BETA
UNIT

EIR~EA

Shell OCS Beta Unit Development

February 21, 1979
Finalizing Addendum

Volume IV

Prepared By:

United States Geological Survey
Department of the Interior
300 North Los Angeles Street
Los Angeles, California 90013

State Lands Commission
1807 13th Street
Sacramento, California 95814

Port of Long Beach
925 Harbor Plaza
Long Beach, California 90801

EIR/EA
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United States Geological Survey
Department of the Interior
300 North Los Angeles Street
Los Angeles, California 90013

Technical Assistance:

WESTEC Services, Inc.
180 East Main Street, Suite 150
Tustin, California 92680

ERRATA SHEET FINALIZING ADDENDUM

Volume	Page	Item	
I	51	Ppg. 5	"200-barrel" should be "2000-barrel."
I	52	Ppg. 8	"Hydrogen gas safety system" should be "hydrogen sulfide gas safety system."
I	54	Ppg. 3	Small spills are to be handled by platform personnel using on-board equipment, not SC-PCO equipment.
I	54	---	In the first paragraph of Section 2.4.2.7, the last sentence should be revised to read "...no discharge of oil into the ocean should occur."
I	161	Ppg. 1	"Significance levels have been included in the ruling" should read "'Significance Levels' have been included in a more recent EPA ruling of 19 June 1978."
II	23	Last Ppg.	The 120 figure should be 300+ (Reference Dames & Moore Report "Pipeline Route Survey" in Table 1 of the Appendix).
II	37	Table 4.3-5	The column for emissions should read lbs/day.
II	39	Table 4.3-7	SO_2 Emissions for Fuel Oil until 1992 should be 35.0 lbs/10^3 gal. oil.
II	43	Table 4.3-11	SO_2 Emissions for the D398 Diesel Engines should be 1.73, 1.01, 0.67, 0.34, 0.07. Please note that this is based on the use of 0.25 percent sulfur diesel fuel.
II	44	Table 4.3-12	HC emissions for the turbines for the year 2000 should be 37.0 with a new total of 37.4. The SO_2 total should be 61.7.
II	45	Ppg. 2	Reference should read (Sivader and Mikolaj, 1973).
II	51	---	The equations at the top of the page should read: $Lw = \frac{T}{103}$
II	60	Table 4.3-22	SO_x emissions for the Saturn Turbines should be 0.09 tons/day.

Volume	Page	Item	
II	74	Ppg. 5	The second sentence should read (2.0 times the annual average emissions)... In this case, it is shown that the Project Benefit Ratio is the governing factor for all emissions except SO_2 which will be governed by the Project Safety Factor.
II	75	Table 4.3-30	The heading for the third column should read, 2.0 Times Annual Average Emissions.
II	105	Ppg. 3	Change to: "depth of 130 feet (40m)."
II	111	Ppg. 3	Change to: "The water intake pipe will be located 42 feet (13m) below the surface, with the discharge at a depth of 130 feet (40m)."

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

In Reply Refer To:
Mail Stop 630

19 JAN 1979

Memorandum

To: Acting Conservation Manager, Western Region

From: Chief, Conservation Division

Subject: Review of Draft EIR-EA on the Shell OCS Beta Unit Development

We have reviewed the subject document and received comments from both the Director's office and the Office of Environmental Impact Analysis Program, Land Information Analysis Office. Coordinated comments are enclosed.

The document appears to be comprehensive and well written. Noteworthy features are the oil spill discussions, and the detailed text and illustrations of offshore geology, profiles, bathymetry, subsea faults, other subsea features, oil seeps and pipeline routes.

Several additions need to be made to the document prior to the final publication. These areas are discussed in the enclosed comments.

Harold L Pumphrey
Acting Chief, Conservation Division

Enclosure

1. The impact discussion omits the analysis of the impacts of the proposal and its associated onshore facilities on endangered and threatened species. This impact discussion should include all endangered species known to inhabit or frequent both the onshore and offshore areas involved with the project and its associated facilities. Appendix I clearly suggests that the Area Oil and Gas Supervisor has completed an analysis of the situation and has determined that the proposal and its associated facilities will not affect the endangered/threatened species. The impact section should clearly demonstrate the basis for the Area Oil and Gas Supervisor's determination of no effect; therefore, Endangered Species, Section 7, consultation with both the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) is not necessary.

2. A second ommission relates to the alternatives available to the Federal interests. In view of the State interest assertion on vol. II, p. 223, second paragraph, the final document should address more specifically the Federal position and provide the basis for it. This can be done most completely by adding our established "admininstrative alternatives," as reflected in section VIIID, of the Santa Barbara Channel Development FES (SBC-FES). As a minimum, the EIR/EA discussion on vol. II, p. 223, first paragraph, should be redone to include more specific language and thrust of the SBC-FES, and a statement adding the SBC alternatives cited, by reference, to the EIR/ EA. Either way, a more comprehensive treatment of the Federal alternatives is needed.

3. vol. I, p. 89. Figures 3.1-9 show, by an arrowhead symbol, a type of seafloor seep identified as "gas and oil (?) seep." A comparison between the three categories of seeps shown on the map with those identified in the text (p. 88) suggest that the arrowhead symbols correspond to the third category of seeps, which are termed "seep questionable--extremely doubtful." If this is so, it should be indicated in the map explanation. The distinction could be important because one such seep occurs only 600 feet southwest of the Platform Ellen site, according to the map.

4. vol. I, p. 224, 3.5.1.4, paragraph 2. Other documents that could be referenced are the BLM Sale 48 documents and the associated Section 7 "Biological Opinion" for that sale.

5. vol. I, p. 268, item (5). This lists the birds which are classified as endangered or threatened and assumes that these are the only listed endangered or threatened species that occur in the nearshore/offshore area. Have the NMFS listed species been considered?

6. vol. I, p. 274, 3.5.2.2. These species should be discussed in vol. II, along with the Section 7 requirements of the Endangered Species Act.

7. vol. II, p. 105, 4.4.2.2. Some measures, such as silt screens, should be considered to control the migration of suspended solids within the turbidity plume resulting from seawater disposal of drilling fluids.

8. vol. II, p. 170-172, 4.5.2.5. We assume that there are not any endangered/threatened mammals discussed in this section. If any occur, they should be identified.

9. vol. II, p. 235. With regard to the proposed boat launch facility in Huntington Harbor, the impacts do not appear to have been assessed, and the recommendations are inconclusive. Statements in the Executive Summary (p. XVII, paragraph 2) and in vol. II (p. 235, last paragraph) suggest that the proposed facility will have impacts on parking and circulation, but little or no information is provided on the magnitude of such impacts or whether they are likely to be unacceptable. It is stated that "Location at a more industrialized area might reduce parking and circulation impacts . . ." (p. XVII). It would be helpful to clarify what jurisdication the Government has over this type of facility and, until the impacts have been assessed, it might be preferable to omit statements that give the appearance of favoring alternative sites to the proposed site.

10. vol. III. A copy of the response from NMFS review of the plan and the BLM S.O. 2974 worksheet is usually included in the appended EA correspondence.

RESPONSE TO COMMENTS OF THE UNITED STATES
DEPARTMENT OF INTERIOR, GEOLOGICAL SURVEY

1. The applicable endangered and threatened species within the project area were discussed in Volume I, Section 3.5, p. 261 and 274, and also enumerated on several species lists included in Volume I (Table 3.5-32, page 262) and Volume III. This information can be augmented by the data displayed on the attached table. This table is based on information contained within the Draft EIS for OCS Lease Sale 48. The Beta Unit impact discussion (Volume II) covered the mechanisms of how different events (in particular, oil spills) could affect different species and habitats and the variance in impact severity between habitats. No specific discussion was made of endangered or threatened species because there is no clear distinction of impact within habitats.

   The document clearly indicates that a major oil spill would adversely affect a variety of habitats if containment procedures are not effective. These impacts would include the endangered and threatened species discussed in Volumes I and III. The text does note, in the Shell Beta Volume II as well as in Volume II of the Draft EIS for OCS Lease Sale 48, that some mortality to species (including endangered and threatened) may occur as a result of project implementation. However, it is stated that this will be a short-term impact and that adverse population decline would not occur.

2. To more accurately reflect the Federal position regarding the "no project" alternative, the following additional discussion is provided.

   1. <u>No Action</u>

      Pursuant to implied covenants of both the OCS Lands Act and the existing lease agreements, the Secretary is obligated to respond to a legitimate application to conduct operations on a valid lease providing all terms and conditions thereunder have been met. His response may be approval as proposed, rejection on various legitimate grounds, approval in part and rejection in part, approval subject to such additional conditions and requirements as he may impose under the law, or deferral of decision, based on proper grounds, as described below. Accordingly, and as previously discussed, the alternative of "no action" by the Secretary is not tenable with respect to legitimate operations which may be proposed in the future on leases existing at this writing. "No action" would equate to maintaining the status quo, and the constraints and impacts would be the same as stated in "D.3.", below.

TABLE 1

MOST PROBABLE POTENTIAL IMPACTS ON ENDANGERED SPECIES BETWEEN POINT REYES AND PUNTA EUGENIA

(R = Very remote probability of any impacts, Min = Minor, M = Moderate, H = Heavy, S = Severe)
(See narrative for a definition of these terms)

Organisms	Most Probable Level of Impacts from Most Probable Sources Point Reyes To Punta Eugenia								Worldwide Long Term	
	Traffic, Boat, Air	Exploratory Drilling Activity	Mud Cuttings Form. H_2O	Prod. Plat	Pipeline Const.	Oil Spills & Cleanup	Combined Sale 48 Impacts	Cum. Of All Proj.	Sale 48	Cum.
I. Mammals										
Whales										
1. Gray	Min	Min	R	Min	Min	M	M	M	M	M
2. Humpback	Min	Min	R	Min	Min	M	M	M	Min	Min
3. Pacific Right	Min	Min	R	Min	Min	M	Min	M	Min	Min
4. Blue	Min	Min	R	Min	Min	M	M	M	Min	Min
5. Sei	Min	Min	R	Min	Min	M	Min	M	Min	Min
6. Sperm	Min	Min	R	Min	Min	M	Min	M	Min	Min
Seals										
7. Guadalupe Fur	Min	Min	Min	Min	Min	S	S	S	Min	M
Sea Otters										
8. Southern Sea	R	R	R	R	R	Min	Min	M	Min	Min
Terrestrial Mammals										
9. Salt Marsh Harvest Mouse	R	R	R	R	R	Min	Min	Min	Min	Min
10. Morro Bay Kangaroo Rat	R	R	R	R	R	R	Min	Min	Min	Min

Organisms	Most Probable Level of Impacts from Most Probable Sources Point Reyes To Punta Eugenia								Worldwide Long Term	
	Traffic, Boat, Air	Exploratory Drilling Activity	Mud Cuttings Form. H_2O	Prod. Plat	Pipeline Const.	Oil Spills & Cleanup	Combined Sale 48 Impacts	Cum. Of All Proj.	Sale 48	Cum.
II. Birds										
11. Brown Pelican	Min	Min	Min	Min	Min	M	M	H	Min	Min
12. Aleutian Canada Goose	R	R	R	R	R	Min	Min	Min	R	Min
13. California Clapper Rail	R	R	R	R	R	Min	Min	Min	Min	Min
14. Light-Footed Clapper Rail	R	R	R	R	R	Min	Min	Min	Min	Min
15. California Black Rail	R	R	R	R	R	Min	R	Min	R	Min
16. California Least Tern	R	R	R	R	R	M	Min	Min	Min	Min
17. American Peregrin Falcon	R	Min	R	R	R	M	M	M	Min	Min
18. Beldings Savannah Sparrow	R	R	R	R	R	Min	Min	Min	Min	Min
III. Reptiles										
Sea Turtles										
19. Leatherback	Min	Min	Min	Min	Min	M	M	M	R	Min
20. Hawksbill	Min	Min	Min	Min	Min	M	M	M	R	Min
21. Green	Min	Min	Min	Min	Min	M	M	M	R	Min
22. Loggerhead	Min	Min	Min	Min	Min	M	M	M	R	Min
23. Pacific Ridley	Min	Min	Min	Min	Min	M	M	M	R	Min
IV. Insects										
Butterflies										
24. El Segundo Blue	R	R	R	R	R	Min	R	Min	R	Min
25. Smith's Blue	R	R	R	R	R	Min	R	Min	R	Min
26. Globose Dune	R	R	R	R	R	Min	R	Min	R	Min

Organisms	Most Probable Level of Impacts from Most Probable Sources Point Reyes To Punta Eugenia								Worldwide Long Term	
	Traffic, Boat, Air	Exploratory Drilling Activity	Mud Cuttings Form. H_2O	Prod. Plat	Pipeline Const.	Oil Spills & Cleanup	Combined Sale 48 Impacts	Cum. Of All Proj.	Sale 48	Cum.
V. Molluscs										
27. Banded Dune Snail	R	R	R	R	R	Min	Min	Min	R	Min
VI. Plants										
28. San Clemente Broom	R	R	R	R	R	Min	R	Min	R	Min
29. San Clemente Island Bushmallow	R	R	R	R	R	Min	R	Min	R	Min
30. San Clemente Island Larkspur	R	R	R	R	R	Min	R	Min	R	Min
31. San Clemente Island Indian Paintbrush	R	R	R	R	R	Min	R	Min	R	Min
32. *Astragalus miguelensis*	R	R	R	R	R	Min	R	Min	R	Min
33. *Astragalus pycnostachyus lanosissimus*	R	R	R	R	R	Min	R	Min	R	Min
34. Little Sur Manzanita	R	R	R	R	R	Min	R	Min	R	Min
35. Surf Thistle	R	R	R	R	R	Min	R	Min	R	Min
36. Saltmarsh birds beak	R	R	R	R	R	Min	R	Min	R	Min
37. Prostrate nosackia	R	R	R	R	R	Min	R	Min	R	Min

[a]All the references listed for this section were used in compiling this table.

2. Defer Action

The Secretary may defer final action on a proposal with proper grounds. These could include but not be limited to the need and time required for:

a. Modification of the proposal to correct administrative or technologic deficiencies;

b. Re-design to reduce or avoid environmental impact;

c. Acquisition of additional data to provide an improved basis for technical or environmental evaluation;

d. Further evaluation of the proposal and/or alternatives.

The principal effect of deferring action on a proposal would be a comparatively short-term delay in the imposition of all related impacts of the proposal -- both adverse and beneficial, as previously described in Volume II.

3. Prevent Further Development of These Leases

The only alternatives to allowing full development of these leases are preventing such development or imposing additional conditions and restrictions on the operations. The several apparent means of preventing full development are discussed in the draft EIS for Lease Sale 48.

If prevention of full development of leases were accomplished, substantial quantities of oil and gas, known to be present, would be left in place and not recovered for use.

3. The gas and oil seeps designated on Figure 3.19 with arrows do in fact correspond to Rank 3 discussed on page 88 of Volume I. These seeps are considered questionable - extremely doubtful by MESA[2] in their Beta Platform site evaluations.

4. The Draft EIS for OCS Lease Sale 48 was only available in preliminary form during preparation of the Shell Beta Draft EIR/EA. Subsequent to public review of the Shell Beta Draft EIR/EA the OCS Lease Sale 48 document was reviewed and some information from that document concerning endangered and threatened species has been included in this finalizing addendum (as Table 1).

5. In addition to the discussion in Volume I on page 268, there is a discussion on page 274 of endangered species and Figures

3.5-27 and 3.5-28 provide further specificity to sensitive offshore and onshore habitats. The National Marine Fisheries Service (NMFS) was consulted during preparation of the document as referenced on several of the species lists contained in Volume I of the Draft EIR/EA.

6. Please see the response to comment number 1.

7. The Shell Oil Company Plan of Development includes the use of high speed shale shakers, desanders, and desilters to maintain a low solids drilling fluid. This should serve to mitigate the amount of drilling fluid which might migrate within the turbidity plume.

8. Endangered and threatened species are covered within Section 3.5. Please see response to comment Number 1.

9. The specific impacts of the Huntington Harbour Crew Launch are discussed in Sections 4.6.6 - 4.6.9. The recommendations made in Section 5.3 are based on these specific impact sections. This particular site would fall under the jurisdiction of the City of Huntington Beach.

10. The NMFS review and the Bureau of Land Management (BLM) worksheet were not received with correspondence from these agencies and therefore was not included in the Technical Appendix (Volume III). It was felt that the correspondence from these agencies and the Fish and Wildlife Service on pages I-1, I-2, I-5, I-6 and I-7 was sufficient.

State of California — The Resources Agency of California

Memorandum

To : (1) L. Frank Goodson, Projects Coordinator
The Resources Agency

(2) Dwight Sanders
State Lands Commission
1807 - 13th Street
Sacramento, CA 95814

Date : January 10, 1979

Subject: SCH #78121133: EIR-EA · Shell OCS Beta Unit Development

From : Department of Boating and Waterways

After careful review, the Department of Boating and Waterways (DBW) would like to offer the following comments:

11. Page IX of the Executive Summary states that measures to reduce risk of large-ship collision should be taken. Our Department recommends that such measures as approved navigation aids, visual identification, notification of marine interests, and safety zones must be taken in order to reduce the chance of collision.

12. On page 290 of Volume I, Item 3.6.3.2., reference is made to the U.S.C.E. decision not to implement safety fairways as recommended by the U.S.C.G. However, there is no information provided as to why the U.S.C.E. would not implement the safety fairways.

13. On page 195, Volume II, Item 4.6.3.3.(1), reference is made to "the U.S.C.G. considering testing a Radar Responder Beacon Unit" on an offshore platform. The DBW recommends that testing be a must in order to determine its effectiveness as a navigational aid.

14. In reference to Page 220, Volume II, Item 4.6.9.3.(2), we recommend, as a matter of safety, that the platforms be clearly identified and visible to marine traffic and that this concern have priority over the mitigation to aesthetic impacts.

15. Our Department concurs with the position of the U.S.C.G. as stated in their letter of August 8, 1978, (Page III-I of Volume III) which reads "the proposal . . . is unacceptable without the institution of the shipping safety fairways."

Thank you for the opportunity to review this document.

Marty Mercado
MARTY MERCADO
Director

cc: Larry Thomas, Operations Division

RESPONSE TO COMMENTS OF THE RESOURCES AGENCY OF CALIFORNIA, DEPARTMENT OF BOATING AND WATERWAYS

11. The mitigation measures summarized in the Executive Summary and displayed in detail in Section 4.6.3 are recommendations to the lead agency as measures to reduce the level of impact (i.e., risk of ship collision). The lead agencies may or may not choose to accept these mitigations during their certification process.

12. Discussions with the United States Army Corps of Engineers indicate that they do not wish to implement the safety fairways. It is their feeling that implementation at this time is not warranted because of the distance (500+ meters) of the Beta platforms away from the traffic lanes. Further, they feel that implementation might serve to preempt the possibility of other oil development within that area specified as the safety fairway.

13. The United States Coast Guard (U.S.C.G.) has not determined if use of Radar Responder Beacon Units on offshore platforms is viable. Prior to requiring such devices on platforms and in conjunction with the determination of viability, it is anticipated that the U.S.C.G. would conduct an intensive testing program.

14. The paragraph referenced to page 220 of Volume II clearly states that painting of the structures may need to be highly visible because of marine traffic hazards, and that this need is overriding to aesthetics. In fact, it is now proposed that the platform jackets be painted yellow with white platforms.

15. No comment is required.

State of California THE RESOURCES AGENCY

Memorandum

To : 1. Mr. L. Frank Goodson
Projects Coordinator
The Resources Agency
Resources Building, 13th Floor
2. State Lands Commission
1807 13th Street
Sacramento, CA 95814

Date: JAN 12 1979

In Reply Refer To: 420:DD

(916) 322-4517

From : **STATE WATER RESOURCES CONTROL BOARD**
DIVISION OF PLANNING AND RESEARCH

Subject: REVIEW OF NOTICE OF INTENT: SCH 78121133, DRAFT EIR, SHELL OIL COMPANY OCS BETA UNIT

The attached comments from the California Regional Water Quality Control Board constitute the comments of the State Water Resources Control Board.

Thomas E. Bailey
Assistant Division Chief .

Attachment

cc: California Regional Water Quality Control Board, Los Angeles Region
107 South Broadway, Room 4027
Los Angeles, CA 90012

California Regional Water Quality Control Board, Santa Ana Region
6833 Indiana Avenue, Suite 1
Riverside, CA 92506

REGIONAL WATER QUALITY CONTROL BOARD

INTERNAL MEMO

TO: State Water Resources Control Board
Peter Rogers, Division of Planning & Research

FROM: Francisco E. Velez, Staff Engineer
Santa Ana Region, Region 8

DATE: January 3, 1979

SIGNATURE: Francisco E. Velez

SUBJECT: EIR-EA-SHELL OCS BETA UNIT DEVELOPMENT, SCH #78121133

16. We have reviewed this report and feel that the water quality impacts likely to result from the proposed project have been adequately addressed. If the proponent, however, chooses to alter the present project's pipeline route to either Seal Beach or Huntington Beach instead of to Long Beach, an application for a waste discharge permit must be filed with this office at least 180 days prior to any construction activity.

FEV:ng

SWRCB 326A(4/75)

SURNAME:

RESPONSE TO COMMENTS OF THE STATE WATER RESOURCES CONTROL BOARD, DEPARTMENT OF PLANNING AND RESEARCH

16. No comment is required.

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY EDMUND G. BROWN JR., Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 7, P.O. BOX 2304, LOS ANGELES 90051
(213) 620-5335

December 18, 1978

Shell Oil OCS
Beta Unit Development
Draft EIR/EA

Mr. Dwight E. Sanders
Chief, Planning & Environmental
Coordination
State Lands Commission
1807 13th Street
Sacramento, California 95814

Dear Mr. Sanders:

17. The above referenced document has been reviewed and found to be adequate in regards to discussion of effect of project on land transportation facilities. It appears the project will have only minimal effect on land transportation, primarily during the construction phase.

Sincerely,

KEITH E. McKEAN, Chief
Environmental Planning Branch

RESPONSE TO COMMENTS OF THE STATE OF CALIFORNIA
BUSINESS AND TRANSPORTATION AGENCY,
DEPARTMENT OF TRANSPORTATION

17. No comment is required.

BETA UNIT EIR REVIEW

VOLUME 1

EXECUTIVE SUMMARY

Page 12, Para. 6, Lines 3, 4, 5, - temperatures should have degree symbols e.g. ^{o}C and ^{o}F

SECTION 1.0 - INTRODUCTION

8. Page 6, Para 15 - "GRAVITY" should be "SPECIFIC GRAVITY" and defined as follows:

SPECIFIC GRAVITY. The specific gravity of liquids is defined as the ratio of the density of the liquid to the density of water, both at specified conditions of pressure and temperature.

SECTION 2.0 - PROJECT DESCRIPTION

9. Page 12, Para. 3 - Figure 2.1-1 does not show lease numbers but tract numbers instead and corresponding lease numbers are not shown. Tract 255 is unleased.

10. Page 12, Para. 5 - Subsequent to the lease sale, drilling is on leases and the previous tract numbers cease to exist.

11. Page 15, Fig. 2.2-1 - Legend is not clear as to which numbers are lease numbers and which are tract numbers. Also, a notation should be made that unleased Tract 255 is included within the Beta Unit.

SECTION 3.0 ENVIRONMENTAL SETTING

12. Page 68, Para. 4 - First sentence of this Para. would be much clearer if written: After a history of subsidence and deformation, renewed activity along the Palos Verde fault zone in late Pleistocene time continued uplifting a large island area which subsequently became the present Palos Verde Peninsula".

13. Page 301, Para. 2 - Line 3 - "The federal government has a 33-1/3% royalty interest in these leases." (not tracts).

24. Page 301, Para. 4, Line 3 - "In 1976 U.S. domestic production of crude oil dropped by 3.6 percent ..." (not three percent).

VOLUME II

SECTION 4.0 - ENVIRONMENTAL IMPACT

25. Page 3, Para. 1, Line 9 - reference is made to report by State Lands Commission 1975 with no page number given. If this reference is to the seep report listed in SECTION 9.0, page 255, it should be dated 1978. Also, in a comprehensive report such as this, the page number is almost essential to finding the reference.

Para. 4 - The name Dos Quadras should be spelled Dos Cuadras.

26. Page 17, Para. 5 - This table should have a title and be listed in Table of Contents under List of Tables. Also, in the heading of the first column the word earthquake is misspelled.

In the general discussion of Shell Oil Company's pipeline easement across State lands, further consideration should be given to the impact that non-unit oil may have if eventually it is included with oil from the Beta Unit.

DAVID A. ROSEN CONSULTANTS

5 January 1979

Dwight E. Sanders
State Lands Commission
1807 13th Street
Sacramento, CA 95814

Dear Dwight:

In my review of the published Draft Shell OCS Beta Unit Development EIR/EA, I have hade note of the following errors and omissions within the document. They are relatively minor in nature, but might prove helpful to you during your analysis.

Volume 2

Page

27. 42- The worse case year was in fact 1999 for the hydrocarbon analysis, not 2000.

28. 45- "Sivadier and Mikolaj," 1973.

29. 57- The discussion of EPA PSD Class 1,2, and 3 are not clear. It was my impression that Class 3 areas did not already exceed the NAAQS. If this was the case, New Source Review would apply.

30. 61- Table 4.3-24, was to show the location of maximum concentrations downwind. The significance of the three-mile territorial limit is not extablished in the text.

31. 62- Table 4.3-25, (same comment as above).

32. 74- Project Benefit Ratio (PBR) is 2.0 times the annual average emissions. Also, the PBR is the governing factor for tradeoffs except for sulful dioxide, where the Project Safety Ratio (PSR) will exceed the PBR (87.4 tons/year vs. 56.4 tons/year).

33. Misc. air quality- Project induced air emissions are not related to ambient conditions (i.e., Bolsa Chica) and thus are not described as cumulative values. Additionaly, references such as "SCAQMD" are not listed in the compilation of sources. These particular references are the basis for SCAQMD tradeoff policy.

Volume 2 (cont.)

	Page	
34.	121-	Figure 4.4-4, it is still not clear as to the size of the hypothetical oil spill.
35.	122-	Size of spill?
36.	179-	Coastal Land Use Impacts: The text is not clear as to the applicability of the Coastal Act to a basically OCS project.
37.	216-	The Huntington Harbour crew launch-induced automobile traffic does not take into account the expected increases in Pacific Coast Highway traffic from other sources.
38.	219-	Curvature losses appear to be to small.

RESPONSE TO COMMENTS OF THE STAFF OF THE STATE LANDS COMMISSION

18. There should be an additional definition which defines specific gravity as:

> The ratio of the density of the liquid to the density of water both at specified conditions of pressure and temperature.

19. The correction is noted, the relevant lease numbers for the Beta Development are shown on Figure 2.2-1 along with unleased Tract 255.

20. The correction is noted.

21. The Beta Unit is shown on Figure 2.2-2 using a heavy black line as a perimeter. Unleased Tract 255 is included within that boundary.

22. The uplifted island noted on Page 68, paragraph 4 did become the Palos Verde Peninsula.

23. Tracts should read leases. The royalty interest of 33-1/3% for the federal government is correct.

24. We believe that 3 percent is the accurate value for the drop in domestic production of crude oil in 1976.

25. The reference should be dated 1978.

26. The information has been typed into the text and hence is not called out as a separate table.

27. The hydrocarbon emissions for the year 2000 were miscalculated and should be 37.0 tons per year for the turbines. When added to the diesel engine emissions, this gives a yearly total of 37.4, making the year 2000 the worst-case year.

28. See Errata Sheet.

29. Class I increments permit only minor air quality deterioration; Class II moderate deterioration; and Class III deterioration up to the secondary NAAQS. At this time, the EPA incremental limits apply only to sulfur dioxide and particulate matter, although incremental limits for NO_2 and other pollutants may be added.

