CCP Chambers Consultants and Planners

PROPOSAL FOR A

JOINT ENVIRONMENTAL ASSESSMENT/ENVIRONMENTAL IMPACT REPORT

FOR

PITAS POINT UNIT

PROPOSED TEXACO GAS PLATFORM PIPELINE INSTALLATION

AND

ONSHORE TIE-IN, SANTA BARBARA CHANNEL

Submitted to:

DEPARTMENT OF ENVIRONMENTAL RESOURCES
County of Santa Barbara, California

September 1980

CHAMBERS CONSULTANTS AND PLANNERS
P.O. Box 356 · 10557 Beach Boulevard
Stanton, California 90680
714/828-3324

September 15, 1980
(80-040)

The Department of Environmental Resources
County of Santa Barbara Administration Building
Room 103
105 East Anapamu Street
Santa Barbara, California 93101

Attention: Mr. Dev Vrat

Dear Mr. Vrat:

Chambers Consultants and Planners (CCP) is pleased to respond to your request for Proposal to prepare a Joint Environmental Assessment/Environmental Impact Report (EA/EIR) for the Pitas Point Unit Proposed Texaco Gas Platform Pipeline Installation and Onshore Tie-In, Santa Barbara Channel.

The Scope of Work outlined in this proposal will meet all requirements listed in the RFP. Should we be entrusted with this assignment, you may be assured that the work tasks will be performed in accordance with the highest professional standards.

If you require further information, please contact me at your convenience.

Sincerely,

CHAMBERS CONSULTANTS AND PLANNERS

M.D. Chambers
General Manager

MDC:db

80-040

A proposal for a. . .

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

LIST OF ILLUSTRATIONS

LIST OF TABLES

Section 1

INTRODUCTION

1.1 BACKGROUND

Texaco, Inc., the designated operator for Pitas Point Unit (encompassing the Outer Continental Shelf (OCS) Leases P-0233, 0234 and 0236), is proposing the development of a drilling and production platform on Lease P-0234. Texaco proposes to transport natural gas by a pipeline to be constructed from the platform to a point connection with Southern California Gas Company's coastal transmission pipeline in or near the City of Carpinteria.

The County of Santa Barbara Department of Environmental Resources (DER) is the Co-Lead Agency with the Bureau of Land Mangement (BLM), the Army Corps of Engineers (Corps), and the U.S. Geological Survey (USGS). For Texaco's proposed drilling and production platform. The Lead Agencies, subsequent to review of Texaco's application and proposal, have determined that an Environmental Assessment (EA) and Environmental Impact Report (EIR) is necessary to define the significant effects that the proposed project will have on the environment. The Lead Agencies have, therefore, sought to retain the services of a qualified consultant to prepare a document that will satisfy applicable State and Federal laws, regulations and guidelines, as well as address the concerns of other Government agencies and responsible, interested citizens.

Chambers Consultants and Planners (CCP) is a well qualified environmental consulting company that has the background, facilities, financial resources and technical qualifications for undertaking this challenging

project. CCP has provided a wide range of scientific, planning and engineering services for completed controversial projects:

- Design of the Environmental Documentation for the 1980 Summer Olympic Games - Co-Lead Agencies: City of Los Angeles and U.S. Army Corps of Engineers.

- Environmental Statement for Goat, Pigs and Cat Removal at San Clemente Island - Lead Agency: U.S. Navy.

- Las Positas Park Development on an Uncontrolled Landfill - Lead Agency: City of Santa Barbara.

CCP staff have been involved with offshore oil and gas development for the past 10 years. CCP is currently preparing under contract with the State Lands Commission the EIR for Shell Oil Company's request to explore and test the Pierpont Prospect (PRC 3314.1) for hydrocarbon accumulation. Dr. Noël Davis, Project Manager, has been involved in documentation of biological activity for many of the platforms in the Santa Barbara Channel as well as Platform Emmy of Huntington Beach. As part of Dr. Davis' studies of Platforms Hilda and Hazel in the Santa Barbara Channel, biological transects by video-tape methods were performed. Other staff members (Mr. Matlovsky) have participated in of the environmental documentation of Platform Holly and Chevron development in the project area. Mr. M.D. Chambers, Director of CCP, was a key member of the project team to investigate the environmental effects of the Northwest Alcan Pipeline Project to bring Alaska's natural gas from Prudhoe Bay, Alaska to the lower 48 states through Canada.

CCP has a fully staffed office in Orange County and an operating office in Santa Barbara. Existing supervisory and staff personnel at these offices will be used. CCP and its parent company has the financial ability to carry out this program - $4 million per year gross income.

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1.2 CCP APPROACH AND OVERALL OBJECTIVES

In response to the County of Santa Barbara RFP dated July 18, 1980, CCP has prepared the following proposal, demonstrating:

1. CCP's understanding of the problems involved in this particular study;

2. CCP's command of the technical expertise required to develop this EA/EIR;

3. The quality of the resources that CCP has assembled to conduct this specific project; and

4. The ability and willingness of CCP and its key personnel to work closely with the Lead Agency to ensure successful completion of the project.

The CCP approach will emphasize, as the primary objective, the development of a complete, unbiased, totally defensible document. This EIR will meet the requirements of the California Environmental Quality Act of 1970 (PRC Sec. 21000 et seq.), State EIR Guidelines (14 California Admin. Code Sec. 1500 et seq.), California Administration Code regulations (Art. 10, Div. 3. Title 2), the National Environmental Policy Act of 1969 (NEPA), as amended and the Council of Environmental Quality (CEQ) Regulations which implement procedural requirements for EAs. The EA/EIR is also required to respond to the comments and questions of other Federal, State and local agencies (pursuant to PRC Sec. 21080.4[a]). To be complete, and entirely defensible, the EIR will also anticipate and address the reasonable concerns of responsible citizens.

