.7, 38.0     18.75       13.32        0.73        1.89        2.36
13.25    37.3, 38.5     1.8-87      12.77        0.70        1.87        2.35
13.50    38.6, 39.1     18.97       12.27        0.65        1.85        2.34
13.75    40.4, 39.7     19.06       11.78        0.62        1.84        2.33
14.00    42.9, 40.5     19.12       11.35        0.59        1.83        2.32
14.25    45.3, 41.1     19.95       11.15        0.54        1.81        2.33
14.50    47.0, 41.4     20.71       10.89        0.50        1.79        2.33
14.75    47.8, 41.4     21.41       10.62        0.46        1.78        2.34
15.00    47.9, 41.1     22.02       10.35        0.42        1.77        2.34
15.25    48.0, 40.6     22.55       10.08        0.38        1.76        2.34
15.50    49.0, 40.3     23.02        9.82        0.36        1.75        2.35
15.75    50.8. 40.0     23.46        9.57        0.33        1.75        2.35
16.00    53.5, 39.8     23.86        9.37        O*3O        1.76        2.35
16.25    56.1, 39.6     24.17        9.22        0.26        1.77        2.36
16.50    57.7, 39.2     24.41        9.09        0.23        1.77        2.36
16.75    58.2, 38.6     24.61        8.98        0.20        1.78        2.37
17.00    57.8, 38.0     24.75        8.90        0.18        1.78        2.38
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                REM2 PHOTOCHEMICAL MCDEL  (4/1/77)


        OCS  -  1986 IMPACT WITH SALE-48 -  7/25
        CUMULATIVE 3 TRAJECTORY - SOHIO TERMINAL  PART 1 - 3 HRS
        START AT 0300, END AT 0600
        EMISSICNS GRID: OCDATA86.SALE48


      TIME    POS1TION(X,Y)      O3(PPHM)    NO2(PPHM)    NO(PPHM)    NNHC(PPMC)    CO(PPM)

      3.00    245.0,206.0          1.00        4.00         3.00        2.0C         2.00
      3.25    245.0,208.3          0.00        5.06         1.96        2.00         2.00
      3.50    245.0,210.5          0.00        5*09         1.95        2.00         2.00
      3. ?5   245.0,212.8          0.00        5.10         1.95        2.00         2.00
      4.00    245.0,215.0          0.00        5.11         1.96        2.00         2.00
      4.25    244.7,217.1          0.00        5.11         1.98        2.00         2.00
      4.50    ?44.0,?18.8          O*OL        5.10         2.00        2.0C         2.00
      4.75    242.7,220.1          0.00        5.12         1.99        2.00         2.00
      5.00    241.0,221.0          0.03        5* 09        2.03        2.00         2*OO
      5.25    239.3,222.1          0.03        5.10         2.03        2.00         2.00
      5*5O    238.3,223.8          0.12        5.07         2.06        2.00         2.00
      5.75    237.8,226.1          0.28        5.06         2*08        2.00         2.00
      6.00    238.0,229.0          0.47        5.13         2.00        2.00         2.00



     KFLAG  =  1
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                                          PACIFIC ENVIRONMENTAL SERVICES
                                        REM2 PHCTOCHEMICAL MODEL   (4/1/77)

      Ocs  -  1986 IMPACT WITH SALE-48 - 7/25
      cumulative 3 TRAJECTORY - SOHIO TERMINAL - PART 2-11HRS
      STARTAT 0600, END AT 1700
      EMISSIONS GRID: LADATA86.SALE48

    TIME   POS1TION{,X,YI    O3(PPHM)   NO2(PPHM)   NO(PPHM)  NMHC(PPMC)  CO(PPM)

    6.00   25.5, 10.6        0.47        5.13       2.0C       2.00       ?.00
    6.25   25.7, 12.5        0.52        5.30"      2.14       2.01       2.01
    6.50   25.8, 14.0-       0.66        5.65       2.71       2.05       2.03
    6.75   25.7, 15.3        0.73        6.29       3.24       2.10       2.04
    T.00   25.5, 16.2        0.66        7.31       5.21       2.19       2.07
    7.25   25.3, 17.1        0.47        8.93"     10.40       2.35       2.11
    7.50   25.2, 18.2        0.50       11.49      13.92       2.48       2.17
    7.75   25.3, 19.6        0 . 7 7    14.55      12.6C       2.50       2.24
    8.00   25.5, 21.2        1.29       17.86       9*95       2.51       2.27
    8.25   25.8; 22.7        2.09       20.05       7.08       2.48       2.29
    8.50   26.0, 23.8        3.28       21.37       5.07       2.43       2.30
    8.75   26.1, 24.6        4.79       21.96       3.76       2.39       2.32
    9*00   26.1, 24.9        6.48       22.06       2.93       2.34       2.33
    9.25   26.3, 25.3        8.19       21.91       2.37       2.29       2.34
    9.50   26.7, 26.0        9.84       21.58       2.01       2.24       2.35
    9.?5   27.5, 27.1       11.34       21.22       1.78       2.20       2.36
   10.00   26.,6, 28.7      12.75       20.81       1.59       2.1?       2.37
   10.25   29.7, 30.2       13.75       20.19       1.45       2.14       2.37
   10.50   30.3, 31.3       14.64       19.61       1.36       2.12       2.38
   10.75   3C.6, 32.0       15.55       18.95       1.25       2.09       2.38
   11.00   30.5, 32.4       16.40       18.30       1.15       2.06       2.38
   11.25   30.4, 32.6       17.16       17.67       1.06       2.03       2.38
   11.50   30.8, 33.2       17.88       17.01       1*00       2.00       2.38
   11*75   31.6, 33.9       18.49       16.41       0.93       1.98       2.30
   12.00   33p, 34.9        18.88       15.97       0.89       1.96       2.39
   12.25   34.4, 35.9       18.76       15.40       0.87       1.95       2.39
   12.50   35.4, 36.7       18.76       14.80       0.83       1.94       2.39
   12.75   36.2, 37.4       18.85       14.19       (3.76      1.92       2.38
   13.00   36.7, 38.0       18.98       13.59       0.74       1.91       2.37
   13.25   37.3, 38.5       19.11       13.02       0.71       1.89       2.36
   13.50   38.6, 39.1       19.22       12.51       0.66       1.87       2.35
   13.75   40.4, 39.7       19.31       12.02       0.63       1*86       2.35
   14.00   42.9, 40.4       19.37       11.59       0.59       1.84       2.34
   14.25   45.3* 41.1       20.22       11.37       0.55       1.83       2.34
   14.50   46.9, 41.4       21.01       11.11       0.51       1.81       2.35
   14.75   47.8, 41.4       21.70       10.B4       0.46       1.8C       2.35
 " 15..007 47.9, 41.1       22.32       10.56       0.42       1.79       2.35
   15.25   48.0, 40.6       22.86       10* 30      0.37       1.78       2.36
   15.5C   49.0, 40.3       23.35       10.02       0.36       1.77       2.36
   15.75   50.8, 40.0       23.78        9.80       0.31       1.77       2.36
   16.00   53.5, 39.8       24.19        9.57       0.30       1.78       2.37
   16.25   56.1, 39.6       24.52        9.41       0.27       1.79       2.37
   16.50   57.7, 39.2       24.78        9.28       0.24       1.79       2.38
   16.75   58.2, 38.6       24.99        9.16       0.21       1.8C       2.39
   17.00   57.8, 37.9       25.14        9.08       0.19       1.81       2.39
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                                                        PACIFIC Environmental SERVICES
                                                       REM2 PHOTOCHEMICAL MODEL  (4/1/77)


        OCS  -  1986 IMPACT WITHOUT SALE-48 - 2/28
        SANTA MARIA 1 TRAJECTORY  - POINT CONCEPTION LNG - PART 1 - 11 HRS
        START AT 1800, END AT 0500
        EMISSIONS GRID: OCDATA86.SALE35


 TIME   POSITION(X,Y)     O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

18.00   114.0  )288.0       1.00       4.00       1*00        1000        1.00
18.25   111*2  *288.1       0.17       4.68       0*12        1.00        1.00
18.50   108.4,288.3         0.11       4.94       0.05        1.00        1.00
18.75   105.7,288.6         0.10       4.97       0.03        1.00        1.00
19.00   103.0,289.0         0.09       4.98       0.02        1.00        1000
19.25   100.3,289.5         0.08       4.98       0.02        O*99        1.00
19.50    97.5,290.0         0.07       4.98       0.01        0.99        1900
19.75    94.8,290.5         0.07       4.98       0.01        0.99        1.00
20.00    92.0,291.0         0*07       4.98       0.00        0.99        1000
20.25    89.1,291.5         0.07       4.97       0.00        0999        1.00
20.50    86.2s292.0         0.07       4.96       0.00        0.99        1*OO
20.75    83.1 ,292.5        0.07       4.96       0.00        0.98        1.00
21.00    80.0 ,293.0        O*G7       4.95       0.00        0.98        1000
21.25    76.9,293.5         0007       4094       0000        0998        1*OO
21.50    74.0,294.0         0907       4.94       0.00        0.98        1.00
21.75    71.4 ,294.5        0.07       4*93       0*00        0098        1*OO
22.00    69.0,295.0         0.07       4.92       0*00        0.98        1.00
22.25    66.6,295.5         0.07       4.91       0*00        0.98        1.00
22.50    64.0,296.0         0.07       4.91       0.00        0.97        1.00
22.75    61.1,296.5         0.07       4.90       0.00        O*97        1.00
23.00    58.0,297.0         0.07       4.90       0.01        0.97        1.00
2?s25    55.0s297.,7        0.06       4.90       0*01        0.9?        1*O9
23.50    52.5,298.8         0.06       4090       0002        0.97        1*OO
23.75    50.5,300.2         0.06       4.91       0.03        0.97        1*01
24.00    49.0,302.0         0.05       4.92       0004        0.97        1.01
24.25    47.6,303.8         0.04       4*93       0005        0097        1901
24.50    46.0$305,0         0.03       4.95       0.06        0.97        1001
24.75    44.1,305.8         0002       4.96       0807        0.96        1.01
25.00    42.0,306.0         0.02       4.97       0.08        0.96        1*01
25.25    40.09306.5         0.01       4.97       0.08        0.96        1.01
25.50    38.3,307.8         0.01       4.98       0.08        0.96        1900
25.75    37.0,310.0         0.01       4*98       0.09        0.96        1*00
26.00    36.0,313.0         0.01       4.98       0.10        0.96        1.00
26.25    35.2,315.9         0.00       4.98       O*13        0.96        1000
26.50    34.2,317.5         0.00       4.98       O*15        0.96        1000
26.75    33.2,317.9         O*OO       4.9?       0.17        0.96        1.00
27.00    32.0,317.0         0.00       4*97       0.19        0.96        1*00
27.25    3080s3164?         0000       4.96       0.20        0 . 9  5    1.00
27.50    29.6,317.3         0000       4.96       0.22        0.95        0.99
21.75    28.39319.9         0.00       4*95       O*22        O*95        0.99
28*OO    27.0,324.1         0.00       4.95       O*22        0.95        0.99
28.25    25.8,328.3         O*OO       4*94       O*22        O*95        0099
28.50    24.7,330.8         0.00       4,93       O*22        O*95        0.99
28.75    23.8,331.7         0.00       4.93       0.22        0.95        0.99
29.00    23.0,331.1         0,00       4.92       0.22        0.95        0.99
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                                                PACIFIC ENVIRONMENTAL SERVICES
                                                REM2 PHCTOCHEMICAL MCDEL " (4/1/77)

   OCS  -  1986  IMPACTWITHOUT SALE-48 - 2/28
   SANTA MARIA 1 TRAJECTORY - PCINT CONCEPTION LNG - PART 2 - 6 HRS
   START AT 0500, END AT 1100
   EMISSICNS GRID: `OCDATA86.SALE35


  TIME     POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

  5.00      23.0,331.0          0.00          4.92         0.22.        0.95         0.99
  5.25      22.2,330.4          0.00          4.92         0.22         0.95         0.99
  5.50      21.0,331.6          O*OO          4.92         0.22         0.95         0.99
  5.75      19.7s334.9          0.00          4.92         0.22         0.95         0.99
  6.00      18.0,340.0          0.00          4.92         0.22         0.95         0.99
  6.25      16.5,345.1          0.00          4.92         0.22         0.95         O*99
  6.50      15.7,348.5          0.24          4.69         0.45         0.95         0.99
  6.75      15.5?350.1          0.48          4051         0.62         0.95         0.99
  7.00      16.0.350.0          0.65          4.46         0.68         0.95         0.99
  7.25      16.6,349.9          0.79          4.48         0.65         0.95         0.99
  7.50      16.6,351.8          1.07          4.40         0.72         0.94         0.99
  7.75      16.6,355.5          1.46          4.29         0.82         0.94         0.99
  8.00      16.0,361.1          1.83          4.24         0.85         0.94         0.99
  8.25      15.5*366.6          2.15          4.28         0.81         0.93         C*99
  8.50      15.5,370.3          2.45          4.34         0.73         0.93         0.99
  8.75      16.0,'372.1         2.87          4.31         0.74         0.92         0.99
  9*00      17.0,372.0          3.29          4.30         0.73         0.92         0.99
  9.25      18.6,371.4          3.71          4.31         0.70         0.91         0.99
  9.50      20.8,371.7          4.14          4.31         0.68         0.9C         0.99
  9.75      23.7,372.9          4.55          4.33         0.63         0.90         0099
 10.00      27.1,375.0          4.99          4.32         0.61         0.89         0.99
 10.25      3C.4,376.7          5.50          4.32         0.58         0.88         0.99
 10.50      33.2,377.0          6.01          4.31         0.55         0.87         0.99
 10.75      35.4,375.7          6.50          4.30         0.52         0.86         0.99
 11.00      37.0,373.0          6.98          4.29         0.48         0.85         0.99


 KFLAG  =  1
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                                                PACIFIC ENVIRONMENTAL SERVICES
                                              REM2 PHOTOCHEMICAL MODEL  (4/1/77)


      Ocs  -  1986 IMPACT WITH SALE-48 - 2/28
      SANTA MARIA 1 TRAJECTORY - POINT CONCEPTION LNG - PART 1-11 HRS
      START AT 1800, ENO AT  0500
      EMISSIONS GRID: OCDATA86.SALE48