30. The question of jurisdiction required that concentrations of pollutants be provided at various areas. The three-mile territorial limit was used because it represents a political change in jurisdiction between state and federal agencies. The platforms and shoreline were also used as points of reference because of the various agencies reviewing the document.

31. See response to Comment 41.

32. See Errata Sheet for pages 74 and 75. The Project Benefit Ratio would be applied to all emissions except SO_2, which will be governed by the Project Safety Factor.

33. Please see the Technical Appendix I to this Volume IV, page 57. The SCAQMD is defined in the text as the South Coast Air Quality Management District. The references are listed on Page 273 (Volume II) under the full title.

34. The solid lines represent the trajectories for a 5000-bbl spill at the platform. The broken line represents a trajectory and time to shore value for the hypothetical 80,000-bbl spill.

35. Figure 4.4-5 represents a 50-bbl spill at the mid-point of the pipeline transporting crude oil to shore from the production platform.

36. The coastal land use discussion is aimed primarily at the onshore facilities. The Coastal Commission would have jurisdiction out to the three-mile territory limit. However, the land use policies discussed reflect a concern for consistency within the coastal zone and indirectly can effect development within the OCS by controlling onshore facility siting.

37. The traffic impact analysis is related to the total existing average daily traffic (ADT) on Pacific Coast Highway of approximately 26,000. This figure reflects the impact of other sources within the project area. The total ADT does include certain new development actions presently being completed to the south of the crew launch site. As noted in the text (Volume II, p. 214), the highway is already over capacity for certain sections of roadway.

38. The curvature calculations have been reviewed and are found to be accurate.

South Coast
AIR QUALITY MANAGEMENT DISTRICT
DISTRICT HEADQUARTERS
9420 TELSTAR AVENUE. EL MONTE. CALIFORNIA 91731 • (213) 443-3931

Date 1/9/79
File No. A81212C

Dwight E. Sanders
State Lands Commission
1807 13th Street
Sacramento, CA 95814

COMMENTS ON: EIR-EA, Shell OCS Beta Unit

ADEQUACY OF AIR QUALITY ANALYSIS

	Adequate	Inadequate	NA
39. Existing Air Quality in Area	☒	☐	☐
Existing Emissions in Area	☒	☐	☐
Project Emissions:			
Construction phase	☒	☐	☐
Completed project vehicular	☒	☐	☐
Stationary	☒	☐	☐
Project Impact on Air Quality	☒	☐	☐

ARE ADEQUATE MITIGATION MEASURES PROVIDED FOR PROJECT AIR POLLUTANTS?

1) ☒ Yes ☐ No ☐ Incomplete ☐ NA

ARE GROWTH INDUCING EFFECTS OF PROJECT ON POLLUTANT EMISSIONS DISCUSSED?

☒ Yes ☐ No ☐ Partially ☐ NA

AQMD PERMIT

☐ Not required
☒ Required
☐ May be required, contact Zone office

POTENTIAL EFFECT ON AIR QUALITY (AQ)

☐ Beneficial: will probably tend to improve AQ
☐ No effect
☒ Impairment: probably no substantial adverse effect
☐ Unfavorable: may degrade AQ to a significant extent
☐ Adverse: will degrade AQ to a significant extent
☐ Indeterminate: due to lack of data

IS PROJECT CONSISTENT WITH THE ATTAINMENT AND MAINTENANCE OF THE NATIONAL AIR QUALITY STANDARDS? 1) ☒ Yes ☐ No

COMMENTS

We are pleased to offer these comments on the EIR-EA for the Shell OCS Beta Unit Development.

We commend the Report's air quality analysis for its completeness and thorough treatment of all emission sources related to the project. There appears to be no deficiencies in the analysis worthy of note.

1) Contingent on the use of best available control technology and the provision of all offset measures that may be required by New Source Review, we would conclude that this project is consistent with the attainment and maintenance of the national air quality standards.

If you have any questions regarding these comments please call Thomas Mullins at (213) 443-3931, extension 241.

Very truly yours,

J.A. Stuart
Executive Officer

Thomas P. Mullins

for/John Danielson
Senior Air Quality Specialist

RESPONSE TO COMMENTS FROM THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

39. No comment is required.

AD 21/00

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, California 90731

January 8, 1979 FS33/RSH

Mr. Dwight E. Sanders
Chief, Planning and Environmental Coordination
State Lands Commission
1807 13th Street
Sacramento, California 95814

Dear Mr. Sanders:

Subject: Review of Draft EIR-EA, for the Shell OCS Beta Unit Development

We have reviewed the subject EIR and offer the following comments for your consideration:

Volume I

Page XIV - Marine Biology

40. Oil platforms do act as artificial reefs attracting many species of fish and invertebrates which normally do not occur in these areas. However, designating this as a long term benefit for recreational fishing may not be appropriate, since the U.S. Coast Guard intends to propose regulations which would prohibit fishing within 500 meters of these structures.

Page 54 - Oil Spill Handling

41. The National Marine Fisheries Service should be included as an appropriate agency to be contacted in the event of an oil spill.

Page 261 - Marine Mammals

42. The Pacific right whale (Eubalaena glacialis) should be included in the list of marine mammals which are known to occur in the San Pedro Channel.

Volume II

Environmental Impact

Page 154 - Fishes

43. See comments for page XIV - Volume I

We appreciate the opportunity to comment on this draft report and look forward to receiving the final report upon its completion.

Sincerely,

for Gary Smith

Gerald V. Howard
Regional Director

RESPONSES TO COMMENTS FROM THE UNITED STATES
DEPARTMENT OF COMMERCE,
NATIONAL MARINE FISHERIES SERVICE

40. We concur that the long-term benefit for recreational fishing may be reduced if the U.S.C.G. prohibits fishing within 500 meters of these structures. However, this designation of a clear zone has not as yet been established.

41. The revised National Contingency Plan specifies that the National Marine Fisheries Service (NMFS) should be contacted in the event of an oil spill, especially where endangered species are involved. Shell's Spill Contingency Plan, when updated, will allow for such action.

42. In response to the U.S.G.S., a new table of sensitive marine mammals is provided which includes the Pacific Right Whale, as well as other important species.

43. See Response to comment 40.

State of California

Memorandum

To : Frank Goodson
Project Coordinator
Resources Agency

Date : January 11, 1979

Subject: DEIR/EA for Shell OCS
BETA Unit Development
SCH# 78121133

From : Air Resources Board
Harmon Wong-Woo, Chief
Stationary Source Control Division

INTRODUCTION

Shell Oil Company plans to construct a drilling platform (Ellen) with 80 well slots in 265 feet of water and a production platform (Elly) in 255 feet of water to develop an estimated 100 to 200 million barrels of oil reserves on its outer continental shelf (OCS) leases approximately nine miles off the shore of Huntington Beach, California. Shell plans to construct a second drilling platform in 700 feet of water at a later date to develop the south portion of the reservoir. Oil production from the first two platforms is expected to begin in April 1980. The ultimate maximum production rate from all three platforms would be 24,000 barrel oil per day (BOPD) in 1986.

The production platform contains process equipment for treating oil and water, and systems for gas handling and electricity generation. All produced gas will be used as fuel for gas turbines and produced water will be reinjected through injection wells for maintaining reservoir pressure. The processed oil will be transported to Shell's proposed Long Beach distribution facility through a 16 inch diameter subsea pipeline. The onshore distribution facility includes a 10,000 barrel tank and 4 electric pumps to move the oil to Shell's refinery in Wilmington.

Sources of emissions from the two platforms and onshore distribution facility include gas/diesel fired gas turbines, diesel fired engines, helicopters, crew and supply ships, hydrocarbon emissions from valves and seals, oil spills, gas flaring, and hydrocarbon emissions associated with onshore storage and pumps.

RECOMMENDATIONS

44. The proposed Beta project consists of both onshore and offshore facilities in the South Coast Air Quality Management District. Since Shell Oil Company is the operator of both facilities and there is a physical connection (subsea pipeline) between the onshore and offshore facilities, and since operation of the onshore and offshore facilities are closely related, both onshore and offshore facilities would be considered part of the same stationary source under the SCAQMD's new source review rule, Rule 213. The DEIR/EA should indicate that Rule 213 applies to emissions from the total project and should indicate that Shell will submit an application for an authority to construct for both onshore and offshore facilities to the SCAQMD.

According to the Environmental Setting section of the DEIR/EA, the percentage of wind directions that could transport pollutants into the South Coast Air Basin (SCAB) occur about 65% of the time on an annual basis. This conclusion is consistent with those of the ARB's Status Report Regarding Adoption by Local Air Pollution Control Districts of Rules for the Control of Emissions from Lightering Operations, which stated that any pollutant emissions released within California Coastal Waters will frequently be transported on shore, and hence would exacerbate inland air quality problems. Since the State ambient air quality standards for oxidant, SO_2, NO_2, CO, sulfate, and particulate matter were exceeded in the SCAB during 1977, we believe that all project emissions must be offset by amounts that will result in a net air quality benefit to impacted areas.

COMMENTS

The DEIR/EA states that, as part of this project, Shell Oil Company proposes to offset emissions from offshore and onshore operations so that a net air quality benefit will result for the Basin. However, in Shell's November 17, 1978 application to the SCAQMD for permits to Construct and Operate an onshore crude oil distribution facility (which is connected to the offshore production platform Elly), no indication was given that emissions from offshore platforms would be considered as portions of the project emissions and would be mitigated through internal or external trade-offs as mentioned in the DEIR/EA. Therefore, unless Shell amends its application to the SCAQMD to include emissions from the offshore platforms, the DEIR/EA inadequately addresses the impacts of offshore emissions.

45. On pages 145 and 150 of volume 1, the DEIR/EA discusses air quality data at the Costa Mesa station and in the South Coast Air Basin during 1976. No 1977 data were included. A summary of the 1977 data are available from both the ARB's California Air Quality Data report and SCAQMD reports, and should be used in the EIR/EA. In addition, the EIR/EA should address the federal air quality standards for ozone and carbon monoxide (8 hr), since these federal standards are more stringent than the state standards.

46. The final EIR/EA should tabulate air quality data from the Bolsa Chica monitoring station.

47. Emissions listed in Table 4.3-5 should be expressed as lbs/day rather than lbs/week.

48. On page 51, the DEIR/EA reports that 0.35 lb per day of hydrocarbon would be emitted from a 20,000 barrel production facility, and concludes that fugitive emissions from pumps, seals, and valves are negligible. However, there is no discussion of how these low emissions levels would be achieved and maintained. According to the KVB's Control of Hydrocarbon Emissions from Stationary Source in the California South Coast Air Basin, emissions from pump seals (mechanical) serving products with less than 25 Reid vapor pressure, and from valves serving gas and liquid products, would be 0.3, 0.4 and 0.02 lb per day/device respectively. We recommend that emissions from valves, pump seals and compressor seals be reestimated and included in the EIR/EA based on the number of valves and seals to be installed on platforms.

49. The DEIR/EA assumes that the H_2S content in the natural gas produced is negligible. This is not appropriate for worst case emissions estimates because (1) the H_2S content in the gas varies depending on the depth of the formation from which oil and gas are being extracted, and (2) Figure 2.4-12 indicates that Shell intends to install a sour gas treating facility in the future, implying that the H_2S content may not be negligible. As a result, for the worst case project emissions estimates, the expected highest H_2S level in gas produced from the production platform should be used.

cc: Dwight E. Sanders, State Lands Commission

RESPONSE TO COMMENTS FROM THE STATE OF CALIFORNIA, AIR RESOURCES BOARD

44. During the course of the preparation of the draft EIR/EA, several attempts were made to clarify the issue of responsible agency jurisdiction. However, the issue of jurisdiction was not resolved prior to publication of the document. Therefore, the document has been prepared in such a manner as to include all facilities, both on and offshore, that are part of this project. Further, the degree of impact has been assessed using federal, state, and local standards. The analysis does include an impact assessment of all emissions on and offshore, and relates the pollutant levels to the SCAQMD Rule 213. After reviewing the total project to Rule 213, it was found that if the entire project was under SCAQMD jurisdiction, offsets would be required. Therefore, Shell's proposed offset package was included in the report and analyzed for its impact.

Some mitigation of the anticipated impacts, as discussed in the EIR/EA, may be required and such mitigation will ultimately be implemented via the permit process by the applicable agency. Such a determination is not part of this EIR/EA, but it must be emphasized that the document covers all potential impacts. The 1977 data summaries were not available at the time of preparation of the EIR/EA.

45. As shown in Table 3.3-8 and Section 3.3.2.2 (Volume I, p. 145), Costa Mesa exceeded the national standard for ozone, 0.08 ppm per hour, 17 days out of the 1976 year. This was significantly less than almost all other stations. Inland stations exceeded the standard well over 100 days and at some locations by as much as 200 days. According to the 1976 data, Costa Mesa exceeded the national primary CO standard, 9 ppm per 8 hours, 58 days of the year. It did not exceed the national secondary standard, 25 ppm for 1 hour.

As shown on pages 149 and 150 (Volume I), and Table 3.3-11, district wide, the national standards for ozone were exceeded 251 days. District wide the national standards for 8 hours for CO were exceeded 150 days. The national 1 hour standards were exceeded only four days.

46. The data from the Bolsa Chica Monitoring Station and an impact assessment of that data is included in Appendix I of this Finalizing Addendum.

47. The emissions listed in Table 4.3-5 are expressed in lbs/day. The column is mislabeled lbs/week.

48. During the course of the preparation of the draft EIR/EA, the exact number of valves, pumps, and seals was not readily available. Therefore, the hydrocarbon emissions were estimated based on information obtained by Woffinder (1976) during a monitoring program conducted at an ARCO facility which had a production capacity similar to the Shell Beta project. The original calculation of 0.35 lbs/day was for the estimated production level of 24,000 bbls/day. Using the platform capacity of 40,000 bbls/day, a conservative estimate of the total project hydrocarbon emissions would be 0.70 lbs/day. Under the New OCS Land Act Amendments of 1978, the U.S.G.S. will have responsibility to ensure that a maintenance program be established to control fugitive emission levels from pumps, seals, and valves.

49. All tests conducted by Shell have shown that the gas produced by the Beta project is sweet gas, and does not contain H_2S. Apparently under certain conditions bacteria from certain types of source water will sometimes produce H_2S gas because of their sulfate reducing action. However, Shell does not anticipate that this will occur, based on historical data from other petroleum operations in the Channel, and does not intend to install a sour gas treatment facility unless the injection of the source water causes sulfate reduction. Space was provided on the platform for the sour gas treating facility in case such a situation would occur. It should be emphasized that such a treatment facility is in fact a form of mitigation. The facility would scrub the sour gas and remove the H_2S. Only during emergency platform shutdown would the sour gas be flared, untreated. The release of H_2S during such a system upset is felt to be negligible.

Memorandum

To : L. Frank Goodson
Project Coordinator
Resources Agency
1416 Ninth Street
Sacramento, CA 95814

Date: January 22, 1979

From : **Department of Conservation**
Division of Mines and Geology
1416 - 9th Street, Sacramento 95814

Subject: SCH 78121133, EIR - EA Shell OCS Beta Unit Development

50. The Division Seismologist, Lalliana Mualchin, has reviewed the report and has provided the following commentary.

The strongest ground shaking is expected from the Palos Verdes fault which is about 0.76 kilometer (p. 78, Vol. I) from the site. In the consideration of the liquefaction potential, the seismic loading was scaled to 0.5g for an earthquake of M6.75 from the Palos Verdes fault (p. 8, Vol. II). The same value of rock acceleration was used for input to the computer program DCHARM (p. 17, Vol. II). It should be noted that rock acceleration for the above earthquake (M6.75) is not less than 0.67g by using Schnabel-Seed attenuation curves.

In the investigation by T. C. Hanks and D. A. Johnson (Geophysical Assessment of Peak Accelerations, Bulletin Seismological Society of America, Vol. 66, 1976) it was found that peak acceleration was independent of magnitudes of M4.5 to M7.1 located less than 10 kilometers from the source to the site. Accelerations of 0.75g to 1.8g were obtained in their study assuming limits of shear strength of crustal rocks at 10 kilometer depths of 2 kilobars and 5 kilobars, respectively.

Therefore, it should be emphasized in the EIR that oil spill contingency plans must be reliable, because it is likely that earthquakes of M6 3/4 or M7 on the active fault located 2500 feet from the site may cause accelerations exceeding the .5g design. No assurances have been provided that guarantees structural integrity if earthquake shaking effects exceed the design considerations.

Perry Y. Amimoto

PERRY Y. AMIMOTO
Advisory Services Officer

APPROVED:

James F. Davis

JAMES F. DAVIS
State Geologist

RESPONSE TO COMMENTS OF THE STATE OF CALIFORNIA,
RESOURCES AGENCY, DEPARTMENT OF CONSERVATION,
DIVISION OF MINES AND GEOLOGY

50. Although single peaks of acceleration may exceed 1g at the site under certain circumstances, the ranges of acceleration suggested in the EIR/EA report represent accelerations which can reasonably be expected and which reflect more accurately the severity of shaking that could occur at the site. A reasonable range of rock accelerations at the site for the maximum earthquake postulated on the Palos Verdes fault was considered to be 0.5g-0.7g. With one exception (Pacoima Dam), all of the peak acceleration data shown in Figure 1 of Hanks and Johnson (1976) are within this range or are less (90% of the peak accelerations in this figure are less than 0.5g; 60% are below 0.25g). The corresponding range of accelerations for the mudline level (0.25g-0.4g) reflects the nature of the soils at the site (alluvium). Evidence suggests that these soils cannot support higher acceleration levels. In a recent paper by Seekins and Hanks (1978), peak acceleration data from the Oroville aftershocks indicate that accelerations were significantly greater on rock than on alluvium. Further, the facility as proposed by Shell is designed for an acceleration of 0.7g, not 0.5g.

REF: Seekins, L.C. and T.C. Hanks, 1978, Strong-motion accelerograms of the Oroville aftershocks and peak acceleration data, Bull. Seism. Soc. Am., v. 68, p. 677.

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2711
LOS ANGELES, CALIFORNIA 90053

SPLED-E

12 January 1979

Mr. Dwight E. Sanders
Chief, Planning and Environmental Coordination
State Lands Commission
1807 13th Street
Sacramento, California 95814

Dear Mr. Sanders:

This is in response to a letter from your office, dated 4 December 1978, which requested review and comments on the draft environmental impact report (EIR-EA) for the Shell OCS Beta Unit Development project. Our comments are as follows:

51. a. The "Environmental Setting," Section 3, should include mention of commercial fishing activities, if any, in the vicinity of the proposed pipeline route. Should a determination be made that commercial trawling operations are active in the vicinity of the pipeline route, burial of the pipeline should be considered to avoid any potential interference.

52. b. The "Potential for Maximum Earthquake Ground Motion," Section 3.1.2.4, page 116, is limited to a discussion of ground motion at the site. This section should also include a similar discussion of ground motion along the proposed pipeline route, especially in areas where faults, if any, intersect the proposed pipeline.

53. c. Page 25, Volume II, "Ocean Wave Loading." The location of areas of probable liquefaction resultant from ocean waves should be pointed out, along with appropriate mitigating measures, if any, which would be required to insure safe operation.

54. d. Page 26, 2nd paragraph: This section discusses the potential for wave induced scour of the pipeline. Wave induced currents, along with currents generated by other sources, should be investigated in more detail prior to construction of the project. The probable location of any anticipated scour pits should be presented along with the appropriate mitigating measures.

SPLED-E 12 January 1979
mr. Dwight E. Sanders

Should you have any questions regarding these comments, please feel free to contact Mr. Richard Surynt, Environmental Quality Section, telephone (213) 688-2934.

Thank you for the opportunity to review and comment on this DEIR/EA.

Sincerely yours,

NORMAN ARNO
Chief, Engineering Division

RESPONSE TO COMMENTS OF THE DEPARTMENT OF THE ARMY,
LOS ANGELES DISTRICT CORPS OF ENGINEERS

51. The relationship of the project (including the pipeline) to commercial fishing is discussed in detail in Volume I pp. 254-260. Commercial trawling activities are not allowed in this area without specific permits from the California Department of Fish and Game.

52. Please see the Technical Appendix to this finalizing addendum.
53. Appendix II provides a discussion, which clarifies the pipeline
54. impacts.

SHELL OIL COMPANY

P. O. BOX 831

HOUSTON, TEXAS 77001

January 19, 1979

Subject: EIR/EA Comments
Shell OCS Beta Unit
Development

State Lands Commission
1807 - 13th Street
Sacramento, California 95814

Attention Mr. Dwight E. Sanders

Gentlemen:

We have completed our review of the three-volume EIR/EA Shell OCS Beta Unit Development which was prepared on December 1, 1978 by the California State Lands Commission, the Port of Long Beach and the United States Geological Survey. We offer the following observations and comments which we request that you consider in finalizing this extensive document.

General Observations

Our reaction to the EXECUTIVE SUMMARY is that the Beta Unit Development plans are fairly portrayed with a well balanced discussion of both positive and negative impacts upon the environment, resources and the general public.

Specific Comments

55. In Volume I, page 135, last paragraph, it was concluded that annually 65 percent of the winds in the vicinity of the Beta platforms blow toward directions in the South Coast Air Basin. Data from streamline charts in Figures 3.3-1 through 3.3-4, CUSS I data and Keith and Selik, "California South Coast Air Basin Hourly Wind Flow Patterns," January, 1977, all provide information more representative of the Beta platform area and indicate that 45 percent or less of the emissions from Beta could arrive in the South Coast Air Basin, not 65 percent as stated in the EIR/EA. (See attached letter from Science Applications, Inc., dated January 15, 1979, for expanded discussion.)

56. Of major significance, the EIR/EA indicates that 40 percent is the "air exchange factor" for converting Ventura emission reductions to South Coast Air Basin credits. This value is substantially lower than the factors quoted in previous studies by the California Air Resources Board and Science Applications, Inc., which are 60 percent and 75 percent, respectively. A review of the bases

for development of these various factors indicates that there is no real conflict. A more detailed analysis of air flow toward the South Coast Air Basin from the Shell Ventura field suggests that the four hours a day that the EIR/EA discounts as contributing to any "air exchange factor" is in fact a contributor and should be included in the calculations. This brings the total back up to the average 13 hours per day initially indicated on page 91 of the report, representing 54 percent of the annual period. In addition, the elevated location of Shell's Ventura compressors would likely inject these emissions into the mesoscale rather than the microscale flow system described in the EIR/EA. We conservatively assume half the Shell compressors will be in microscale and half in the mesoscale regime. As a result it is our belief that the best estimate of an "air exchange factor" should be 65 percent rather than the 40 percent stated in the EIR/EA. (See attached letter from Science Applications, Inc., dated January 15, 1979, for specific details of this analysis.)

59. Discussions concerning the impact of oil spills address at length the impact of spilled oil on fauna, flora and beaches, and further stress the damage which can occur from clean-up activities. These concerns may be valid during major disasters; however, the likelihood of the worst case occurring during the life of the Beta Field is quite small. This risk assessment should be reflected clearly in the section on oil spills.

Errata and Minor Comments

We are providing Attachment A, entitled "Errata and Minor Comments", which is a listing of corrections to factual information presented. These corrections should be included in the final version of the EIR/EA for the sake of accurate representation. The errors found however do not affect conclusions which have been developed.

Very truly yours,

for W. M. Marshall
Division Production Manager
Western Division

TAS:MSP

Attachments

cc: Port of Long Beach
925 Harbor Plaza
Long Beach, CA 90801 (w/attachs)

U.S. Geological Survey
Department of the Interior
300 North Los Angeles Street
Los Angeles, CA 90013 (w/attachs)

WESTEC Services, Inc.
180 East Main Street, Suite 150
Tustin, CA 92680 (w/attachs)

ATTACHMENT A

Errata and Minor Comments
EIR/EA Shell OCS Beta Unit Development

Comments by Shell Oil Company

Vol.	Page	Item	Correction or Comment
I	48	Fig. 2.4-15	Heat for oil dehydration utilizes the waste heat from the turbines driving the electric generators, not from the gas compressors as shown. Also, the gas from the test separator appears to be introduced into the wet oil line, rather than to the gas compressor.
I	51	Ppg. 5	"200-barrel" should be "2000-barrel".
I	52	Ppg. 8	"Hydrogen gas safety system" should be "hydrogen sulfide gas safety system".
I	54	Ppg. 3	Small spills are to be handled by platform personnel using on-board equipment, not SC-PCO equipment.
I	54	--	In the first paragraph of Section 2.4.2.7, the last sentence should be revised to read "...no discharge of oil into the ocean should occur".
I	133	Last Ppg.	Shell data (SAI) states only 45 percent of emissions from Beta will reach the South Coast Air Basin (see comment in main body of letter).
I	161	Ppg. 1	"Significance levels have been included in the Ruling", should read "Significance Levels' have been included in a more recent EPA ruling of 19 June 1978".
II	23	Last Ppg.	The 120 figure should be 300+ (Reference Dames & Moore Report" Pipeline Route Survey" in Table 1 of the Appendix).

Vol.	Page	Item	Correction or Comment
II	39	Table 4.3-7	SO_2 emission factor "until 1992" is listed as 70 lbs/10^3 gal fuel oil. For 0.25 percent (wt) sulfur content, factor should be 35, not 70.
II	44	Table 4.3-12	Total SO_2 emission for year 2000 should be 61.7 tons/years.
II	46	Table 4.3-14	The Preliminary Draft EIR/EA listed in Table 4.3-9 emission factors for gas flaring. The source of these factors (which was erroneously listed as EPA AP-42) is the report "Atmospheric Emission from Offshore Oil and Gas Development and Production", EPA-450/3-77-026, June 1977 (page 124). The new Draft EIR/EA now lists emission factors from AP-42 for gas flaring that apply to domestic and commercial heating by natural gas. It is not clear why WESTEC switched to these emission factors since they do not apply to plaform gas flaring at all. Combustion of natural gas in a boiler generates emissions that are very different from those generated by gas flaring. For instance, the NOx emission from flaring are negligible (EPA-450/3-77-026, page 124; and AP-42 (August 1977, Part B, page 9.2-3, Table 9.2-1) whereas they are the highest pollutant emissions for natural gas combustion in a boiler. In addition, the sulfur content of the produced natural gas is negligible, as stated on page 39 in Note (2) to Table 4.3-7, and on page 42, Section (C). For correctness and consistency, Table 4.3-14 should therefore list the SOx emission from gas flaring as negligible.
II	51	--	The equation for L_W is missing a factor. The correct equation is: $$L_W = \frac{T}{10^3} \frac{22.4 \times d \times C_f}{D}$$ The calculated withdrawal losses are correct.
II	80	--	Statement that scrubbers could reduce SO_2 emissions by 95 percent should more correctly read 90 percent, or up to 95 percent.

Vol.	Page	Item	Correction or Comment
II	105	Ppg. 3	Change to: "depth of 130 feet (40m)".
II	111	Ppg. 3	Change to: "The water intake pipe will be located 42 feet (13m) below the surface, with the discharge at a depth of 130 feet (40m)".
II	151	Table 4.5-1	We question the rating of "sublethal effects" on Nekton as "potentially high" severity.
II	155	Sec. 4.5.1.4	We suggest inserting the following sentence just before the last sentence in the paragraph: "However, Chow et al (1978) also presents data showing that some of the highest Barium numbers were found 80 miles offshore where no drilling had occurred".

TAS/BLF:MSP
1/19/79

SCIENCE APPLICATIONS, INC. COMMENTS
TO
"EIR-EA SHELL OCS BETA UNIT DEVELOPMENT"

Volume I, page 135, last paragraph -- Moderate Significance

"It may be concluded, based on the meteorological information presented, that annually 65 percent of the winds in the vicinity of the platform blow toward directions in the South Coast Air Basin."