The CCP study will stress efficiency by making maximum use of previous research and existing studies particularly the recent EIRs and EISs for the area. Through work on similar projects, the CCP professional staff has become thoroughly familiar with the existing body of knowledge

relevant to the environmental concerns regarding offshore oil and gas development in the Santa Barbara Channel area. Most of the members of the Project Team have participated in previous studies in the Santa Barbara Channel area. These previous projects involved literature searches which encompassed all the literature available for the Santa Barbara Channel.

1.3 FORMAT AND CONTENTS OF THE CCP PROPOSAL

This proposal follows the general outline presented in the County of Santa Barbara's RFP. Section 2 of the proposal presents an overview of the CCP approach, the qualifications of the Project Team, the relationships of the parties involved, and a description of the deliverable items. Section 3 is a complete description of CCP's Technical Approach to the study program, and will establish CCP's command of the field. Section 4 sets forth the estimated time and cost requirements for this EA/EIR. Section 5 presents the manner in which CCP will control the elements of quality, cost, and time during execution of the program. The Statement of Qualificaitons contained in Section 6 gives an introduction to the Project Team and its organization, the resumes of each member of the CCP professional staff assigned to the project, the background and capabilities of CCP as an organization, and a series of abstracts describing other projects completed by the CCP staff. Section 7 gives a complete introduction to the specialty consultants in air quality and geological surveys retained by CCP as subcontractors for this study, along with their own respective Statement of Qualifications.

Section 2

STUDY PLAN

2.1 INTRODUCTION TO THE SECTION

This section of the CCP proposal describes in general how CCP will meet the objectives presented in Section 1. There will first of all be a discussion of the study program itself, which will be expanded in detail in Section 3, Technical Approach. This discussion will be followed by an introduction of the CCP Project Team and its capabilities. The relationships between and among the Co-Lead Agencies, Texaco, Inc., and C CCP will then be clarified. The description of the actual deliverable items will be given in the final subsection.

2.2 STUDY PROGRAM OVERVIEW

The drilling and production platform and gas pipeline may result in a complexity of environmental impacts. Potential impacts associated with the proposed project may be expected from normal operations as well as possible accidents. It is essential that the approach to planning and implementation of a study of these impacts be clearly defined. The following statement briefly outlines the philosophy of CCP, relating to development of a comprehensive EA/EIR for this project.

Of prime importance is quickly establishing and maintaining a close liaison with key personnel of Government agencies and private industry involved in the development and production program. This liaison will

ensure that there is an evolution of the planning process whereby potential problems are identified at an early stage and addressed to the satisfaction of all concerned. We feel that by conducting a program in this manner many potentially serious "surprises" can be avoided.

Our approach to environmental studies stems from the understanding that the environment is a complex and interrelated system, despite the fact that air, water and terrestrial pollution problems are regulated more or less independently. The CCP Study Team will analyze the problems as an interconnected system and evaluate the full range of impacts and effects governing the location, severity and nature of environmental phenomena.

It is of major importance that the environmental information be keyed into the development plan. In other words, it is necessary to address the effect of the development on the environment as well as the effect of the environment on the development. This approach will assist the proponents in accomplishing their objective to develop the resources in a manner that is compatible with the existing environment. CCP uses a stepped approach which is efficient, flexible and economical. Each step, overlapping in time, allows for the focusing of project resources in real areas of concern rather than "nonproblems." Figure 2-1 shows the CCP approach for this study.

CCP and the selected Study Team have particular strength in integrating development plans and environmental considerations and providing realistic and practical recommendations. Our approach, experience and expertise will ensure a program which demonstrates a high degree of professional competence.

The following outlines the overall tasks of the study while Section 3 contains the more specific tasks for each study component:

1. Identify, review and assess all relevant environmental data in order to:
   - determine the data base;

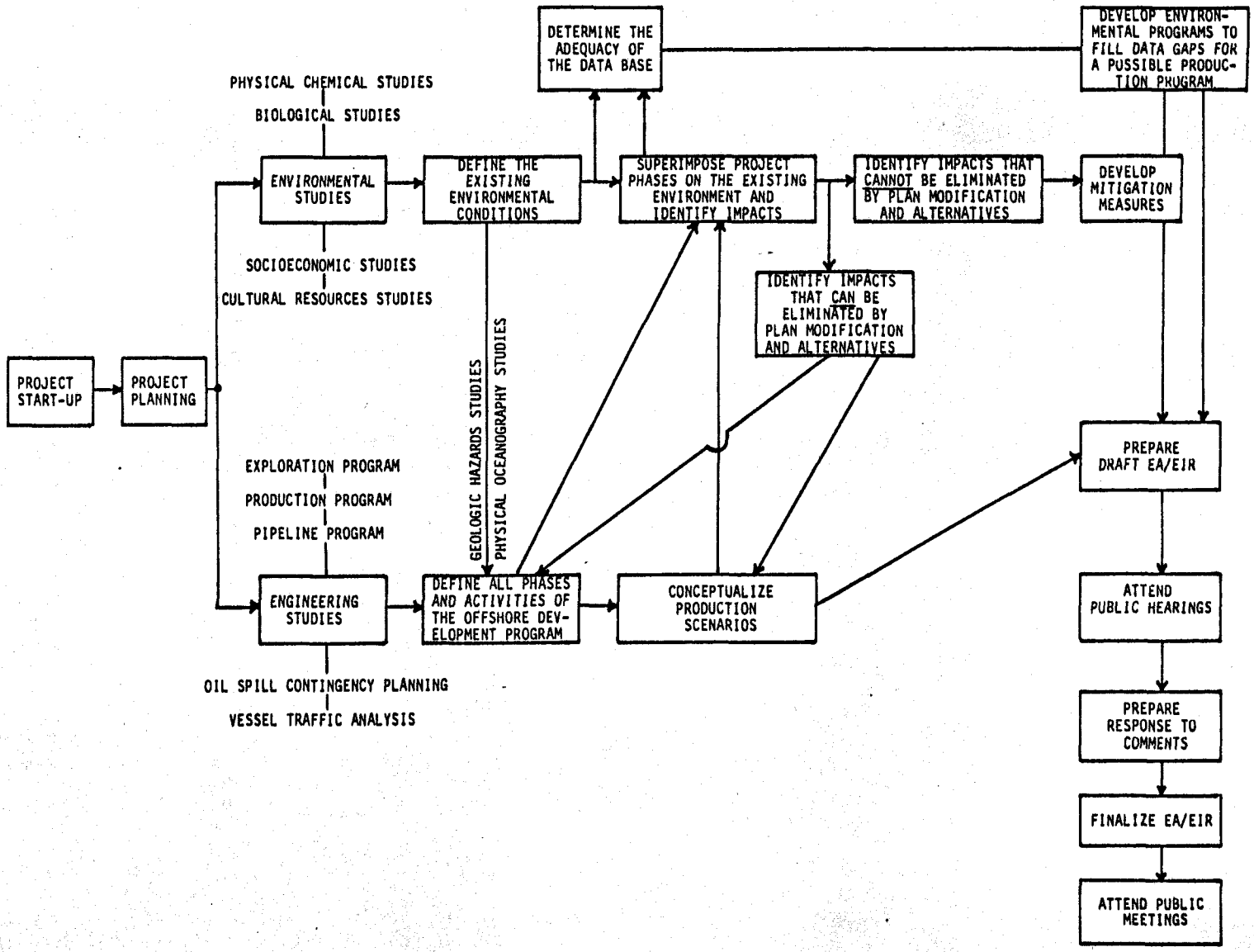

Figure 2-1. CONCEPTUAL PROJECT PLAN

- identify and discuss sensitive environmental features;
- identify and discuss development plan alternatives that can incorporate environmental features; and
- identify data gaps.

2. Superimpose the development alternative on the existing conditions to assess environmental concerns on- and off-site.

3. Identify, assess and place in perspective all possible environmental concerns associated with the proposed development.

4. Evaluate possible alternative development plans.

5. Recommend mitigating measures.

6. Discuss other relevant planning considerations:
   - growth-inducing impact;
   - boundary of the significantly affected area;
   - relationship between short-term uses and long-term productivity;
   - irreversible and irretrievable commitments of resources;
   - energy consumption; and
   - aesthetics.

7. Prepare an EA/EIR.

The CCP approach for development of the required EA/EIR is designed to provide the public, Government and industry the means whereby trade-offs and alternatives may be evaluated from the best possible data base. The approach ensures a consistent technique of assessing environmental impacts, and is designed to ensure that all significant gains and losses are placed in perspective and included in the environmental protection processes.

Detailed presentation of the CCP Technical Approach for conducting this program appears in Section 3. The approach is described in terms of the functional disciplines involved in conducting the study, but the actual work program will be integrated and implemented as described in the above section.

2.3 CCP PROJECT TEAM

In order to execute the work program outlined above, CCP has assembled a unique and highly qualified Project Team (Figure 2-2).

M.D. Chambers, with his years of experience in conducting environmental studies will serve as Director for this project. His function will be overall coordinative control of the study, and he will ensure that the objectives of the Co-Lead Agencies are met by the Project Team within the schedule and budgetary constraints of the project.

As Project Manager, Dr. N. Davis will be responsible for day-to-day coordination and control of the Project Team. Dr. Davis has extensive experience managing highly complex environmental projects. Her background includes environmental assessments involving marine structures, and she is thoroughly familiar with the problems involved in offshore oil development.

Mr. Chambers has made available his firm's most highly qualified professionals in the fields that are considered critical to this study. The CCP professional staff has established a reputation of quality and technical excellence through their work on similar projects involving highly complex interdisciplinary collaboration, a high degree of public awareness, and sensitive public issues.

These scientists and professional engineers are introduced, by discipline in Section 6.1, where their detailed resumes will also be found.