 TIME   POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

 18.00   114.0,288.0        1.00        4.00         1.00        1.00        1.00
 18.25   111.2,288.1        0.17        4.68         0.12        1.00        1.00
 18.50   108.4*288.3        0.11        4.95         0.05        1.00        1.00
 18.75   105.7,288.6        0.09        4.97         0.03        1.00        1.00
 19.00   103.0,289.0        0.08        4.98         0.03        1.00        1.00
 19.25   100.3,289.5        0.07        4.99         0.02        0.99        1.00
 19.50    97.5,290.0        0.07        4.99         0.02        0.99        1.00
 19.75    94.8,290.5        0.06        4.99         0.01        0.99        1*OO
 20.00    92.0,291.0        0.06        4.99         0.01        0.99        1.00
 20.25    89.1,291.5        0.06        4.99         0.00        0.99        1.00
 20.50    86.2,292.0        0.06        4.98         0.00        0.95        1*OO
 20.75    83.1,292.5        0.06        4.98         0.00        0.99        1000
 21.00    80.0,293.0        0.06        4.97         0.01        0.99        1.01
 21.25    76.9,293.5        0.06        4.97         0.01        0.99        1.01
 21.50    74.0,294.0        0.05        4.97         0.02        1.00        1.01
 21.75    71.4,294.5        0.05        4.97         0.03        1.00        1.01
 22.00    69.0,295.0        0.04        4.98         0.04        1.00        1.01
 22.25    66.6,295.5        0.04        4.98         0.04        1.00        1.01
 22.50    64.0,296.0        0.03        4.99         0*04        1*OC        1.01
 22.75    61.1s296.5        0.03        4.99         0.05        1.00        1.00
 23.00    58.0,297.0        0.02        4.99         0.05        1.00        1.00
 23.25    55.0,297.7        0.02        4,99         0.05        1*OC        1*00
 23.50    52.5,298.8        0.02        5.00         0.05        1.00        1.00
 23.75    50.5,300.2        0.01        5.00         0.07        1.00        1*00
 24.00    4'3.0,302.0       0.01        5.00         0.09        1.00        1.00
 24.25    47.6,303.8        0.01        5.00         0.10        0.99        1.00
 24.50    46.0,305.0        0.01        5.01         0.12        0.99        1.00
 24.75    44.1,305.8        0.00        5.01         0.14        0.99        1.00
 25.00    42.0,306.0        0.00        5.01         0.15        0.99        1.00
 25.25    40.0,306.5        O*OO        5.00         0.17        0.99        1*00
 25.50    38.3,307.8        0.00        5.00         0.17        0.99        1.00
 25.75    37.0,310.0        O*OO        5.00         0.18        0.99        1.00
 26.00    36.0,313.0        0.00        4.99         0.20        0.95        1*00
 26.25    35.,2,315.9       0.00        4.99         0.23        0.98        1.00
 26.50    34.2,317.5        0.00        4.98         0.26        0.98        1*00
 26.75    33.2,317.9        0.00        4.98         0.28        0.98        0.99
 27.00    32.0,317.0        0.00        4.97         0.30        0.98        0.99
 27.25    30.8,316.3        0.00        4.96         0.32        0.98        0.99
 27.50    29.6,317.3        0.00        4.96         0.33        0.98        0.99
 27.75    28.3,319.9        0.00        4.95         0.34        0.98        0.99
 28.00    27.0,324.1        0.00        4.94         0.34        0.97        0.99
 28.25    25.8,328.3        0.00        4.94         0.34        0.97        0.99
 28.50    24.7,330.8        0.00        4.93         0.34        0.97        0.99
 28.75    23.8,331.7        0.00        4.92         0.34        0.91        0.99
 29.00    23.0,331.1        0.00        4.92         0.34        0.97        0.99
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                                                        PACIFIC ENVIRONMENTAL SERVICES
                                                       REM2 PHCTOCHEMICAL MCDEL (4/1/77)

      OCS  -  1986 IMPACT WITH SALE-48 - 2/28
      SANTA MARIA 1 TRAJECTORY POINT CONCEPTION LNG - PART 2 - 6 HRS
      START AT0500,END AT L1OO
      EMISSIONS GRID:OCDATA86.SALE48

   TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CC(PPM)

   5*00     23.0,331.0         0.00          4.92          O*34         0.97         0.99
   5.25     22.2.330,.4        0.00          4.92          0.34         0.97         0.99
   5.50     21.0,331.8         0.00          4.92          0.34         0.97         0.99
   5*75     19.7*334.9         0.00          4.92          0.34         0.97         0.99
   6.00     18.0.340.0         0.00          4.92          0.34         0.97         0.99
   6.25     16.5,345.1         0.00          4.92          O*34         0.97         0.99
   6.50     15.7,348.5         0.21          4.72          0.54         0.97         0.99
   6.75     15.5?350.1         0.43          4.56          0.7C         0.91         0.99
   7.00     16.0,350.0         0.6C          4.50          0.75         0.97         0.99
   ?.25     16.6,349.9         0.73          4.53          0.72         0.97         0.99
   7.50     16.80351.8         1.01          4.46          0.78         C.96         0.99
   7.75     16.6,355.5         1.39          4.35          0.88         0.96         0.99
   0.00     16.0,361.1         1.76          4.31          0.9C         0.96         0.99
   8.25     15.5*366.6         2.08          4.35          0.85         0.95         0.99
   8.50     15.59370.3         2.39          4.42          0.77         0.95         0.99
   8.75     16.0,372.1         2.81          4.40          0.77         0.94         0.99
   9.00     17.0,372.0         3.24          4.39          0.76         0.94         0.99
   9.25     18.6,371.4         3.67          4.40          0.73         0.93         0.99
   9,50     20.8,371.7         4.10          4.41          0.69         0.92         0.99
   9.75     23.6,372.9         4.53          4.43          0.65         0.92         O*99
  10.00     27.1,375.0         4.90          4.42          0.63         0.91         0.99
  10.25     30.5,376.8         5.51          4.42          0.59         0.9C         0.99
  10.50     33.3,377.0         6.04          4.4?          0.56         0.89         0.99
  10.75     35.4,375.7         6.54          4.41          0.53         0.88         0.99
  11.00     37.C,372.9         7.04          4.40          0.49         0.87         0.99


  KFLAG =    1
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                                                      PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL (4/1/77)


            OCS  -  1986 IMPACT WITHOUT SALE-48  - 100% TANKERING - 7/10
            cumulative 1 TRAJECTORY  -  OXNARD LNG AND VACA TAR SANDS - PART 1 - 7 HRS
            START AT 0400, END AT 1100
            EMISSIONS GRID:OCDATA86.SALE35T


   TIME   POSITION(X,Y)     O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

   4.00    47.0,313.0        1*OO       2*OO        1000       1.00        0950
   4.25    49.6s310.4        0.17       2.89        0.12       1.00        0.50
   4.50    52.1$307.9        0011       2.97        O*O7       1.00        0.50
   4.75    54.6,305.4        0.10       2.99        O*11       1.00        0.50
   5.00    57.0,303.0        0.15       2.96        0.21       1.00        0.50
   5.25    59.7s300.5        0.27       2.89        0.32       1.00        O*5O
   5.50    62.7,298.0        0.46       2.79        0.43       1.00        0.50
   5*?5    66.29295.5        0.72       2.67        0054       1.00        0.50
   6.00    70.0,293.0        0.98       2.60        0.60       1.00        0050
   6.25    73.7s290.8        1.24       2.58        0.61       0.99        0.50
   6.50    76.8,289.2        1*51       2.61        0.57       0.99        0.50
   6*75    79.2,288.3        1.83       2.62        0.55       0.98        0.49
   7.00    81.0s288.0        2*2O       2.60        0.56       0.96        0.49
   7.25    82.9,287.7        2.58       2.59        0.56       O*97        0.49
   7.50    85.7s286.5        2.97       2.61        0.52       0.96        0.49
   7*75    89.5,284.6        3*35       2.63        0.348      0.96        0.49
   8.00    94.0,282.0        3.78       2.62        O*47       0.95        0.49
   8.25    98.7,279.6        4.21       2.62        0.46       O*94        0.49
   8.50   102.9,278.4        4.64       2.62        0.45       0.93        0.49
   8.75   106.3s278.6        5.04       2.64        0.42       0.92        0.49
   9*00   10Q.O*28O*O        5.47       2.64        O*41       0091        0.49
   9.25   111.7s281.5        5.90       2.63        0.40       o* 89       0.49
   9.50   114.8)282.0        6.32       2.62        0.38       0.88        0049
   9.75   118.20281.5        6.73       2.61        O*37       O*87        0.49
  10*OO   122.1$280.0        7.13       2.59        0.36       0.86        O*49
  10.25   126.0,278.5        7.19       2.57        0.35       0.85        0.49
  10.50   129.9,278.2        7.27       2.55        0.35       0.85        0.49
  10.75   133.5$279.0        7.35       2.52        o* 35      O*84        0.49
  11,00   137,1s281.0        7.44       2.49        O*35       0.84        0049



  KFLAG  =  1
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                                                     PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL (4/1/77)


OCS - 1986 IMPACT WITHOUT SALE-48 - 100% TANKERING - 7/10
Cumulative 1 TRAJECTORY - OXNARD LNG AND VACA TAR SANDS - PART 2 - 3 HRS
START AT 1100, END AT 1400
EMISSIONS GRID:V2DATA86.SALE35


 TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)   NMHC(PPMC)   CO(PPM)

 11.00    17.0, 15.0         7.44         2.49          O*35        0.84        0.49
 11.17    19.3, 16.5         7.68         2.48          0033        0.83        0.49
 11.34    21.5, 17*7         7.93         2.47          0.33        0.83        0.50
 11.50    23.7, 18.5         8.11         2*54          0934        0.83        O*5O
 11.67    25.9, 19.0         7*73         3.17          0.45        0.83        0.51
 11.83    28.0, 19.2         7.80         3.37          0.46        0.84        0.52
 12.00    30.0, 19.0         7.94         3*48          0.47        0.85        O*53
 12.17    32.1, 18.8         8.10         3051          0.46        0.85        0053
 12.33    34.2, 19.2         8.23         3*55          O*47        0.85        0653
 12.50    36.3, 20.0         8.02         3.91          0.53        0.85        0.54
 12.67    38.5, 21.2         8008         4.03          0.53        0.85        0.54
 12.83    40.7, 22.9         8.24         4.03          0.52        0.85        0.55
 13*OO    43.1, 25.0         8.46         3.96          0.49        0.85        O*55
 13.17    45.4, 27.1         0.68         3.88          0.47        0885        0055
 13.33    47.8, 28.8         8.88         3.00          0.44        0.85        0.55
 13.50    50.2, 30.0         9.07         3.71          0.42        0.85        0.54
 13.67    52.8, 30.$3        9.24         3.63          0.40        0.84        0054
 13.83    55.4, 31.1         9*39         3.56          0.38        0.84        0954
 14.00    58.1, 31.0         9.53         3.49          0.37        0.84        O*54


KFLAG =   1
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL (4/1/77)


        OCS  -  1986 IMPACT WITH SALE-48 - 100% TANKERING - 7/10
        CUMULATIVE 1 TRAJECTORY - OXNARD LNG AND VACA TAR SANDS - PART 1 - 7 HRS
        START AT 04009 END AT 1100
        EMISSIONS GRID: OCDATA86.SALE48T


  TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

  4*OO    47.0,313.0        1.00       2.00        1.00       1900         0.50
  4.25    49.6,310.4        0.17       2.89        0.12       1*OO         O*5O
  4050    52.1,307,9        0.11       2.97        0.07       1.02         0.50
  4.75    54.6,305.4        0811       2.99        0011       1*O5         0.50
  5.00    57.0,303.0        0.16       2.96        0.20       1.08         0.50
  5.25    59.7,300.5        0.28       2.89        0.31       1.10         0.50
  5*5O    62.7,298.0        0.47       2.80        0.42       1.11         O*5O
  S*75    66.2,295.5        0.74       2.68        0.54       1.11         0.50
  6.00    70.0,293.0        0.99       2.64        0.60       1.10         O*5O
  6.25    73.7,290.8        1.26       2.64        0.62       1010         0.50
  6.50    76.8,289.2        1053       2.68        0,58       1.10         0.50
  6.75    79.2,286.3        1.87       2.70        0.56       1*O9         0.49
  7.00    81OOD288OO        2.26       2.68        0.57       1.09         0.49
  7.25    82.9,287.7        2.68       2.68        0.56       1.08         0.49
  7.50    85.7,286.5        3.08       2.70        0.52       1.07         0.49
  7.75    89.4,284.6        3*5O       2.72        0.48       1.06         0.49
  8.00    94.0,282.0        3.96       2.72        O*47       1*O5         O*49
  0.25    98.8s279.6        4.42       2.72        0045       1.04         O*49
  8*5O   102.8,278.5        4.87       2.71        0.44       1*O3         0.49
  8.75   106.3.270.6        5*31       2.73        0.41       1.02         0.49
  9000   109.0,280.0        5*77       2.73        0.40       1.01         0.49
  9.25   111.7,281.6        6.23       2.73        O*39       1.0!         0.49
  9.50   114.89282.0        6.69       2.71        0.38       0.99         0.49
  9.15   118.2,281.5        7.13       2.70        0.36       0.98         O*49
 10.00   122.0s280.0        7.55       2.69        0.35       0.96         0.49
 10.25   126.0*278.5        7.61       2.67        0.34       0.95         0.49
 10.50   129.8s276.2        7.68       2.64        0034       0.94         0.49
 10*75   133.5,279.0        7.76       2.61        0.34       0093         Q*5O
 11.00   137.0,281.0        7.85       2.58        0.34       0.92         0850



 KFLAG  =  1
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                R E M 2  PHOTOCHEMICAL NODEL (4/1/77)


      Ocs  -  1986 IMPACT WITH SALE-48 -  1 0 0 %  TANKERING 7/10
      CUMULATIVE 1 TRAJECTORY - OXNARD LNG AND VACA TAR SANDS PART 2  3 HRS
      START AT 1100,   END AT 1400
      EMISSIONS GRID:V2DATA86.SALE48


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  11.00   17.0, 15.0        7.85        2.58         0.34       0.92         0.50
  11.17   19.3, 16.5        8.10        2.57         0.33       0.92         0.50
  11*34   21.5, 17.7        6.37        2.55         0.32       0.91         0.50
  11.50   23.7, 18.5        8.55        2*62         0.33       0.91         0.50
  11.67   25.9, 19.0        8.19        3.24         0.43       0.92         0.51
  11.84   28.0, 19.2        8.27        3.45         0.44       0.92         0.52
  12.00   30.0, 19.0        8.42        3.56         0.45       0.93         0.53
  12.17   32..1, 18.8       8.58        3.59         0.44       0.94         0.53
  12.33   34.2, 19.2        8.72        3.62         0.45       0.94         O*54
  12.50   36.3, 19.9        8.52        3.99         0.51       0.94         0.54
  12.67   38.5, 21.2        8.57        4.10         0.51       0.94         0.55
  12.84   40.8, 22.9        8.73        4.10         0.49       0.94         0.55
  13.00   43.0, 25.0        8.96        4.02         0.47       0.94         O*55
  13.17   45.4, 27.1        9.19        3*93         0.45       0.%          0.55
  13.34   47.8, 28.8        9.39        3.84         0.43       0*93         0.55
  13.50   50.2, 30.0        9*5B        3*75         O*4O       0.93         0.55
  13.67   52.8, 30.8        9.75        3.67         0.39       0.93         0.55
  13.84   55.4, 31.1        9.90        3.59         0.37       0.93         0.55
  14.00   58.1, 31.0        10.04       3*52         0.35       0.93         0.54


  KFLAG = 1
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                                                           PACIFIC  ENVIRONMENTAL  SERVICES
                                                          REM2  PHOTOCHEMICAL  MODEL  (4/1/77)


            OCS  -  1986 IMPACT WITHOUT SALE-48  100% TANKERING - 7/10
            CUMULATIVE 2 TRAJECTORY - ELKHILLS - PART 1 - 7 HRS
            START AT 0400, END AT 1100
            EMISSIONS GRID: OCDATA86.SALE35T


   TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

   4.00    47.0,313.0          1*OO          2.00          1.00          1.00         0.50
   4.25    49.6s310.4          0.17          2.89          0.12          1.00         O*5O
   4.50    52.1,307.9          O*11          2.97          0.07          1.00         0.50
   4.75    54.6,305.4          0.10          2.99          0.11          1.00         0.50
   5*OO    57.0s303.0          0.15          2.96          0.21          1.00         O*5O
   5.25    59.7s30005          0.27          2.89          0.32          1.00         0.50
   5.50    62.7,298.0          0.46          2079          O*43          1*OO         0.50
   5.75    66.2,295.5          0.72          2.67          O*54          1.00         0.50
   6.00    70.0,293.0          0.98          2.60          0.60          1.00         0.50
   6.25    73.7s290.8          1.24          2.58          0.61          0099         0050
   6.50    76.8,289.2          1051          2461          0057          O*99         0.50
   6.75    79.2,288.3          1.83          2.62          0.55          0.98         0.49
   7.00    81.0,288.0          2.20          2.60          0.56          0.98         0.49
   7.25    82.9s287.7          2.58          2.59          0.S6          0.97         0.49
   7050    85.7,286.5          2.97          2.61          0.52          0.96         0.49
   7.75    89.5,284.6          3*35          2.63          0.48          0.96         0.49
   0000    94.0s282.0          3.78          2.62          O*47          O*95         0.49
   8.25    98.7,279.5          4.21          2.62          0.46          0.94         0.49
   8.50   10209B278.2          4.64          2.62          O*45          0.93         0.49
   8.75   106.3s278oO          5.04          2.64          0.42          0.92         0.49
   9.00   109,0s279.0          5.48          2.63          0041          0.91         0.49
   9.25   111.7s280.1          5*9O          2,63          0.40          0.89         0.49
   9950   114.8,280.3          6.32          2.62          0.38          0.88         0.49
   9*75   118.2,279.6          6.74          2.60          0.37          0.87         0.49
  10.00   122.1s278.0          7.13          2.59          0.36          0.86         0.49
  10.25   126.2,276.4          7* 19         2.57          0.35          0.85         0049
  10.50   130.4,276.0          7.26          2.54          O*35          0.85         0.49
  10.75   134.6,276.5          7*35          2.51          003s          0.84         0.49
  11,00   139.1,278.0          7*43          2.49          O*35          0.84         0.49



 KFLAG =    1
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                                           PACIFIC ENVIRONMENTAL SERVICES
                                          REM2 PHOTOCHEMICAL MODEL (4/1/77)

 OCS - 1986 IMPACT WITHOUT SALE-48 100% TANKERING -  7/10
 CUMULATIVE 2 TRAJECTORY - ELK HILLS - PART 2 - 3 HRS
 START AT 1100, END AT 1400
 EMISSIONS GRID:   V2DATA86.SALE35

 TIME   POSITION(X,Y)   O3(PPHM)  NO2(PPHM)  NO(PPHM)  NMHC(PPMC)  CO(PPM)

 11.00   19.0, 12.0       7.43      2.49       0.35      0.84       0.49
 11.17   21.9, 13.3       7.66      2.47       0.34      0.83       0.49
 11.34   24.4, 14.3       7.86      2.50       0.34      0.85       0.50
 11.50   26.7, 15.0       7.82      2.71       0.37      0.92       0.50
 11.67   28.7, 15.6       7.86      2.88       0.39      0.93       0.51
 11.83   30.5, 15.9       7.98      2.99       0.40      0.92       0.52
 12.00   32.0, 16.0       8.13      3.07       0.40      0.91       0.53
 12.17   33.5, 16.0       8.29      3.08       0.39      0.90       0.53
 12.33   35.4, 16.2       8.47      3.06       0.38      0.89       0.53
 12.50   37.6, 16.5       8.63      3.04       0.37      0.87       0.53
 12.67   40.0, 16.8       8.77      3.02       0.36      0.88       0.53
 12.83   42.9, 17.4       8.90      3.00       0.35      0.85       0.54
 13.00   46.0, 18.0       9.01      2.98       0.35      0.85       0.54
 13.17   49.2, 18.8       9.02      3.05       0.36      0.84       0.55
 13.33   52.0, 19.6       9.10      3.06       0.35      0.83       0.55
 13.50   54.5, 20.5       9.20      3.03       0.34      0.83       0.55
 13.67   56.6, 21.6       9.27      3.02       0.33      0.82       0.55
 13.83   58.5, 22.7       9.33      3.02       0.33      0.81       0.55
 14.00   60.0, 24.0       9.38      3.02       0.32      0.81       0.56


KFLAG =    1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL  MODEL  (4/1/77)


    OCS  -  1986 IMPACT WITH SALE-48  -  100% TANKERING 7/10
    CUMULATIVE 2 TRAJECTORY - ELK HILLS - PART  1   7 HRS
    START AT 0400, END AT 1100
    EMISSIONS  GRID:OCDATA86.SALE48T


  TIME     POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

  4.00     47.0,313.0          1.00         2*00          1.00         1.00         O*5O
  4.25     49.6,310.4          0.17         2.89          0.12         1.00         0.50
  4.50     5?.1,307.9          0*11         2.97          0.07         1.02         O*5O
  4.75     54.6,305.4          0.11         2.99          0.11         1.05         0.50
  5.00     57.0,303.0          0.16         2.96          0.20         1.08         O*5O
  5.25     59.7,300.5          0.28         2.89          0.31         1*1O         0.50
  5.50     6?.7,298.0          0.47         2.80          0.42         1.11         0.50
  5.75     66.2,295.5          0.74         2.68          0.54         1.11         0.50
  6.00     70.0,293.0          0*Q9         2.64          0.60         1.10         0.50
  6.25     73.7,290.8          1.26         2.64          0.62         1.1C         O*5O
  h. 50    76.8,289.7          1.53         2.68          0.58         1.10         0.50
  6.75     79.2,289.3          1.87         2.70          0.56         1.09         0.49
  7.00     81.0,288.0          2.26         2.68          0.57         1.09         0.49
  7.25     82,9,287.7          2.68         2.68          0.56         1.00         0.49
  7.50     85.7,286.5          3.08         2.70          0.52         1.07         0.49
  7.75     89.4,284.6          3.50         2.72          0.48         1.06         0.49
  8.00     94.0,282.0          3.96         2.72          0.47         1.05         0.49
  9.25     9S.8,279.5          4.42         2.72          0.45         1.04         0.49
  8.50    102.8,278.2          4.87         2.71          0.44         1.03         0.49
  8.75    106.2,278.0          5.31         2*73          0.41         1.02         0.49
  9.00    10Q.O,279.O          5.78         2.72          0.40         1*O1         0.49
  9. 25   111.7.?80.1          6.?4         2.72          0.39         1.00         0.49
  9.50    114.7,280.3          6.69         2.71          0.37         0.99         0.49
  9.75    118.2,?79.6          7.13         2.69          0.36         0.98         0.49
 10.00    1?2.0,278.0          7.54         2.69          0.34         0.96         0.49
 10.25    126.1s276.5          7.60         2.67          0.35         O*95         O*49
 10.50    130.3,?76.0          7.66         2.65          0.35         0.94         0.49
 10.75    134.7,276.5          7.75         2.61          0.34         0.93         0.50
 1.1.00   139.1,278.0          7.84         2.58          0.34         0.92         0.50



 KFLAG =   1
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                                        PACIFIC ENVIRONMENTAL SERVICES
                                        REM2PHOTOCHEMICAL MODEL [4/1/77)

    OCS  -  1986 IMPACT WITH SALE-48"- 100% TANKERING - 7/10
    CUMULATIVE 2 TRAJECTORY - ELKHILLS - PART 2 - 3 HRS
    START AT 1100, END AT 1400
    EMISSIONS GRID: V2DATA86.SALE48


  TIME   POSITION (X,Y)   O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO (PPM)

  11.00   19.0, 12.0       7.84       2.58        0.34       0.92         0.50
  11.17   21.9, 13.3       8.09       2.56        0.33       0.91         0.50
  11.33   24.4, 14.3       &29        2.58        0.33       0.93         0.50
  11.50   26.7, 15.0       8.26       2.79        0.36       1.00         0.50
  11.67   28.7, 15.6       8.31       2.96        0.38       1.01         0.51
  11.84   30.5, 15.9       8.64       3.07        0.39       1.00         0.52
  12.00   32.0, 16.0       8.60       3.14        0.39       0.99         0.53
  12.17   33.5. 16.0       &76        3.15        0.38       0.96         0.53
  12.33   35.4, 16.2       8.93       3.13        0.37       0.96         0.54
  12.50   37.6, 16.5       9.10       3.11        0.36       0.95         0.54
  12.67   40.1, 16.9       9.24       3.08        0.35       0.94         0.54
  12.83   42.9, 17.4       9.37       3.06        0.34       0.93         0.54
  13.00   46.0, 18.0       9.48       3.04        0.34       0.92         0.54
  13.17   49.1, 18.7       9.49       3.10        0.34       0.92         0.55
  13.34   52.0, 19.6       9.57       3.11        0.34       0.91         0.55
  13.50   54.5, 20.6       9.67       3.07        0.33       0.90         0.55
  13.67   56.6, 21.6       9.75       3.06        0.32       0.90         0.55
  13.83   58.5, 22.7       9.80       3.05        0.32       0.89         0.56
  14.00   60-0, 24.0       9.85       3.05        0.31       0.88         0.56


 KFLAG  =  1
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                                                        PACIFIC ENVIRONMENTAL SERVICES
                                                      REM2 PHOTOCHEMICAL MODEL (4/1{?7!

      OCS  -  1986 IMPACT WITHOUT SALE-48  - 100% TANKERING - 7/25
      CUMULATIVE 3 Trajectory - SOHIO TERMINAL - PART 1 - 3 HRS
      START AT 0300. END AT 0600
      EMISSIONS 6$10: OCDATA86.SALE35T


   TIME   POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

   3.00   245.0,206.0        1.00        4.00         3.00        2.00        2.00
   3.25   245.0,208.3        0.00        5.07         1*94        2.00        2*O1
   3.50   245.O*21O.5        0.00        5.09         1.92        2.00        2.01
   3.75   245.0.212.8        0.00        5.10         1.93        2.00        2.01
   4.00   245.0,215.0        0.00        5.10         1.96        2.00        2.01
   4.25   244.7,217.1        0.00        5.09         1.98        2.00        2.01
   4.50   244.0,218.8        0.01        5.08         2.01        1.99        2.00
   4.75   262.7,220.1        0.00        5.09         2.01        1.99        2.00
   5.00   241.0,221.0        0.03        5*05         2.04        1.99        2.00
   5.25   239.3,222.1        0.03        5.06         2.03        1.99        2*OO
   5.50   238.3.223.8        0.12        5.02         2.06        1.98        1.99
   5.75   237.8,226.1        0.28        5.00         2.07        1.98        1*99
   6.00   238.0,229.0        0.46        5.06         1.99        1.97        1.99


  KFLAG  =  1
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PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL (4/1/77)

OCS - 1986 IMPACT WITHOUT SALE-48 - 100X TANKERING - 7/25
CUMULATIVE 3 TRAJECTORY - SOH1O TERMINAL - PART 2-11HRS
START AT (?600, END AT 1700
EMISSIONS GRID: LADATT86.SALE35

TIME	POSITION(X,Y)	O3(PPHM)	NO2(PPHM)	NO(PPHM)	NMHC(PPMC)	CO(PPM)
6.00	25.5, 10.6	0.46	5.06	I*99	1.97	1.99
6.25	25.7, 12.5	0.51	5.23	2.14	1.99	2.00
6.50	25.8, 14.0	O*66	5.56	2.65	2.01	2.02
6.75	25.7, 15.3	0.79	6.14	2.91	2.04	2.03
7.00	25.5. 16.2	0.73	7.11	4.61	2.11	2.06
7.25	25.3, 17.1	0.49	8.70	9.76	2.27	2.10
7.50	25.2, 18.2	0.50	11.18	13.37	2.39	2.16
7.75	25.3, 19.6	O*77	14.13	12.20	2.42	2.23
8.00	25.5, 21.2	1.27	17.29	9.71	2.43	2.26
8.75	25.8, 22.7	2.04	19.38	6.98	2.41	2.28
8.50	26.0, 23.8	3.19	20.70	5.00	2.36	2.29
8.75	26.1, 24.6	4.66	21.31	3.73	2.32	2.31
9.00	26.1, 24.9	6.29	21.44	2.92	2.27	2.32
9.25	26.3, 25.3	7.96	21.30	2.38	2.23	2.33
9.50	26.7, 26.0	9*58	21.02	2*O1	2.19	2.34
9.75	27.5, 27.1	11.04	20.70	1.76	2.15	2.35
10.00	28.6, 28.7	12.42	20.30	1.60	2.12	2.36
10.25	29.7, 30.2	13*4O	19.72	1.46	2.09	2.36
10.50	30.3, 31.3	14.27	19. 19	1.35	2.07	2.37
10.75	30.6, 32.0	15.19	18.55	1.25	2.04	2.37
11.00	30.5, 32.4	16.02	17.93	1.15	2.02	2.37
11.25	30.4, 32.6	16.78	17.32	1.07	1.99	2.37
11.50	30.8, 33.2	17.49	16.70	0.99	1.96	2.37
11.75	31.6, 33.9	18.10	16.11	0.93	1.94	2.37
12.00	33.0, 34.9	18*49	15.70	0.89	1.92	2.38
12.25	34.4, 35.9	16.39	15.14	0.87	1.91	2.38
12.50	35.5, 36.1	18.40	14.56	0.83	1.90	2.37
12.75	36.2, 37.4	18.50	13.96	0.80	1.89	2.37
13.00	36.7, 38.0	18.61	13.39	0.74	1.88	2.36
13.25	37.3, 38.5	18.75	12.85	0.70	1.86	2.35
13.50	38..6, 39.1	18.87	12.33	0.67	1.85	2.34
13.75	40.4, 39.7	18.97	11.86	0.62	1.83	2.33
14000	42.9, 40.5	19.04	11.44	0.59	1.82	2.33
14.25	45.3* 41.1	19.87	11.22	0.55	1.80	2.33
14.50	46.9, 41.4	20.63	10.97	O*5O	1.79	2.33
14.75	47.8, 41.4	21.32	10.71	0.45	1.7?	2.34
15.00	47.9, 41.1	21.95	10.4?	0.42	1.76	2.,34
15.25	48.0, 40.6	22.46	10.16	0.38	1.75	2.34
15.50	49..0, 40.3	22.94	9.92	0.34	1.75	2.35
15.75	50.8, 40.0	23.39	9.67	0.31	1.75	2.35
16.00	53.51 39.8	23.79	9.46	0.30	1.76	2'.36
16.25	56.1, 39.6	24.11	9.29	0.28	1.76	2.36
16.50	57.7, 39.2	24.37	9.17	0.23	1.77	2.37
16.75	58.2, 30.6	24.59	9.05	0.22	1.78	2.38
17.00	57.8, 38.0	24.74	8.99	0.18	1.78	2.38

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                                                     PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL  (4/1/77)


        OCS   -  1986 IMPACT WITH SALE-48  - 1 0 0 %  TANKERING - 7/25
        CUMULATIVE 3 TRAJECTORY - SOHIO TERMINAL  PART 1  3 HRS
        START AT 0300, END AT  0 6 0 0
        EMISSIONS GRID: OCCATA86.SALE48T


      TIME   POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

      3.00   245.0,206.0          1.00          4.00          3.00         2*OC          2.00
      3.25   245.0,?06.3          0.00          5.06          1.96         2*OC          2.00
      3.50   245.0,210.5          0.00          5.09          1.95         2.01          2*00
      3.75   245.0,212.8          0.00          5.10          1.96         2.02          2.00
      4.00   245.0,215.0          0.00          5.11          1.99         2.03          2.00
      4.?5   ,?44.7,217.1         0.00          5.11          2.02         2.05          2.00
      4.50   244.0,218.8          0.01          5.10          2.05         2*O6          ?.00
      4.75   242.7,?20.1          0.00          5.12          2.06         2.07          2.00
      5.00   241.0,221.0          0.03          5.09          2.10         2.07          2.00
      5.25   ?39.3,222.1          0.03          5.11          2.09         2.07          2.00
      5.50   238.3,223.8          0.12          5.08          2.12         2.08          2.00
      5.75   237.8,226.1          0.28          5.07          2.13         2.07          2.00
      6.00   238.0,729.0          0.46          5.15          2.04         2.07          2.00