The land-based (both island and mainland) direction data presented in the EIR-EA is not completely representative of the wind directions prevalent in the OCS where the BETA platforms will be located. The streamline charts presented in Figures 3.3-1 through 3.3-4 provide some indication of such flow. The limited CUSS I data is also more representative of conditions in the platform area. A better source of wind direction data is that presented by Keith and Selik in their January 1977 report "California South Coast Air Basin Hourly Wind Flow Patterns." This report was compiled from wind data taken from sixty stations over the period 1950-1973. The various data cited indicate that on the order of 65 percent of the winds from the platform area blow shoreward, but not necessarily into the South Coast Air Basin. Although the Keith and Selik report does not indicate annual averages, the average hourly streamlines presented by month seem to indicate that in addition to offshore flow, there are periods when the OCS flow tends to parallel the coast for appreciable distances.

Volume I, page 161, first full paragraph -- Minor Significance

"'Significance Levels' have been included in the Ruling."

Sentence should more properly read: "'Significance Levels' have been included in a more recent EPA ruling of 19 June 1978."

Volume II, page 39, Table 4.3-7 -- Errata Moderate Significance

The SO_2 emission factor "until 1992" is listed as 70.0 lbs/10^3 gal fuel oil. For a sulfur content of 0.25 percent by weight (as stated in note 2), the emission factor should be 35 lbs/10^3 gal fuel.

Volume II, page 43, Table 4.3-11 -- Moderate Significance

The SO_2 emission factors are presented for diesel fuel containing 0.5 percent sulfur by weight. To be consistent throughout the report, they should be given for 0.25 percent sulfur content. Caterpillar Tractor Company provides factors for 0.2 percent sulfur fuel. Since the data must be extrapolated to a higher sulfur content, it should be consistent with what is planned for the project.

Volume II, page 44, Table 4.3-12 - Minor Significance

There is a typographical error in the total sulfur dioxide emission for the year 2000. The correct figure should be 61.7 tons/yr. Also, the HC emissions from the turbines drop between 1999 and 2000. This is probably an inconsequential error.

Volume II, page 45, paragraph 1 and Table 4.3-13 -- Moderate Significance

The concepts of annual average emissions and worst-case emissions are confused. The listed "annual average" emissions are averages of the annual emissions between 1980 and 2000. The listed "worst-case" emissions are merely the highest annual emissions during that period of time (see Table 4.3-12). Table 4.3-13 should be eliminated, or replaced by a listing of the highest annual emissions which are generally those in the year 2000, and of the associated short-term worst-case emissions. The modeled short-term pollutant concentrations at the three-mile territorial limit will be, as a consequence, slightly higher than those reported yet still not of any significance to the project's environmental impact.

Volume II, page 46, Table 4.3-14 -- Moderate Significance

The Preliminary Draft EIR-EA listed in Table 4.3-9 emission factors for gas flaring. The source of these factors (which was erroneously listed as EPA AP-42) is the report "Atmospheric Emission from Offshore Oil and Gas Development and Production," EPA-450/3-77-026, June 1977 (page 124). The new Draft EIR-EA now lists emission factors from AP-42 for gas flaring that apply to domestic and commercial heating by natural gas. It is not clear why Westec switched to these emission factors since they do not apply to platform gas flaring at all. Combustion of natural gas in a boiler generates emissions that are very different from those generated by gas flaring. For instance, the NO_x emission from flaring are negligible (EPA-450/3-77-026, page 124; and AP-42 (August 1977), Part B, page 9.2-3, Table 9.2-1) whereas they are the highest pollutant emissions for natural gas combustion in a boiler.

In addition, the sulfur content of the produced natural gas is negligible, as stated on page 39 in Note (2) to Table 4.3-7, and on page 42, Section (C). For correctness and consistency, Table 4.3-14 should therefore list the SO_x emission from gas flaring as negligible.

Volume II, page 51, Equation for L_W -- Minor Significance

The equation for L_W is missing a factor. The correct equation is:

$$L_W = \frac{T}{10^3} \frac{22.4 \times d \times C_f}{D}$$

The calculated withdrawal losses are correct.

Volume II, page 53, Table 4.3-19 -- Minor Significance

The "annual average" emission values listed as a second row (see Footnote 2) are irrelevant and should be eliminated. See comments to page 45, paragraph 1 and Table 4.3-13.

Volume II, page 59, paragraph 2 -- Minor Significance

The EIR-EA states that only STAR data for Long Beach are available, but those for Los Angeles are also available and may be more representative.

Volume II, page 59, paragraph 3 -- Moderate Significance

The EIR-EA states that pollutants could be transported into the South Coast Air Basin 65 percent of the time on an annual basis. See comments for Volume I, page 133. If 65 percent transport is approximately correct, it is shoreward rather than directly into the South Coast Air Basin.

Volume II, page 60, Table 4.3-22 -- Moderate Significance

The SO_x emissions for the Saturn turbines should be 0.09 tons/day rather than 0.06. The EIR-EA does not state explicitly whether the same input data were used for both the long-term and short-term air quality modeling. If the input data were the same, which would be incorrect, it could cause problems later. Even with the correct worst-case emission rates, the basic conclusion of an insignificant short-term impact is still valid.

Volume II, page 63, last paragraph -- Minor Significance

There is a typographical error in the CO significance level. The value should be 2 mg/m^3.

Volume II, page 70, footnote -- Minor Significance

Footnote should more correctly read "Assumes proposed new CARB model rule not in effect."

Volume II, page 80, Power Plant Section -- Minor Significance

Statement that scrubbers could reduce SO_2 emissions by 95 percent should more correctly read 90 percent, or up to 95 percent.

Volume II, page 81-93, Discussion of Internal Offsets Outside South Coast Air Basin -- Major Significance

The EIR-EA recommends a 40 percent "air exchange factor" for converting Ventura emission reductions to SCAB credits. This value is substantially lower than the factors quoted in previous studies by CARB and SAI (60 percent and 75 percent, respectively); however, the factors are not actually conflicting when one examines the bases on which each was made.

The EIR-EA contends, on page 91 of their report, that the CARB and SAI studies were based on flow patterns characteristic of the Oxnard Plain area. This is indeed true and is due in most part to the absence of quality long-term meteorological or dispersion data in the area of the Shell Ventura field (only data for March 1975 through February 1976 from a private source were available). The EIR-EA makes several assumptions about the flow in and around the Ventura River Valley that are neither supported nor discounted by existing long-term data. Additionally, the fact that a large number of the Shell compressors are located on elevated terrain on either side of the Ventura River was not considered in the analysis.

On page 93 of the Westec report it states, "approximately one-third of the annual down-valley flow along the Ventura River Valley (an average of four hours per day) will be advected up the Santa Clara Valley." Although the basic foundation of this statement is correct (offshore flow will start earlier and persist longer in such a river valley when compared to the surrounding terrain), the contention that it will immediately be channelled only up the Santa Clara Valley is likely incorrect. The prevailing surface winds along the coast in that area have a distinct northwest component, especially during the early evening and late morning transitional periods. This northwesterly component (evident even in Figure 4.3-3 on page 85 of the report) would most likely divert at least part if not all of the airflow out of the Ventura River Valley across the Oxnard Plain and along Highway 101 or through the Simi-Santa Susana Valley into the SCAB. That portion of the Ventura field airflow that is initially directed up the Santa Clara Valley would meet the onset of the usual offshore flows being channelled down the valley. This surface air convergence will likely take place very near the coast since it can be assumed that the drainage winds in the Santa Clara Valley will have also developed earlier than over the remainder of the Oxnard Plain.

The mixing heights in the immediate area of this convergence zone can be expected to be somewhat higher than the average for the inland data stations summarized in the referenced SAI report. However, even the average mixing height of 562 meters is significantly higher than most of the terrain separating the two air basins and as such will facilitate the intermixing of the two air masses at the level of the outflow from the surface convergence. This intermixing, although certainly not vigorous, can be expected to result in significant pollutant reductions in the SCAB should Shell reduce the Ventura field emissions as planned.

In summary, the four hours a day that the EIR-EA discounts as contributing to any "air exchange factor" between the Shell Ventura field and the SCAB should actually be included in the calculations. This brings the total amount of

interaction back up to the average 13 hours per day initially indicated on page 91 of the report. This represents 54 percent of the annual period.

A somewhat more difficult effect to quantify is the elevated location of several of Shell's Ventura compressors. The increased height would likely inject the emissions from these units into the mesoscale flow patterns in the area rather than the microscale flow system described by the EIR-EA for the Ventura River Valley. At this higher level, the air flows relatively undisturbed toward the southeast across the Oxnard Plain approximately 75 percent of the annual period (based on Point Arguello winds aloft data for the northwest quadrant). It is then likely to be channelled along Highway 101 or through the Simi-Santa Susana Valley into the SCAB. The turbulence imparted by the slightly elevated terrain in the Simi-Santa Susana area would be sufficient to cause thorough mixing of the initially homogeneous air mass so that it would not be likely to remain intact over the SCAB.

If one assumes that roughly half of Shell's Ventura units are in the valley regime and half are influenced by the mesoscale flow (a somewhat conservative assumption), the best estimate for an "air exchange factor" would be

$$0.5\ (54\ \text{percent}) + 0.5\ (75\ \text{percent}) = 65\ \text{percent}$$

SAI believes that this value most accurately describes the average conditions in the area based upon the best available long-term climatological and dispersion data. Studies based on shorter-term data may yield values smaller or even larger than 65 percent due to year-to-year fluctuations in meteorological conditions in the area. The recent four-year California drought climaxed by last year's torrential rains provide an excellent example of this frequently drastic variability. In all climatologically-related studies, it is imperative that the most representative long-term data be incorporated in the analyses.

55. The streamline charts in Figures 3.3-1 through 3.3-4 (Volume I) very judiciously show large blank areas of wind flow at the location of the Beta platforms because of lack of reliable wind information in this area. All of the 60 stations used in the Kutlo and Selik report were stations located within the South Coast Air Basin (SCAB). Data from offshore locations were not used in that report. The limited Cuss I data, as stated on page 133, Volume I, showed 65 percent of the wind directions between 0800 and 2400 occurred with the proper directions to blow toward the SCAB. While some of the OCS flow will parallel the coast, this type of flow is included in the remaining 35 percent. A larger percentage than 65 percent of the wind flow from the platform is shoreward, but it doesn't fit into the window that defines flow toward the SCAB. Also, please note the following information provided by the CARB in their letter of January 11, 1979, which responded to the draft EIR/EA:

> According to the Environmental Setting Section of the DEIR/EA, the percentage of wind directions that could transport pollutants into the South Coast Air Basin (SCAB) occur about 65% of the time on an annual basis. This conclusion is consistent with those of the CARB's Status Report Regarding Adoption by Local Air Pollution Control Districts of Rules for the Control of Emissions from Lightening Operations . . .

56. The 40 percent "air exchange factor" depicted in the draft EIR/EA is lower than the 75 percent developed by SAI or the 60 percent by the CARB, 1975. However, in Table 4.3-38, a 12 percent air exchange factor was also presented. The 12 percent factor was also based on work completed by CARB.

While one year of data from the private source was summarized, more data is available. However time constraints did not permit summarization of additional data.

Figure 4.3-3, page 85 (Volume II), does not indicate a northwest flow in the area of the Shell Ventura oil field. This is also documented in recent CARB streamline analyses. Their study clearly shows west to west-southwest flow along the coast.

Long-term data available for wind flow in the Ventura-Oxnard area are presented in Figure 3.3-1 through 3.3-4, pages 122-125 (Volume I). Data for typical months of the four seasons for nighttime 0000-0600 or 0700 indicate that offshore flow is

typical during all months except the summer. Figure 3.3-1 indicates, even during the nighttime hours in the summer, the typical wind flow in the area of the Shell Ventura Oil Field is onshore. The flow pattern along the Ventura River Valley and across the Shell Oil Field is basically from the south or up valley. The analysis in the EIR/EA considered the flow to be generally down valley every night of the year. Figures 3.3-3 and 3.3-4 (Volume I) show typical wind patterns for the time periods from 1200 to 1700 or 1800. None of the streamlines show any northwesterly component of wind flow in the area of the Shell Ventura Oil Field. Data taken from the Ventura County Air Pollution Control District weather station located in Ventura, as shown in Figure 4.3-2 (Volume II), indicate generally, the late afternoon and early evening winds are from the west at this location. Since the drainage flow in the Ventura River Valley will start sooner than in the rest of the Oxnard plain, the drainage flow will travel only a short distance offshore and will be entrained into the westerly air flow. While the westerly air continues at Ventura, the air will blow up the Santa Clara River Valley. During the early morning hours after the sea breeze has started in the Ventura and Oxnard plain area, drainage wind will continue to blow down the Ventura River Valley. These drainage winds will be entrained into the onshore flow and would be transported up the Santa Clara River Valley. In addition, streamlines prepared by CARB staff meteorologists show a definite west to southwest flow along the coast.

The EIR/EA included the percentage of east and west winds as a down valley flow with the possibility that some of this air could later be advected into the SCAB. However, it is unlikely that an east wind across the Shell Ventura Oil Field would have air exchange from this area into the SCAB. A west wind would blow the effluents from the oil field across the foothills toward the Santa Clara River Valley. Since the mountains on the east side of the Santa Clara River Valley are higher than the area of the oil field the air flow would most likely be diverted in a northerly direction, up the Santa Clara River Valley. Therefore, it is reasonable to doubt the east and west winds across the oil field, which on the average comprise five percent of the day (1.2 hours) will have any impact on the SCAB.

In addition to the issue of our exchange between the Shell Oil Field in Ventura and the SCAB is the relationship between the actual exchange rate and the location of Shell's compressors. As discussed in the EIR/EA, there are two major ventilating actions. The first is the unrestricted flow off the ocean at Point Arguello. As this northwesterly flow moves inland, the large mountain mass to the north and northwest of the Oxnard plain will cause a blocking effect and the winds will be diverted to higher elevations and different directions. Then they are at Point Arguello. It has been stated by the applicant that approximately half of the field compressors are

along the hillsides of the Ventura River Valley. However, the orographic affects on the wind patterns would be such that at best not more than 50 percent of the air flow across the elevated compressors would be from the northwest, and it would be even less than 50 percent. Further, this exchange rate impacts only half of the compressors in the total field, therefore it is anticipated that only 25 percent of the winds will exchange pollutants with the SCAB.

The second source of ventilation is the down valley flow along the Ventura River Valley. The down valley flow along the Ventura River Valley occurs, on the average, 13 hours per day. However, it is quite possible three to four hours per day of this down valley flow is not transported into the SCAB. In addition, the east and west winds across the Ventura oil field most probably are not transported into the SCAB. The 40 percent "air exchange factor" is 9.6 hours per day. If the 1.2 hours for east and west winds are removed from this figure, only 8.4 hours remain. The long-term data presented in Figure 3.3-1 (Volume I) indicates even this number may be high. If the data for July is representative of the summer months, it is possible that the 8.4 hours only occurs 75 percent of the year. This would indicate an average of only 6.3 hours of air exchange exists during the day. Thus a 26 percent air exchange factor of air from the Ventura River Valley to the SCAB may be anticipated. Again, only if half of the compressors are located in the Ventura River Valley the actual exchange rate is 13 percent.

Therefore, the best estimate for an air exchange factor would be:

0.5 compressors (50%) + 0.5 compressors (25%) = 38%

Thus the 40 percent air exchange factor appears to be a reasonable conclusion.

57. We concur that the possibility of an occurrence of a catastrophic spill (defined as 80,000 Bbls) is very remote (perhaps 1 in 27000 years). However, it was felt that to be prudent, the applicant should be prepared to respond to such a large spill because of the significant adverse impacts which could result if such a spill occurred.

IN REPLY REFER

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

1792

Pacific OCS Office
300 N. Los Angeles St., Rm. 7127
Los Angeles, California 90012

JAN 16 1979

Mr. Dwight E. Sanders
Chief, Planning and Environmental Coordination
State Lands Commission
1807 13th Street
Sacramento, California 95814

Dear Mr. Sanders:

Thank you for the opportunity to review the "Draft EIR/EA for the Shell OCS Beta Unit Development." We found the document to be comprehensive and well done. We have only one comment. In Volume II page 55 add the following paragraph at the end of section (2):

58. The Department of the Interior is currently in the process of developing appropriate air quality regulations to control OCS-related emissions, when they significantly affect the air quality of any adjacent state. An intent to issue such regulations was published in the Federal Register during December, 1978. The final air quality regulations are expected to be issued during June, 1979.

Again, thank you for the opportunity to comment.

Sincerely,

William E. Grant

Manager

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

RESPONSE TO COMMENTS OF THE
UNITED STATES DEPARTMENT OF THE INTERIOR,
BUREAU OF LAND MANAGEMENT

58. No comment is required.

APPENDIX I

AIR QUALITY
TECHNICAL APPENDIX

AIR QUALITY BASELINE STUDY
BOLSA CHICA ECOLOGICAL PRESERVE
(Huntington Beach, California

LIST OF FIGURES

SECTION I
MONITORING SITE SELECTION FOR BASELINE STUDY

Site selection for the Shell Beta air quality baseline study was made using the following criteria. First, the site should be located near the point of land where potential emissions from the platforms would most probably cross the shoreline. The air monitoring samplers should be located as close as possible to the shoreline to both sample air coming in from the ocean and to avoid sources of contamination between the shoreline and the sampling site. The site should be as free as possible of surrounding structures, nearby construction, adjacent highways with traffic, local emitters, and nearby trees. Electric power had to be available. Access to the site at all hours was desirable and security of both site and station were very important.

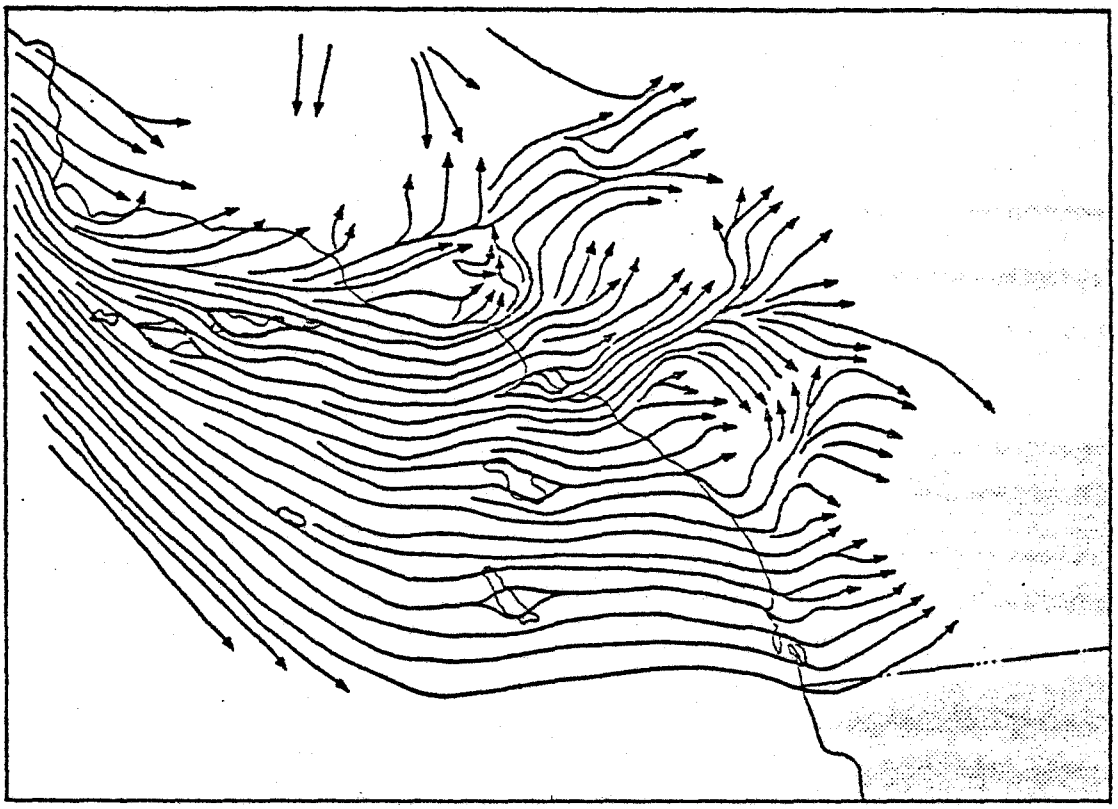
A study of historical wind flow data (summarized in streamline charts, Figures 1 and 2) from the area surrounding the proposed Shell Beta site indicated air transport past the platforms would most probably enter the South Coast Air Basin (SCAB) in the Huntington Beach-Costa Mesa area. Costa Mesa has had a South Coast Air Quality Management District (SCAQMD) monitoring station since February 1972. The Costa Mesa station is located about 6.6 km (4.0 miles) inland from the probable shoreline crossing point of emissions from the proposed platforms.

The site that best fitted the above criteria was found within the Bolsa Chica Ecological Preserve, just inland from the Bolsa Chica State Beach in Huntington Beach. The general location of the site is shown in Figure 3. Three SCAQMD monitoring stations in the general area and nearest to the coastline are also shown. Only the Costa Mesa station monitors nitrogen oxides, SO_2, and TSP; Los Alamitos monitors SO_2 and TSP only; and Laguna Beach (closed since early 1977) monitored TSP only. The proximity of the Costa Mesa station to the Bolsa Chica site allowed the utilization of Costa Mesa's data base to establish a correlation between the two locations.

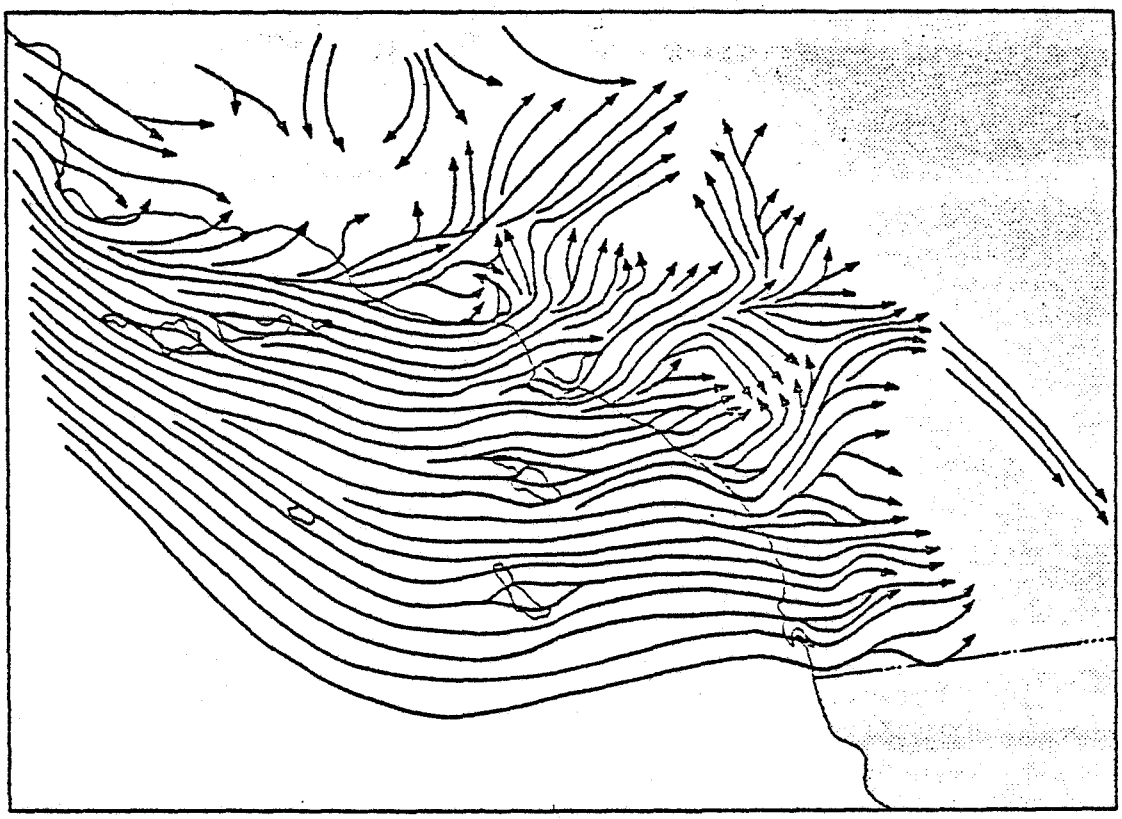
The Bolsa Chica Preserve overlaps an oil field owned by Signal Oil Company. The monitoring trailer was parked on the pad of a capped oil well (Signal S Bolsa S.123) with the geographical coordinates of north latitude 33°41'49", and west longitude 118°2'29".

The selected site was about 530 meters (1,740 feet) inland from the mean beach waterline. From this point, the proposed Shell Beta platforms would be exactly 15 kilometers (9.32 miles) distant at an azimuth of 212°. The nearby beach also represents the closest point of land to the proposed platform site.

From an air quality monitoring standpoint, the site has many desirable characteristics. Among these were the total absence of



April, 1200-1700, PST



July, 1200-1800, PST

SOURCE: DeMarrais, 1965

FIGURE 1 South Coast Streamline Charts, April and July Afternoon Hours

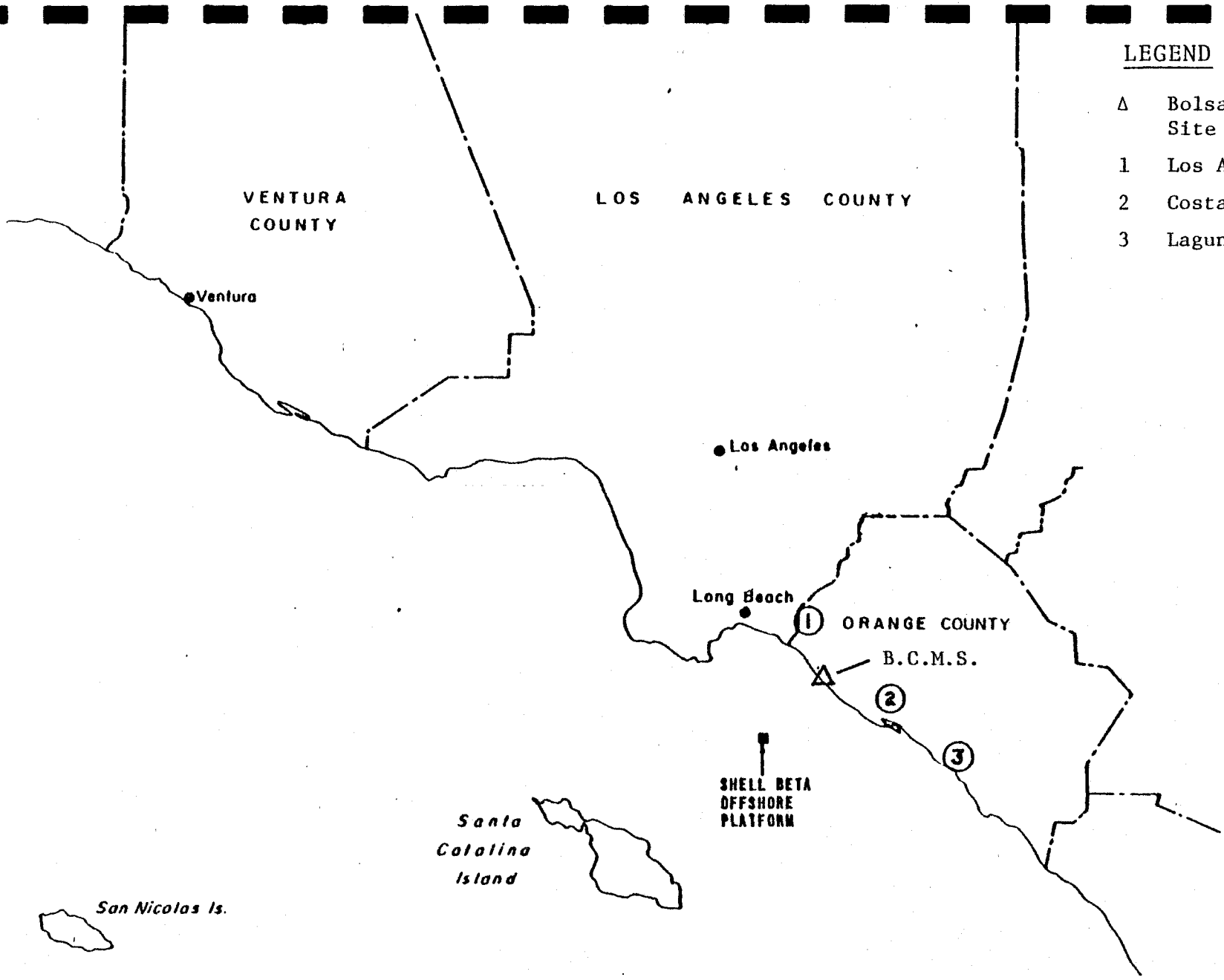


FIGURE 3 Air Monitoring Stations Nearest Shell Beta Site

nearby structures, highways, construction, and trees. This location provided excellent exposure to winds coming from the ocean. Power was available and the site had direct road access and reasonable security.