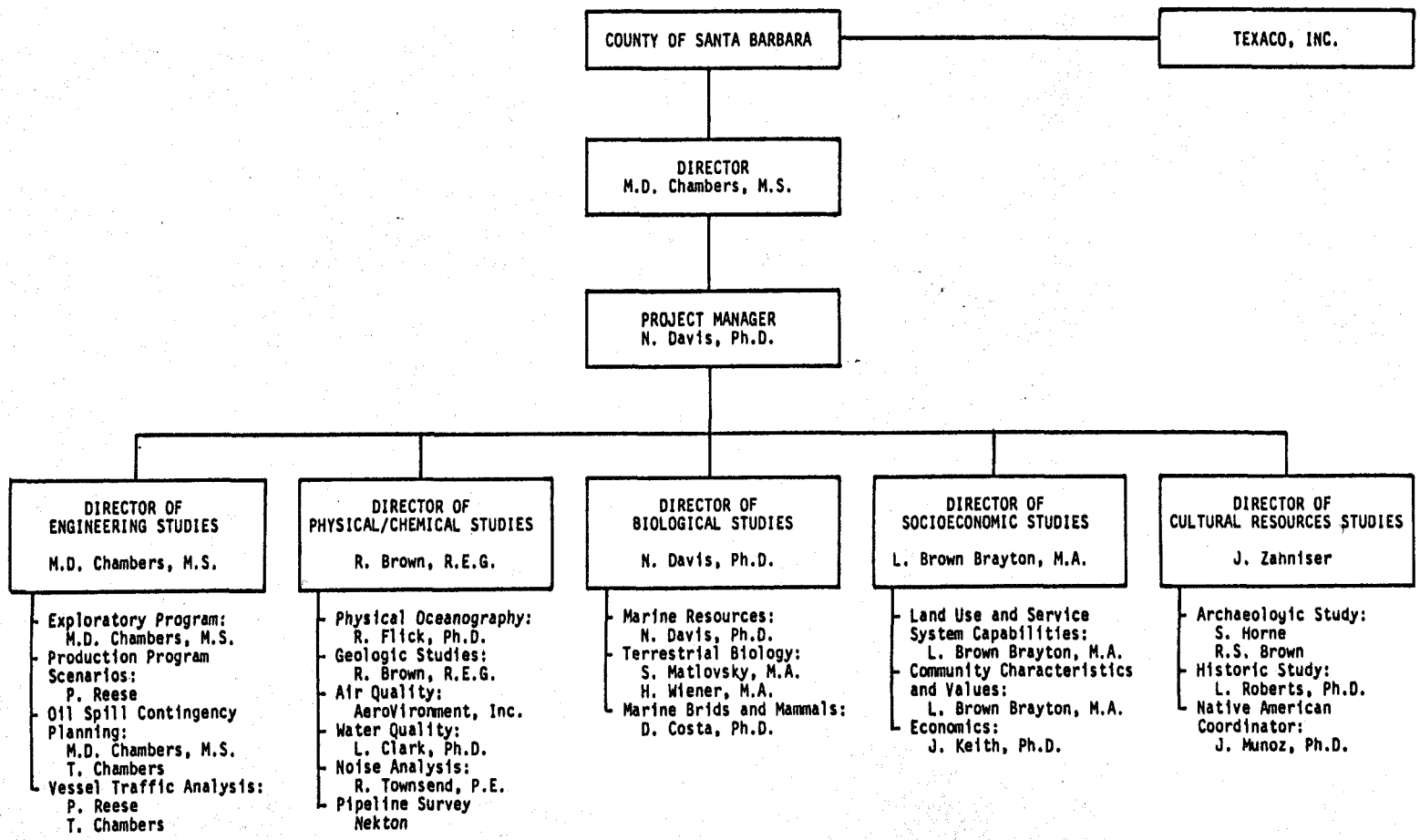

Figure 2-2. CCP PROJECT STUDY TEAM

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An organization chart showing the relationships of the members of the team was shown on Figure 2-2 and reproduced in Section 6.1 as well.

In addition to the internal resources that CCP is commiting to this project, CCP has retained the services of AeroVironment, Reese and Chambers, and Nekton, leading specialty consultants in their fields of expertise. CCP feels that it has assembled a Project Team that is unrivaled in its ability to develop a thorough, complete, and defensible EA/EIR.

A more detailed presentation of the subcontractors' qualifications will be found in Section 7.

2.4 RELATIONSHIP OF ENTITIES INVOLVED IN THE STUDY

The County of Santa Barbara, BLM, Corps, and USGS are the Co-Lead Agencies for the proposed drilling and production platform by Texaco on the Pitas Point Unit. CCP will be developing the EA/EIR under direct contract to the County of Santa Barbara. Under these contractual arrangements, CCP will be directly responsible to the Co-Lead Agencies for developing an EA/EIR in the manner presented in this proposal.

Texaco, Inc. is also in a direct relationship to the Co-Lead Agencies as applicant for the proposed development operation. Timely and thorough implementation of this study is in the best interests of Texaco, and for this reason, their complete cooperation with the Co-Lead Agencies and with CCP, as the study contractor, will be expected.

No direct relationship exists between CCP and Texaco as a result of this contract except in regards to CCP's activities as an agent of the Co-Lead Agencies in conducting the study and developing a complete document. These activities will be confined to collection of information concerning operational analysis and possible environmental effects of

the proposed operation. To accomplish this, lines of communication will be opened and maintained with Texaco during the course of the study.

The County of Santa Barbara has been designated Lead Agency in the permitting process under AB 884 and CEQA, and the USGS is the major permitting Federal Agency under NEPA.

CCP will maintain a constant and continuing liaison with the Lead Agencies while performing the study and developing the EA/EIR. It is in the best interests of all parties that the Lead Agencies be kept constantly informed of CCP's activities and progress, and so continuous liaison over and above progress reports and other deliverables is considered very important.

CCP is very experienced in conducting studies that involve the participation of, and input from, a large number of divergent interests. CCP has shown itself capable of minimizing and managing the conflicts involved, and of promoting an atmosphere of commonality and cooperation that results in much greater efficiency in meeting as much as possible, the goals of everyone concerned.

2.5 DELIVERABLE ITEMS, TIME FRAME AND TOTAL COST

During the course of the study, CCP will present the following items to the Co-Lead Agencies:

1. A master outline of the EA/EIR showing in detail the topics to be researched and assessed; along with a complete network diagram schedule showing the interdependence of each element of the study as well as a scheduled completion of each of the elements. This outline will be reviewed with the Co-Lead Agencies.