     KFLAG =    1
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PACIFIC ENVIRONMENTAL SERVICES
REM2 PHOTOCHEMICAL MODEL (4/1/77)

Ocs - 1986 IMPACT WITH SALE-48 - 100% TANKERING 7/25
CUMULATIVE 3 TRAJECTORY - SOHIO TERMINAL - PART 2 - 11 HRS
START AT 0600, END AT 1700
EMISS1ONS GRID:LADATT86.SALE48

TIME	POSITION(X,Y)	O3(PPHM)	NO2(PPHM)	NO(PPHM)	NMHC(PPMC)	CO(PPM)
6.00	25.5, 10.6	0.46	5.15	2.04	2.07	2.00
6. ?5	25.7, 12.5	0.51	5.33	2.18	2.09	2.01
6.50	25.8, 14.0	0.67	5.68	2.67	2.11	2.03
6.75	25.7, 15.3	0.81	6.28	2.91	2.14	2.05
7.00	25.5, 16.2	0.75	7.29	4.56	2.21	2.07
7.25	25.3, 17.1	0.51	8.96	9.64	2.36	2.11
7.50	25.2, 18.2	0.51	11.61	13.09	2.49	2.17
7.75	25.3, 19.6	0.82	14.64	11.80	2.51	2.24
8.00	25.5, 21.2	1.36	17.84	9.24	2*S2	2.27
8.25	25.8, 22.7	2.25	19.84	6.58	2.50	2.28
8.50	26.0, 23.8	3.49	21.01	4.75	2.45	2.30
8.75	26.1, 24.6	5.02	21.52	3.56	2.41	2.32
9.00	26.1, 24.9	6.69	21.59	2.80	2.36	2.33
9.25	26.3, 25.3	8.30	21.42	2.28	2.31	2.34
9.50	26.7, 26.0	9.99	2A.1O	1.94	2.27	2.35
9.75	27.5* 27.1	11.46	20.76	1.71	2.23	2.36
10*OO	28.6, 28.7	12.83	20.36	1.54	2.20	2.37
10.25	29.7, 30.2	13.82	19.75	1.41	2.17	2.37
10.50	30.3, 31.3	14.66	19.21	1.32	2.15	2.38
10.75	30.6, 32.0	15.57	18.57	1.22	2.12	2.38
11.00	30.5, 32.4	16.41	17.93	1.12	2.09	2.38
11.25	30.4, 32.6	17.17	17.31	1.06	2.06	2.38
11*50	30.8, 33.2	17.88	16.68	0.96	2.04	2.38
11.75	31.6, 33.9	18.48'	16.10	0.92	2.01	2.38
12.00	33.0, 34.9	18.86	15.68	0.88	2.00	2.39
12.25	34.4, 35.9	18.73	15.13	0.86	1.99	2.39
12.50	35.4, 36.7	18.73	14.54	0.83	1.98	2.38
12.75	36.2, 37.4	18.81	13.97	0.77	1.97	2.38
13.00	36.7, 38.0	18.93	13.39	0.73	1*95	2.37
13.25	37.3, 38.5	19.07	12.83	0.70	1.94	2.36
13.50	38.6, 39.1	19.17	12.33	0.66	1.92	2.35
13.75	40.4, 39.7	19.25	11.86	0.61	1.90	2.34
14.00	42.9, 40.4	19.33	11.43	0.58	1.89	2.33
14.25	45.3, 41.1	20.17	11.22'	0.54	1.87	2.34
14.50	46.9, 41.4	20.94	10.96	0.49	1.86	2.34
14.75	47.8, 41.4	21.64	10.69	0.45	1.84	2.35
15.00	47.9* 41.1	22.26	10.41	0.40	1.83	2.35
15.25	48.0, 40.6	22.80	10.14	0.37	1.82	2.35
15.50	49.0, 40.3	23.27	9.88	0.35	1.82	2.36
15.75	50.8, 40.0	23.72	9.63	0.31	1.82	2.36
16.00	53.5, 39.8	24.12	9.41	0.29	1.82	2.36
16.25	56.1, 39.6	24.44	9.25	0.27	1.83	2.37
16.50	57.7, 39.2	24<68	9.12	0.23	1.84	2.38
16.75	58.2, 36.6	24.89	8.99	0.21	1.84	2.35
17.00	57.8, 38.0	25.03	8.92	0.19	1.85	2.39

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                                                            PACIFIC ENVIRONMENTAL SERVICES
                                                          REM2 PHOTOCHEMICAL MODEL  (4/17/77)

        OCS  -  1986 IMPACT WITHOUT SALE-48 - 100% TANKERING - 2/26
        SANTA MARIA 1 TRAJECTORY - POINT CONCEPTION LUG - PART 1 - ?1 HRS
        START AT 1800, END AT 0500
        EMISSIONS GRID: OCDATA86.SALE35T


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

 18.00    114.0,288.0         1.00        4.00         1.00         1.00         1.00
 18.25    111.2,288.1         0.17        4.88         0.12         1.00         1.00
 18.50    108.4,288.3         0.11        4.96         0.05         1.00         1.00
 18.75    105.7,288.6         0.09        6.99         0.03         1.00         1.00
 19.00    103.0,289.0         0.08        5.01         0.03         1.00         1.00
 19.25    100.3,289.5         0.07        5.02         0.02         1.00         1.00
 19.50     97.5,290.0         0.07        5.03         0.02         1.00         1.00
 19.75     94.8,290.5         0.07        5.04         0.01         1.00         1.00
 20.00     92.0,291.0         0.06        5.04         0.01         1.00         1.00
 20.25     89.1,291.5         0.06        5.05         0.00         1.00         1*OO
 20.50     86.2.292.0         0.06        5.05         0.00         1.00         1.00
 70.75     83.1,292.5         0.06        5.05         0.00         1.00         1.00
 21.00     80.0,293.0         0.06        5.05         0.00         1.00         1.00
 21.25     76.9,293.5         0.06        5.05         0.00         1.00         1.00
 21.50     74.0,294.0         0.06        5.05         0.00         1.00         1.00
 21.75     71.4,294.5         0.06        5.05         0.00         1.00         1.00
 22.00     69.0,295.0         0.06        5.05         0.00         1.00         1.00
 22.25     66.6,295.5         0.06        5.05         0.00         1.00         1.00
 22.50     64.0.296.0         0.06        5.05         0.00         1.00         1.00
 22.75     61.1,296.5         0.06        5.05         0.00         1.00         1.00
 23.00     58.0,297.0         0.06        5.05         0.00         1.00         1.00
 23.25     55.0,297.7         0.06        5.05         0.01         1.00         1.00
 23.50     52.5,298.8         0.06        5.05         0.01         1.00         1.00
 23.75     50.5,300.2         0.06        5.06         0.02         1.00         1.00
 24.00     49.0,302.0         0.05        5.07         0.02         1.00         1.00
 24.25     47.6,303.8         0.05        5.08         0.02         1.00         1.00
 24.50     46.0,305.0         0.04        5.09         0.02         1.00         1.00
 24.75     44.1,305.8         0.04        5.09         0.02         1.00         1.00
 25.00     42.0,306.0         0.04        5.10         0.02         1.00         1.00
 25.25     40.0,306.5         0.03        5.11         0.02         1.00         1.00
 25.50     38.3,307.8         0.03        5.11         0.02         1.00         1.00
 25.75     37.0,310.0         0.03        5.12         0.02         1.00         1.00
 26.00     36.0,313.0         0.03        5.13         0.04         1.00         1.00
 26.25     35.2,315.9         0.02        5.14         0.06         1.00         1.00
 26.50     34.2,317.5         0.02        5.15         0.07         1.00         1.00
 26.75     33.2,317.9         0.01        5.16         0.09         1.00         1.00
 27.00     32.0,317.0         0.01        5.17         0.10         1.00         1.00
 27.25     30.8,316.3         0.01        5.18         0.11         1.00         1.00
 27.50     29.6,317.3         0.01        5.18         0.11         1.00         1.00
 27.75     28.3,319.9         0.00        5.19         0.12         1.00         1.00
 28.00     27.0,324.1         0.00        5.19         0.11         1.00         1.00
 28.25     25.8,328.2         0.00        5.20         0.11         1.00         1.00
 28.50     24.7,330.8         0.00        5.20         0.11         1.00         1.00
 28.75     23.8,331.7         0.00        5.20         0.11         1.00         1.00
 29.00     23.0,331.1         0.00        5.20         0.10         1.00         1.00
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)


       OCS  -  1986 IMPACT WITHOUT SALE-48 - 100% TANKERING - 2/28
       SANTAMARIA 1" TRAJECTORY - POINT CONCEPTION LUG - PART 2 - 6 HRS
       START AT 0500, END AT '1100
       EMISSIONS GRID: O CDATA86.SALE35T


   TIME    POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO (PPM)

   5.00     23.0,331.0          0.00         5.20          0.10         1.00          1.00
   5.25     22.2,330.4          0.00         5.20          0.10         1.00          1.00
   5.50     21.0,331.8          0.00         5.20          0.10         1.00          1.00
   5.75     19.7,334.9          0.00         5.20          0.10         1.00          1.00
   6.00     18.0,340.0          0.00         5.20          0.10         1.00          1.00
   6.25     16.5,345.1          0.00         5.20          0.10         1.00          1.00
   6.50     15.7,348.5          0.30         4.92          0.38         1.00          1.00
   6.75     15.5,350.1          0.55         4.73          0.56         1.00          1.00
   7.00     16.0,350.0          0.74         4.67          0.62         1.00          1.00
   7.25     16.6,349.9          0.90         4.69          0.60         1.00          1.00
   7.50     16.8,351.8          1.20         4.61          0.67         0.99          1.00
   7.75     16.6,355.5          1.61         4.49          0.78         0.99          1.00
   8.00     16.0,361.1          2.01         4.44          0.82         0.99          1.00
   8.25     15.5,366.6          2.34         4.46          0.77         0.98          1.00
   8.50     15.5,370.3          2.67         4.52          0.70         0.98          1.00
   8.75     16.0,372.1          3.11         4.49          0.71         0.97          1.00
   9.00     17.0,372.0          3.54         4.48          0.70         0.96          1.00
   9.25     18.6,371.4          3.98         4.48          0.68         0.96          1.00
   9.50     20.8,371.7          4.41         4.40          0.66         0.95          1.00
   9.75     23.6,372.9          4.84         4.49          0.61         0.94          1.00
  10.00     27.0,375.0          5.30         4.48          0.60         0.93          1.00
  10.25     30.5,376.8          5.84         4.47          0.57         0.92          1.00
  10.50     33.3,377.0          6.36         4.46          0.54         0.91          1.00
  10.75     35.5,375.7          6.87         4.45          0.51         0.90          1.00
  11.00     37.0,372.9          7.36         4.43          0.47         0.89          1.00



  KFLAG =    1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                   REM2 PHOTOCHEMICAL MODEL (4/1/77)

          Ocs  -  1986 IMPACT WITH SALE-88 - 100% TANKERING - 2/28
          SANTA MARIA 1 TRAJECTORY - POINT CONCEPTION LNG - PART 1 - 11 HRS
          START AT 1800, END AT 0500
          EMISSIONS GRID: OCDATA86.SALE48T


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO (PPM)

 18.00   114.0,288.0        1.00         4.00         1.00         1.00         1.00
 18.25   111.2,288.1        0.17         4.88         0.12         1.00         1.00
 18.50   108.4.288.3        0.11         4.96         0.05         1.00         1.00
 18.75   105.7,288.6        0.09         4.99         0.04         1.01         1.00
 19.00   103.0,289.0        0.08         5.01         0.03         1.01         1.00
 19.25   100.3,289.5        0.07         5.03         0.03         1.02         1.00
 19.50    97.5,290.0        0.06         5.04         0.02         1.02         1.00
 19.75    94.8,290.5        0.06         5.05         0.01         1.02         1.00
 20.00    92.0,291.0        0.06         5.06         0.01         1.02         1.00
 20.25    89.1,291.5        0.06         5.06         0.01         1.02         1.00
 20.50    86.2,292.0        0.06         S.06         0.0(!        1.02         1.00
 20.75    83.1,292.5        0.05         5.06         0.00         1.02         1.00
 21.00    80.0,293.0        0.05         5.06         0.01         1.02         1.00
 21.25    76.9,293.5        0.05         5.07         0.01         1.02         1.00
 21.50    74.0,294.0        0.05         5.07         0.03         1.02         1.00
 21.75    71.4,294.5        0. 04        5.09         0.03         1.02         1.00
 22.00    69.0.295.0        0. 04        5.10         0.03         1.02         1.00
 22.25    66.6,295.5        0.03         5.11         0.03         1.02         1.00
 22.50    64.0.296.0        0.03         5.12         0.03         1.02         1.00
 22.75    61.1,296.5        0.03         5.12         0.03         1.02         1.00
 23.00    58.0,297.0        0.02         5.13         0.03         1.03         1.00
 23.25    55.0,297.7        0.02         5.14         0.03         1.03         1.00
 23.50    52.5,298.8        0.02         5.15         0.03         1.03         1.00
 23.7S    50.5.300.2        0.02         5. 1s        0. 04        1.04         1.00
 24.00    49.0,302.0        0.02         5.16         o. 04        1.04         1.00
 24.25    47.6,303.8        0.01         5.16         0.05         1.05         1.00
 24.50    46.0,305.0        0.01         5.17         0.05         1.05         1.00
 24.75    44.1,305.8        0.01         5.18         0.05         1.05         1.00
 25.00    42.0,306.0        0.01         S.18         0.05         1.05         1.00
 25.25    40.0,306.5        0.01         5.19         0.05         1.05         1.00
 25.50    38.3.307.8        0.01         5.19         0.05         1.05         1.00
 25.75    37.0,310.0        0.01         5.20         0.06         1.05         1.00
 26.00    36.0,313.0        0.01         5.20         0.07         1.05         1.00
 26.25    35.2,375.9        0.01         5.21         0.10         1.05         ?.00
 26.50    34.2,317.5        0.00         5.22         0.12         1.05         1.00
 26.75    33.2,317.9        0.00         5.22         0.14         1.05         1.00
 27.00    32.0,317.0        0.00         5.23         0.15         1.05         1.00
 27.25    30.8,316.3        0.00         5.23         0.17         1.05         1.00
 27.50    29.6,317.3        0.00         5.23         0.18         1.05         1.00
 27.75    28.3,319.9        0.00         5.23         0.18         1.05         1.00
 28.00    27.0,324.1        0.00         5.24         0.19         1.05         1.00
 28.25    25.8.328.2        0.00         5.24         0.18         1.05         1.00
 28.50    24.7,330.8        0.00         5. 24        0.18         1.05         1.00
 28.75    23.8,331.7        0.00         5.24         0.18         1.05         1.00
 29.00    23.0,331.1        0.00         5.24         0.18         1.05         1.00
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL (4/1/77)

     OCS - 1986 IMPACT WITH SALE-48 100% Tinkering 2/28
     SANTA MARIA1 Trajectory POINT Conception LNG PART 2 6 HRS
     START AT 0500, END AT 1100
     EMISSIONS GRID:OCDATA86.SALF48T

   TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CC(PPM)