The monitoring trailer and its surroundings are shown in Figures 4 through 7. Figure 4 shows a northward view with the trailer centered. The trees beyond are at a distance of at least 1 kilometer (0.62 miles) on a low bluff. Figure 5 is looking southeast and shows the trailer and access road. Figures 6 and 7 are taken from the station roof looking respectively south and west towards the beach. The areas in the foreground are compacted semi-moist ground left over from evaporation of what were once tidal flats. Temporary puddles of rain water can be seen. An existing offshore drilling platform can be seen in the center of Figure 6. The direction of the proposed Shell Beta platforms lies between the scenes of Figures 6 and 7 and has the same appearance.

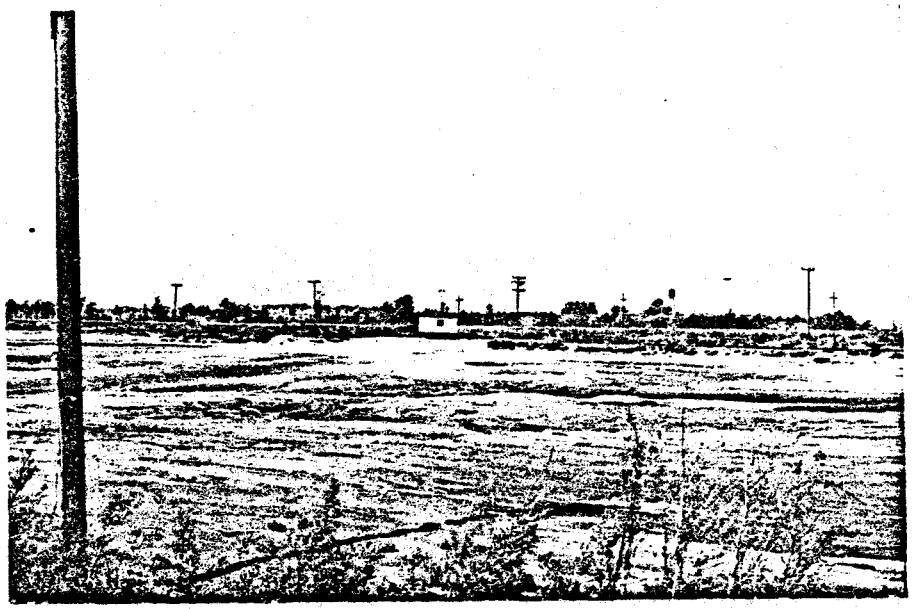


FIGURE 4 Northward View - Bolsa Chica Monitoring Site and Trailer

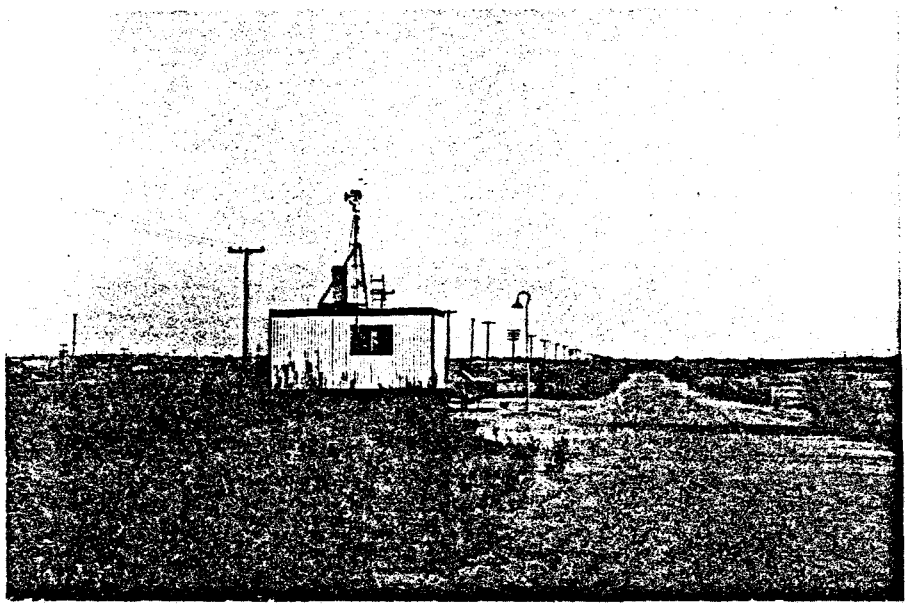


FIGURE 5 Southeast View - Bolsa Chica Monitoring Trailer with Access Road

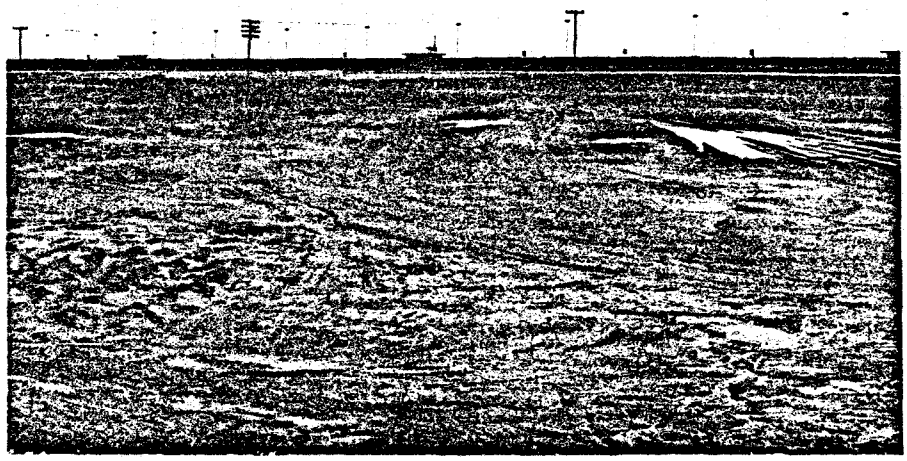


FIGURE 6 Southern View of Beach From Bolsa Chica Monitoring Site

FIGURE 7 Western View of Beach From Bolsa Chica Monitoring Site

SECTION II
MONITORING EQUIPMENT AND METHODS

Measurements made at the Bolsa Chica Ecological Preserve monitoring station were of NO, NO_x (defined as NO + NO_2), SO_2, temperature, wind speed, wind direction, and particulate matter. All but the last were recorded on a continuous basis during the study period. Total suspended particulates (TSP) were measured over a 24-hour period every three days, with every sixth day scheduled to match the SCAQMD TSP monitoring schedule.

A small (8 x 14 feet) mobile office trailer with air conditioning was used to shelter the equipment. The roof provided an elevated platform for mounted externals such as the air sample intake manifold, Hi-Vol (TSP) Sampler, and the meteorological station.

Figure 8 shows the station externals with the capped oil well (and its light stanchion) in the right foreground. The view is northwards with the trailer axis oriented roughly towards the beach with the Shell Beta platform site to the left. The Hi-Vol sampler is to the right on the roof and looks like a small gabled structure. The mechanical weather station is mounted on the short tower in the middle. The sample air intake (of glass) is on the left, supported by a frame of 2 x 4's. The intake mouth is at a height of 6.9 meters (22.75 feet) above the ground and 3.7 meters (12 feet) above the trailer roof. The glass pipe extends downwards along the northwest wall of the trailer and enters through a window panel of the trailer's other side.

The glass sample intake manifold and its entrance into the interior are shown in the upper background of Figure 9. Ten liters of sample air were drawn through the manifold every minute. The air monitoring equipment drew samples from the manifold via a glass and teflon nipple, within the manifold air stream.

The air quality monitoring instruments used and appropriate federal reference or equivalent methods are listed in Table 1.

Figures 9 and 10 show the equipment for monitoring SO_2 and nitrogen oxides. The two units stacked in the center are used for calibration of the SO_2 analyzer on the left and nitrogen oxide units on the right. The SO_2 sample line can be seen attached to the manifold at the center background of Figure 9.

Calibration of the continuous analyzer units was performed on a daily (weekday) basis. The calibration units provided both "zero air" (air known to be clean of pollutants) and air with precise concentrations ("Span Gas") of SO_2, NO, or NO_2. The use of the calibration units permitted testing of analyzer response against a known standard. Span gases are made by introducing carefully

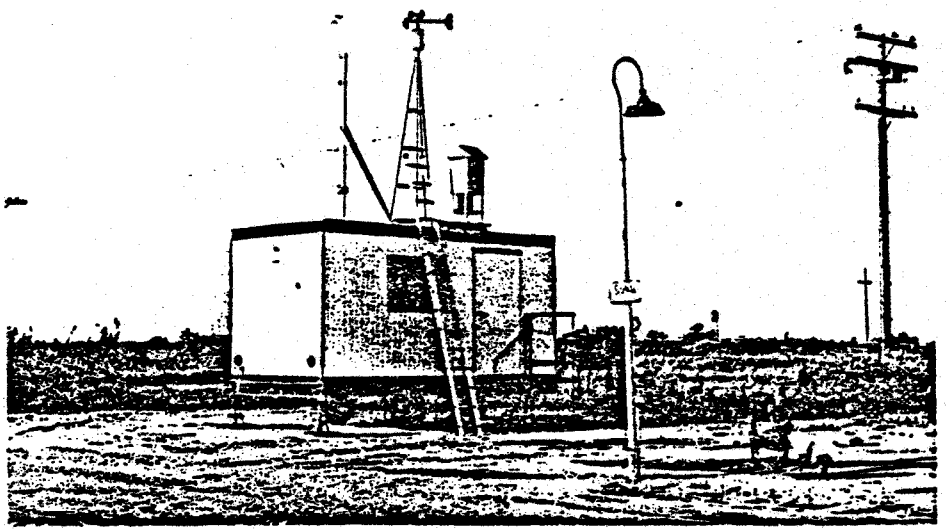


FIGURE 8 Bolsa Chica Site Monitoring Trailer (Northward Vie

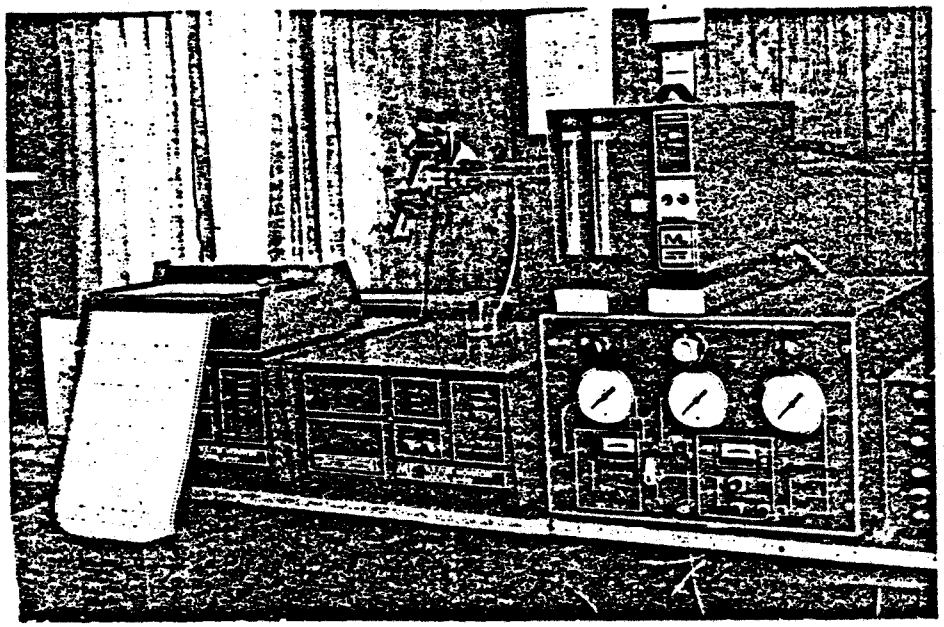


FIGURE 9 Glass Sampling Manifold Entrance and SO_2 Analyzer with Calibration Equipment

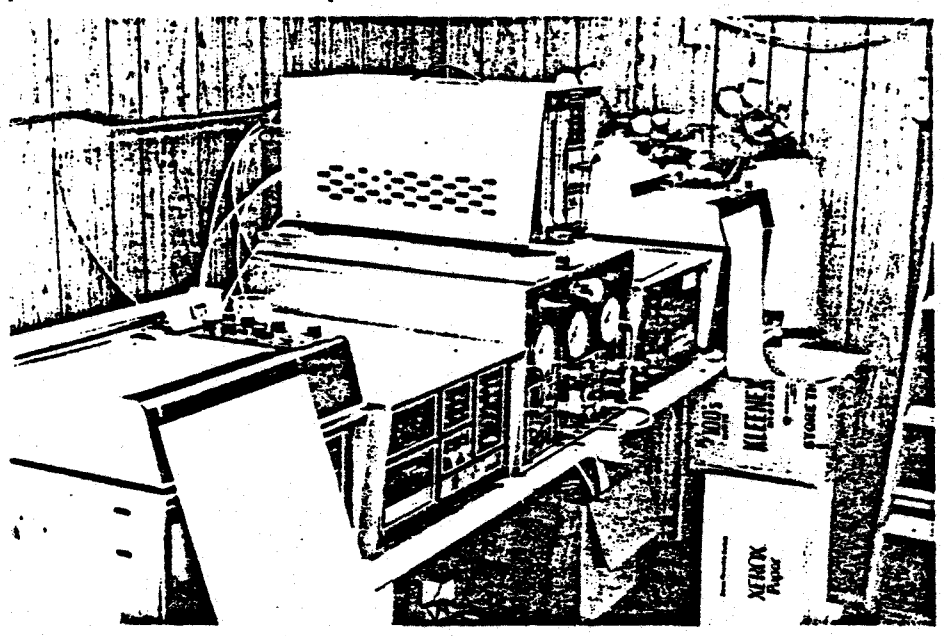


FIGURE 10 Continuous SO_2 and Nitrogen Oxides Analyze with Recorders and Calibration Equipment

TABLE 1

METHODS OF MEASUREMENT AND INSTRUMENTATION

USED AT BOLSA CHICA SITE

Parameter	Method	Instrumentation
Particulate Matter (TSP)	Gravimetric. Federal reference method 40 CFR 40 Appendix B	General Metal Works, Model GMWL200H High Volume Sampler
Sulfur Dioxide (SO_2)	Flame Photometric, Federal equivalent method, Designation No. EQSA-0876-013	Monitor Labs Model 8450E SO_2 Analyzer
Nitrogen Oxides (NO/NO_x)	Chemiluminescence. Federal Reference Method 40CFR50 Appendix F	Monitor Labs Model 8840E Nitrogen Oxides Analyzer
Wind Speed Wind Direction Temperature	3-cup Anemometer Wind Vane Bimetallic Coil (All calibrations traceable to NBS standards.)	Meteorology Research, Inc. Model 1071 MWS Mechanical Weather Station

controlled amounts of pollutants into zero air. All measurements are based on calibrations traceable to NBS standards.

Maintenance was on a continuous basis using a full-time technician assigned to that station. When necessary, extra visits were made on weekends to service the Hi-Vol and other maintenance as required.

Upon arriving at the station, the technician performed routine equipment checks and entered the results in a daily log. The standard procedure included the following equipment checks. Analyzer calibration checks of zero and one span value were performed on the SO_2 and nitrogen oxide units. Accurate timing checks (in Pacific Standard Time) were made on all continuous recording charts. The Hi-Vol filters and charts were changed at routine intervals and the timer set. Multi-point calibrations on the SO_2, nitrogen oxides, and Hi-Vol units were performed at the beginning and end of the study period. Multi-point calibrations were also performed whenever instrumentation responses for zero and span were greater than the EPA specified limits of ± 3 percent for zero and ± 15 percent of span value. Daily zero and span response deviations were plotted on a "Daily Drift Chart." Recorder charts were removed from the recorders every week or ten days and returned to the offices for data reduction.

SECTION III
BOLSA CHICA MONITORING STATION DATA

The station at Bolsa Chica Ecological Preserve was operated continuously for 75 days, covering the period from noon of August 24 to noon of November 7, 1978. This represents one-fifth (20.5 percent) of a year. Climatologically, this period covered conditions typical of summer, the transition through fall, four Santa Ana episodes, two heavy rains and the start of typical winter conditions during the first week of November. This brief period fortuitously included several samples of weather different in character. It also covered the period of greatest change in sunset and sunrise times and length of day.

WIND DATA

Hourly average wind speed and direction data by relative percent frequency of occurrence for the 75-day monitoring period are presented in Table 2. It can be seen that, at the Bolsa Chica site, the winds from the south to west quadrant (which includes the direction to the Shell Beta platform site) total 52.5 percent of all wind occurrences. By wind speed, this quadrant comprises 20.8 percent of the 1 to 3 mph winds, 59.4 percent of the 4 to 12 mph winds, and 81.4 percent of the 13 to 24 mph winds. The wind data indicate a large percentage of the air that would pass the proposed platforms would probably come ashore in the general area of the Bolsa Chica monitoring site. The table also shows the greater strength of onshore winds (usually in the mid-morning and afternoon hours) as compared to offshore winds, the N through E quadrant (generally in nighttime hours).

TOTAL SUSPENDED PARTICULATE (TSP) DATA

TSP data collected using the Hi-Vol sampler during the monitoring period at Bolsa Chica site is presented in Table 3. Comparison values taken at the same time are also included for the Costa Mesa SCAQMD station. The values represent 24 hour averages in $\mu g/M^3$.

Of the 25 Hi-Vol sampling days, 7 exceeded the State of California standard of 100 $\mu g/M^3$, three of these by just small amounts well within method errors. Because of the evaluation technique's accuracy for Hi-Vol samples, it was assumed that only one of these three samples truly exceeded the state standard. If one says that 5 samples clearly exceeded the standard, this represents about 20 percent of the time the standard was violated at the Bolsa Chica site. This compares to 13 violations out of 61 days sampled at Costa Mesa during 1977 - or 21.3 percent violation rate over an entire year. A more detailed comparison of the data from Bolsa Chica with Costa Mesa is presented later in Section IV.

TABLE 2

FREQUENCY (PERCENT-TOTAL OCCURRENCES) DISTRIBUTION
OF WIND SPEED AND DIRECTION
AT BOLSA CHICA SITE

(Period: August 24 to November 7, 1978)

Wind Direction	Wind Speed (M.P.H.) 1-3	4-12	13-24	Total Frequency	Mean Wind Speed (M.P.H.)
N	2.82	2.29	--	5.11	4.7
NNE	1.70	2.35	.23	4.28	6.2
NE	1.35	1.94	.35	3.64	6.8
ENE	2.99	2.76	.41	6.16	5.8
E	3.52	1.99	.12	5.63	4.5
ESE	1.99	2.29	.23	4.51	5.9
SE	.70	1.88	.06	2.64	6.6
SSE	1.23	6.16	.94	8.33	8.3
S	1.58	5.28	.35	7.21	7.2
SSW	1.11	6.80	.47	8.38	7.8
SW	.53	3.81	.23	4.57	7.8
WSW	.94	13.61	5.28	19.83	10.5
W	1.06	7.51	3.93	12.50	10.8
WNW	1.17	1.70	--	2.87	5.5
NW	.47	.70	--	1.17	5.6
NNW	1.94	1.23	--	3.17	4.3
Totals	25.1 %	62.3 %	12.6 %	100.00%	7.8

TABLE 3

BOLSA CHICA MONITORING SITE TSP DATA
(Values in $\mu g/M^3$ - 24 Hour Average)

Date (1978)	Bolsa Chica	Costa Mesa	Notes
24 Aug.	58	67	
27 "	69	-	
30 "	68	67	
2 Sept.	71	-	
5 "	212*	57	Tropical Storm "Norman" -- Costa Mesa station had two inches of rain during period.
8 "	58	-	
11 "	45	33	
14 "	50	-	
17 "	44	35	
20 "	96	-	Santa Ana conditions.
23 "	154*	124*	Santa Ana conditions.
26 "	103*	-	
29 "	72	112*	
2 Oct.	49	-	
5 "	66	60	
8 "	51	-	
11 "	88	77	
14 "	128*	-	Santa Ana conditions.
17 "	58	65	
20 "	84	-	
23 "	202*	175*	Santa Ana and brush fire conditions.
26 "	104*	-	
29 "	77	76	
1 Nov.	67	-	
4 "	105*	85	

* Exceeded State of California Standard of 100 $\mu g/M^3$ - 24 hour average.

Since the Hi-Vol sampler does not discriminate as to wind direction, it cannot be determined which way the particulates came from. The highest concentration occurred during storms or Santa Ana conditions - times at which the normal daily cycle of onshore/offshore wind patterns are disrupted. These are also the periods where preponderance of winds are offshore from the Los Angeles Basin rather than off the ocean.

NITROGEN DIOXIDE (NO_2 DATA)

Data for the Bolsa Chica site are presented in Table 4 as hourly averages in ppm of NO_2. The California 1-hour standard for NO_2 is 0.25 ppm (479 $\mu g/M^3$). This standard was exceeded five days during the 75-day monitoring period (6.67 percent), for a total of nine hours out of the 1,691 monitored (0.53 percent of total time). The highest hourly average observed was 0.33 ppm (632 $\mu g/M^3$) at hour 10 on September 22. A more detailed discussion and look at the conditions of standard violation is given in Sections IV (Data Comparison: Bolsa Chica with Costa Mesa) and V (Analysis of Atmospheric Conditions During High NO_2 Concentrations).

The generalized pattern for NO_2 concentration was higher values for the nighttime and later morning hours, with lower values in the afternoon hours. Figure 11 is a bar chart of hourly averages (in ppm) by hour of day over the 75-day monitoring period. The mid-morning peak is from the higher levels of NO_2 resulting from photochemical reactions following sunrise. These promote the conversion of nitric oxide (NO) to NO_2. The afternoon drops in NO_2 concentrations results from onshore winds bringing fresh air from the ocean. After sunset, the winds shift to offshore and basin drainage flow carries basin air pollution past the station. The NO_2 levels are initially lower, and slowly increase during the night as NO converts into NO_2.

SULFUR DIOXIDE (SO_2) DATA

Table 5 presents the hourly averages in ppm of SO_2. In contrast to NO_2, the striking feature is that over half the time the SO_2 levels were 0.004 ppm or less, i.e., essentially zero. The blank areas in Table 5 indicate this concentration of 0.004 ppm or less. Dashes represent hours where no value was obtained due to machine calibration, maintenance, etc.

The California standards for SO_2 are an hourly average of 0.50 ppm and 0.05 ppm averaged over a 24-hour period. The highest 24-hour average seen at Bolsa Chica was 0.03 ppm (October 14), with only eight days exceeding a 24-hour average of 0.01 ppm. The highest hourly average SO_2 concentrations seen were 0.08 ppm (213 $\mu g/M^3$) at hour 10 on October 13 and 14, and hour 5 on October 15. The highest momentary peak values seen were 0.12 ppm at hour 10 on October 14 and 0.09 ppm at hour 5 on October 13 and 15. Thus, the SO_2 standards were never violated at the Bolsa Chica site.

TABLE 4

NITROGEN DIOXIDE - BOLSA CHICA AMBIENT MONITORING RESULTS
Hourly Averages, Parts Per Million

Date	Hour																							Daily Means
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Aug.'78																									
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.01	.02	.01	0	.01	.02	.01	.02	.04	.016
25	.02	0	0	.01	.05	.04	.05	.02	0	.01	0	0	0	0	0	0	0	.01	.01	.01	.01	.01	.01	.01	.011
26	.02	.04	.03	.04	.05	.05	.04	.02	0	0	0	0	-	-	-	-	0	.01	.02	.01	.01	.01	.01	.03	.020
27	.04	.05	.05	.05	.03	.02	.02	.02	.02	.01	0	0	0	.01	0	0	.01	.01	.01	.01	.01	.01	.02	.02	.018
28	.02	.03	.03	.03	.01	.04	.03	.03	.01	0	0	0	.01	.01	0	-	0	.01	.01	.02	.03	.01	.02	.02	.016
29	.02	0	0	.02	.02	.03	.03	.03	.03	.02	.01	0	0	0	0	0	0	.01	0	0	0	.01	.03	.03	.012
30	.03	0	0	.02	0	.02	.02	.01	0	0	0	0	0	-	0	.01	.01	.01	.01	.01	.01	.02	.03	.04	.011
31	.05	.05	.03	.03	.02	.01	.01	.02	0	0	0	0	0	.01	.01	.02	.01	.01	.01	.01	.01	.01	.01	.01	.014
Sept.'78																									
01	0	0	0	.01	.01	.01	.02	.04	.02	.01	0	0	0	0	-	.01	.01	.01	.01	.01	.05	.02	.02	.04	.013
02	.05	.07	.06	.06	.05	.07	.07	.07	.07	.04	.01	.01	0	0	.01	.01	0	.01	.01	.02	.01	.01	.01	0	.030
03	.01	.02	.01	0	.01	.01	.01	.03	.02	.01	.01	.01	.01	.01	.01	.01	0	.01	.01	.02	.02	.01	.01	0	.011
04	0	.02	.02	.02	.02	.01	.02	.02	.02	.02	-	-	-	-	-	.03	.02	.02	.02	.02	.03	.03	.04	.04	.022
05	.04	.03	.03	.04	.04	.04	.04	.07	.05	.04	.04	.03	.11	.08	.06	.09	.01	.06	.08	.05	.02	.01	.01	.01	.045
06	.02	.02	.01	.01	.01	.01	.02	.02	.01	.01	.01	.01	.01	-	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.012
07	.01	.01	.02	.02	.02	.03	.03	.02	.02	.02	.01	.01	.01	.02	.01	.01	.02	.01	.02	.02	.02	.02	.04	.03	.019
08	.04	.03	.02	.05	.05	.04	.05	.07	.04	.01	-	.01	.01	.01	.01	.01	.01	.02	.02	.02	.02	.02	.03	.03	.027
09	.05	.04	.04	.04	.04	.03	.04	.04	.03	.01	.01	.01	.01	.01	.01	.01	.01	.01	.03	.04	.04	.04	.02	.02	.026
10	.07	.07	.06	.06	.05	.04	.05	.04	.04	.04	.03	.01	.01	.01	.01	.01	.01	.01	.01	.01	-	0	.01	0	.028
11	0	0	.01	0	.01	.02	.02	.03	.03	.02	.01	0	0	0	0	.01	.01	.01	.01	.01	.02	.02	.03	.02	.012
12	.03	.02	.02	.03	.03	.02	.02	.02	.01	.01	.01	.01	-	.01	.01	.01	.01	.01	.01	0	.01	.01	0	.01	.014
13	.01	.02	.02	.02	.02	.02	.02	.01	.01	.01	.01	-	0	0	.01	.01	.01	.01	.01	.01	.01	.01	.01	0	.011
14	0	0	.02	.02	.02	.03	.04	.05	.05	.01	.01	.01	.01	0	.01	.01	.01	.01	.01	.01	.01	.03	.05	.05	.020
15	.04	.05	.04	.05	.05	.04	.05	.07	.06	.06	.05	.01	-	0	0	.01	.01	.01	.01	.01	.01	.01	.01	.02	.029
16	.05	.06	.05	.03	.03	.04	.03	.03	.02	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.020
17	.01	.01	.01	.01	.01	0	.01	.01	.01	.01	.01	0	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.009
18	.01	.01	.01	0	.01	.02	.01	.01	.05	.09	.08	.02	.01	-	.01	.01	.01	.01	.03	.04	.03	.05	.06	.06	.028

TABLE 4 (CONT'D.)