2. Finalized Project Description reviewed and accepted by Taxaco and the Co-Lead Agencies.

3. EA/Draft EIR.

4. The Project Manager and selected technical personnel to be available for a public hearing.

5. Preparation of responses to written and oral comments concerning the Draft EA/EIR.

6. Preliminary drafts of the Final EA/EIR.

7. Final EA/EIR.

8. The Project Manager and selected technical personnel to be available for defending the Final EA/EIR in a public hearing.

The report will describe all reasonable operational alternatives which could attain the basic objectives of the project. The specific alternative of "no project" and "Alternative Energy Resources" will be included in the evaluation along with its impact. The discussion of alternatives shall include alternatives capable of substantially reducing or eliminating any significant environmental effects, even if these alternatives substantially impede the attainment of the project objectives, and are more costly.

The proposed time period for the completion of a Draft EA/EIR is the 6 months specified in the RFP. The total cost would be $174,256. If CCP is required to deliver 50 copies of the Draft EA/EIR and 50 copies of the Final EA/EIR, the cost will be an additional $1,100.

The Project Director and Project Manager are scheduled for 32 manhours each to attend the public hearing. CCP has committed another 184 manhours for members of the technical staff for response to the comments on the Draft EA/EIR.

Section 3

TECHNICAL APPROACH

There is a growing public concern in the southern California area that offshore oil and gas development may causes serious environmental damage to the oceans and coastlines. In conducting this environmental study, CCP will seek to:

1. Identify the type, cause and degree of the impacts associated with Texaco's construction, drilling and gas production program;

2. Define realistic mitigation measures for the undesirable impacts; and

3. Assess the cumulative effects of unavoidable impacts on Southern California oceans and coastlines.

In order to identify all the areas of environmental concern, the environmental consequences of this project must be addressed from a national, regional, local, and site-specific standpoint. The people of Southern California will be most subject to the economic, social, and environmental impact of the proposed Texaco program while many of the benefits of increased energy resources will be reaped by other parts of the State.

The CCP study plan is designed to assess both the immediate effects of the construction, drilling, and gas production program as well as the cumulative effects of Texaco's program in conjunction with other activities in the region such as other proposed offshore oil and gas programs.

In developing our approach to this environmental study, and in assembling the Project Team that will carry it out, CCP has emphasized the areas that are considered critical to quality and completeness:

1. Geologic Hazards
2. Air Quality
3. Marine Resources
4. Cultural Resources
5. Marine Traffic

The technical approach presented in the following section for each of the functional divisions is designed to contribute to a comprehensive environmental program that will assess the effects of the proposed drilling operation on both the human and the natural environment. The technical approach will be organized on the basis of the following functional areas, which also represent the actual organization of the Project Team:

1. Engineering Studies
2. Physical/Chemical Studies
3. Biological Studies
4. Socioeconomic Studies
5. Archaeological and Historic Studies

3.1 ENGINEERING STUDIES

Most of the onshore support for the proposed project during construction, drilling, and production is likely to be generated from the Port of Hueneme. The Project Team's previous experience in this area and with OCS developments will be directly applicable to this project, and will greatly contribute to the efficient conduct of this study.

The conceptual approach to the preparation of environmental impact assessments for an operation of the type proposed by Texaco requires

that a great many topics and questions of a highly technical nature be defined clearly enough to superimpose the relevant aspects of the proposed operation on the existing environment and determine their impacts. In keeping with the primary objective of developing a complete, unbiased, and thoroughly defensible document, the study program designed by CCP will independently explore these technical areas.

The operational aspects of Texaco's proposal has been divided into two sections: construction and drilling programs and operation. Each phase will be defined in sufficient detail to determine the consistency with State and Federal offshore drilling operations and the environmental impacts during normal operations as well as in the event of any possible mishap. The possibility of oil spills resulting from Texaco's activities must be explored as well as the proper response and recommended contingency planning. The navigational implications of the presence of Texaco's platform equipment in this area must be examined. CCP has developed an approach to this concern, which is presented in Section 3.1.4. These four elements have been grouped together under Engineering Studies, since they will entail investigations of a highly technical nature involving the contributions of many disciplines.

3.1.1 Platform and Pipeline Construction and Drilling Program -

3.1.1.1 Tasks

A comprehensive description of the relevant elements of the gas production platform construction, subsea pipeline construction from the platform to the existing Southern California Gas Coastal Pipeline and drilling program will be developed using input from the operating engineers from Texaco. The description will include:

1. Time-phased description of the construction and drilling program activities:
   - Mobilization of equipment
   - Platform construction

- Recompletion of existing wells
- Drilling of new wells
- Gas production
- Pipeline construction

2. Each activity identified as being relevant will be defined in terms of:
   - Equipment and manpower utilized
   - Resources used and waste produced
   - Standard procedures to protect against environmental hazards
   - Procedures to protect against the aggressive nature of natural gas containing H_2S and CO_2 (i.e.; drill pipe and tool joint grades, cementing and mud programs, and completion equipment materials).
   - Consequences of breakdowns in protective procedures.

3. Comparison of Texaco's proposed exploration program with the State and Federal regulations for oil and gas drilling and production operation on state tide and submerged lands.

3.1.1.2 Methodology

Initially, CCP will obtain existing documents and reports from Texaco (applications, proposals, etc.) and establish liaison between CCP and Texaco personnel in an effort to discover, to the greatest extent possible at this stage of development, Texaco's operational plan. It is foreseen at this time that at least one meeting will be necessary involving the Co-Lead Agencies, Texaco, and CCP.

The information obtained from Texaco will be combined with knowledge of standard exploration technology in order to develop the elements described above and will result in an operational profile report addressing the elements listed above.