   5.00    23.0,331.0         0.00         5.24        0.18         1.05         1.00
   5.25    22.2*330.4         0.00         5.24        0.18         1.05         1.00
   5.50    21.0,331.8         0.00         5.24        0.18         1.05         1*OO
   5.75    19.7,334.9         0.00         5.24        0.18         1.05         1.00
   6.00    18.0,340.0         0.00         5.24        0.18         1.05         1.00
   6.25    16.5,345.1         0.00         5.24        0.18         1.05         1.00
   6.50    15.7*348.5         0.27         4.98        0.44         1.05         1.00
   6.75    15.5,350.1         0.52         4.80        0.61         1.05         1.00
   7.00    16.0,350.0         0.70         4.74        0.67         1.04         1.00
   7.25    16.6,349.9         0.86         4.77        0.64         1.04         1.00
   7.50    16.8,351.8         1.16         4.69        0.70         1.04         1.00
   7.75    16.6*355.5         1.57         4.58        0.81         1.04         1.00
   8.00    16.0,361.1         1.98         4.53        0.84         1.03         1.03
   8.25    15.5,366.6         2.33         4.56        0.80         1.03         1*OO
   8.50    15.5,370.3         2.66         4.62        0.72         1.02         1.00
   8.75    16.0s372.1         3.11         4.59        0.73         1.02         1.00
   9.00    17.0,372.0         3.57         4.58        0.72         1.01         1.00
   9.25    18.6,371.4         4.02         4.58        0.69         1.00         1.00
   9.50    20.8,371.8         4.48         4.50        0.66         1.00         1.00
   9.75    23.7,372.9         4.92         4.60        0.62         0.99         1.00
  10.00    27.1.375.0         5.40         4.59        0.60         0.98         1.00
  10.25    30."5,376.7        5.95         4.58        0.57         0.97         1.00
  10.50    33..,3,377.0       6.49         4.57        0.54         0.96         1.00
  10.75    35.4,375*7         7.02         4.56        0.51         0.94         1.00
  11.00    37.0,373.0         7.53         4.55        0.47         O*93         1.00


  KFLAG =    1
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Accident Scenarios Results

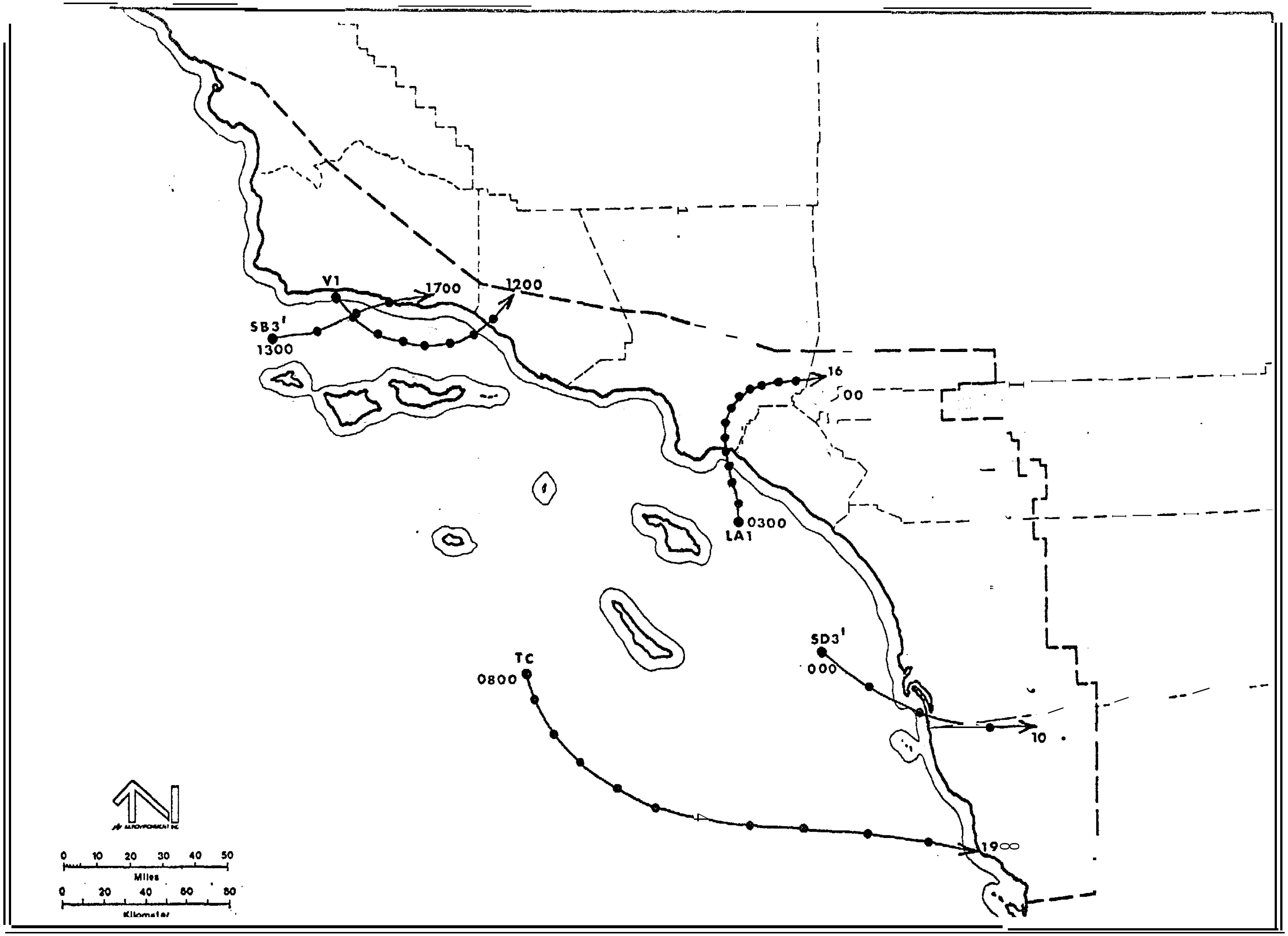

FIGURE C-8. analysis.

Hour	x (km)	y (km)	Temp°C	Relative Humidity %	Mixing Height (mAGL)*
SANTA BARBARA SPILL TRAJECTORY					
1300	177	3794	29	24	120
1400	193	3797	29	21	120
1500	208	3803	29	19	120
1600	228	3809	29	18	120
1700	248	3813	29	18	120
LOS ANGELES SPILL TRAJECTORY					
0300	394	3706	16	82	150
0400	395	3715	17	77	150
0500	389	3722	17	77	150
0600	388	3730	18	73	150
0700	387	3739	21	56	150
0800	387	3747	24	41	150
0900	388	3752	25	39	185
1000	392	3758	27	34	215
1100	396	3764	28	29	260
1200	400	3768	29	25	305
1300	406	3773	31	21	380
1400	416	3777	33	17	455
1500	424	3778	35	16	455
1600	433	3776	35	16	455
SAN DIEGO SPILL TRAJECTORY					
1000	434	3640	27	34	150
1100	457	3623	27	34	150
1200	482	3609	27	34	150
1300	505	3602	27	34	150
1400	520	3602	28	33	150
1500	535	3605	28	33	150

***meters above ground level**

Flour	x (km)	y (km)	Temp°C	Relative Humidity %	Mixing Height(m AGL)
VENTURA SPILL TRAJECTORY					
0400	200	3810	17	80	150
0500	207	3803	17	77	150
0600	221	3796	18	73	150
0700	233	3792	19	68	150
0800	243	3790	21	60	150
0900	256	3792	22	56	150
1000	268	3796	24	50	150
1100	277	3803	27	32	185
1200	287	3813	29	21	215
TANNER/CORTEZ SPILL TRAJECTORY					
0800	291	3629	21	60	150
0900	295	3615	23	54	150
1000	302	3599	24	50	150
1100	315	3585	24	47	150
1200	330	3574	25	39	150
1300	350	3565	26	36	150
1400	372	3560	27	34	150
1500	398	3557	27	34	150
1600	425	3556	27	34	150
1700	456	3553	25	44	150
1800	483	3550	24	50	150
1900	507	3547	23	57	150

* meters above ground level

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                                                     PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL  (4/1/77)


    OCS  -  1986IMPACT WITH SALE-48 - 9?24
    SANTA  BARBARA  3"SPILL TRAJECTORY. BLOWOUT  AND  FIRE - PART 1 - 3 HRS
    START  AT  1300, END AT 1600
    EMISSIONS GRID: OCDATA86.SALE48


  TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

  13.00    27.0,294.0         5.00         4.00          1.00          1.00          1.00
  13.17    29.7,294.9         5.14         4.24          0.75          1.00          1.00
  13.34    32.4,295.6         5.5?         4.29          00.70         0.99          1.00
  13.50    35.0,296.2         5.92         4*33          0.66          0.99          1.00
  13.6?    37.7,296.6         6.29         4.38          0.62          0.98          1.00
  13.83    40.3,296.9         6.69         4.41          0.59          0.98          1.00
  14.00    43.0,297.0         7.06         4.44          0.54          0.97          1.00
  14.17    45.6,297.2         7.4'5        4.45          0.52          0.97          1.00
  14.34    48.3,297.7         7.81         4.48          0.48          0.96          1.00
  14.50    50.8,299.6         8.13         4.52          0.45          0.96          1.00
  14.67    53.2,299.7         8.45         4.55          0.44          0.96          1.00
  14.83    55.6,301.2         8.71         4.62          0.41          0.95          1.01
  15.00    58.0,303.0         8.95         4.70          0039          0.95          1.01
  15.17    60.5,304.8         9.19         4.76          0.37          0.95          1.01
  15.33    63.3,306.3         9.47         4.78          0.35          0995          1.01
  15.50    66959307.5         9.73         4.78          0.32          O*94          1.01
  15.67    70.0,308.3         9.98         4.78          0.30          0.93          1.01
  15.83    73.8,308.9        10.21         4.78          0027          0.93          1.01
  16.00    78.0,309.0        10.43         4.70          0.25          0.92          1.01



 KFLAG =    1
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                                                        PACIFIC ENVIRONMENTAL SERVICES
                                                      REM2 PHOTOCHEMICAL MODEL (4/1/77)


      OCS - 1986 IMPACT WITH SALE-48 - 9/24
      SANTA BARBARA 3 SPILL TRAJECTORY - BLOWOUT AND FIRE - PART 2 - 1 HR
      START AT 1600, END AT 1700
      EMISSIONS GRID: SBDATA86


   TIME     POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)     NMHC(PPMC)    CO(PPM)

  16.00     11.0, 18.0          10.40         4.78          0.25          0.92          1.01
  16.09     13.2, 18.0          10.49         4.77          0.24          0.92          1.01
  16.17     15.2,       18.1    10.62         4.78          00.24         0.92          1.01
  16.25     17.1, 19.3          10.73         4.82          0.21          0.92          1.01
  16.33     19.0, 18.5          10.86         4.82          0*.21         0.92          1.01
  16.42     20.8, 18.7          11.00         4*83          0.21          0093          1.02
  16.50     22.5, 19.1          11.11         4.87          0.18          0.93          1.02
  16.58     24.1, 19.4          11.22         4.90          0.18          0.93          1.03
  16.67     25.7, 19.8          11.33         4.93          0.16          0.94          1.04
  16.75     27.1, 20.3          11.45         4095          0016          0,.94         1.04
  16.84     28.5, 2008          11.53         5.00          0.1 3         0,94          1.05
  16.9?     29.8, 21.4          11.61         5.05          0.14          0,95          1.06
  17.00     31.0, 22.0          11.52         5.25          0912          0.96          1.09



 KFLAG =    1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2   PHOTOCHEMICAL MODEL(4/1/77)


          Ocs - 1986 IMPACT WITH SALE-48 - 9/24
          SANTA BARBARA3' SPILL TRAJECTORY - 140 BARREL SPILL - PART 1 - 3 HRS
          START AT 1300, END AT 1600
          EMISSICNS GRID: OCDATA86.SALE48


  TIME    POSITION(X,Y)    O3(PPHM)    NC2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

 13*00     ?7.0,294.0        5.00        4.00         1.00        1.00         1.00
 13.17     29.7,294.9        5.14        4.24         0.75        1.00         1.00
 13.34     32.4,295.6        5.52        4.29         0.70        0.99         1.00
 13050     35.0,296.2        5.92        4.33         0.66        0.99         1.00
 13.67     37.7,296.6        6.29        4.38         0.62        0.98         1.00
 13.83     40.3.296.9        6.69        4.41         0.59        0.98         1.00
 14.00     43.0,?97.0        7.06        4.44         0.54        0.97         1.00
 14.17     45.6*297.2        7.45        4.45         0.52        0.97         1.00
 14.34     48.3,257.7        7.81        4.48         0.48        0.97         1.00
 14.50     50.8,298.6        8.14        4.51         0.45        0.98         1.00
 14.67     53.2.299.7        8.47        4.54         0.43        0.99         1.00
 14.84     55.7,301.2        8.74        4.61         0.40        1*O3         1.00
 15.00     58.0.303.0        9.00        4.68         O*38        1.08         1*OO
 15.17     60.5,304.8        9.27        4.74         0.36        1.12         1.00
 15.34     63.4,306.3        9.58        4.75         0.35        1.13         1.00
 15.50     66.5,307.5        9.87        4.75         0.32        1.12         1.00
 15.67     70.0,300.3       10.14        4.75         0.29        1.11         1.00
 15.83     73.8,308.8       10.39        4.75         0.26        1.19         1.00
 16.00     78.0,309.0       10.63        4.75         0.24        1010         1.00


 KFLAG =    1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL (4/1/77)

      Ocs  -  1986 IMPACT WITH SALE-4a - 9/24
      SANTA BARBARA3'SPILL TRAJECTORY 140 BARREL SPILL PART 2 1 HR
      START AT 1600, END AT 1700
      EMISSIONS GRID: SBDATA86


  TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  16.00   11.0, 18.0        10.60        4*75         0.24         1.10          1.00
  16.09   13.2, 18.0        10.70        4.75         0.24         1.10          1.00
  16.17   15.2, 18.1        10.84        4.76         0.24         1.1'0         1.00
  16.25   17.2, 18.3        10.96        4.79         0.21         1.10          1.00
  16.34   19.1, 18.5        11.11        4.79         0.20         1.10          1.00
  16.42   20.8, 18.8        11.26        4.80         0.20         1.10          1.01
  16.50   22.6* 19.1        11.37        4.84         0.17         1.11          1.01
  16.58   24.2, 19.4        11.46        4*89         O*15         1.11          1.02
  16.67   25.7, 19.8        11.58        4.91         0.15         1.11          1.03
  16.75   27.1* 20.3        11.70        4.93         0.15         1.12          1.03
  16.84   28.5, 20.8        11.81        4.96         0.14         1.12          1.04
  16.92   29.8, 21.4        11.90        5.01         O*14         1.13          1.05
  17.00   31.0, 22.0        11.81        5*21         O*12         1.14          1.07


 KFLAG  =  1
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)

          OCS  -  1986 IMPACT WITH SAL E-48 - 9/24
          SANTA BARBARA 3* SPILL TRAJECTORY 10000 BARREL SPILL PART1 3 HRS
          START AT 1300, ENO AT 1600
          EMISSIONS GRID: OCDATA66.SALE48


   TIME    POSITION(X,Y)     O3( PPHM)   NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