NITROGEN DIOXIDE - BOLSA CHICA AMBIENT MONITORING RESULTS
Hourly Averages, Parts Per Million

Date	Hour																							Daily Means
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Sept. '78 (Cont'd.)																								
19	.06	.06	.07	.04	.08	.08	.07	.07	.01	.01	.01	.01	.01	.01	0	.01	.02	.03	.03	.05	.08	.05	.03	.02	.038
20	.02	.02	.02	.01	.01	.02	.03	.03	.02	.01	.01	.01	.01	.03	.03	.03	.03	.02	.02	.02	.02	.05	.05	.07	.025
21	.07	.08	.05	.05	.06	.07	.07	-	.17	.13	.18	.09	.16	.11	.03	.02	.02	.02	.03	.05	.03	.06	.06	.08	.073
22	.09	.09	.10	.10	.09	.09	-	.15	.12	.26	.33	.25	.11	.07	.09	.05	.05	.08	.14	.16	.17	.03	.03	.09	.119
23	.12	.13	.16	-	-	-	.17	.16	.25	.26	.11	.07	.07	.05	.05	.06	.08	.08	.13	.09	.05	.08	.03	.09	.109
24	.05	-	-	-	.11	.11	.15	.20	.14	.09	.07	.09	.09	.08	.06	.03	.02	.09	.08	.11	.11	.05	.02	.05	.086
25	-	-	-	-	-	-	-	-	-	-	-	-	-	.08	-	.02	.06	.09	.12	.12	.08	.04	.08	.03	.072
26	.08	.07	.04	.06	.05	.08	.11	.19	.27	.15	.11	.07	.06	.02	.04	.02	.02	.02	.03	.02	.02	.02	.02	.03	.067
27	.02	.03	.02	.01	.03	.09	.04	.03	.02	.02	.02	.01	.01	.01	-	.02	.02	.03	.03	.02	.02	.02	.04	.03	.023
28	.03	.03	.04	.04	.04	.04	.05	.03	.02	.01	.02	.02	.02	.01	-	.02	.02	.03	.03	.03	.02	.02	.02	.03	.027
29	.03	.05	.06	.06	.05	.06	.08	.08	.06	.06	.02	.04	.01	.01	.01	.01	.02	.02	.04	.03	.02	.02	.03	.03	.038
30	.02	.02	.02	.04	.03	.05	.06	.05	.02	.02	.02	.01	.01	.01	.01	.01	.01	.02	.02	.02	.02	.07	.03	.02	.025
Oct. '78																								
01	.01	.01	.01	.01	.02	.02	.02	.03	.03	.02	.01	.01	.01	.01	.01	.01	-	.02	.02	.01	.01	.01	.01	.01	.014
02	.01	.01	.01	.01	.01	.01	.02	.03	.03	.03	.02	.02	.01	.01	.01	.01	.02	.02	.01	.01	.01	.01	.02	.02	.014
03	.03	.03	.04	.04	.06	.06	.06	.06	.07	.08	.10	.08	.06	.02	-	.02	.02	.02	.02	.02	.08	.08	.08	.06	.052
04	.02	.04	.06	.11	.08	.08	.06	.06	.07	.09	.07	.03	.02	.02	.02	.02	.02	.02	.02	.06	.08	.08	.08	.03	.052
05	.01	.01	.01	.01	.02	.02	.03	.03	.03	.03	.03	.02	.03	.02	.02	.02	.02	.02	.02	.01	.01	.01	.02	.03	.020
06	.02	.02	.02	.02	.02	.02	.04	.05	.06	.04	.03	.02	-	.03	.03	.03	-	.02	.02	.02	.03	.03	.02	.03	.028
07	.03	.03	.03	.02	.02	.05	.06	.04	.03	.02	.02	.02	.02	.02	.02	.02	.02	.01	.01	.01	.02	.03	.03	.03	.024
08	.02	.02	.02	.03	.03	.02	.02	.03	.02	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.02	.06	.06	.05	.06	.024
09	.06	.06	.06	.06	.05	.06	.06	.07	.08	.12	.11	.03	.02	.04	.02	-	.01	.02	.04	.08	.07	.06	.07	.08	.058
10	.07	.07	.06	.07	.07	.08	.08	.10	.08	.07	.04	.03	-	.01	.01	.01	.01	.01	.01	.01	.01	.01	.03	.04	.041
11	.04	.05	.07	.06	.03	.05	.04	.06	.03	.03	.04	.05	.04	.04	.03	.02	.04	.05	.01	.01	.01	.01	.04	.03	.037
12	.05	.06	.05	.05	.05	.04	.02	.03	.06	.06	.02	.01	.01	.01	-	.04	.04	.03	.02	.02	.04	.02	.03	.07	.036
13	.02	.01	.02	.03	.06	.07	.08	.08	.09	.10	.15	.13	.09	.05	-	.02	.02	.02	.02	.03	.07	.06	.05	.04	.057

TABLE 4 (CONT'D.)

NITROGEN DIOXIDE - BOLSA CHICA AMBIENT MONITORING RESULTS
Hourly Averages, Parts Per Million

Date	Hour																								Daily Means
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Oct. '78 (Cont'd.)																									
14	.04	.04	.05	.05	.06	.08	.09	.09	.08	.09	.13	.14	.13	.06	.03	.02	.03	.04	.10	.09	.09	.09	.09	.09	.075
15	.09	.08	.08	.09	.09	.11	.11	.10	.13	.13	.13	.09	.05	.03	.02	.02	.02	.02	.02	.05	.08	.08	.09	.08	.075
16	.06	.06	.01	.04	.05	.04	.06	.05	.03	.01	.01	.02	.01	.01	–	.01	.01	.01	.01	.01	.01	.03	.02	.02	.026
17	.02	.02	.02	.02	.02	.02	.04	.03	.03	.03	.02	.01	.01	.01	.01	.01	.02	.02	.02	.01	.02	.07	.05	.04	.024
18	.04	.04	.04	.08	.05	.05	.05	.08	.07	.07	.04	.02	.02	.02	.02	.02	.02	.03	.09	.09	.08	.08	.07	.06	.051
19	.07	.06	.07	.06	.06	.07	.09	.15	.21	.28	.09	.03	.05	–	–	–	–	–	–	–	.05	.05	.06	.08	.090
20	.08	.06	.02	.02	.02	.05	.04	.06	.05	.05	.02	.01	–	–	–	–	–	–	–	.01	.01	.02	.01	.01	.032
21	.01	.01	.01	.04	.02	.03	.03	.06	.03	.02	.02	.01	.01	.01	.01	.01	.01	.02	.02	.03	.08	.08	.08	.07	.030
22	.07	.07	.04	.03	.03	.04	.04	.04	.02	.02	.02	–	–	–	–	–	.03	–	–	.08	.08	.08	.07	.07	.049
23	.06	.06	.07	.07	.08	.04	.06	.03	.02	.02	.01	.01	–	–	–	–	.05	.06	.06	.05	.04	.02	.05	.04	.045
24	.05	.06	.03	.02	.02	.02	.03	.03	.01	.02	.01	.01	–	–	–	.01	.01	.01	.01	.01	.01	.01	.04	.02	.020
25	.02	.02	.03	.02	.02	.02	.03	.01	.01	.01	.01	.01	–	.01	.01	.01	.01	.01	.01	.05	.06	.05	.05	.05	.023
26	.05	.05	.06	.05	.05	.05	.06	.07	.07	.16	.11	.02	–	.01	.01	.02	.02	.06	.10	.08	.06	.02	.10	.06	.050
27	.05	.10	.08	.08	.03	.02	.03	.07	.10	.10	.12	.08	–	0	.02	.02	.03	.09	.11	.10	.08	.08	.10	.08	.068
28	.08	.08	.04	.04	.04	.06	.08	.08	.06	.07	.07	.04	.03	.04	.03	.02	.03	.06	.05	.02	.02	.01	.01	.02	.044
29	.02	.02	.02	.02	.02	.02	.02	.06	.04	.05	.05	.03	.02	.02	.02	.02	.02	.01	.02	.03	.01	.01	.01	.01	.024
30	.01	.02	.03	.02	.02	.02	.03	.02	.02	.01	.01	.01	.01	–	.01	.01	.02	.02	.01	.01	.01	.01	.01	0	.014
31	0	.01	.04	.05	.06	.05	.06	.08	.05	.02	0	0	0	0	–	0	.01	.01	.02	.04	.04	.03	.06	.06	.025
Nov. '78																									
01	.06	.06	.04	.04	.03	.04	.03	.06	.08	.04	.04	.02	.01	0	0	–	–	.01	.03	.03	.02	.02	.03	.03	.033
02	.05	.08	.07	.06	.05	.05	.04	.08	.10	.06	.08	.12	.03	.01	–	0	.02	.03	.06	.06	.04	.09	.08	.06	.057
03	.07	.08	.04	.10	.08	.05	.06	.08	.11	.11	.16	.06	.05	.03	.02	–	.02	.05	.05	.07	.08	.09	.09	.02	.068
04	–	–	–	.09	.09	–	.08	.09	.08	.02	.02	.01	.01	.01	.01	.01	.03	.03	.04	.05	.04	.03	.05	.06	.043
05	.08	.07	.05	.03	.03	.03	.04	.03	.03	.02	.02	.01	.01	.01	.01	.01	.01	.01	.01	.03	.03	.04	.05	.05	.030
06	.05	.06	.06	.07	.06	.05	.05	.05	.05	.06	.07	.09	.08	.08	.08	.09	.05	–	–	.11	–	–	.05	.06	.066
07	.07	.09	.08	.09	.08	.10	.09	.14	.21	.14	.25	.29	.13	–	–	–	–	–	–	–	–	–	–	–	.135

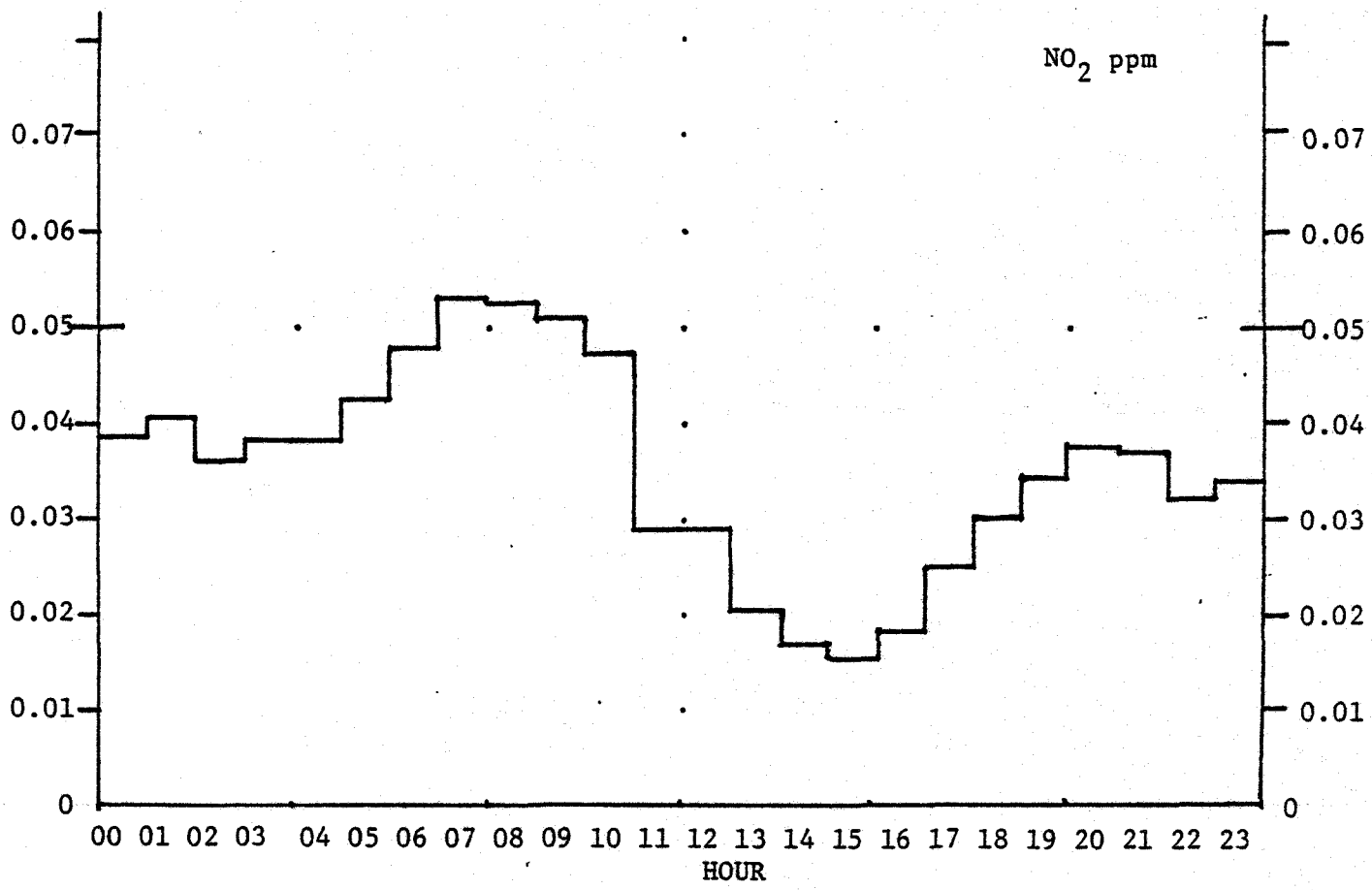


FIGURE 11 Average Hourly Concentrations of NO_2 by Hour of Day Observed at Bolsa Chica

TABLE 5

SULFUR DIOXIDE - BOLSA CHICA AMBIENT MONITORING RESULTS
Hourly Average, Parts Per Million

Note: Blank spaces indicate SO_2 concentrations of 0.004 ppm or less, i.e. essentially zero.
Dashes indicate no data availablr for that hour due to instrument calibration, maintenance, etc.

Date	Hour																							Daily Means
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Aug. '78																									
25	-	-	-	-	-	-	-	-	-	-	-	-	-												0
26										-															0
27																									0
28																-									0
29									.01						-										.000
30												-													0
31																									0
Sept. '78																									
01																-	-								0
02	.01			.01	.02	.05	.05	.06	.06	.04										.01					.013
03								.01																	0
04											-				.01										0
05													.03	.02											.002
06															-										.000
07			.01				.01		.01	.01															.002
08												-	-	-	-										0
09																			.01						0
10									.02	.03	.01							-	-	-					.003
11																									0
12													-	-	-	-	-								0
13													-	-											0
14						.01	.01																		0
15									.02	.04	.01	-										.01			.003
16																									0
17																									0
18						.01			.01	.01	.01		-							.01					.002

TABLE 5 (CONT'D.)

SULFUR DIOXIDE - BOLSA CHICA AMBIENT MONITORING RESULTS
Hourly Average, Parts Per Million

Date	Hour																							Daily Means
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Sept. '78 (Cont'd.)																									
19														-				.01	.01	.02	.01				.002
20																									0
21	.01										.01	.01		-											.001
22										.01	.02	.02	.02	.01	-	.02	.01		.02	.02	.02				.007
23						.01	.01				.01	.01	.01				.02	.02	.03	.02					.006
24														.01	.03			.01	.01	.01	.01				.003
25											.01	.01	.01	-				.01	.01	.01					.003
26														.01											0
27														-				.01							0
28														-											0
29																									0
30																									0
Oct. '78																									
01																-									0
02																									0
03				.01	.03	.03	.02	.01	.02	.04	.06	.05	.02	-							.01	.01	.01	.01	.014
04	.01	.01	.02	.03	.02	.02	.02	.01	.01	.02	.03									.01	.01				.009
05																-	-								0
06												-		.01											.000
07							.01																		.000
08																					.01				.000
09									.02	.02	.02	.01			-				.01	.02	.01	.01	.01	.01	.006
10	.01	.01	.01						.01	.01				-											.002
11				.01	.01			.01	.01	.02	.01	.01													.003
12						.01	.01	.01	.02	.03	.01			-	.01	.01	.01	.01		.01	.01	.01	.01	.01	.008
13	.01		.01	.01	.03	.05	.04	.02	.02	.03	.08	.06	.05	.03		-				.01	.01	.01	.02	.02	.022

TABLE 5 (CONT'D.)

SULFUR DIOXIDE - BOLSA CHICA AMBIENT MONITORING RESULTS
Hourly Average, Parts Per Million

Date	Hour																							Daily Means
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Oct. '78 (Cont'd.)																									
14	.02	.02	.02	.02	.02	.06	.07	.06	.02	.02	.08	.07	.07	.02				.01	.03	.02	.02	.02	.03	.03	.030
15	.03	.04	.04	.04	.05	.08	.05	.04	.07	.06	.06	.06	.01							.02	.02	.02	.01		.029
16					.01			.01						-											.001
17																									0
18									.02	.03	.01	.01						.01	.03	.03	.02	.01			.007
19									.01	.01	.01		.01	.01			-								.002
20														-											0
21																									0
22												-						.02	.02	.01	.01	.02	.02	.01	.005
23	.01			.01										-											.001
24													-												0
25													-							.01					.000
26										.01	.01			-				.01	.02	.02	.02	.01	.02	.03	.007
27	.07	.06	.04	.02	.01			.01	.01	.01	.03	.04		-				.02	.03	.03	.02	.01	.01	.01	.019
28	.02	.03	.02	.02	.01	.01	.02	.02	.02	.02	.02	.01	.02	.01				.02							.011
29									.01	.01	.01														.001
30														-											0
31																			.01						.000
Nov. '78																									
01										.01	.01						-						.01		.001
02										.01	.01	.02			-						.01				.002
03									.01	.01	.02	.01				-				.01	.01	.01	.01		.004
04																									0
05																									0
06											.03	.03	.02	.02	.01	.01		-	.01	.02	-	-	-		.007
07					.04	.02		.01	.03	.03	.04	.05	.03	-	-	-	-	-	-	-	-	-	-	-	.019

A more detailed look at the highest SO_2 concentrations is given in the following section which compares data from the Costa Mesa SCAQMD monitoring station.

SECTION IV
DATA COMPARISON: BOLSA CHICA WITH COSTA MESA

One prime consideration in choosing the Bolsa Chica Beach site was the possibility that air quality monitored there would be similar to the more inland SCAQMD station in Costa Mesa. The comparisons presented below show that this similarity exists. The importance of the similarity is that, for future Shell Beta air quality impacts, the long-term data base available at Costa Mesa can be used in addition to the relatively brief Bolsa Chica monitoring data period.

COMPARISON OF AIR QUALITY VIOLATIONS

TSP

The comparison values between the two stations have already been presented in Table 3. Costa Mesa had three violations out of 13 samples that were seen during the Bolsa Chica monitoring period. This represents a 23 percent violation rate compared to 20 percent at Bolsa Chica. This is good agreement in a comparison of TSP violation levels.

In examining the individual values made on the same days, they generally are reasonably close, with the gross exception of September 5 during tropical storm "Norman" when Costa Mesa recorded nearly two inches of rain during the sampling period.

From a statistical viewpoint, comparing the ten common pairs of values other than during Santa Ana conditions and "Norman," the average TSP values are 68.1 $\mu g/m^3$ for Bolsa Chica (Sigma = 18.8) and 67.7 $\mu g/m^3$ for Costa Mesa (Sigma = 23.0). These are, again, very good agreement between these two stations, one about 6.4 kilometers (4 miles) inland and downwind from the other near the beach.

NO_2

Table 6 lists the dates, hours of day, and the number of hours the California hourly average NO_2 standard was violated during the Bolsa Chica monitoring period. Here the agreement is fair in the earlier part of the period; it becomes excellent in the latter half.

A striking feature is clustering of the violation hours: all are in the late morning hours -- between 0900 and 1300 hours PST. This is discussed in Section V of this report ("Analysis of Atmospheric Conditions During High NO_2 Concentrations").

TABLE 6

NITROGEN DIOXIDE CALIFORNIA STANDARD VIOLATIONS
AT BOLSA CHICA AND COSTA MESA

(NO_2 Hourly Average $\geq$0.25 ppm)
(August 24 through November 7, 1978)

Date (1978)	Bolsa Chica	Costa Mesa
22 Sept.	Hours 10, 11, 12	- (peaked at 0.14 ppm at 10 hour)
23 Sept.	Hours 09, 10	- (peaked at 0.11 ppm at 08 hour)
26 Sept.	Hour 09	- (peaked at 0.16 ppm at 09 hour)
10 Oct.	- (Peaked at 0.11 ppm at 08 hour)	Hour 10
19 Oct.	Hour 10	Hour 10
7 Nov.	Hours 11, 12	Hours 12, 13

It should be noted that the number of days in violation (i.e., one or more hourly averages $\geq$0.25 ppm NO_2 is five days out of 75 at Bolsa Chica and three out of 75 at Costa Mesa. This is in accordance with the number of NO_2 violation days gradient that runs along the coast, increasing northwestward from Newport Beach to the Long Beach Harbor area. Figure 12 shows this gradient as it exists along the coast and is reproduced from the SCAQMD Report "Contour Maps of Air Quality in the South Coast Air Basin - 1976." Location identifiers have been added to Figure 12 for the Bolsa Chica site and the proposed Shell Beta platforms. The data from the Bolsa Chica site shows the isopleth lines extend into the ocean rather than paralleling the beach once they cross the shoreline.

SO_2

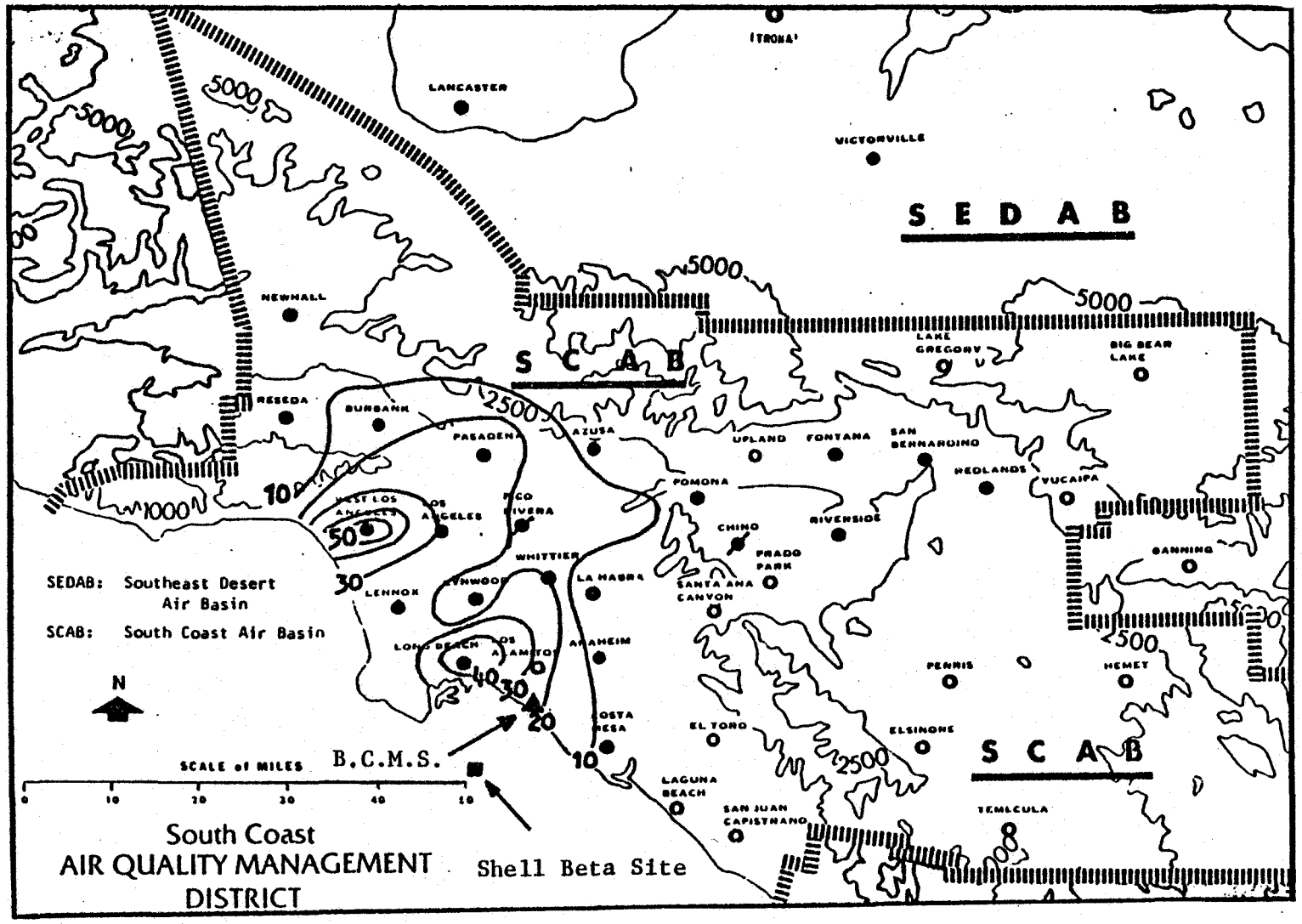
No violations of SO_2 air quality standards were recorded for Costa Mesa during the 75-day period of monitoring at Bolsa Chica. The highest hourly averages at Costa Mesa were 0.06 ppm at hour 13 on October 13 and 14 and hour 11 on October 15. The highest Costa Mesa monitoring peak values were at 0.07 ppm at hour 12 on September 28, hour 14 on October 11, hour 13 on October 13 and 14, and hour 11 on October 15. A graphed comparison between SO_2 levels at the two stations is given in the next section.

TIME OF DAY COMPARISONS WITH HIGHEST OBSERVED LEVELS OF NO_2 AND SO_2

For purposes of comparison, five days were selected showing the highest levels each of NO_2 and SO_2 at Bolsa Chica. Since only one day had a coincidence of highest NO_2 and SO_2 values, nine days are given (four for each pollutant and one common to both).

Data was obtained for the Costa Mesa station from SCAQMD and plotted against the Bolsa Chica values in a manner that permits rapid, direct comparison. The format used is a bar plot of hourly average values by hour over the entire day. The Bolsa Chica values are plotted above the line with Costa Mesa below the line, both use the same scales and hours. Both NO_2 and SO_2 values are plotted together with the latter shaded as its values were almost always lower. Missing bars indicate data were not available for that hour. At the right of each plot is the average hourly concentration (in ppm) for that day over the entire day.

These comparison charts are given in Figures 13, 14, and 15. The first five plots show the highest NO_2 values seen at Bolsa Chica with the fifth plot (November 7) as the date where both NO_2 and SO_2 were at high levels. The first four plots (for highest NO_2) also include SO_2 values to give a picture of its "normal" or average behavior. The last four plots represent the highest SO_2 values. The NO_2 values are likewise included to indicate their more "normal" or average NO_2 levels and behavior.



▲ Bolsa Chica Monitoring Site (B.C.M.S.)