This operation profile will be discussed with the Co-Lead Agencies and Texaco, to ensure that there are no objections to the nature of the operation as defined in the report. The report, with these inputs, will be integrated into the analysis and assessment of environmental impacts and will be compared with State and Federal regulations.

All data sources, references, consultations and discussions, analytic techniques, and decision rationales will be completely documented. All assumptions made and all data limitations will be identified with a discussion, as appropriate, of the influence and sensitivity of changes in such assumptions on the results reached. For a complete discussion of the data management policies to be used, refer to Section 5.

3.1.2 Production Operations

The Project Team proposes to use the information available from the Co-Lead Agencies, other agencies, and Texaco to generate the descriptive scenarios of the gas production from the lease. The operation will be based on possible resource production over time, and will consider both offshore and onshore facilities that would be necessary for processing of product.

3.1.2.1 Tasks

The tasks involve describing in operational terms the most likely alternatives for production and entails developing the following information:

1. Define the activities that would be necessary to develop the field:
   - Well testing procedures
   - Construction and installation of facilities both onshore and offshore
   - Development of wells
   - Abandonment of site when formation is no longer productive.

2. Define the operational characteristics of each of these activities in terms of:
   - Capital equipment and manpower utilization
   - Resources used and waste produced
   - Standard procedures to protect against environmental hazards
   - Consequences of breakdowns in protective procedures.

3.1.2.2 Methodology

The methodology used will be similar to that applied in operational analysis of the drilling program itself. The first step will be collecting as much information as possible from Texaco concerning likely production alternatives. The information available from Texaco, in conjunction with state of the art offshore production technology, will be used by CCP to develop the characteristics of the production phase. This report will be reviewed with the Co-Lead Agencies and Texaco and, together with their inputs, will be integrated into the study.

3.1.3 Oil Spill Contingency Planning Studies

Even though gas production is the primary objective of Texaco's mission, oil spill contingency planning must be considered.

The purpose of the oil spill contingency planning studies is to determine oil spill probabilities, sizes, and transport and to evaluate the effectiveness of Texaco's Oil Spill Contingency Plan. In review of comments for other offshore drilling EIRs and EISs for the Santa Barbara Channel, the greatest public concern is the threat of oil spills. Members of the CCP staff have developed regional-type oil spill contingency planning programs for tanker routes as well as offshore drilling operations. Reese and Chambers, subcontractors to CCP, are curently under contract to the Coastal Commission to evaluate Clean Seas Oil Spill Containment and Cleanup procedures. This experience will be invaluable in reviewing the oil spill threat and the effectiveness of Texaco's contingency planning.

3.1.3.1 Tasks

In view of the possibility of inadvertent oil spills resulting from offshore development, the members of the Project Team will conduct the following tasks:

1. Use background information to determine the probability of an oil spill for the drilling, production and transportation operation of the Texaco project.

2. Evaluate the operation plans of the project and estimate the amount of oil that can be spilled at any given time.

3. Evaluate the wind, wave and current data to be developed by the oceanographic and meteorologic studies to determine the areas most likely to be affected by spilled oil.

4. Evaluate the effectiveness of Texaco's Contingency Plan:
   - Command and organization structure for containment and cleanup operation;
   - Available equipment, materials, containment and cleanup methods and procedures;
   - Containment and cleanup procedures that are location and/or time-specific;
   - Priorities for containment and cleanup based on the identification of biologically sensitive areas potentially affected by oil slicks; and
   - Methods and procedures for reconnaissance and prediction of oil movement.

5. Develop recommendations for effective environmental protection planning.

3.1.3.2 Methodology

There is a small potential of a major oil spill during Texaco's program. The probability of oil entering the ocean from this source is low, but the effect of a major spill can be very large. In the analysis, the Project Team will determine how Texaco's project will increase the threat of oil spills to the section of coastline. The amount of oil spilled at any one time will be determined by estimating amounts of oil that can be lost during drilling operations.

After evaluating the oil spill potential, amount and movement, the existing Contingency Plan will be reviewed for effectiveness. In areas where the plan is felt to be ineffective, recommendations will be made. These recommendations could include:

1. Increase spill containment boom;
2. Relocation of onshore equipment to protect sensitive natural areas;
3. Collection of wind, wave and current data at facilities; and
4. Development of equipment and methods for wildlife dispersal.

3.1.4 Vessel Traffic Analysis

To evaluate vessel traffic conditions, study members have utilized computer simulation models in extensive work for both the California Public Utilities Commission and the California Coastal Commission. These models operate on the basis of type of vessel, density, routing, the geography of the area and existing aids to navigation, environmental condition statistics, ship characteristics, and other factors, and produce statistical descriptions of the frequency of occurrence, geography, and geometry of occasions of exposure to potential casualty. These models permit evaluation of changes in operational procedures.

Sufficient analysis has been made such that the actual application of the models is not believed necessary for this EA/EIR. Enough information

is available so that the Project Team can properly interpret and scale available data and derive statistical estimates of the risk of vessel casualty and the mitigation measures necessary to reduce that risk to an acceptably low level. Establishing the probability of marine traffic casualty is based on three sources of information. First, there is a large body of information describing vessel casualties on a worldwide basis. The data for casualties in unconfined, open waterways and for major vessels will be reviewed and applied to the proposed project. Second, considerable data are available relative to actual experience in the California coastal waters. Information covering the years since the vessel traffic separation scheme was instituted is most pertinent. Third, site-specific modifiers to the above two data sets can be generated. Such modifiers result from the existing conditions of environment (wind, wave, and visibility), the results of the models described above, available aids to navigation, and the exact nature of the ships sailing in the vicinity.