  13.00    2?.0,294.0          5.00        4.00         1*OO        1.0C        1.00
  13.17    29.7,294.9          5.14        4.23         0.75        1.00        1.00
  13*34    32.4,295.6          5.52        4.28         0.70        O*99        1.00
  13*5O    35.0,296.2          5.90        4.3?         0.66        0.95        1.00
  13.67    37.7.296.6          6.27        4.36         0.62        0.98        1.00
  13.83    40.3,296.9          6.66        4.39         0.5B        0.99        1.00
  14*OO    43.0,2'57.0         7.03        4.42         0.54        O*97        1.00
  14.17    45.6,?97.2          7.41        4.42         0.52        1.01        0.99
  14.33    48.2,247.7          7.78        4.45         0.48        1.37        c. 99
  14.50    50.8,?98.6          8.?3        4.48         0.43        2.30        0*99
  14.67    53.2,299.7          8.65        4.51         0.41        3.92        0.99
  14.83    55.6,301.?          9.60        4.57         0.36        6.84        0.99
  15*OO    58.0,303.0         10054        4.62         0.31       10.91        0.99
  15.17    60.5,304.8         11.59        4.61         0.27       13.96        0.99
  15.34    63.3,306.3         12.68        4.54         0.23       14.85        0.99
  15.50    66.5,307.5         13.64        4.4.?        0.20       14.79        1.00
  15.67    70.0,308.3         14.49        4.28         0.18       14.58        1*00
  15.83    73.8.308.8         15.22        4.14         0.15       14.36        1*00
  16.00    78.0,309.0         15.84        3. 99        0.14       14.12        1*0I


 KFLAG =    1
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                                          PACIFIC ENVIRONMENTAL SERVICES
                                       REM2 PHOTOCHEMICAL MODEL (4/1/77)

   OCS  -  1986 IMPACT WITH SALE-48 - 9/24 .
   SANTA BARBARA -3' SPILL TRAJECTORY - 10000 BARREL SPILL - PART 2 - 1 HR
   START AT 1600,  END AT 1700
   EMISSIONS GRID: SBDATA86


  TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  16.00    11.0, 18.0       15.80        3*99         0.14        14.11         1.01
  16.08    13.2* 18.0       16.08        3.93         0.13        14.01         1.01
  16.17    15.2, 18'.1      16.38        3.88         0.12        13.97         1.01
  16.25    17.1, 18.3       16.66        3.84         0.10        13.94         1*02
  16.33    19.0, 18.5       16.95        3.78         0.10        13.90         1.02
  16.42    20.8, 18.7       17.21        3.75         0.09        13.88         1*03
  16.50    22.5, 19.1       17.44        3.72         0.08        13.86         1004
  16.58    24.1, 19.4       17.66        3.70         0.08        13.85         1.05
  16.67    25.7, 19.8       17.,88       3.68         0.08        13.84         1.06
  16.75    27.1, 20.3       18.08        3.66         0.07        13.84         1.07
  16.84    28.5, 20.8       18.26        3.65         0.06        13.85         1.08
  16.92    29.8, 21.4       18.40.       3.67         0.06        13.87         1.09
  17.00    31.0, 22.0       18.40        3.83         0.05        13.91         1.11


 KFLAG  =  1
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                                                         PACIFIC ENVIRONMENTAL  SERVICES
                                                         REM2 PHOTOCHEMICAL MODEL (4/1/77)

          OCS  -  1986 IMPACT WITH SALE-48    7/25
          LOS ANGELES 1 TRAJECTORY  BLOWOUT AND FIRE  - PART 1 - 2 HRS
          START AT 0300, END AT 0500
          EMISSIONS GRID: OCDATA86.SALE48


  TIME    POSITION (X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO (PPM)

  3.00    244.0,206.0         1.00        4.00         3.00         2.00         2.00
  3.17    244.2,207.5         0.00        5.04         1.97         2.00         2.00
  3.34    244.5,209.0         0.00        5.07         1.96         2.00         2.00
  3.50    244.6,210.5         0.00        5.09         1.96         2.00         2.00
  3.67    244.8,212.0         0.00        5.10         1.97         2.01         2.00
  3.84    244.9,213.5         0.00        5.10         1.98         2.01         2.01
  4.00    245.0,215.0         0.00        5.11         2.00         2.02         2.01
  4.17    244.9,216.5         0.00        5.11         2.02         2.02         2.01
  4.34    244.4,217.8         0.01        5.10         2.05         2.03         2.01
  4.50    243.6.219.1         0.01        5.10         2.06         2.03         2.02
  4.67    242.4,220.2         0.00        5.12         2.06         2.03         2.02
  4.84    240.8,221.1         0.00        5.12         2.06         2.04         2.02
  5.00    238.9,222.0         0.03        5.09         2.10         2.04         2.02



KFLAG  =  1
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                REM2 PHOTOCHEMICAL MODEL  (4/1/77)

      Ocs  -  1986 IMPACT WITH SALE-48 - 7/25
      LOS ANGELES1 TRAJECTORY - BLOWOUT AND FIRE - PART 2 - 11 HRS
      START AT 0500, END AT 1600
      EMISSIONS GRID: LADATA86.SALE48


    TIME   POSITION(X,Y)   03 (PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO (PPM)

    5.00    26.1,  6.2       0.03        5.09        2.10        2.04        2.02
    5.25    24.6,  7.1       0.04        5.09        2.10        2.04        2.02
    5050    24.0,  8.2       0.16        5.04        2.15        2.04        2.02
    5.75    24.3,  9.6       0.30        5.08        2.14        2.04        2.02
    6.00    25.5, 11.2       0.48        5.21        2.09        2.06        2.02
    6.25    26.7, 12.8       0.55        5.59        2.00        2.08        2.02
    6.50    26.9. 14.3       0.85        5.90        2.06        2.11        2.00
    6.75    26.3, 15.6       1.00        6.52        2.38        2.16        2.06
    7.00    24.8, 16.8       0.65        7.85        5.69        2.28        2.09
    7.25    23.4, 17.9       0.58        9.50        8.80        2.39        2.12
    7.50    22.9, 19.1       0.81       11.53        8.25        2.42        2.16
    7.75    23.4, 20.4       1.23       13.84        7.13        2.44        2.21
    8.00    24.9, 21.8       1.89       16.02        5.00        2.45        2.23
    8.25    26.4, 23.0       2.87       17.22        4.41        2.43        2.26
    8.50    27.0. 24.0       4.02       18.02        3.52        2.39        2.30
    8.75    26.7, 24.6       5.40       18.41        2.82        2.36        2.32
    9.00    25.5, 24.9       6.89       18.50        2.32        2.32        2.34
    9.25    24.4, 2,5.2      8.46       18.37        1.93        2.28        2.35
    9.50    24.5, 25.9       9.97       18.09        1.66        2.25        2.36
    '3.75   25.7, 27.1      11.35       17.81        1.48        2.22        2.37
   10.00    28.0, 28.6      12.54       17.59        1.37        2.19        2.39
   10.25    30.3, 30.1      13.36       17.22        1.27        2.16        2.40
   10.50    31.5, 31.3     '14.24       16.75        1.18        2.14        2.40
   10.75    31.5. 32.0      15.10       16.23        1.10        2.12        2.40
   11.00    30.4, 32.3      15.86       15.74        1.02        2.09        2.40
   11.25    29.4, 32.6      16.43       15.39        0.97        2.07        2.41
   11.50    29.5, 33.1      16.93       15.08        0.93        2.05        2.42
   11.75    30.6, 33.8      17.40       14.75        0.89        2.03        2.43
   12.00    33.0, 34.8      17.81       14.85        0.86        2.01        2.44
   12.25    35.3. 35.8      17.68       14.06        0.83        2.01        2.44
   12.50    36.7, 36.7      17.74       13.59        0.80        1.99        2.44
   12.75    37.2, 37.4      17.92       13.04        0.75        1.98        2.43
   13.00    36.6, 37.9      18.09       12* 53       0.72        1.$6        2.42
   13.25    36.3, 38.4      18.20       12.10        0.68        1.95        2.42
   13.50    37.2, 39.0      18.30       11.70        0.65        1.94        2.41
   13.75    39.4, 39.6      18.42       11.32        0.61        1.93        2.40
   14.00    42.9. 40.4      18.51       10.95        0.58        1.92        2.39
   14.25    46.3, 41.0      19.36       10.78        0.53        1.91        2.40
   14.50    48.2, 41.3      20.10       10.56        0.49        1.89        2.41
   14.75    48.7, 41.3      20.91       10.32        0.45        1.88        2.41
   15.00    47.8, 41.0      21.54       10.08        0.40        1.87        2.42
   15.25    47.0, 40.6      22.12        9.85        0.37        1.87        2.02
   15.50    47.6, 40.2      22.62        9.63        0.34        1.87        2.43
   15.75    49.8, 40.0      23.08        9.43        0.32        1.87        2.43
   16.00    53.4, 39.8      23.53        9.26        0.28        1.89        2.44
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)

         OCS  -  1986 IMPACT WITH SALE-48 - 7/25
         LOS ANGELES SPILL TRAJECTORY - 140 BARREL SPILL - PART 1 - 2 HRS
         START AT 0300,ENO AT 0S00
         EMISSIONS GRID:OCDATA86.SALE48


  TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)   CO(PPM)

  3.00    244.0,206.0        1000         4.00         3.00         2.00        2.00
  3.17    244.2,207.5        0.00         5.04         1.97         2.00        2.00
  3.34    244.5,209.0        0.00         5.06         1.95         2.00        2.00
  3*5O    244.6,210.5        0.00         5.07         1894         2.02        1.99
  3067    244.8,212.0        0*00         5008         1.94         2.04        1*.99
  3*84    244.9,213.5        0.00         5.08         1,95         2.07        1.99
  4*OO    245.0,215.0        0000         5.08         1.95         2.11        1,.99
  4.17    244.9,216.5        0*00         5.08         1.96         2.15        1*.99
  4.34    244.4,217.8        O*O1         5.07         1*97         2.18        1.99
  4.50    243.6,219.1        0.01         5*O7         1.98         2.21        1.98
  4,67    242.4,220.2        0900         5.00         1.97         2022        1.98
  4.84    240.8,221.1        0000         5*O8         1.97         2.23        1.98
  5.00    238.9,222.0        O*O3         5.04         2.01         2.23        1.98


KFLAG =   1
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                REM2 PHOTOCHEMICAL MODEL  (4/1/77)

     Ocs  -  1986 IMPACT WITH SALE-48 - 7/25
     10S ANGELES SPILL TRAJECTORY - 140  BARREL SPILL-PART 2 - 11HRS
     START AT0500, END AT 1600
     EMISSIONS GRID:LADATA86.SALE48


  TIME    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

  5*OO     26.1, 602        O*O3        5.04       2.01        2.23        1*.98
  5,25     24.6,  7.1       0.04        5.04       2001        2.23        1.98
  5.50     24.0,  8.2       0.17        4*99       2.06        2.23        1.98
  5*75     24.3,  9.6       0.31        5.03       2.04        2,24        1.90
  6.00     25.5, 11.2       0.51        5.18       1.98        2.26        1.98
  6.25     26.7, 12.8       0.59        5.58       1.87        2*2.8       1*.98
  6.50     26.9, 14.3       0.92        5*9O       1.91        2.31        2.00
  6.75     26.3, 15.6       1.08        6.53       2.21        2.36        2.02
  7.00     24.8, 16.8       0.69        7.95       5.44        2.48        2.05
  7.25     23.4, 17.9       0.61        9.68       8.45        2.59        2.08
  7.50     22.9, 19.1       G*9O       11.81       7.80        2.61        2.12
  7.75     23.4, 20.4       1.35       14.10       6.69        2,63        2.17
  8.00     24.9, 21.8       2.08       16,23       5.45        2.64        2.19
  8.25     26.4, 23.0       3.15       17935       4.08        2.62        2822
  8.50     27.0, 24.0       4.38       18.06       3.26        2.5.8       2.26
  8.75     26.7, 24.6       5.71       18.46       2.56        2.54        2,28
  9.00     25.5, 24.9       7.27       18.44       2.16        2.50        2.30
  9.25     24.4, 25.2       8.90       18.24       1.83        2.46        2.31
  9*5O     24.5, 25.9      10.42       17095       1.58        2.43        2.32
  9.75     25.7, 2701      11.80       17.65       1.41        2.39        2.33
 10000     28.0, 28.6      12.99       17041       1.31        2.36        2.35
 10.25     30.3, 30.1      13.79       17904       1.22        2.34        2.35
 10*5O     31.5, 31.3      14.65       16.56       1,14        2.32        2.36
 10*75     31.5, 32.0      15.49       16.05       1,05        2,29        2,36
 11.00     30.4, 32.3      16.27       15.55       0.99        2.26        2.36
 11.25     29.4, 32.6      16.82       15.20       0.94        2.24        2,37
 11.50     29.5, 33*1      17.31       14.89       0.90        2.22        2.38
 11.75     30.7, 33*9      17.78       14.56       O*87        2.20        2,39
 12.00     33.0, 34*8      18.18       14.27       0.83        2919        2.40
 12.25     35.3* 35.8      18*04       13.88       0.81        2.18        2.40
 12.50     36.7, 36.7      18.07       13.42       0.78        2.17        2.40
 12.75     37.2, 37.4      18.25       12.87       0.73        2.15        2.39
 13.00     36.6, 37.9      18*4O       12.37       0.70        2.14        2.38
 13.25     36.3, 38.4      18.51       11.94       0.66        2.13        2.37
 13*5O     37.2, 39,0      18.62       11.54       0.63        2.11        2.37
 13075     39.4, 39.6      18.72       11*15       0.60        2.10        2.36
 14.00     42.9, 40.4      18.81       10.80       0.56        2009        2.35
 14,25     46.3, 41.0      19.67       10.62       0.52        2*O8        2,36
 14.50     48.2, 4103      20.49       10040       0.48        2.06        2.36
 14*75     48.7, 41*3      21.23       10.16       0..43       2.05        2,37
 15.00     47.8, 41.0      21.88        9.92       0.39        2.05        2,37
 15.25     47.0, 40.6      22.47        9.68       0.36        2004        2.38
 15.50     47.6, 40.2      22.96        9.46       O*34        2,04        2.39
 15475     49.8, 40.0      23.41        9.27       O*3O        2005        2.39
 16.00     53.4, 39.8      23.85        9.10       0.27        2.06        2,.40
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                                                      PACIFIC ENVIRONMENTAL SERVICES
                                                    REM2 PHOTOCHEMICAL MODEL (4/1/77)

      OCS  -  1986  IMPACTWITH SALE-48 - 7/25
      LOS ANGELES SPILL TRAJECTORY - 10000 BARREL SPILL PART 1 2 HRS
      START AT 03009 EN() AT 0500
      EMISSIONS GRID:OCDATA86.SALE48


    TIME   POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

    3.00   244.0,206.0         1.00        4.00         3.00       2000         2.00
    3.17   244.2,207.5         0.00        5.04         1.97       2.15         2*DO
    3.34   244.5,209.0         0.00        5.06         1.95       2.64         2.00
    3*50   244.6s210.5         0.00        5.08         1.94       38 70        1.99
    3.67   244.8,212.0         0.00        5*O9         1.94       504?         1*,99
    3.84   244.9,213.5         0.00        5.09         1094       7.90         1.99
    4.00   245.0,215.0         0.00        5.10         1*94       10069        1,.99
    4.17   244.9,216.5         0.00        5910         1.93       13*47        1,.99
    4.34   244.4,217.8         0.01        5.10         1.94       15.91        1.99
    4.50   243.6,219.1         0.01        5.13         1091       17.75        1.90
    4.67   242.4,220.2         O*OO        5.21         1.84       18.96        1.98
    4,84   240.9,221.1         0901        5031         10.74      19.72        1.98
    5,00   239.0,222.0         0.05        5.42         1,62       20.19        1098