• Stations Where NO_2 Measured

ϕ Less than Full Year's Data in 1976

o NO_2 not Measured at that Station

FIGURE 12 Nitrogen Dioxide - Number of Days the State Standard Was Violated (1-hour average $NO_2 \geq 0.25$ ppm) - 1976

Ref. "Contour Maps of Air Quality in the South Coast Air Basin - 1976" SCAQMD Report E&P 77-1

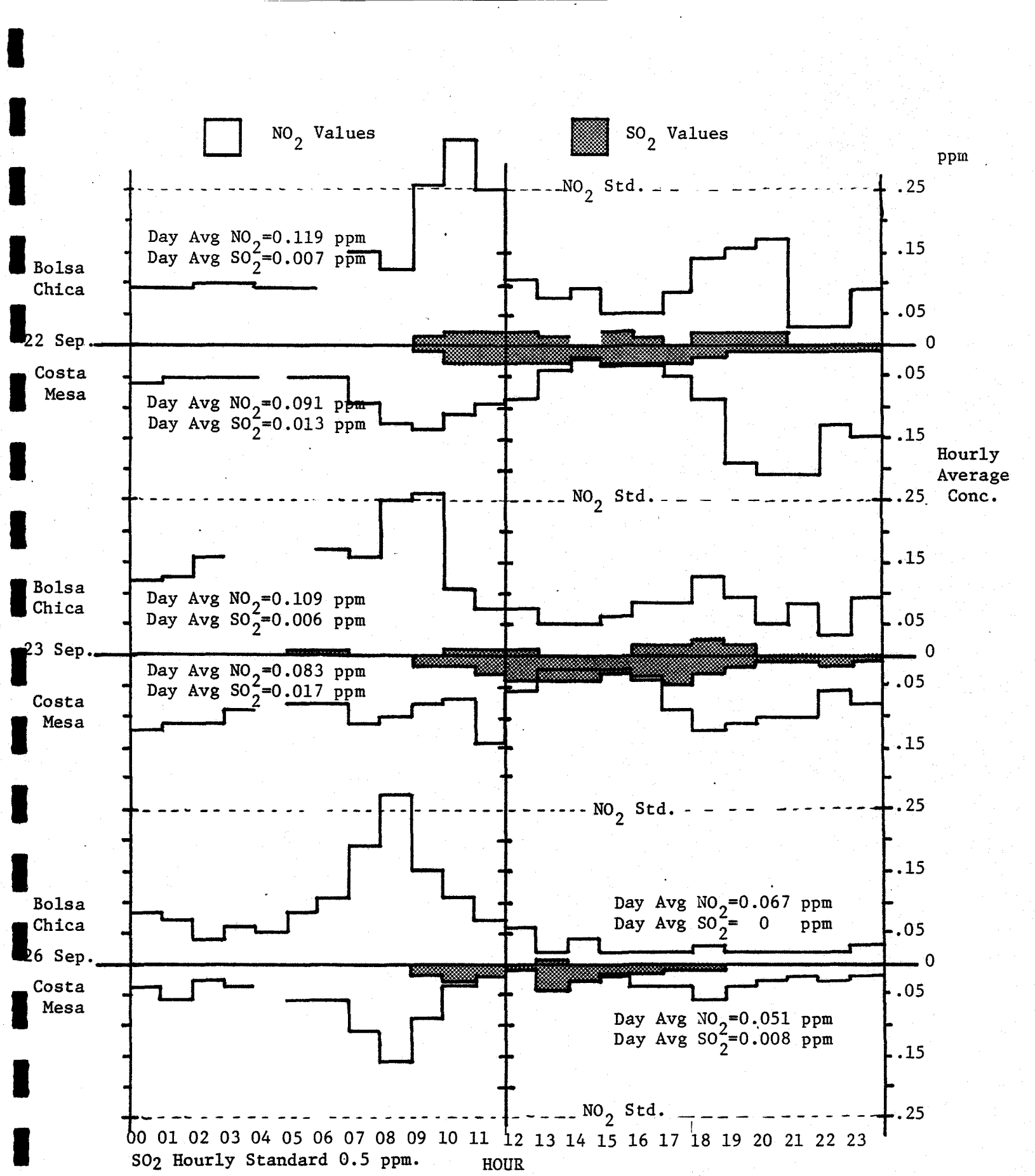


FIGURE 13 Highest NO_2 Hourly Averages Comparison for Bolsa Chica and Costa Mesa - 22, 23 and 26 September 1978.

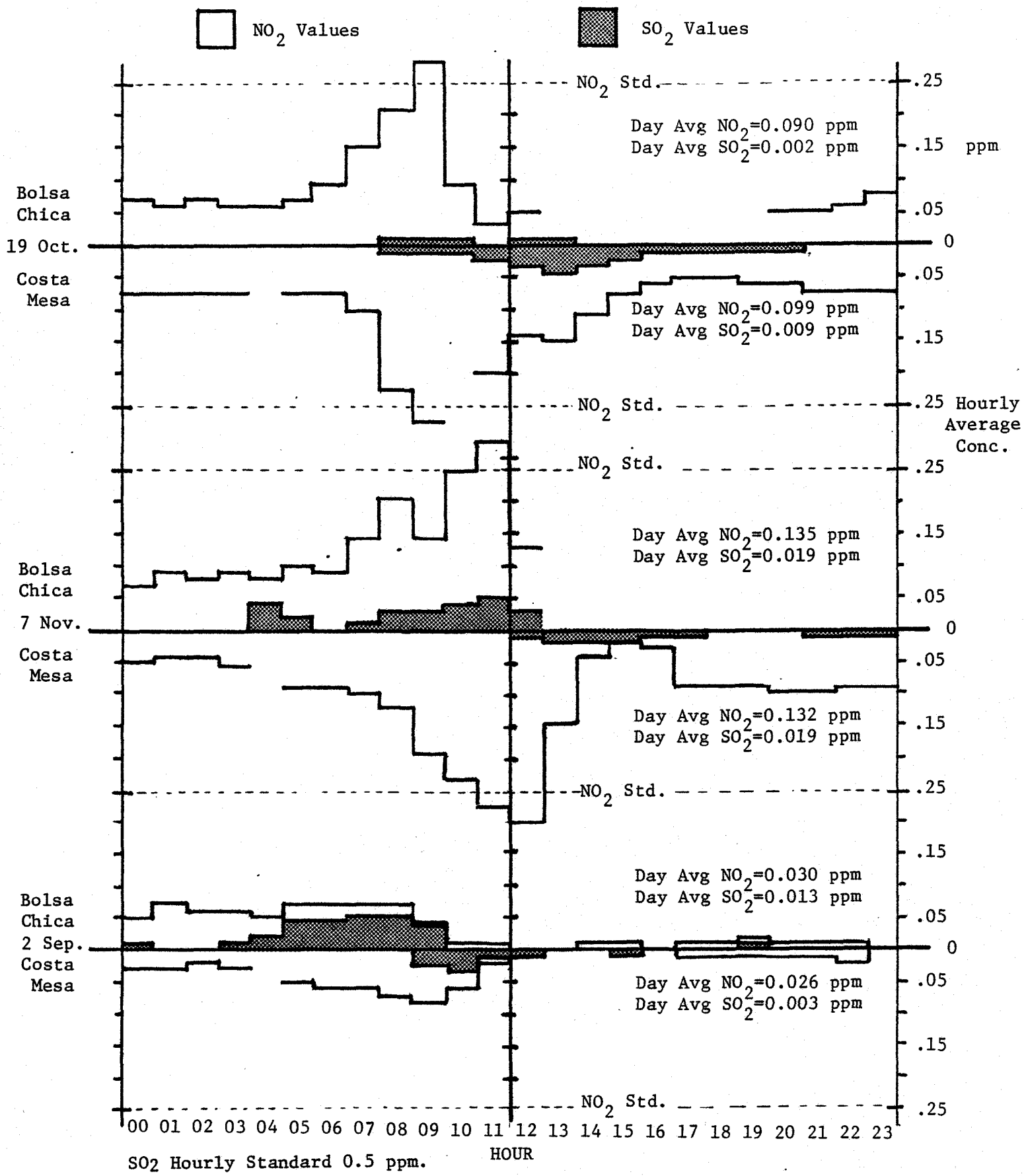
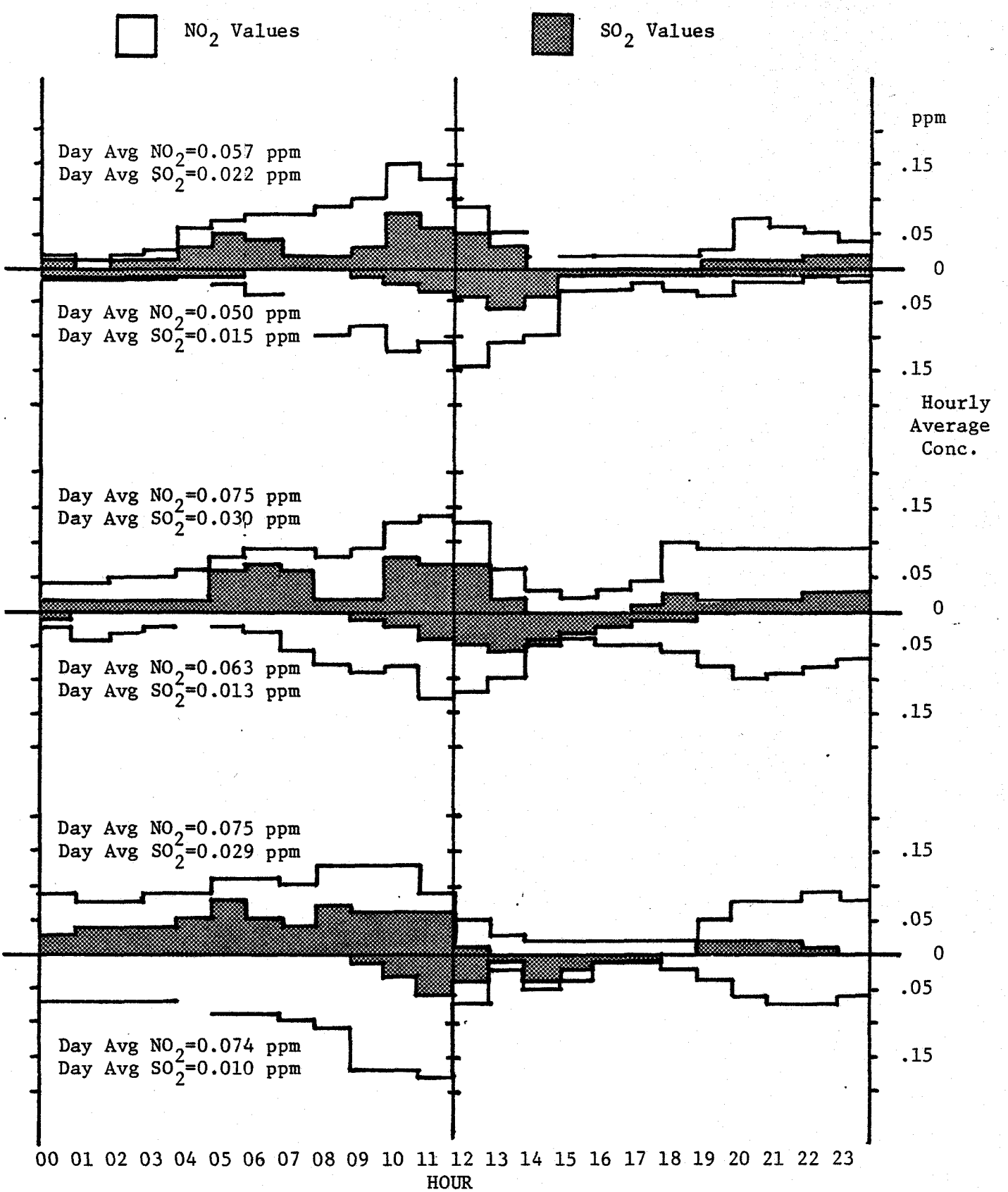


FIGURE 14 Highest NO_2 and SO_2 Hourly Averages Comparison for Bolsa Chica and Costa Mesa - 19 October, 7 November, and 2 September 1978.



SO_2 Hourly Standard 0.5 ppm.

FIGURE 15 Highest SO_2 Hourly Averages Comparison for Bolsa Chica and Costa Mesa - 13, 14 and 15 October 1978.

Examination of the plots shows the NO_2 levels at Bolsa Chica and Costa Mesa are generally in step and form reasonably symmetrical mirror images of each other. The comparison is good enough to enable the use of the Costa Mesa historical data base for NO_2 levels at Bolsa Chica with reasonable confidence. This is explained by the fact that NO_2 comes mostly from oxidation of NO over time and favorable conditions. The NO is emitted from very large numbers of point and area sources (both stationary and mobile) that are widespread throughout the SCAB. Hence, concentrations of NO_2 are more likely to be uniform over large areas.

Unfortunately, the SO_2 concentrations do not show the same correlation as NO_2 and TSP between Bolsa Chica and Costa Mesa. The order of SO_2 concentrations are similar, however the two stations differ in both timing and magnitude. The differences are attributed to the fewer numbers and greater specificity of the SO_2 sources.

Comparisons of the daily average concentrations (given at right of each plot in Figures 13, 14, and 15) confirm this pattern between the two stations of similarity for NO_2 and disparity for SO_2.

SECTION V
ANALYSIS OF ATMOSPHERIC CONDITIONS DURING HIGH NO_2 CONCENTRATIONS

The Bolsa Chica monitoring site location was expected to receive the least polluted air from the ocean and the most contaminated air from the Los Angeles Basin. All major sources of pollution in the SCAB are located inland, such as automobile, industry, construction, etc.; while only minor sources of pollution are located offshore: shipping traffic, some air traffic and oil production, and drilling rigs. In general, the pollution concentrations at Bolsa Chica occurred as expected. However, during specific meteorological conditions, a circulation of polluted inland air moved offshore, stagnated, and returned onshore at a later time; high concentrations of NO_2 were observed at Bolsa Chica. All instances of NO_2 violations (one-hour California State Ambient Air Quality Standards) observed at the Bolsa Chica station occurred during this "blow-back" or recirculation phenomena.

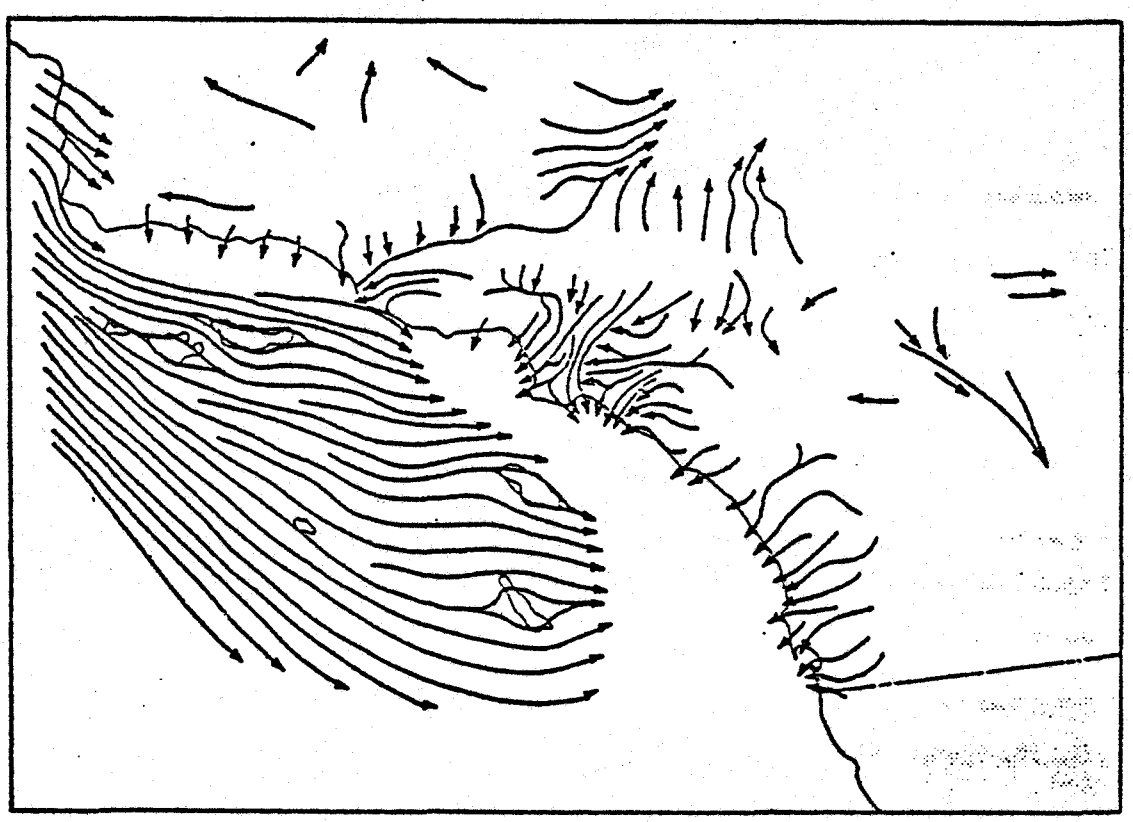
The interpretation of this NO_2 violation scenario is as follows. During nighttime hours and sometimes during Santa Ana wind conditions, offshore winds transport the already polluted Los Angeles Basin air over the ocean. These air masses are high in nitric oxides (NO). NO_2 levels remain at a relatively constant value of one-third to one-fifth as high as NO. This is seen at the site by the nighttime levels of NO (which read $\geq$0.50 ppm at times) and NO_2, during wind directions from the northeasterly quadrant.

The offshore drainage winds which occur at night transport basin air a limited distance offshore before the air stagnates. The stagnation results from the opposing prevailing westerly winds commonly found offshore. These typical nighttime air streamline patterns are shown in Figures 16 and 17 with stagnation zones left blank. Thus the polluted air masses have a chance to stagnate offshore for several hours.

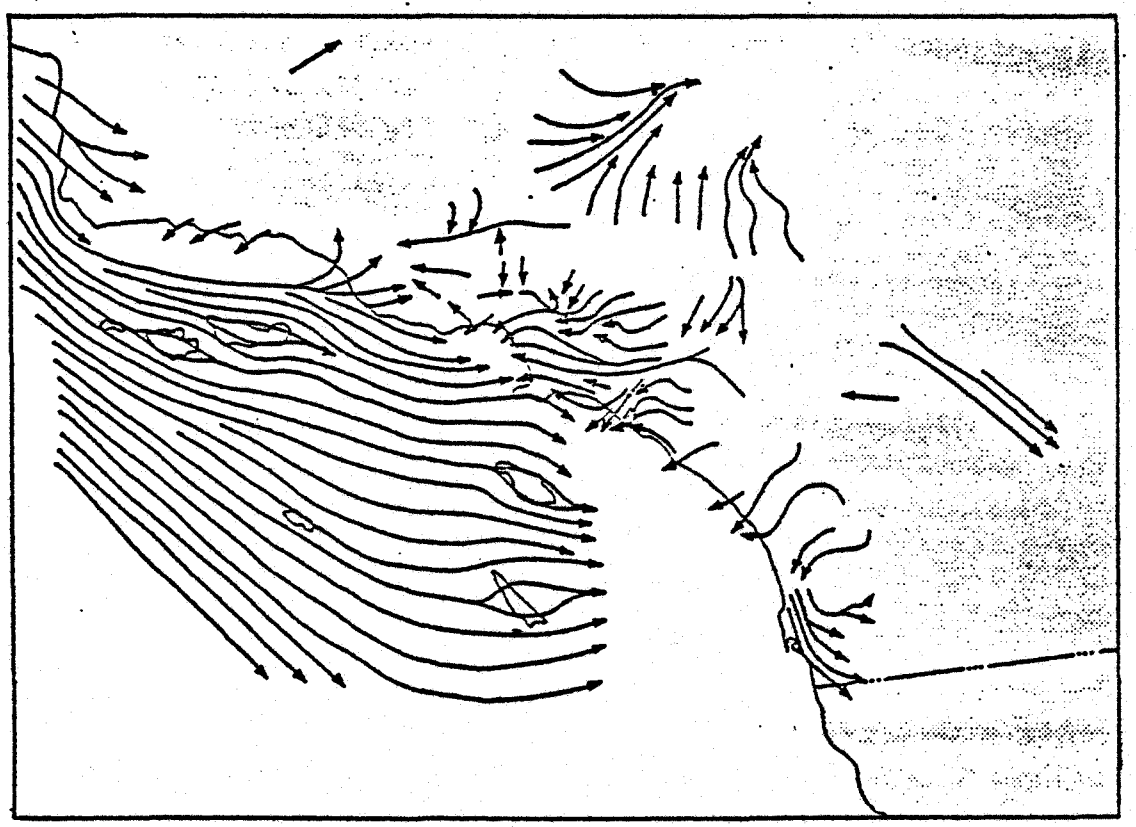
Upon sunrise, there is an increase of photochemical reactions among the pollutants which promotes the conversion of NO to NO_2. This produces a drop in NO concentrations accompanied by a rise in NO_2 levels. In some instances the increase in NO_2 is great enough to exceed the California State one-hour standard of 0.25 ppm (there is no standard set for NO levels).

With sunrise and subsequent warming of the land, an onshore wind develops in the late morning, and usually continues throughout the daylight hours. Because of the onshore flow, the stagnated air mass over the ocean begins to move onshore after having had a chance to "cook" and convert its NO to NO_2.

As the air mass moves ashore in the vicinity of the Bolsa Chica station there is a wind shift in the late morning hours from the north and east (with previously very high NO and moderate NO_2



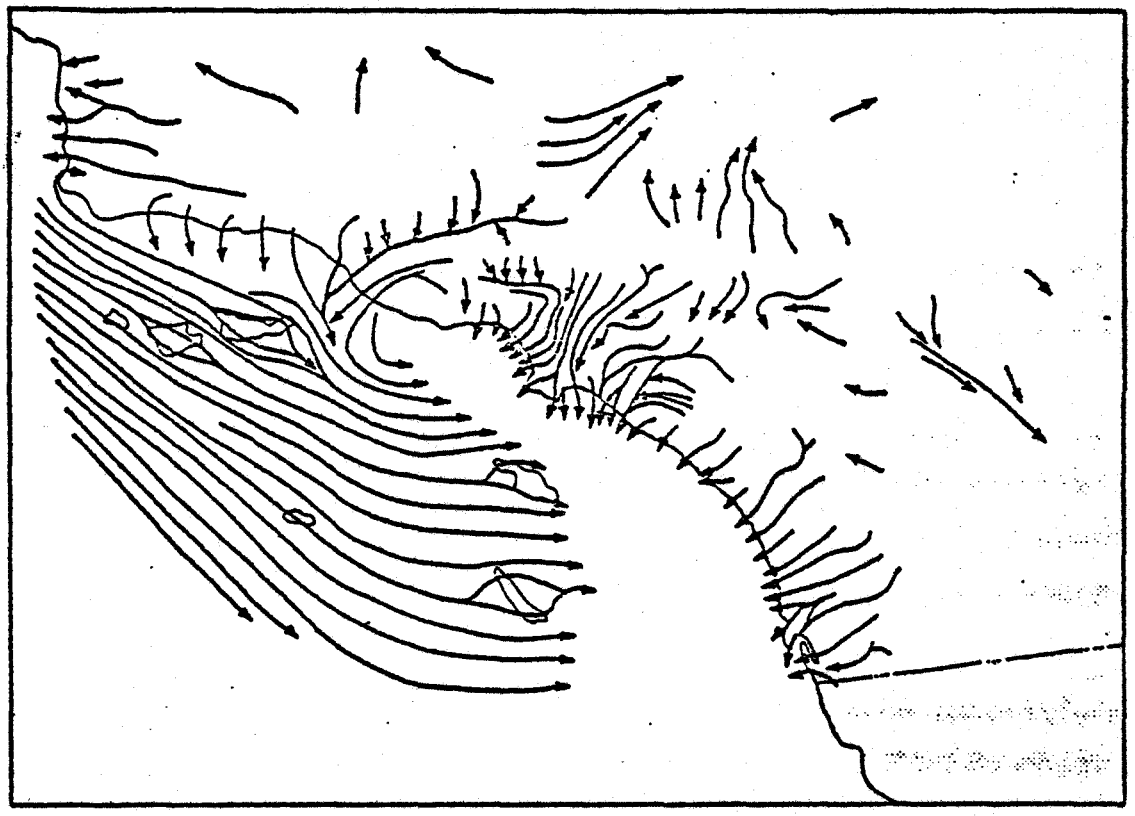
April, 0000-0600, PST



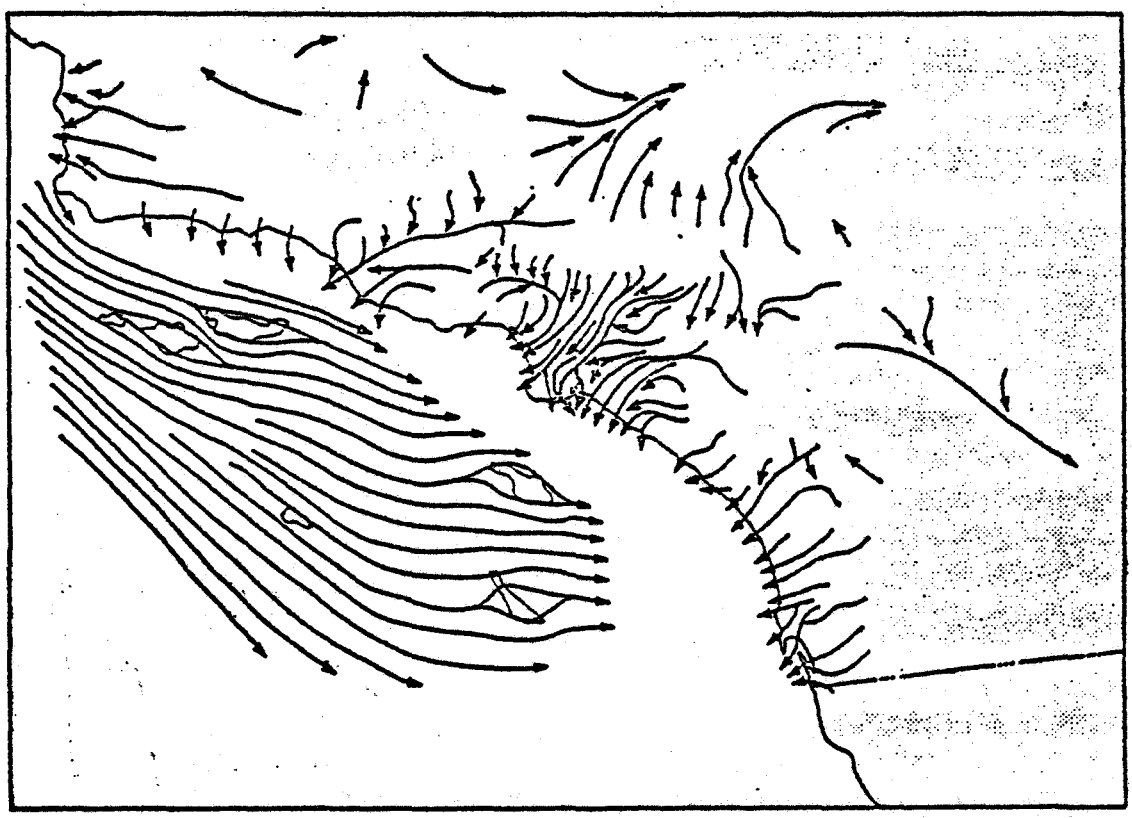
July, 0000-0600, PST

SOURCE: DeMarrais, 1965

FIGURE 16 South Coast Streamline Charts, April and July Nighttime Hours



October, 0000-0700, PST



January, 0000-0700, PST

SOURCE: DeMarrais, 1965

FIGURE 17 South Coast Streamline Charts, October and January Nighttime Hours

concentrations) to a strong west or WSW wind. The wind shift, which takes an hour or two, is accompanied by a drop in the NO levels to low values (usually less than 0.05 ppm) while the NO_2 levels remain essentially constant at 0.05 to 0.10 ppm. Once the onshore flow has become established, the NO_2 levels rise rapidly to their maximum (at about 0900 to 1000 hours PST) -- and remain high for an hour or two during the passage of the stagnated air mass. After the stagnated air has passed, the NO_2 level rapidly drops to join the previously low NO levels. The drop of NO_2 concentrations marks the arrival of the clean air from the Pacific that was behind the former basin air mass.