3.1.4.1 Tasks

1. Project definition.

2. Identification of the current situation and conditions.

3. Conduct a vessel traffic analysis to include the presence of Texaco equipment, particularly the possible conflict with the operation on vessel traffic to and from the proposed offshore platform. This analysis will include all support vessels within the area.

4. Documentation.

3.1.4.2 Methodology

The first task will consist of examination of all current documentation. Liaisons will be established with responsible State, Federal and local

agencies to provide details and clarify as necessary the technical characteristics of the analysis. This work will provide a basis for the remaining tasks.

The identification of the current situation and conditions in the area of the proposed project, in terms of vessel traffic, and oceanographic and meteorological parameters will be the second step. Recent and extensive work by the California Coastal Commission has resulted in a detailed, multi-source data base of wind, wave, swell, current, visibility, temperature, etc., environmental parameters which will be used for this analysis. Further, work conducted by Project Team members for the California Public Utilities Commission has produced the most up-to-date, extensive, and detailed data base available of Naval, commercial, recreational, and fishing vessel traffic in California waters. This data base will be applied to this portion of the work.

Also included in the description of the extant conditions in the area will be a description and evaluation of available aids to navigation, such as Navigation Satellite, Loran-C, OMEGA, radio beacons, radar reflectors, RAYDIST/LORAC, lighthouse/aerobeacons, buoys, fixed structural markers, visual range markers, surveyed and lighted structures, marine light-beacon lanterns, and bathymetric data. From previous work with NOAA/NOS, the U.S. Navy and the U.S. Coast Guard, the Project Team has detailed knowledge of the existence, function, and effectiveness of these navigational aids in the California area.

A comprehensive survey and evaluation will be conducted of existing and potential applicable rules and regulations. The CCP study team CCP will fully evaluate the effects of the applicable laws and regulations, including the Port and Waterways Safety Acts of 1972 and 1978, and the International Rules for the Avoidance of Collision at Sea.

The third step will be divided into two areas:

1. Determination of potential for major vessel casualty and definition of mitigating measures to reduce this potential; and

2. Analysis of impact on commercial and recreational vessel traffic in the area.

The first subtask will make use of the extensive data base of vessel traffic in the Santa Barbara Channel. These data will be used to operate on available worldwide, U.S. and Santa Barbara Channel casualty statistics to produce the statistical estimates, thus greatly simplifying the task.

For the second task area, the types and density of commercial fishing, sport fishing, and recreational boat traffic using the area will be examined, and an evaluation made of the impact on these activities.

All data sources, references, consultations and discussions, analytic techniques, model inputs and outputs, and decision rationales will be completely documented. All assumptions made and all data limitations will be identified with a discussion, as appropriate, of the influence and sensitivity of changes in such assumptions on the results reached.

3.2 PHYSICAL/CHEMICAL STUDIES

3.2.1 Physical Oceanography

The purpose of the physical oceanography studies will be to describe the existing oceanographic conditions in the project area, to determine to what extent the proposed platform and pipeline construction will modify these conditions, to determine the probable effects of the ocean on construction activities and on the proposed structures themselves, and to model the way materials released into the ocean from oil operations will be dispersed away from the site.

Within the Santa Barbara Channel, large-scale water circulation patterns are complicated by many small-scale forces such as the configurations of the coastline. The proposed structures will probably have only a very local effect on current patterns. The platform will cause small wakes

for a distance around the platform of about 10 diameters of the pylons. There will be some bottom scour of the sediments around the base of the structures. Materials associated with construction, drilling, production, and transportation could more dramatically affect physical and chemical water column properties. Turbidity may be increased, water quality impaired, and temperature characteristics altered.

The most important impact of physical oceanographic conditions on offshore operations would be that of waves. The project area is relatively sheltered from waves by the Channel Islands and Point Conception. However, occasional violent storms do occur. The platform itself would be designed to withstand the most severe storm conditons, but storms would increase the chances of an accident during construction and support operations.

The construction, drilling, and production operations will result in the discharge of such substances as drilling muds, drill cuttings, wastewater, and sewage. The physical oceanography team will study the way these substances will be disseminated to areas remote from the site of operations. The team will be concerned with persistence of these materials in the ocean waters and deposition in coastal areas.

The chances of a major oil platform spill is greatest during drilling operations. Once production has been achieved, minor spills can occur at any time. The main factors influencing the direction and rate of movement of an oil slick, and hence the basis for predicting potentially affected areas, are surface currents and wind. A synthesis of the existing data base pertaining to mean distribution of ocean currents, boundary effects, and short-term wind-induced effects will be presented for the proposed development. A thorough understanding of the physical aspects of the ocean in the Santa Barbara Channel will aid in developing contingency planning and mitigation measures to protect the coastline in the event of a major oil spill.

3.2.1.1 Tasks

1. Outine the necessary information to be obtained to fully evaluate the effect of oceanographic conditions on construction, drilling, and production operations.

2. Determine the existing data base by reviewing all pertinent published and unpublished reports and contacting oceanographers who have worked in the project area.

3. Describe relevant oceanographic conditions.

4. Identify the effect of oceanographic conditions on drilling operations.

5. Determine the effect of waves and currents on the dissemination of substances discharged or spilled into the ocean during operations.

6. Work with oil spill team to predict the probable movement of an oil slick depending on wind and current patterns in the Santa Barbara area at different times of the year.