  KFLAG  =  1
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                                                  PACIFICENVIRONMENTAL SERVICES
                                                REM2 PHOTOCHEMICAL MODEL (4/1/77)


      OCS  -  1986 IMPACT WITH SALE 48  -  7/25
      LOS ANGELES SPILL TRAJECTORY - 10000 BARREL SPILL - PART 2A - 1 HR
      START AT 1500, END AT 1600
      EMISSIONS GRID: LADATA86.SALE48


  TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

 15.00     47.9, 41.0       34* 00       6.40         0.16       17.80        2.65
 15.25     47.0, 40.6       35.68        6.11         0.14       17.90        2.67
 15.50     47.7, 40.2       36.56        5.88         0.13       18.05        2.69
 15*75     49.8, 39.9       37.35        5.69         O*11       18*21        2.,71
 16.00     53.5, 39.8       36.06        5.52         O*1O       18037        2.73


KFLAG =    1
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL  -(4/1/77)


        Ocs  -  1986 IMPACT WITH SALE-48 - 9/3
        SAN DIEGO 3'SPILL TRAJECTORY - BLOWOUT AND FIRE - PART 1 - 1.5 HRS
        START AT 1000,   END AT 1130
        EMISSIONS GRID: OCDATA86.SALE48


   TIME     POSITION(X,Y)      O3(PPHM)     NO2(PPHM)     NO(PPHM)    NMHC(PPMC)    CO(PPM)

  10.00     284.0,140.0          3.00         3.00          1.00         1.00         0.50
  10.17     288.1,137.5          3.14         3.09          0.91         1.00         0.50
  10.33     292.1,134.9          3.47         3*13          0.85         0.99         0.50
  10.50     296.0,132.1          3.83         3* 19         0.79         0.99         0.50
  10.67     299.8,129.2          4.21         3.23          0.74         0.99         0.50
  10.84     303.5,126.2          4*57         3.28          0.70         0.99         0.50
  11.00     307.0.123.0          4.94         3.33          0.66         0.99         0.51
  11.17     310.7,119.9          5.32         3.37          0.62         0.99         0.51
  11.34     314.5,117.1        ' 5.71         3.39          0.59         0.99         O*5I
  11.50     318.6,114.6          6.09         3.41          0.56         0.98         0.51


 KFLAG  =  1
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                                                           PACIFIC ENVIRONMENTAL SERVICES
                                                         R E M 2  PHOTOCHEMICAL MODEL (4/1/77)


          OCS   -  1986 IMPACT WITH SALE-48  -   9/3
          SAN DIEGO 3'SPILL TRAJECTORY - BLOWOUT AND FIRE - PART 2 - 3.5 HRs
          START AT 1130,END AT 1500
          EMISSIONS GRID: SDDATA86


    TIME     POSITION(X,Y)        O3(PPHM)      NO2(PPHM)      NO(PPHM)     NMHC(PPMC)     CO(PPM)

   11.50      28.6,  24.6           6.09          3.41           0.56          0.98          0.51
   11.75      35.1,  21.5           6*6O          3.42           0.52          0.97          0.51
   12.00      42.1,  19.0           7.16          3.43           0.48          0.96          0.51
   12.25      49.0,  17.0           7.75          3.48           O*45          O*95          0.51
   12.50      55.1,  15.2           8.11          3.74           0.46          O*97          0.53
   12.75      60.5,  13.5           8.57          3.87           0.45          0.96          0.54
   13*OO      65.1,  12.0           9.08          3.94           0.43          0.95          0.55
   13.25      69.2,  11.0           9.59          3.99           0.41          0.94          0.55
   13.50      73.1,  10.6          10.09          4.02           0.39          0.93          0.56
   13.75      76.7,  11.0          10.56          4.05           0.37          0.92          0.56
   14.00      80.1,  12.0          11.00          4.07           0.35          0.91          0.56
   14.25      83.5,  13.3          11*4O          4*O9           0.32          0.90         "0.57
   14.50      87.1,  14.2          11.78          4.10           0.31          0.89          0.57
   14.75      91.0,  14.8          12.13          4.11           0.29          0.80          0.57
   15.00      95.1,  15*O          12.44          4. 12          0.27          0.88          0.58



 KFLAG =    1
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                                                    PACIFIC ENVIRONMENTAL SERVICES
                                                   REM2 PHOTOCHEMICAL MODEL (4/1/77)

          OCS - 1986 IMPACT WITH SALE-48 - 9/3
          SAN DIEGO 3 SPILL TRAJECTORY - 140 BARREL SPILL PART 1 - 1.5 HRS
          START AT 1000, END AT 1130
          EMISSIONS GRID:DCDATA86.SALE48


   TINE    POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

  10*OO    284.0,140.0       3900        3*90        1000        1900        0050
  10.17    288.1,137.5       3.14        3*09        0*91        1.00        0.50
  10033    292.1,134.9       3.47        3.13        0.85        0.99        0.s0
  10.50    296.0,132.1       3883        3.18        0.79        0.99        O*SO
  10.67    299.8,129.2       4*21        3.22        0.74        o* 99       0050
  10.84    303.5,126.1       4.58        3.27        0*69        1091        O*5O
  11.00    307.1,123.0       4.95        3*31        0.66        1*O5        0.50
  11.17    310.7,119.9       5.33        3034        0*62        1.06        O*SO
  11.34    31,4.59117.1      5.73        3.36        0.58        1.06        0.50
  11050    318.6,114.6       6.12        3m37        0.55        1.05        0.50


 KFLAG =    1
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                                                    PACIFIC ENVIRONMENTAL  SERVICES
                                                 REM2 PHOTOCHEMICAL MODEL   (4/1/77)

    OCS  -  1986 IMPACT WITH SALE-48  9 / 3
    SAN DIEGO3' SPILL TRAJECTORY - 140 BARREL SPILL PART 2 3.5HRS
    START AT 1130, END AT 1500
    EMISSIONS GRID: SDDATA86

 TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   Co{PPM)

 11.50    28.6, 24.6        6.12        3.37         0.55        1.05        0.50
 11.75    35.1, 21.5        6.64        3.38         0.51        1.04        0.50
 12.00    42.1, 19.0        7.21        3.39         0.47        1.03        0.50
 12.25    49.0. 17.0        7.81        3.43         0.44        1*02        0.50
 12.50    55.1, 15.2        8.18        3.69         0.45        1.04        0.53
 12.75    60.4* 13.5        8.65        3.83         0.44        1.03        0.53
 13.00    65.1, 12.0        9.10        3.90         0.42        1.02        0.54
 13.25    69.2, 11.0        9.70        3.94         0.40        1.01        0*54
 13.50    73.1, 10.6       10*20        3.98         0.38        0.99        0.55
 13.75    76.7, 11.0       10.67        4.01         0.36        0.98        0.55
 14.00    80.1, 12.0       11.12        4.03         0.34        0.97        0.55
 14.25    83.5* 13*3       11.53        4.04         0.32        0.96        0.56
 14.50    87.1, 14.2       11.90        4.06         0*30        0.96        0.56
 14.75    91.0, 14.7       12.25        4.06         0.28        0.95        0.56
 15.00    95.1, 15.0       12.57        4.07         0.27        0.94        0.57


KFLAG =    1
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                                                  PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL  (4/1/77)


      Ocs  -  1986 IMPACT WITH SALE-48'- 9/3
      SAN DIEGO 3'SPILL TRAJECTORY 10000 BARREL SPILL - PART 1 - 1.5 HRS
      START AT 1000, END AT 1130
      EMISSIONS GRID: OCDATA86.SALE48


   TIME     POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

  10.00    284.0,140.0        3.00        3.00         1.00        1.00          O*5O
  10.17    288.1,137.5        3.14        3.09         0.91        1.00          0.50
  10*33    292.1,134.9        3.47        3.13         0.85        0.99          0.50
  10.$0    296.0,132.1        3.83        3.19         0.79        1.02          0.50
  10*67    299.8,129.2        4.23        3.22         O*?4        1.44          0.50
  10.84    303 .5*126.2       4.71        3.'29        0.67        3.03          0.50
  11.00    307.1,123.0        5.42        3.36         0.60        5.69          O*5O
  11.17    310.7,119.9        6.33        3.41         0.52        6.91          0.50
  11033    314.5* 117.1       7.30        3.43         0.46        7.16          O*5O
  11.50    318.5,114.6        8.25        3.44         0.40        7.11          0.50



  KFLAG =   1
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                                                 PACIFIC ENVIRONMENTAL SERVICES
                                             REM2 PHOTOCHEMICAL MODEL [4/1/77]


        Ocs  -  1986 IMPACT WITH SALE-48 9/3
        SAN DIEGO 3' SPILL TRAJECTORY 10000 BARREL SPILL PART 2 3.5 HRS
        START AT 1130,. END AT 1500
        EMISSIONS GRID: SDDATA86


   TIME    POSITION(X,Y)    O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    co(PPM)

  11.50     28.6, 24.6        8.25        3.44         0.40         7.12         0.50
  11.75     35.1, 21.5        9.58        3.42         0.35         7.04         0.50
  12.00     42.1, 19.0       10.8U        3.38         0.30         6.92         0.51
  12.25     48.9, 17.0       12.07        3.36         0.27         6.86         0.52
  12.50     55.1, 15.1       13.04        3.57         0.27         6.81         0.54
  12.75     60.5, 13.5       14.03        3.64         0.25         6.70         0.56
  13.00     65.1, 12.0       15.03        3.65         0.23         6.60         0.57
  13.25     69.2. 11.0       15.98        3.63         0.22         6.52         0.58
  13.50     73.1, 10.6       16.86        3.60         0.20         6.47         0.59
  13.75     76.7, 11.0       17.66        3.54         0.19         6.44         0.61
  14.00     80.1, 12.0       18.36        3.44         0.17         6.42         0.62
  14.25     83.4, 13.3       18.96        3.30         0.15         6.41         0.63
  14.50     87.1, 14.2       19.47        3.12         0.14         6.41         0.64
  14.75     91.0, 14.8       19.92        2.94         0.12         6.41         0.64
  15.00     95.1, 15.0       20.30        2.80         0.11         6.42         0.65



 KFLAG =    1
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                                              PACIFIC ENVIRONMENTAL SERVICES
                                            REM2 PHOTOCHEMICAL MODEL(4/1/77)

     OCS  -  1986 IMPACT WITHOUT SALE-48 - 7/10
     VENTURA SPILL TRAJECTORY BASE CASE - PART 1 - 7 HRS
     START AT 0400,END AT 1100
     EMISSIONS GRID:OCDATA86.SALE35


   TIME   POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO(PPM)

   4*OO   38.0,308.0         1.00        2.00         1.00        0050         0.50
   4.25   42.9,307.0         0.15        2.87         0.14        0.50         0.50
   4.50   47.733050.9        0.08        2.96         0.10        0.50         0,s0
   4.75   52.4,304.5         0.07        2.98         0.16        00s0         0.50
   5*00   57.0s303.0         0.11        2,95         0.31        D*SO         0.50
   5.25   61.39301"03        0020        2.87         0.44        0.50         0.50
   5.50   65.1,299.6         0835        2.76         0056        0.50         0.50
   5*75   68.3,297.8         0056        2.62         O*JO        O*SO         0.60
   6.00   71.0,296.0         O*74        2.53         0.78        0.50         0.50
   6.25   73.6,294.3         0.90        2.50         0.80        O*6D         0.49
   6,50   76.4,293.1         1.06        2*51         0039        00s0         0.49
   6.75   79.6,292.4         1.26        2.50         0.?8        O*SO         8049
   7.00   83.0,292.0         1050        2.48         ooa o       0.49         0.49
   7.25   86o.3c291o.8       1..75       2.47         O*J9        0.49         0.49
   7.50   89o.L,291oA        1.98        2*$0         0.75        0.49         0.49
   T*75   91.3,290.8         2.24        2.53         0.31        0.48         0.49
   8.00   93.09290.9         2.53        2.53         O*69        0.48         0.49
   8025   94.9,289.5         2.84        2.54         o●b7        0.47         0.49
   8.50   97.7,289.6         3.14        2.54         0.65        0.47         0.49
   8075   101.4,290.5        3.43        2.57         0060        0.46         0.49
   9000   106D.1s292o.O      3..75       2.58         0.59        0.46         0.49
   9.25   110.6,293.7        4.07        2.58         0.57        0.45         0.49
   9.50   114.1,294.9        4.40        2.5?         0.55        0.45         0.49
   9075   116.6,295.7        4.72        2.56         0.52        0.44         0.49
  10000   118.0,296.0        5.02        2.56         0.49        0.44         0.49
  10,25   119.2,296.6        5.12        2.53         0.49        0.43         0.49
  10.50   121ols297o.9       5.21        2.50         0.49        0.43         0.49
  10.75   123.7,300.1        5031        2.47         0.48        0.43         0.49
  11.00   127.0,303.0        5.40        2.45         0.47        0.43         0.49


  KFLAG  =  1
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                                                           PACIFIC ENVIRONMENTAL SERVICES
                                                          REM2 PHOTOCHEMICAL MODEL “’(4/4-1-1)

     OCS  .  1986 IMPACT WITHOUT SALE-48  7/10
     VENTURA SPILL TRAJECTORY - BASE CASE PART 2  1HR
     START AT 1100, END AT 1200
     EMISSIONS GRID: V2DATA86.SALE35


   TIME    POSITION(X,Y)     O3(PPHM)     NO2(PPHM)     NO(PPHM)     NMHC(PPMC)     CO(PPM)

   11.00      7.0; 37.0        5.40          2.45          0.47          0*U3          0.49
   11.08      8.2, 38.1        5.48          2.44          0.46          0.42          0.49
   11.17      9.3; 39.1        5.57          2.44          0.46          0.42          0.49
   11.25     10.3, 40.1        5.67          2.44          0.45          0.42          0.49
   11.33     11.3, 41.1        5.76          2.43          0.44          0.42          0.49
   11.42     12.2, 42.0        5.83          2.42          0.44          0.42          0.49
   11.50     13.1, 42.9        5.90          2.41          0.43          0.41          0.49
   11.58     13,9, 43.7        5.97          2,40          0,02          0*U1          0.49
   11067     14.6, 44.4        6.04          2.39          0.42          0.41          0.49
   11.75     15.3, 45.1        6.12          2.38          0.41          0.41          0.49
   11.83     15.9, 45.8        6.20          2*38          0.41          0.41          0.49
   11.92     16.5, 46.4        6,2?          2.38          0.40          0.41          0.49
   12.00     17.0, 47.0        6.38          2.38          0.40          0.41          0.49


  KFLAG =    1
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                                                   PACIFIC ENVIRONMENTAL SERVICES
                                                  REM2 PHOTOCHEMICAL MODEL (4/1/77)

   OCS  -   1986 IMPACT WITH SALE-48 - 7/10
   VENTURA SPILL TRAJECTORY - 10000 BARREL SPILL PART 1 7 HRS
   START AT 0400, END AT 1100
   EMISSIONS GRID: OCDATA86.SALE48


 TIME    POSITION(X,Y)     O3(PPHM)    NO2(PPHM)    NO(PPHM)   NMHC(PPMC)   CO (PPM)