The onshore wind stops later in the day. As the land cools, the basin drainage pattern of lower strength offshore winds begin and the recirculation cycle may start again. This pattern was often seen at the Bolsa Chica station as a wind shift from the W-WSW to the north and east with lower strength winds and a consequent rise in NO levels and a lesser rise in NO_2.

The above pattern is sometimes amplified during Santa Ana conditions because onshore winds are slower to develop and are weaker. The Santa Ana winds could transport the basin air masses farther over the ocean and therefore would produce a longer period of air stagnation. Consequently, the NO_2 concentrations could be higher under these conditions than during the above scenario.

During the NO_2 standard violations at the Bolsa Chica site, the violation period lasted from one to three hours and started between 0900 hours and 1100 hours (see Table 6). The violations came after a shift in wind direction from the previously north or northeasterly (offshore) orientation that prevailed during the preceding night and early morning hours to a WSW or west direction.

The relevance of this pattern to the Shell Beta project is although the platforms are well out to sea, they can be immersed (during later nighttime hours) in a polluted atmosphere which has arrived from the SCAB. The platforms' location places them in the nighttime stagnation zone offshore of the SCAB.

In Section 4.3.2 of Volume II the impacts of the Shell Beta project emissions at the shoreline were presented. The effects of the pollutant impacts from the Shell Beta project can be related to the Bolsa Chica monitoring data as a means of showing the impacts of the project on the air along the shoreline.

NO_2 is emitted in the greatest concentrations compared to the other pollutants from the Shell Beta project. If it were assumed that the worst case of NO_2 concentrations for 1 hour from Shell Beta occurred at the same time as the maximum concentration at Bolsa Chica had occurred, the measured values would have only increased by 1.3 percent. That is adding the 8 $\mu g/m^3$ from Shell Beta to the maximum at the Bolsa Chica site, 632 $\mu g/m^3$. The annual increase would be less than 0.05 percent.

If the worst 1 hour case for SO_2 from the Shell Beta project occurred at the same time as the highest reading for SO_2 at Bolsa Chica, the concentration would have only increased 0.9 percent. If the maximum 24-hour concentrations from the Shell Beta project had occurred simultaneously with the maximum at the Bolsa Chica site, the concentration would have only increased 1.2 percent. The chances that the maximum concentration of pollutants from the worst case from the Shell Beta project would occur at the same time as the maximum concentrations at the Bolsa Chica monitoring site is extremely small.

SECTION VI
CONCLUSIONS AND SUMMARY

Air quality was continuously monitored for 75 days (August 24 through November 7, 1978) at a site located near the beach in the Bolsa Chica Ecological Preserve at Huntington Beach. This location was selected as the best available onshore sampling site to monitor air masses which had passed the proposed Shell Beta offshore platforms. NO, NO_x, SO_2, TSP, and meteorological variables (temperature, wind speed, and wind direction) were measured at the Bolsa Chica site.

Overall air quality at the site was very good. SO_2 did not exceed any ambient air quality standards. The highest hourly value of SO_2 recorded was 0.08 ppm. The 24-hour California Ambient Air Quality Standard (100 $\mu g/m^3$) for TSP was exceeded about 20 percent of the time. The highest value of TSP (212 $\mu g/m^3$) measured occurred during the passage of a tropical storm; the remaining periods of violation occurred during Santa Ana conditions. The California NO_2 hourly standard of 0.25 ppm was exceeded on five days during the sampling period. The highest hourly average value recorded was 0.33 ppm. All of the NO_2 violations occurred during the recirculation of previously polluted Los Angeles Basin air as it returned onshore during the late morning hours.

A comparison of data between the Bolsa Chica site and the farther inland Costa Mesa SCAQMD station showed a generally good correlation for TSP and NO_2. This good correlation for TSP and NO_2 indicates the long term data base at Costa Mesa can be considered as representative of the conditions at Bolsa Chica.

The correlation for SO_2 between Costa Mesa and Bolsa Chica is not significant. The lack of correlation is due to the extremely low concentrations at both sites and the physical location of the sites compared to specific SO_2 sources.

APPENDIX II

GEOTECHNICAL APPENDIX

3.12.4 Potential for Maximum Earthquake Ground Motion at Site and along Pipeline

The previous sections indicate that the potential for significant earthquake ground shaking at the site and along the pipeline is high. The most severe motions would be generated from large earthquakes on the Palos Verdes or Newport-Inglewood faults. Based on the lengths of these faults documented in previous sections and correlations of fault rupture length and earthquake magnitude (Patwardhan and others, 1975; Albee and Smith, 1966; Housner, 1970), reasonable estimates of the maximum earthquake magnitudes for these two faults would be between 6.5 and 7. The maximum magnitudes assigned to the Palos Verdes (6.75) and Newport-Inglewood (7) faults by Dames and Moore (1978) lie within this range and are similar to the maximum magnitudes estimated by Greensfelder (1974). Severe ground motions produced by the San Andreas fault are also of concern because of its potential to produce a great earthquake (Magnitude $\geq$8), which could result in large, long-period motions at the site.

Levels of shaking expected at a site are typically referred to in terms of peak accelerations relative to bedrock or firm ground conditions. Such accelerations are derived basically from attenuation relationships which predict maximum ground accelerations for given earthquake magnitudes and source-site distances. For strong ground shaking (i.e., accelerations greater than about 0.1 g), accelerations experienced at the ground surface have been estimated to be lower at a deep alluvial site than at bedrock sites (Seed and others, 1975). For the seismic design of structures, design spectra anchored to an appropriate acceleration level are usually recommended.

In general, the characteristics of earthquake ground motion at a site depend on the site soil conditions, distance from the source to the site, size and type of fault rupture, regional geology, and travel paths of the seismic waves. Even with a consideration of these factors, actual acceleration levels predicted for a site generally vary depending on the attenuation relation used. Based on available literature (Seed and others, 1975; Schnabel and Seed, 1973; Donovan, 1973), data of the geologic and seismologic aspects of Beta site (Dames & Moore, 1977a; Shell, 1977), and Fugro's knowledge of existing strong motion data and the dynamic response characteristics of soils, the following table is presented, showing the range of maximum levels of shaking that can be reasonably expected at the platform site for the three maximum earthquakes discussed above.

Fault	Maximum Earthquake Magnitude	Closest Approach of Fault to Site (km)	Maximum Accelerations (g)	
			Rock	Mudline
Palos Verdes	6.5-7.0	0.7	0.5-0.7	0.25-0.4
Newport-Inglewood	6.5-7.0	15.0	0.2-0.5	0.15-0.3
San Andreas	8.5+	71.5	0.10	0.10

Accelerations along the pipeline route will vary from those shown above (near the platform) to those shown in the following table for the portion within Long Beach Harbor.

Fault	Maximum Earthquake Magnitude	Closest Approach of Fault to Site (km)	Maximum Accelerations (g)	
			Rock	Mudline
Palos Verdes	6.5-7.0	5.0	0.5-0.7	0.25-0.4
Newport-Inglewood	6.5-7.0	3.0	0.5-0.7	0.25-0.4
San Andreas	8.5+	82.0	0.10	0.10

4.1.2 Impact of Pipelines

A subsea pipeline will be used to transport oil from the production platform to the onshore terminus. Pipelines will also be used to transport oil between the two shallow-water platforms and between the deep-water and shallow-water platforms. Failure of any of these pipelines could potentially result in significant oil spills. The following sections provide a discussion of the potential causes of pipeline failure.

4.1.2.1 Production Platform to Onshore Terminus

Oil will be transported from the production platform to an onshore terminus through a concrete-encased, steel pipeline. The pipeline will be located on the surface of the seafloor from the production platform to a point near the Long Beach Breakwater (Figure 2.4-16); from that point to shore, the pipeline will be buried approximately 4 feet (1.2 m). The proposed and alternate pipeline routes are shown in Figure 3.1-10. Section 4.6.3 discusses impacts related to marine operations interference with the pipeline.

During operation, the offshore and onshore portions of the oil pipeline must remain intact to preclude the possibility of oil spills. Hazards related to ground subsidence, slumping, and fault movement must, therefore, be considered during design. To ensure the integrity of the pipeline, it is also necessary to consider the potential effects of gravity loads, seismic loads, and ocean-wave loads on the pipeline and the supporting foundation materials. These considerations, along with structural design considerations, are addressed in the following paragraphs.

(1) Subsidence

The withdrawal of fluids from subsurface reservoirs during the development of an oil field can result in general ground subsidence. Such subsidence is caused by the compaction of subsurface rock as pore fluids are removed.

About 29 feet (9 m) of subsidence were recorded in the Long Beach-Wilmington area through the 1950's when a water reinjection program was initiated. If present trends continue, the pipeline in the area affected by past subsidence, mainly the Harbor area and about a mile beyond the breakwater, will not be impacted. Subsidence at the platform sites will also be negligible as long as effective injection methods are followed. It is probable that even if subsidence occurred, the affected area would be so broad that only small relative displacements would occur at the surface. Normal pipe design should be sufficient to tolerate such displacements.

Overpressurization could result in some rebound in certain situations. The magnitude of rebound would generally be extremely small and, thus, have no adverse effect on pipeline performance.

(2) Ground Movement

The results of subsea profiles indicate that seafloor slopes along the pipeline route are very gentle. Furthermore, no evidence of past non-seismic ground movement exists. In view of these conditions, the potential for subsea pipeline rupture due to ground movement (not associated with earthquakes or wave loading) appears low.

Slopes near or at the shoreline exceed those offshore; hence the potential for ground movement and pipeline rupture increases. However, these slopes are statically stable. As long as slope angles are not altered and as long as drainage conditions along the route remain the same, the potential for future ground movement (not associated with earthquake loading) appears to be low.

(3) Fault Movement and Ground Rupture

Ground displacement due to active faulting is a hazard that must be considered in the tectonically-active Long Beach/Los Angeles region. Surface rupture is most likely to occur along faults which display evidence of Holocene displacements.

Fault traces in the Palos Verdes and "unnamed" fault zones are located near the project pipeline route and display evidence of displaced Holocene-age deposits. However, faults F_1 through F_4, within the Palos Verdes fault zone, trend nearly parallel with the pipeline alignment and do not intersect it (Figure 3.1-12). Similarly, Faults F_5 through F_7 were not reported by Dames and Moore (1977b) to cross the pipeline corridor. Three faults are shown to cross the project pipeline route in the vicinity of the Long Beach breakwater (Figure 3.1-13). Two of these faults, designated F_A and F_B, may be associated with the "unnamed" fault zone of Junger and Wagner (1977) which forms the boundary of the Wilmington graben a few miles to the south (Figure 3.1-3). Faults within this zone are considered to be active in light of reported displacements of Holocene deposits (Greene *et al.*, 1975).

There are no mapped active or potentially active faults along the onshore portion of the Long Beach pipeline route. This does not preclude the possibility of future fault movement along this route, but the probability is very low. The offshore sections of the Huntington Beach and Seal Beach alternate routes are imprecisely located at this time. An assessment of fault hazards should be made if either alternative is chosen over the proposed route.

Faults which cross the pipeline and which display evidence of Holocene movement must be considered capable of undergoing additional movement during the lifespan of the pipeline. To assess the potential consequences of fault movement relative to pipeline behavior, it is necessary to postulate the amounts of displacement which could occur during fault rupturing. The "unnamed" fault zone forms a discontinuous series of faults, none of which can be traced for more than about 14 miles (22 km). If it is assumed that 50 percent of the total length [conservatively measured as 20 miles, or 32 km, based on Vedder *et al.*, (1974) map sheet 3] ruptures laterally during a single event, the earthquake magnitude associated with this length (Albee and Smith, 1966; Housner, 1970) would be in the range of 6.0 to 6.5. The average maximum ground surface displacement associated with a Magnitude 6.5 earthquake is approximately 2 feet (0.6 m) (Bonilla, 1970). While fault displacements could occur at other points along the pipeline route, such as along the onshore portion of the route or within Long Beach Harbor, it is likely that these movements will be less than those which occur within the "unnamed" fault zone.

Any fault movement will cause either displacement of the pipeline or slippage of the pipeline relative to the seafloor. The amount of displacement along faults within the "unnamed" fault zone could vary from less than a few inches to several feet. Most displacement is expected to be lateral offset (strike-slip) rather than vertical (normal or reverse). These displacements could result in additional bending stresses in the pipe either during movement (relative slippage) or following fault movement (permanent offsets). If bending stresses are sufficiently large, pipeline rupture could occur.

The potential effects of horizontal fault displacement on pipeline integrity have been considered (Dames and Moore, 1978c). This evaluation indicates that any horizontal fault displacement along the offshore route will result in uplift of the pipe from the seafloor, thereby freeing the pipeline from any significant shearing stresses that would normally be produced by friction and lateral soil pressure at the point of soil rupture. Hence pipelines will be able to tolerate 3 feet (1 m) or more of lateral offset. Stress analyses for other pipelines (Kennedy, *et al.*, 1977) also indicate that a pipeline can normally withstand large lateral offsets as long as the pipeline is free to slide relative to the ground surface. To facilitate slippage, burial and soil bearing pressures must be minimized and anchor points such as caused by bends must be located at considerable distance from the fault offset. As the pipeline will be located on the seafloor surface where fault crossings occur and as bearing pressures will be small, slippage should occur. It is, therefore, expected that the pipeline will be able to tolerate horizontal fault displacements in excess of those predicted along the pipeline route; hence the hazard is low.

Similarly, the consequence of vertical offsets have also been considered (Dames and Moore, 1978c; Shell, 1979). It

was shown that the pipe can accommodate offsets in excess of 3.0 feet (2.1 m) without yielding or buckling as long as the displacement occurs over spans in excess of about 200 feet (61 m). As the pipeline will be located on the seafloor surface, rather than being buried, it is reasonable to expect such conditions to occur. No impacts are, therefore, anticipated.

(4) Bearing Failure and Ground Instability

Failure or movement of the ground beneath the pipeline could result in either loss of bearing support and subsequent pipeline rupture or horizontal movement of the pipe from its original location. Three potential causes of bearing failure and ground instability exist along the pipeline route: soil failure due to gravity loading, soil failure due to seismic loading, and soil failure due to ocean-wave loading.

- Gravity Loading

Soil samples have been obtained at 19 locations along the offshore portion of the pipeline routes (Dames and Moore, 1977b and 1978b). From these limited investigations, it appears that surficial sediments consist of fine sands, silty sands, and soft clays. Most soils will be fine sandy silts; deposits of cohesive soils exist near and within Long Beach Harbor. Onshore soils will vary from sands at the shoreline to silty sands and silty clays along the onshore route. Relatively loose hydraulic fills are found within Long Beach Harbor (Fugro, 1978).

The bearing capacity of offshore materials could vary from essentially 0 at the soil-water interface to 120 psf (5.8 kPa) or more at a depth of 1 feet (0.3 m). As the bearing pressure of the pipeline under gravity loading will be about 80 psf (3.8 kPa), the pipeline is expected to sink into the seafloor. However, the maximum depth of settlement is expected to be less than 1 foot (0.3 km). For normal offshore pipeline design, no impact will result from such movement.

In offshore areas where rapid changes in sediment types occur (e.g. from sands to soft clays), large differential settlements could occur over short distances. At these locations larger bending stresses could develop in the pipeline. If bending stresses are sufficiently large, the pipe could rupture. However, along most of the pipeline route, the depositional environment has been relatively uniform in recent times, and the occurrence of rapid changes in sediment type is generally expected to be very limited. In these areas, it is believed that the hazard associated with differential movement under gravity loading at offshore sites is slight. At locations where buried channels exist (Dames and Moore, 1978b), larger differential settlements may occur. However, the widths of these existing channels are generally large; hence differential movement would probably be gentle. Stress analyses have been performed (Shell, 1979) which indicate that the pipelines

can undergo in excess of 3.0 feet (0.9 m) of vertical sag within a 200 foot (61 m) distance without yielding or buckling. As differential settlements will likely be far less than 3.0 feet (0.9 m) within 200 foot (61 m) distances, it is expected that the pipeline will be able to accommodate any potential settlements. No hazards are, therefore, anticipated.

Soils along the onshore portion of the pipeline route are expected to be appreciably stronger than the offshore soils because effective confining pressures will generally be higher and because apparent overconsolidation from dessication will generally exist. As pipe bearing pressures will be less (concrete coating will be eliminated), ground stability under gravity loading will be better than that offshore. As a result, the hazards from bearing failures and settlement along the onshore route appear to be very low.

- Seismic Loading

Seismic loading is likely to occur during the lifespan of the pipeline. For high levels of acceleration, it is possible that surficial zones of cohesionless soil will liquefy at points along the offshore portion of the pipeline route. Due to the possibility of relatively thick [>10 feet (3 m)] loose deposits of hydraulic fill along some portions of the onshore pipeline route, a potential also exists for liquefaction at onshore sites. Finally, some steep slopes (greater than 10°) occur along the pipeline route. These slopes could fail during seismic loading.

Liquefaction would result in partial or complete loss of soil bearing capacity. In this situation the pipeline may sink into the liquefied sediment. The depth to which the pipeline sinks will depend upon the vertical and lateral extent of liquefaction, the duration of strong shaking (which defines the time during which the pipe can sink), and the buoyancy characteristics of the pipe. The primary danger to the pipeline will arise in areas where transitions in soil type occur, *e.g.*, from a clean, loose, cohesionless sand to a more compact clay, over short distances. In these locations, large differential settlements could occur which would, in turn, cause significant bending stresses in the pipeline.

The potential effects of liquefaction on the offshore portion of the pipeline to be located on the sea floor have been considered (Dames and Moore, 1978c). It was concluded that localized liquefaction could occur; however, differential settlement due to sinking will be small because the weight of the pipeline flowing full is only slightly greater than the buoyant weight of the liquefied soil. This qualitative assessment is supported by calculations made on the basis of procedures suggested by Kennedy *et al.* (1977). For a pipe which is only slightly heavier than the liquefied soil, the rate of settlement will be slow (*e.g.* less than 1 foot/minute - 0.3 m/min); hence

total settlements will be small (*e.g.* less than 1 foot - 0.3 m) as the duration over which the soil remains liquefied would be fairly short (*e.g.* less than 1 minute). Stress analyses (Shell, 1978) show that the pipeline can tolerate much larger vertical sag without yielding or buckling, as long as the sag occurs over distances greater than about 200 feet (61 m). It is likely that any loss in bearing support due to liquefaction will be such that the pipeline can withstand any resulting vertical displacement; hence the hazard due to bearing capacity loss seems very low.

Similarly, the potential effects of liquefaction on the buried portion of the offshore pipeline were considered (Dames and Moore, 1978c). Surficial soils within the breakwater are believed to be organic sandy silts and claying silts, and thus not susceptible to large-scale liquefaction. Where localized zones of liquefaction occur, some settlement of the pipe may result. However, as noted in the preceding paragraphs, such settlements are expected to be small and well within the tolerances of pipe movement. It was pointed out (Dames and Moore, 1978c) that in the area where the pipeline goes from on the soil surface to a buried line a change in pipeline stiffness produced by embedment will result. In this configuration, the unburied portion could potentially be excited to whip laterally with the buried portion acting as the whip handle. Analyses show, however, that peak ground motions would probably be insufficient to overcome the lateral friction forces between the pipeline and the seafloor. For conservatism, it was suggested that this potential effect could be further mitigated by gradually burying the pipeline over a 100 to 200 ft. (30 to 61 m) length. This approach is consistent with normal construction procedure; hence the potential hazard appears to be low.

The potential effects of liquefaction on the pipeline as it comes onshore at Pier J have also been considered (Dames and Moore, 1978c). The dikes were believed to be inherently stable under seismic loading; however the hydraulic fill behind the dikes are potentially liquefiable. The applicant's consultant has, therefore, recommended that the hydraulic fills with 50 to 75 feet (15 to 23 m) inboard of the dike crest and 50 feet (15 m) on each side of the pipeline alignment be densified. This remedial measure should mitigate any potential ruptures due to excessive pipeline bending between the stable dike and liquefied hydraulic fill.

Another type of ground instability, which is directly related to liquefaction of cohesionless soils, is the flow slide. This slide can be manifested in either of two forms. It can occur as turbidity flows or as retrograding ground instabilities. The turbidity flow typically occurs below submarine canyons. As the pipeline route follows a course above the San Gabriel Canyon, this type of slide is not of concern. The second type of ground instability results from a progressive series of slumps which progress upslope due to failure of a downslope, steeper section of a slope. Such a phenomena could occur upslope

of steeper sections of the San Gabriel Canyon. If the slump migrates far enough, it could intersect the pipeline route. As materials in the San Gabriel Canyon are believed to be geologically young and are silt-size in consistency (Dames and Moore, 1978c), seismic shaking could induce liquefaction which could, in turn, result in such a retrograding instability. Whereas the probability of such an instability appears remote, it cannot be discounted. According to Holish and Hendron (1975), the amount of lateral movement due to liquefaction on small slopes (less than 5 degrees) is generally small (*e.g.* less than 10 feet - 3 m). It is believed that the pipeline could tolerate such movements as long as the pipeline is able to slide relative to the soil. Soil bearing pressures imposed by the pipeline are low and the pipeline is supported on the seafloor; therefore, it seems likely that slippage could occur. The potential hazard associated with seismically-induced ground instability is, therefore, regarded as low.

Slopes within borrow pits in the Long Beach Harbor area adjacent to Pier J are believed to be steep (*i.e.*, greater than 30 degrees) and, therefore, potentially unstable under seismic loading (Dames and Moore, 1978c). Results of geotechnical investigations in proximity to the borrow pit slope indicate that below a depth of about 5 feet (1.5 m) soils are stiff plastic soils and dense granular pre-Holocene soils. Driving resistances and soil classifications indicate that these soils are not susceptible to liquefaction (Dames and Moore, 1978c). To mitigate the potential for seismic instability, the applicant's consultant recommends that the pipeline be placed on a 22 degree or flatter incline aligned normal to the slope. It was further recommended that the pipe be bedded in firm ground at the toe of the slope. This approach should be sufficient to insure pipe integrity during postulated slope failures. Hence the potential hazard associated with the potential phenomena would be low.

- Ocean-Wave Loading

Ocean waves result in additional loading to a pipe and the supporting soil. This loading can result in instability of the soil and consequential pipeline movement, and in loss of soil bearing support through liquefaction of cohesionless soil or through scour of material from beneath the pipeline. Viscous drag from waves and currents also load the pipeline, and could potentially cause lateral displacements if loading forces exceed shear resistance.

The potential for wave-induced soil instability has been considered (Doyle, 1978). Analyses were made by determining shearing stresses on the basis of elastic theory for a maximum wave height equal to 51 feet (15.5 m). Shearing stresses were calculated at different depths below the seafloor (0 to 40 feet - 0 to 12 m) for different water depths (40 to 250 feet - 12 to 76 m). These shearing stresses were compared to the drained strength of the soil, calculated on the basis of a Mohr-Coulomb

strength criterion with the soil density equal to 30 pcf (0.5 gm/cc) and the soil friction angle equal to 25° to 30°. This comparison indicated that soils would not fail for design wave heights.

Studies by Doyle (1978) assume that the permeability of the soil will be sufficiently high to preclude pore pressure buildup. If soils do not drain, cycles of shearing stress will result in porewater pressure buildup. If porewater pressures equal the effective soil pressure, liquefaction could result. Should liquefaction occur, settlement of the pipeline could take place. While the rate of sinking will be small due to the nearly buoyant condition of the pipeline, the duration of liquefaction could be appreciably greater than that for an earthquake. As a result, the pipeline could undergo greater settlements than would occur during an earthquake. The magnitude of settlement will depend on the duration of liquefaction (which will be determined by the duration of large wave-loading and soil permeability) and the tendency of the soil to compact or dilate during shear. It is expected that maximum settlements will not exceed several feet. Provided that differential settlements over short distances are not excessive, the pipeline should be able to withstand such movement. Where liquefaction appears probable, and if likely levels of pipeline differential movement exceed tolerable limits, various mitigating measures can be taken to reduce the potential hazard. These measures include rerouting to areas where soils are more compact, modifying pipe design, or altering pipeline alignment.

The second wave-associated hazard is caused by scour of materials beneath the pipeline. Currents in shallow waters may be sufficient to transport cohesionless soils, and such scour will result in loss of bearing support and, consequently, higher bending stresses in the pipeline. The potential occurrence of scour is unknown. However, it is expected that during large storms, horizontal wave particle velocity at the bottom will vary from about 6 feet per second (1.8 m/sec) in shallow water [less than 80 feet (24 m)] to less than 1 foot per second (0.3 m/sec) in deep water (platform deposits). A velocity of 6 feet per second (1.8 m/sec) is sufficient to transport coarse sands and fine gravels in a river (Sunborg, 1956). Loss of material from beneath the pipeline might, therefore, occur during the lifespan of the pipeline. The consequence of this loss in material will be gradual settlement of the pipeline. No adverse behavior is expected unless scour occurs in specific areas, resulting in the pipeline bridging scour pits. Studies by Shell (1979) indicate that the pipeline can tolerate up to 3 feet (0.9 m) of settlement over a 200 foot (61 m) length before yield or buckling of the pipeline occurs. As it is unlikely that scour pits of such size could develop without gradual scour at the edge of the scour pit (hence reducing the radius of curvature), the hazard from loss in foundation material due to scour appears to be low.

The final wave-related hazard involves the lateral stability of the pipeline during wave loading. Pipelines located on the seafloor are subjected to lateral loadings from

current and wave forces. For the pipeline to remain in place during such loading, it is necessary for the frictional resistance developed at the soil-water interface to exceed the drag forces caused by wave or current action. These hydrodynamic effects have been considered at water depths between 40 and 300 feet (12.2 and 91 m) for the 100-year storm using the procedure suggested by Jones (1978). It was shown that a pipe with an outer diameter of 16-inches (41 cm) [total outside diameter of 18.3 inches (46.5 cm) with corrosion protection and concrete thickness] would withstand the largest predicted hydrodynamic loads (at the Long Beach Harbor breakwater). This approach appears to be consistent with state-of-the-art practice. As a result, the possibility of pipeline rupture due to lateral movement of the pipeline appears to be low.

(5) Structural Integrity

The pipeline will be 16-inches (41 cm) in outer diameter with a 0.5-inch (1.3 cm) wall thickness. A 0.156-inch (0.4 cm) corrosion-protection coating and a 1.0-inch (2.54 cm) concrete coating surround the pipe. The resulting total pipe diameter is 18.3 inches (46.5 cm). The submerged weight of the pipe will be 118 pounds per linear foot (16.5 kg/m). The pipe is designed for a maximum operating pressure of 1420 psi (9800 kPa), and can withstand external hydrostatic pressures with the pipeline void and with its absolute internal pressure equal to one atmosphere.

The oil pipeline has been designed in compliance with U.S.G.S., Conservation Division, Branch of Oil & Gas Operations, Pacific Region, OCS Order No. 9, dated June 1, 1971, ANSI B31.4-1974, "Liquid Petroleum Transportation Piping Systems," and Department of Transportation Regulation 49, Part 195, as amended August 18, 1976, "Transportation of Liquids by Pipeline." Portions of the pipeline routes are within the jurisdiction of the State of California. The State will review the design for compliance with the preceeding codes and good engineering practice. In addition to the above, the pipeline design and operating procedures would follow API Recommended Practice RP 1111, Design, Construction, Operation and Maintenance of Offshore Hydrocarbon Pipelines, March 1976, and the Department of Interior/Department of Transportation memorandum of understanding of June 11, 1976.