 4.00     38.0,258.0        1.00        2.00         1.00        O*5O        0.50
 4.25     42.9.257.0        0.15        2.88         0.14        0.50        0.50
 4.50     47.7,255.9        0.08        2.96         0.10        0.71        0.50
 4.75     52.4,254.5        0.08        2.99         0.15        3.97        0.50
 5.00     57.0,253.0        0.15        2.99         0.27       10.64        0.50
 5.25     61.3.251.3        0.37        3.08         0.23       14.02        0.50
 5.50     65.1,249.6        0.87        3*10         0.22       14.92        0.50
 5.75     68.3,247.8        1.59        3.06         0.25       14.87        0.50
 6.00     71.0,246.0        2.40        3.03         0.26       14.81        0.50
 6.25     73.6,244.3        3.29        3.01         0.27       14.73        0.50
 6.50     76.4,243.1        4.26        3.03         0.22       14.62        0.50
 6.75     79.6,242.3        5.25        2.98         0.20       14.48        0.50
 7.00     83.0,242.0        6.27        2.88         0.21       14.28        0.50
 7.25     86.3,241.8        7.27        2.77         0.20       14.03        0.50
 7.50     89.1,241.4        8.23        2.65         0.19       13.74        0.51
 7.75     91.3.200.8        9.15        2.54         0.17       13.45        0.52
 8.00     93.0,240.0       10.08        2.44         0.16       13.20        0.53
 8.25     94.9,239.5       10.96        2.36         0.15       13.00        0.55
 8.50     97.7.239.6       11.85        2.29         0.15       12.07        0.56
 8.75    101.4,240.5       12.69        2.22         0.14       12.78        0.58
 9.00    106.0,242.0       13.44        2.11         0.13       12.73        0.60
 9.25    110.6,243.7       14.09        1.91         0.12       12.70        0.61
 9.50    114.1,244.9       14.64        1.67         0.10       12.68        0.63
 9.75    116.5.245.7       15.10        1.47         0.09       12.66        0.64
10.00    118.0,246.0       15.47        ?.31         0.08       12.64        0.66
10.25    119.2,246.6       15.08        1.26         0.08       12.03        0.66
10.50    121.1,207.9       14.74        1.22         0.08       11.48        0.67
10.75    123.7,250.1       14.43        1*20         0.08       10.97        0.67
11.00    127.0,253.0       14.17        1.17         0.08       10.51        0.68



KFLAG  =  1
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                                          PACIFIC ENVIRONMENTAL SERVICES
                                        REM2 PHOTOCHEMICAL MODEL (4/1/77)

     Ocs  -  1986 IMPACT WITH SALE-48 - 7/10
     VENTURA SPILL TRAJECTORY - 10000 BARREL SPILL - PART 2 - 1 HR
     START AT 1100, ENO AT 1200
     EMISSIONS GRID: V2DATA86.SALE48


  TIME   POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

 11000     7.0, 37*0       14.20       1*17       0009       10*5O        0.68
 11.09     8.2, 38.1       14.32       1*14       0908       10.50        0.68
 11.17     9.3, 39.2       14.43       1.10       0.08       10.50        0.68
 11.25    10.3, 40.2       14.53       1.07       0.07       10050        0.69
 11.33    11.3, 41.1       14.62       1*05       0.07       10.50        0.69
 11.42    12.2, 42.0       14.67       1.01       0907      “1O.47        0.69
 11.50    13.1, 42.9       14.72       0.99       0.07       10.45        0.69
 11.58    13.9, 43*7       14.77       0.96       O*O7       10.42        0.69
 11.67    14.6, 44.4       14.82       0.94       0.06       10.41        0.70
 11.75    1503, 4501       14* 89      0.92       0.06       10.41        0.70
 11.84    15.9, 45*9       14.98       0.91       0.06       10,42        0.70
 11.92    16.5, 46.4       15*07       0*B9       0.06       10*45        0.71
 12.00    17.0, 47.0       15.19       0.88       0.06       10.49        0.71


KFLAG  =  1
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                                                        PACIFICENVIRONMENTAL SERVICES
                                                   REM2 PHOTOCHEMICAL MODEL (4/1/77)

      OCS  -  1986 IMPACT WITHOUT SALE-48 - 7/10
      TANNER/CORTEZ SPILL TRAJECTORY - BASE CASE - 11  HRS
      START AT 0800, END AT 1900
      EMISSIONS GRID: OCDATA86.SALE35

   TIME     POSITIONCKSV)      O3(PPHM)    NO2(PPHM)    NO(PPHM)    NMHC(PPMC)    CO(PPM)

   8*00    141.0,129.0          3.00         1.00         0.50         0.25         0.50
   8.25    142.2,125.6          2.87         1,22         0.31         0.25         0.50
   8.50    143.2,122.1          2..99        1.23         0.32         0.25         0.50
   8.75    144.2,118.6          3.13         1.25         0.33         0.25         0.5 0
   9.00    145.0,115.0          3.26         1,26         0*34         0.25         0.50
   9.25    146.0,111.2          3*39         1.29         0034         0.24         0060
   9.50    147*SS107*3          3.53         1.29         0,34         0.24         0*60
   9.75    1499ss103.2          3,49         1.29         0.33         0.24         0.50
  10.00    152.0, 98.9          3.84         1.29         0033         0.24         0.50
  10.25    154*.99 94.8         3.99         1,29         0.32         0.24         0.49
  10.50    158.0, 91.1          4*14         1.29         0931         0.24         0.49
  10075    161.4, 87.8          4.28         1.2s         0831         0.23         0*A9
  11.00    165.0, 85.0          4.43         1.28         0030         0.23         0.49
  11.25    168.8, 82,3          4,s7         1.28         0.29         0,23         0.49
  11.50    172.6, 79.6          4.70         1.28         0.29         0.23         0.49
  11.75    176.3, 76.8          4.84         1.27         0.28         0822         0.49
  12.00    180.0, 73.9          4..97        1.27         0027         0.22         0.49
  12.25    184.1, 71.2          5.10         1.26         0.26         0.22         0.49
  12.50    188.8, 68.8          5.22         1.26         0.26         0.22         0.49
  12.75    194.1, 660.7         5033         1.25         0025         0.21         0.49
  13.00    200.1, 65.0          5.45         1025         0,24         0.21         0.49
  13.25    206.1, 63.4          5.56         1.24         0.23         0.21         0.49
  13950    211.8,  62A          5.66         1.23         0.23         0,21         0.49
  13875    217.1, 60.9          S*75         1.22         0*22         0.20         0.49
  14.00    222.0, 60.0          5.85         1.21         0.21         0.20         0.49
  14.25    227.2, 59.1          5*S3         1.20         0.20         0.20         0.49
  14050    233.3, 58.3          6.01         1.19         0*A9         0920         0.48
  14.75    240.3, 57.6          6.08         1.18         0.18         0.20         0.48
  15.00    248.1, 56.9          6.14         1.17         0,1?         0.20         0.48
  15.25    255.9, 56.4          6,20         1.15         0.17         0*20         0.48
  15.50    263.0, 56.1          6.25         1.14         0.16         0.20         0.48
  15075    269.4, 55.9          6.29         1.13         0.15         0.19         0.48
  16.00    275.0, 55.9          6.33         1.12         0.13         0.19         0.48
  16.25    280.9, 55.8          6.36         1.12         0.12         0.19         0.48
  16.50    288.0, S503          6.40         1.10         0.12         0.19         0.48
  16.75    296.4, 54.3          6.41         1.10         0.11         0.19         0.48
  17000    306.0, 53.0          6.43         1.09         0.10         0.19         0.48
  17.25    315.4, 51.6          6.43         1.09         One          0.19         0.48
  17.50    323.1, 50.6          6.43         1.10         0.07         0.19         0.48
  1707s    328.9, 50.1          6.44         1.09         0.07         0.19         0.48
  18.00    333.0, 50.0          6.44         1.09         0.06         0.19         0.47
  10025    336.9, 49.9          6.42         1.10         0.04         0.1 9        0.47
  18.50    342.2, 49.3          6.41         1.11         0*E3         0.19         0.47
  18.75    3480,99 48.4         6,39         1.11         0.01         0.19         0.47
  19.00    356.9, 47.0          6,39         1.11         0.01         0.19         0.47
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                                        PACIFIC ENVIRONMENTAL SERVICES
                                       REM2 PHOTOCHEMICAL MODEL (4/1/77)

   Ocs - 1986 IMPACT WITH SALE-48 - 7/10
   TANNER/CORTEZ SPELL TRAJECTORY - 10000 BARREL SPILL - 11HRS
   START AT 0800, END AT 1900
   EMISSIONS GRID: OCDATA86.SALE48


  TIME   POSITION(X,Y)    O3(PPHM)   NO2(PPHM)   NO(PPHM)   NMHC(PPMC)   CO(PPM)

  8000   141.0s129.0        3.00       1*00       0.50        0.25        0*50
  8.25   142.2,125.6        2.96       1.24       0.30        2.71        0050
  8.50   143.2s122.1        3.46       1*31       0.28        6.03        0.50
  0.75   144.2,118.6        4.19       1*37       0.26        7.91        0*50
  9.00   145.0,115.0        5.00       1.40       0.23        8.12        0.50
  9*25   146.0,111.3        5.78       1.42       0.21        8*02        0.50
  9.50   147.5s10744        6.53       1,42       0.19        7.88        0*.50
  9.75   149.5B103.2        7.28       1.41       0.17        7.72        0851
 10.00   152.0, 99.0        7..98      1.39       0.16        7.54        0.51
 10.25   154.9, 94.8        8.67       1.36       0.15        7.37        0.52
 10.50   158.0, 91.1        9*34       1.33       0*13        7.24        0.53
 I0*75   161.4, 87.8        9.97       1.31       0013        7*14        0.54
 11.00   165.0, 85.0       10.56       1.28       0.12        7.07        0.55
 11.25   168.8, 82.3       11.10       1.24       0.11        7*02        0056
 11.50   172.5, 79.6       11.57       1.18       0.10        6.99        0*57
 11.75   176.3, 76.0       11.97       1.09       0909        6.97        0.58
 12.00   180.1, 73*9       12.29       0.99       0.08        6.96        0*59
 12.25   184.1, 7103       12.56       0.90       0.07        6.95        0.60
 12.50   188.8, 68.8       12.79       0.83       0.07        6.94        0.61
 12.75   194.1, 66.7       12.98       0.77       0.06        6.93        0.61
 13.00   200.0, 65.0       13.15       0.72       Q*O5        6.92        0.62
 13.25   206.1, 63.5       13.-30      0.67       0005        6.91        0.63
 13.50   211.8, 62.1       13044       0.63       O*Q5        6.90        0.63
 13.75   217.1, 60.9       13.55       0.60       0904        6.89        0*64
 14.00   222.0, 6000       13*65       0*57       0.04        6.88        0.64
 14.25   227.2, 59.1       13.74       0.55       0.04        6.87        0..65
 14.50   233.3, 50.3       13.82       0053       0.04        6.86        0.65
 140?5   240.2, 57.6       13.89       0.51       0.03        6.85        0.66
 15.00   248.1, 57.0       13.95       '0.49      0.03        6.84        0.66
 15.25   255.9, 56.4       14.01       0*48       0003        6*83        0.67
 15*50   263.1, 56.1       14*05       0.47       0.03        6.82        0.67
 1s075   269.4, S5.9       14.09       0.46       0.03        6.81        0.67
 16.00   275.0, 56.0       14.12       0.45       0.02        6.80        0.68
 16.25   280.9, 55.9       14014       0044       O*O2        6.79        0.68
 16.50   288.0, 5503       14.16       0.43       0002        6.79        0968
 16.75   296.5, 54.4       14.17       'O*43      0.02        6.78        0*68
 17.00   306.1, 53.0       14.18       0.42       O*O2        6.77        0.68
 1?.25   315.4, 51.6       14.18       0.42       O*O1        6.76        0*68
 17.50   323.0, S0.6       14.18       0.41       O*O1        6075        0.69
 17.75   328.9, 50.1       14.17       0.41       0001        6.74        0.69
 18.00   333.0, 50*0       14.16       0.41       0.01        6.73        0.69
 18.25   336.9, 49.9       14.15       0.41       O*O1        6.72        0.69
 18.50   342.2, 49.4       14.13       0.41       0.00        6.71        0.69
 18.75   348.9, 48.4       14.11       0.41       0800        6070        0.69
 19*00   357.0, 47*0       14.09       0.41       o* 00       6.69        0.69
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APPENDIX E

HYDROCARBON LOSSES FROM PETROLEUM STORAGE TANKS AT PROPOSED LNG FACILITIES

E.

E.1 Storage Tank Assumptions for an LNG Facility

1) One 132,000 bbl capacity fixed-roof tank storing Bunker C fuel oil.

2) One 25,000 bbl capacity fixed-roof tank storing #2 fuel oil.

3) One 5,000 bbl capacity fixed-roof tank storing diesel fuel.

4) Four tanks storing liquified natural gas (LNG); it is assumed that all hydrocarbon losses are captured by a compressor and thus the LNG tanks have no hydrocarbon emissions.

E.2 Fixed-roof Tank Loss Equations (Burklin and Honerkamp, 1976)

1) Hydrocarbon breathing losses:

$$L_b = (2.21 \times 10^{-4}) \times M \times \left[\frac{P}{14.7-P}\right]^{0.68} \times D^{1.73} \times H^{0.51} \times \Delta T^{0.5} \times F_p \times C \times K_c \qquad \text{(E-1)}$$

where L_b = breathing loss, lb/day

M = molecular weight, lb/lbmole

P = true vapor pressure of liquid at bulk liquid temperature, psia

D = tank diameter, feet

H = average vapor space height, feet

ΔT = average diurnal temperature change, °F

F_p = paint factor

C = adjustment factor for small diameter tanks

K_c = adjustment factor for crude oil storage

2) Hydrocarbon working losses:

$$L_w = (4.603 \times 10^{-7}) \times M \times P \times K_c \times V \times [N + 180] \qquad \text{(E-2)}$$

where L_w = working loss, lb/day

M = molecular weight, lb/lbmole

P = true vapor pressure of liquid at bulk liquid temperature, psia

K_c = adjustment factor for crude oil storage

V = tank capacity, bbl

N = number of turnovers per year

E.3 Calculated Hydrocarbon Emissions

The parameters used in equations (E-1) and (E-2) are listed in Table E-1; the parameters were derived from Burklin and Honerkamp (1976) and Reid and Sherwood (1966). The resulting calculated hydrocarbon emissions are shown, in Table E-2. The total hydrocarbon emission rate from all tanks was 59.95 lb/day or 1.13 kg/hr.

Table E-1. EQUATION PARAMETERS

Parameter	Bunker C Tank	#2 Fuel Oil Tank	Diesel Fuel Tank
V, bbl	132,000	25,000	5,000
M, lb/lbmole	190	130	130
P, psia	0.00019	0.05	0,15
D, feet	140	80	42
H, feet	25	15	10
T, °F	20	20	20
'P	1.46	1.00	9,00
C	1.0	1.0	1,0
K_C	1.0	1.0	1.0
N	13	13	13

Table E-2. CALCULATED HYDROCARBON EMISSIONS

Tank	Breathing Loss lb/day	Working Loss lb/day	Total Loss lb/day
Bunker C	3.46	0.42	3.88
#2 Fuel Oil	21.06	14.44	35.50
Diesel Fuel	11.91	8.66	20.57
All tanks	36.43	23.52	59.95

REFERENCES

Burklin, C.E. and Honerkamp, **R.L.** (1976) Revision of Evaporative Hydrocarbon Emission Factors. Radian Corporation, Austin, Texas, Report No. EPA-450/3-76-039.

Reid, **R.C.** and **Sherwood, T.K. (1966)** The Properties of Gases and Liquids, 2nd edition. **McGraw-Hill** Book **Co.,** New York.