As these guidelines are consistent with state-of-the-art practice, it is believed that the pipeline will be adequate for normal operation.

4.1.2.2 Drilling Platform to Production Platform

A pipeline will be placed between the drilling and production platforms along a bridge connecting the two platforms. This pipeline is being statically designed in accordance with

industry standards. Dynamic analyses also have been performed on this pipeline. Expansion loops have been incorporated to minimize pipeline buckling. As these design approaches are consistent with accepted and state-of-the-art practices, the pipeline is expected to be adequate during gravity and seismic loading.

4.1.2.3 Deep-Water Platform to Shallow-Water Platform

A steel pipeline is tentatively planned for transporting oil from the deep-water platform to the shallow-water platform. The route for this pipeline is shown in Figure 3.1-6. Water depths along the pipeline route vary from 260 to 700 feet (70 to 213 m); seabottom slopes range from 2° at the shallow-water platform site to about 4° at the deep-water site.

The hazards which could potentially affect pipeline integrity along this route include ground subsidence, ground movement, fault movement, bearing failure or ground instability, and structural failure. These factors are discussed in greater detail in the following paragraphs. This discussion will be qualitative in nature because sediment conditions along the route have not been established and because the design of the pipeline has not been finalized.

(1) Subsidence

Subsidence of the seabottom in areas of petroleum withdrawal is a design consideration, as discussed in Section 4.1.2.1(1). However, as long as proper reinjection procedures are used, this phenomenon will not create any hazard.

(2) Ground Movement

Slopes along this pipeline route exceed slopes shoreward of the shallow-water platforms. This increase in slope increases the potential for slope instabilities. However, data from geophysical surveys show that no significant submarine slides or slumps occur along the pipeline route. Two disturbed areas bordering the pipeline route are associated with surficial expressions of faults (Pyke, 1978).

As slopes are relatively small and no past evidence of slumping exists along the route, the potential for slumping under gravity loading and associated pipeline rupture appears to be low. However, if subsequent route studies determine that soils with low strengths exist along the route (thus increasing the potential for slumping), the hazard associated with slumping could be mitigated by realigning the pipeline to avoid hazardous areas or modifying pipe design to withstand ground movement.

(3) Fault Movement

The deep-water to shallow-water pipeline crosses two faults, F_3 and F4. These faults are within the Palos Verdes fault zone (Mesa[2], 1977). A Magnitude 6.5 to 7.0 earthquake has been postulated as the maximum credible for these faults (Section 3.1.2.3) with a potential for strike-slip sense of displacement. This earthquake has a mean recurrence interval of greater than 1000 years. Empirical relationships have been developed by Bonilla (1970) between earthquake magnitude and maximum amount of surface displacement. Based on the assigned maximum 6.5 magnitude event, as much as 5 to 7 feet (1.5-2.1 m) of lateral displacement could occur along either fault. Consequently, the shallow-water to deep-water pipeline must be designed to withstand significant lateral displacements.

The ability of the pipeline to withstand displacements on the order of 5 to 7 feet (1.5-2.1 m) is being assessed by the applicant. If the pipeline cannot withstand such displacements, several measures can be taken to mitigate this potential hazard. These alternative measures could include modifying pipeline design to withstand larger displacements, altering the configuration of the route to increase the pipeline length per unit distance, or incorporating shutoff valves in areas where maximum displacements might occur.

(4) Bearing Failure and Ground Instability

As discussed in Section 4.1.2.1(4), an offshore pipeline supported on the seafloor can be damaged or ruptured in special situations if the bearing capacity of the supporting soil decreases or if ground instability occurs. The cause of bearing-capacity loss or ground instability can be gravity loading, seismic loading, or ocean-wave loading.

- Gravity Loading

Soils along the pipeline route have not been identified at the time of this review. However, they are expected to be similar to those found at the shallow-water platform site, perhaps with a higher percentage of fine-grained materials. The strength of this material is expected to be somewhat lower than would exist between the shallow-water platform and the onshore terminus. Consequently, greater settlement might be expected if the unit weight of the pipeline is the same as that used for the shallow-water-to-terminus route.

The effects of softer soils on pipeline behavior will be minimal except where differential settlement occurs. If differential settlement is expected, then larger deformation could occur within unit lengths of the pipeline. To mitigate this response, the design of the pipeline could be modified or alternate routes could be selected to avoid unsuitable zones.

- Seismic Loading

Seismic loading considerations will be similar to those cited in Section 4.1.2.1(4). As materials are expected to be more cohesive (fine-grained), the ability of the sediment to withstand liquefaction is expected to increase. The existence of submarine channels along the two faults, F_3 and F_4, increases the likelihood of liquefaction-induced sediment flows. However, geophysical records show no evidence of past flows along these channels. An evaluation of sediment types and layering in proximity to these channels could establish whether or not such flows have occurred in the past.

The extent of seismic-related hazards can be established by determining the type and characteristics of soils along the pipeline route. If conditions exist which suggest that liquefaction or liquefaction-induced flows could occur during the lifespan of the pipeline, several measures can be taken to mitigate their effect. These measures could include modifying the pipeline design or changing pipeline alignment.

- Ocean-Wave Loading

The importance of ocean-wave loading decreases as the water depth increases. For example, wave-induced shearing stresses will be less than 100 psf (4.8 kPa) in the upper 35 feet (10.7 m) of soil (Pyke, 1978) and water particle velocities will be less than 1 foot per second (30.5 cm/sec). It is unlikely that such wave-induced forces will have any appreciable effect on the pipeline or foundation soils along the pipeline route. The hazard associated with wave-induced loading to the soil or pipeline is, therefore, expected to be very low.

(5) Structural Stability

The pipeline will be designed in accordance with appropriate industry standards and government regulations. This should ensure adequate behavior during normal operations.

4.1.3 Hydrogen Sulfide

When sea water is used as reservoir injection fluid, a buildup of corrosion, scale, and adverse micro-biological effects is likely (Mitchell, 1978). This can lead to the formation of hydrogen sulfide gas. Therefore, an early monitoring program should be instigated which would identify hydrogen sulfide conditions so that they can be properly treated.

4.1.4 Mitigation

The following is a summary of mitigation measures which

are recommended to reduce or eliminate potential adverse geotechnical impacts.

4.1.4.1 Well Blowout

Low reservoir pressures, high oil viscosity, and greater thickness of capping strata in the Beta field significantly reduce the likelihood of a well blowout. Compliance with Pacific area OCS orders promulgated by the U.S.G.S., particularly those aspects related to installation and maintenance of subsurface safety valves and the well casing program, should mitigate the potential for uncontrolled flow during the producing life of a well.

4.1.4.2 Over-Pressurization/Subsidence

The reservoir pressure maintenance program planned by Shell using water injection and careful monitoring of the pressure throughout the life of the project should mitigate any adverse impacts associated with either over-pressurization (induced oil seeps) or subsidence.

REFERENCES

Dames and Moore, *Report aseismic design studies, proposed 16-inch San Pedro Bay pipeline, Platform "Elly" to Port of Long Beach - Pier J,* prepared for Shell Oil Company, 1978c, 19 pages.

Doyle, E.H., (1978), *An assessment of ocean-wave induced soil stability for the San Pedro Bay Beta Pipeline Route,* Shell Oil Company Technical Information Record BRC-186, Project Number 32-27603, December, 1978, 7 pages.

Holish, L.L. and D.H. Hendron, "Liquefaction considerations for two submerged essential service cooling ponds," Second ASCE Specialty Conference on *Structural Design of Nuclear Plant Facilities, Volume 1B,* 1975, pp. 887-931.

Kennedy, R.P., A.C. Darrow, and S.A. Short, "General considerations for seismic design of oil pipeline systems," *Proceedings of the current state of knowledge of lifeline earthquake,* ASCE, 1977, pp. 2-17.

Shell Oil Company, *The effects of loss in soil support on a 16-inch pipeline in San Pedro Bay,* January, 1979, 10 pages.

APPENDIX III

COMMENTS WHICH WERE RECEIVED SUBSEQUENT TO THE FORMAL CEQA 45-DAY REVIEW PERIOD WHICH BEGAN DECEMBER 4, 1978 AND ENDED JANUARY 20, 1979

CITY OF LONG BEACH
DEPARTMENT OF PUBLIC WORKS
333 WEST OCEAN BOULEVARD • LONG BEACH, CA 90802 • (213) 590-6522

January 23, 1979

State Lands Commission
1807 13th Street
Sacramento, California 95814

SUBJECT: EIR/EA Shell OCS Beta Unit Development

Gentlemen:

1. The City of Long Beach is presently in the process of developing plans for a small boat marina for approximately 1,660 boat slips to be located between the downtown shoreline and Grissom Island. The feasibility study for the small boat marina has identified the area east of Pier J and southerly of Grissom Island as the most probable barrow area of dredge fill material. (See attached sketch). Present estimates indicate the proposed small boat marina would require approximately 3 million cubic yards of the potential of 40 million cubic yards of dredge fill.

Figure 3.1-12 of the subject EIR shows the proposed underwater pipelines passing through the proposed barrow area. Attached is a copy of Figure 3.1-12 with the proposed barrow area sketched as an overlay of the pipeline alignment.

It is requested that the design location of the proposed pipelines be coordinated with the City of Long Beach City Engineer, in order that an alignment can be established which will cause the least impact on this proposed barrow site.

Sincerely,

JAMES T. POTT
CITY ENGINEER

JTP:GDJ:jp9:50

Attachments

cc: D. Bowers
R. Riffenburgh

BUREAU OF AERONAUTICS 4100 DONALD DOUGLAS DR. 90808 (213) 421-8293 • BUREAU OF ENGINEERING 333 W. OCEAN BLVD. 90802 (213) 590-6383 • BUREAU OF PARKS 2760 STUDEBAKER RD. 90815 (213) 421-9431 • BUREAU OF PUBLIC SERVICE 1601 SAN FRANCISCO AVE. 90813 (213) 432-8904

IED CHANNEL: APPROXIMATE LIMITS CHANNEL
NDICATED (TIC MARK POINT TOWARDS CHANNEL

CHANNEL: APPROXIMATE LIMITS

ED AXIS: AXIAL DEPTH AS INDICATED, ARROW
OW DIRECTION ALONG CHANNEL AXIS

LOW ACOUSTIC REFLECTION DISRUPTION
E TO GAS ACCUMULATION

ACOUSTICAL REFLECTOR DISRUPTION
E TO GAS ACCUMULATION

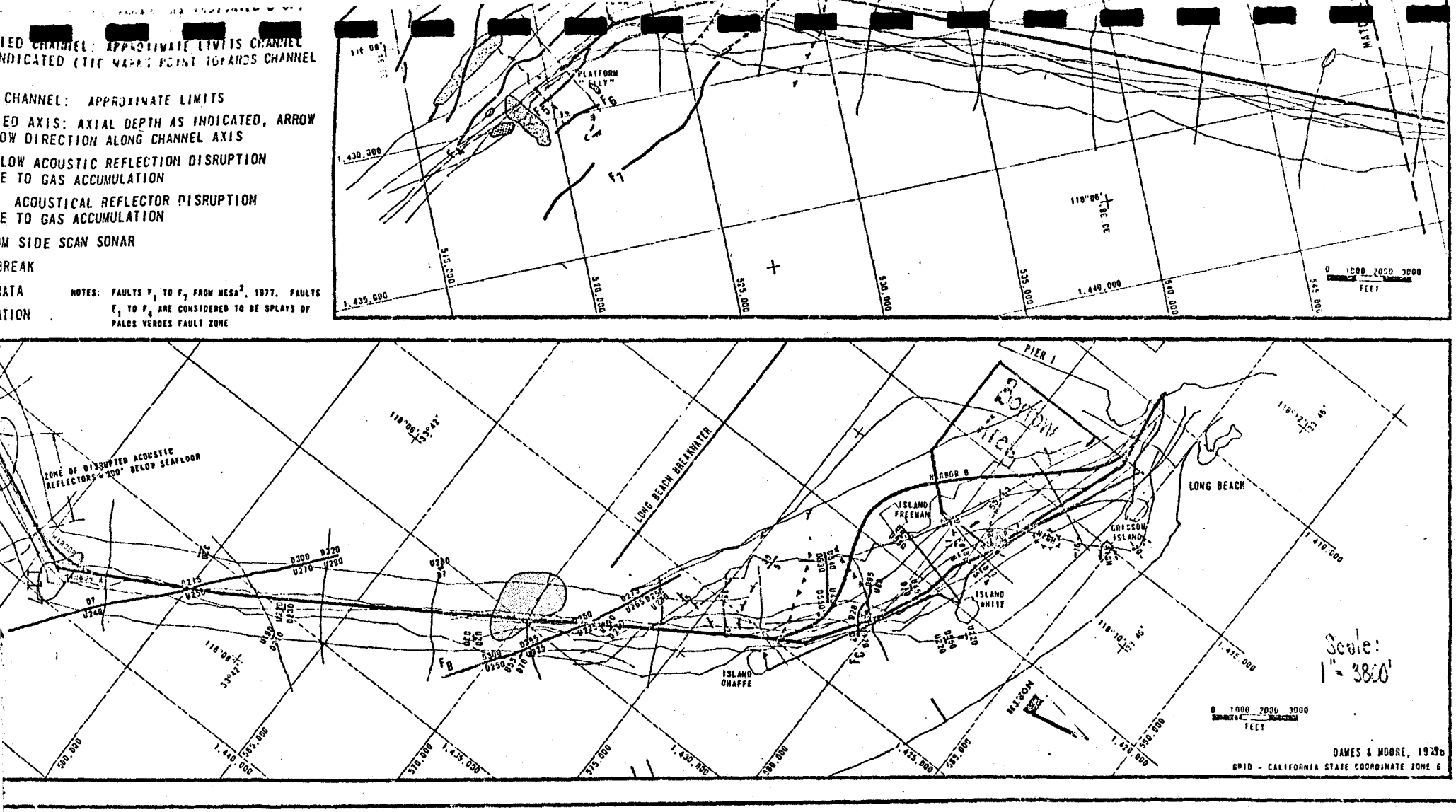
M SIDE SCAN SONAR

BREAK

ATA

ATION

NOTES: FAULTS F_1 TO F_7 FROM MESA[2], 1977. FAULTS F_1 TO F_4 ARE CONSIDERED TO BE SPLAYS OF PALOS VERDES FAULT ZONE



RESPONSE TO COMMENTS OF THE CITY OF LONG BEACH, DEPARTMENT OF PUBLIC WORKS

1. The site for the proposed borrow area for the City's small boat marina was not available during the preparation of the draft EIR/EA. The proposed borrow area coordinates have been forwarded to the applicant via the lead agencies to ensure that proper coordination with the City Engineer is established.

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
COMMANDER (m)
ELEVENTH COAST GUARD DISTRICT
UNION BANK BLDG.
400 OCEANGATE
LONG BEACH, CA. 90822

16652/TSS
22 January 1979

Mr. Dwight E. Sanders
Chief, Planning and Environmental Coordination
State Lands Commission
1807 13th Street
Sacramento, CA 95814

Re: Shell OCS Beta Unit Development

Dear Mr. Sanders:

Thank you for this opportunity to comment on the EIR-EA for the Shell OCS Beta Unit Development (Plan). This proposal has significant impact upon Coast Guard missions, maritime safety and other oil and/or gas development activities in the Gulf of Santa Catalina (GSC).

2. This EIR-EA addresses only its own immediate impacts. It does not address the broader impacts that these platforms will have upon other tracts included in Lease Sale 35 and those to follow due to Lease Sale 48 relative to the existence of the Gulf of Santa Catalina (GSC) Traffic Separation Scheme (TSS) that transits these waters to provide an internationally recognized port access route serving the ports of Los Angeles, Long Beach and vicinity.

3. These platforms would be located in the Separation Zone between the northbound and southbound traffic lanes of the TSS, and would be erected during the midperiod of the exploratory phase of adjacent tracts of Lease Sale 35. Forthcoming Lease Sale 48 will add additional tracts in these same waters which are transited by the GSC TSS further extending the period of exploratory activities which may result in requests for additional platforms. Safe port access routes must be maintained.

The locations of the Shell platforms in effect fix the location of the GSC TSS by being centered (approximately) between the traffic lanes. Potential future TSS relocation possibilities are already quite limited and will be limited still further by any future proposals for additional platforms that would be located in the proximity of TSS.

3. The Coast Guard is not totally adverse to a final relocation of the GSC TSS. We must, however, consider it as the ultimate measure to reduce the conflicts of the OCS/Vessel Routing Measure (of which a TSS is just one) interface. The GSC TSS is internationally recognized and used, sanctioned by the Intergovernmental Maritime Consultative Organization (IMCO) and took many years to establish. Relocation of or adjustments to the present TSS on a permanent basis would be a lengthy process and

Subj: Shell OCS Beta Unit Development

would involve serious risks to navigation. Charts depicting the GSC TSS exist worldwide and it can be expected that these present day charts would be in use by mariners for many years to come (this is so even though contrary to U.S. regulations). One of our greatest fears is that charts will exist showing two different GSC TSS's and marine traffic might well end up being dangerously disorganized. Further, notification to the mariner worldwide is a very difficult task. These are further reasons that we feel a GSC TSS relocation is totally undesirable and no reason has been shown yet that it need be done. Certainly, this Plan does not. Even though it is contrary to IMCO's guidelines laid out in Resolution A378(x), Shell has abided by our compromise position that the platforms be as far removed from the traffic lanes as necessary of the TSS so as to allow for the establishment of OCS Safety Zones by the Eleventh Coast Guard District Commander (CCGD11). It is the District Commander's intention to establish Safety Zones of 500 meter radius around each structure that is in the vicinity of vessel routes in accordance with 33 CFR Part 147.

Our concern over this Plan is that by allowing it, our GSC TSS relocation alternatives, though very limited now, may well be such that there is no other alternative but to insist that the GSC TSS remain where it is regardless of future development plans. The GSC TSS was created after assessing the impacts upon and taking input from organizations and government agencies concerned with the following in the GSC TSS:

a. recreational boating

b. future OCS Lease Sales

c. U. S. Navy usage

d. shipping interests

e. oil development interests

5. It was felt that the present location posed the least negative aggregate impact. Relocating the GSC TSS will have a greater negative impact. This Plan adds another impact to relocation or adjustment of the GSC TSS by making the Beta Platforms a very significant negative impact. Proposed GCS TSS alternatives which would place the platforms in or within 500 meters of a traffic lane will be objected to without compromise by the Coast Guard. If we can be assured that future plans have no impact on the GSC TSS, we basically have no objection to this proposal. This is why the Corps of Engineers (COE) at the request of CCGD11 is formulating regulations governing the siting of permanent structures in the GSC which will give CCGD11 strong imput on the permit approval.

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6. With respect to the proposed pipe line trenching, again Shell has exhibited willingness to avoid negative impacts and has routed around the to be proposed Coast Guard developed Federal Anchorages. Inside the Federal Breakwater where the pipe line must cross existing and soon to be proposed anchorages, trenching will be necessary. We feel that more than four feet of trenching will be necessary. The negative impact of vessels anchors threatening the pipeline should be mitigated on a to be determined trenching depth.

7. With respect to the Risk Analysis, the following is provided. It is understood that there exists little data on OCS structure/vessel accidents in southern California and especially when the structure involved is in the separation zone of a TSS. Quite naturally, the best source of data is the Gulf of Mexico (GOM). The traffic there is much greater and since the accident probabilities were derived from accident data there, they should be conservative. There is one important point left out. In the GOM the mariner knows where structures may and cannot be expected. Through the use of Shipping Safety Fairways (SSFs), areas were preserved where no drilling or structures of any sort are allowed and safe corridors were insured for the mariner. Accidents in the GOM thus occurred when the mariner, in most cases, departed from the SSF. In the GSC, a mariner would not expect a structure anywhere in a TSS because that is contrary to IMCO Resolution A378(x). Even though he (or she) shouldn't be in the separation zone of a TSS (where this Plan's platforms are proposed), navigation is permitted there in extremis or when crossing. These platforms would be in an area where they are not normally allowed and not expected. This and the possibility of exploratory drilling rigs makes the accident probabilities much less conservative.

8. With respect to the Plan's discussion of the painted color(s) of the platforms: The greatest degree of visibility to the mariner is most desired due to their proximity to the vessel traffic lanes. The color should be one that contrasts/stands out against the natural environmental setting. In general, a light color (white or yellow) is superior to a dark color. Large identification markings (name, etc.) are also desirable to aid the mariner. It is improbable that the color regardless of what it is will be discernable to the viewer from on shore.

9. With respect to the use of dispersants and other chemicals in mitigating the effects of oil spills: The use of collecting agents such as Shell Herder must be authorized by the Federal Predesignated On-Scene-Coordinator (OSC) on a case by case basis. The EIR-EA correctly identifies CG and EPA approval as prerequisites prior to the use of dispersants. However, the revised National Contingency Plan further requires the approval of U.S. Fish and Wildlife Service or the National Marine Fisheries Service where endangered species are involved.

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16652/TSS
22 January 1979

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10. The Plan incorrectly identifies the OSC as the Commander, Eleventh Coast Guard District. The OSC for the coastal waters off Los Angeles and Orange Counties is the Coast Guard Captain of the Port (COTP) of Los Angeles/Long Beach and the OSC for San Diego County is COTP, San Diego.

11. The Plan identifies the Federal Water Pollution Control Act of 1970 as amended in 1971 and 1972. That Act was further modified by the Clean Water Act of 1977. One of its primary thrusts was to extend the water jurisdictional limits further to sea.

Thank you for this opportunity to comment.

Yours truly,

D. M. TAUB
Captain, U.S. Coast Guard
Chief, Marine Safety Division
Eleventh Coast Guard District
By direction of the District Commander

RESPONSE TO COMMENTS OF THE DEPARTMENT OF TRANSPORTATION,
UNITED STATES COAST GUARD

2. An EIR/EA is designed to assess the specific impacts of the Shell Beta Plan of Development. The broader impacts of Lease Sales 35 and 48 have been addressed in the final EIS's for those sales prepared by the Department of Interior, Bureau of Land Management.

3. No comment is required.

4. No comment is required.

5. The applicant has located the platform structures such that they are at distances greater than 500 meters from the nearest traffic lane. The draft EIR/EA also recommends the establishment of a safety zone of 500 meter radius around each structure.

6. The draft EIR/EA has indicated a potential impact from the pipeline as it passes through designated anchorage areas. A burial depth of ten feet has been suggested as a possible mitigation of this impact.

7. The accident probabilities developed for the GSC-TSS are felt to be conservative. The analysis is based on accident probabilities for 12-14,000 transits per year in the Gulf of Mexico. These probabilities were not factored down to the 3-4,000 transits per year which are projected to occur in the project area. It is felt that these density factors compensate for any assumptions that mariners might make regarding structures in the TSS. Further, through adequate notification of mariners, vessels using the GSC-TSS should be as aware of structure locations as those operating in the Gulf of Mexico.

8. It is understood that the platform jackets are to be painted yellow with white platform areas. The jackets are visible 42 feet above Mean Higher High water. We concur that it is improbable that the color of the structures will be visible from shore.

9. Please see response to comment Number 40.

10. The comment is noted and forwarded to the applicant to aid in
11. the updating of their Spill Contingency Plan.

OFFICE OF
CITY ATTORNEY
CITY HALL EAST
LOS ANGELES, CALIFORNIA 90012

BURT PINES
CITY ATTORNEY

January 30, 1979

Dwight E. Sanders, Chief
Planning and Environmental Coordinations
State Lands Commission
1807 13th Street
Sacramento, California 95814

Re: Comments on Shell OCS Beta Unit Development Draft E.I.R.

Dear Mr. Sanders:

Although this Office has been deeply involved in the environmental issues of OCS development in general, and lease sale #35 in particular, we did not receive actual notification of issuance of the draft E.I.R. on the Shell OCS Beta Unit Development until after the comment period had ended. We are, therefore, not submitting detailed comments on the draft E.I.R. However, in our review of that document we discovered one inadequacy which we feel is so serious that it should be remedied even though our comments are late.

12. In the air quality information presented in Volume I at pp. 119-161, the prevailing winds data seem to indicate that the air pollution resulting from the offshore components of the project will impact primarily upon Orange County. (See Vol. I, pp. 121-135). The Costa Mesa and Laguna Beach air quality monitoring stations are selected as the "most representative of the coastal area adjacent to the project" (Vol. I p. 143) and it is stated that Costa Mesa's air quality is "generally very good" (Ibid). The overall impression gained from this section is that the coastal area of Orange County, which has relatively clean air, is the proper context within which to evaluate the air quality impacts of the project.

This may generally be true. However, the Shell offshore platforms will be not much farther from San Pedro than they will be from Huntington Beach, and additional wind data presented in Volume II suggest that southern Los Angeles County will experience air quality impacts from the project a significant number of times throughout the year. Specifically, during the wind condition identified as "Diurnal South, Type 1" (Figure 4.3-3 at Vol. II, p. 85) it appears that emissions from the Shell platforms would be blown to the northwest directly over the San Pedro-Wilmington-Long Beach area and on into southern Los Angeles County. Frequency data presented in Table 4.3-36 at Vol. II, p. 86 indicates such wind conditions can be expected to occur 18 percent of the time throughout the year, and 29 percent and 24 percent of the time during the poor air quality seasons of April-June and July-September, respectively.

Based on the above analysis we urge that the final E.I.R. be revised so that background information on Los Angeles County air quality conditions are included and the impacts of project emissions upon Los Angeles County are fully assessed and analyzed. Decisions regarding trade-offs and trade-off locations will be made utilizing the final E.I.R. In order for those decisions to be made equitably, it is essential that the E.I.R. portray the air quality impacts of the project accruately and completely.

We hope this comment is helpful and trust that it will be considered. Please notify us when the final E.I.R. is available.

Very truly yours,

BURT PINES, City Attorney

By: William L. Waterhouse
WILLIAM L. WATERHOUSE
Deputy City Attorney
Environmental Protection

WLW:cl
(213) 485-6286

RESPONSE TO COMMENTS FROM THE CITY OF LOS ANGELES,
CITY ATTORNEY'S OFFICE

12. Page 87, Volume II. Explains the wind conditions defined as Diurnal South, Type I.

As addressed, these winds occur predominantly during the Catalina Eddy. A further discussion of the Catalina Eddy is given in Volume I Pph. 5, pg. 120 under Section 3.3.1.1, "Regional Climatology." An important point to note from this discussion is that when the Catalina Eddy occurs the marine layer deepens, which forces the inversion upward, and permits greater vertical mixing. The average depth of the marine layer during the Catalina Eddy is approximately 2000m (1.2 miles). The discussion of "Dispersion Meteorology," Section 3.3.1.7, p. 139-141 of Volume I indicates the importance of the depth of the mixing layer for the diffusion of pollutants. On page 139 of Volume I it is stated, "the third important meteorological factor used to evaluate the air pollution potential of an area is the depth of the mixing layer, which is defined as the height of the surface through which relatively vigorous vertical mixing occurs."

Pages 59-64 of Volume II discusses the impact of the various project pollutants at the three-mile state territorial limit and the shoreline. The impacts were calculated for the shortest distance from the Beta project's platforms to the three-mile limit and the coastline (Huntington Beach). These distances are approximately six and nine miles, respectively. The Long Beach and San Pedro coastlines are about 13 miles distance from the platforms. As concluded on pages 59-64, the impacts of the project are minimal at the Huntington Beach shoreline, thus the impacts at San Pedro and Long Beach would be much less due to the greater travel distance and the fact that the mixing depth is about five times as great for the south and south-southeast wind directions (Catalina Eddy).

Finally, it is important to note that the Huntington Beach area is within the South Coast Air Basin (SCAB), of which Los Angeles County is a part. The impact study was structured to provide an assessment of the impacts to the air basin. Thus, because the impacts to the SCAB are covered, so are the impacts to Los Angeles County.