3.2.1.2 Methodology

A description of oceanographic conditions in the project area will be developed by reviewing all the published and unpublished literature available for the Santa Barbara Channel. Recent and extensive work by John J. McMullen Associates for the California Coastal Commission has resulted in a detailed, multi-source data base of wind, wave, swell, current, visibility, temperature, etc. This data base will be an invaluable information source for the EA/EIR. Since study team members participated in the John J. McMullen Associates study, CCP is thoroughly familiar with the existing literature sources for oceanographic conditions in the Santa Barbara Channel. In addition, as part of CCP Environmental

Impact Report for Resumption of Drilling Operations on State Oil and Gas Lease PRC 3314.1, oceanographic information for the Santa Barbara Channel area was reviewed. Since CCP has already become acquainted with the existing data base, the literature review for the EA/RIR can be accomplished with maximum efficiency.

Once the oceanographic conditions in the project area have been determined, an assessment will be made of the probable effects of oceanographic conditions on construction, drilling, and production operations. The probable rate of substances discharged or spilled during drilling operations will be mapped by looking at the prevailing wind and current patterns in the area at different times of the year. The Physical Oceanography Study Team will work with the Engineering Study Team to estimate the effects of the ocean environment on the operations.

3.2.2 Geology

The geology program will provide a general background on which site-specific information from our fieldwork and offshore surveys can rationally be placed.

A description of the geologic setting of the Santa Barbara Channel and near onshore areas will provide information on the onshore and subsea physiography and its relation to the sediments, geologic formations and geologic structures. Within this setting, the tectonic and seismic framework will be summarized. Geologic processes that have relevance to the platform, pipeline and onshore facilities area will be described. For example, these processes might include: sediment transport, mass wasting, sea cliff erosion, earthquake shaking, sediment liquifaction, fault rupture, and subsea and onshore seepage of oil and gas.

The site-specific geology, hazards, bottom and subbottom conditions and the bathymetry will be determined, described and mapped from the data collected by our onshore and offshore surveys.

Analysis of the data obtained and CCP's understanding of the geology and geologic processes operational in the site area will allow us to identify potential impacts of the project on the environment and impacts of the environment on the project.

3.2.2.1 Tasks

1. Review the pertinent geologic literature and available reports of the Santa Barbara Channel and nearby onshore areas.

2. Compile regional physiographic, geologic, tectonic, and seismic maps and describe the general geology and seismicity.

3. Identify geologic processes, operational in the Santa Barbara Channel and onshore that could affect or be affected by the project.

4. Determine and describe the onshore geologic and soil conditions by mapping, sampling, testing, and observing.

5. Determine the offshore geologic conditions by performing a comprehensive shipboard geophysical survey.

6. Prepare a plot of the actual survey ship track.

7. Prepare a bathymetric map of the area surveyed.

8. Analyze the seismic reflection, side-scan sonar and magnetometer profiles in terms of the geologic structure, faults, geologic bedrock formations, unconsolidated sediments, areas of hard bedrock, unusual sediments, shallow gas accumulations, surface features of the sediments (e.g., sand waves and erosion), mass wasting phenomena (e.g., subsea landslides or slumps), evidence of liquifaction and subsidence.

9. Prepare an isopach map of unconsolidated sediments.

10. Prepare a geologic hazards map.

11. Prepare a map of known mineral deposits (oil and gas).

12. Determine the impacts on the geologic environment and hazards associated with the project.

3.2.2.2 Methodology

Investigation for the geology and hazard survey will proceed from the general and regional to the site-specific. A good understanding of the regional physiography, geology, and seismicity will be developed in CCP's report, and regional maps of the Santa Barbara Channel and adjacent areas will be complied to clearly display the pertinent features that are discussed in our description of the regional geologic setting. Site-specific geology and hazards will thus be put into the perspective of the regional geologic and tectonic processes.

Onshore Geologic Investigation

The area of the onshore facilities and pipeline route across the beach and sea cliff will be investigated, mapped and described by an engineering geologist to determine the geologic and soil conditions. Potential hazards and impacts of installing the pipeline will be analyzed by observing and evaluating the effects on the geologic environment of similar pipeline installations in the near vicinity. A determination of the geologic units, soil types and topographic features will be made in these cases so that the comparison if the proposed pipeline and system to the existing system is validated.

Offshore Geologic Survey

The offshore geologic survey will consist of a comprehensive shipboard geophysical investigation performed on a survey grid paralleling the 12,668-meter (41,558-foot) long route. Five lines spaced 300 meters (1,969 feet) apart will tie lines speced at 1,200 meters (3,937 feet) will be surveyed (Figure 3-1). The geophysical survey profiles will consist of the following six systems: sparker, minisparker, subbottom profiles, side-scan sonar, fathometer, and magnetometer. These systems will be operated simultaneously with essentially no mutual interference by the use of a seismic control system. The typical survey systems arrangement onboard the survey vessel is shown in Figure 3-2. A dart corer will be availaboe onboard the survey vessel so that selected samples of the bottom material can be obtained. The navigational positioning system consists of a miniranger with two onshore transponder stations.

Survey Vessels

The survey vessel used for the offshore geophysical profiling will be the M/V Bearing Explorer or the R/V Seamark

M/V Bearing Explorer - This is an all steel seismic vessel capable of sustaining operations 24 hours per day on the high seas. It has 10 large cabins and will accommodate 25 people. Due to its wide (32 feet) beam, the Bering Explorer is an extremely stable sea vessel.

General Specifications:

- Length: 120 feet
- Beam: 32 feet (9.7 meters)
- Draft: 7 feet (2.1 meters)
- Tonnage: Gross - 147 tons
  Net - 99 tons
- Speed - Cruising: 8 knots
- Main Engine - Two Catepiller D-375 600 horsepower

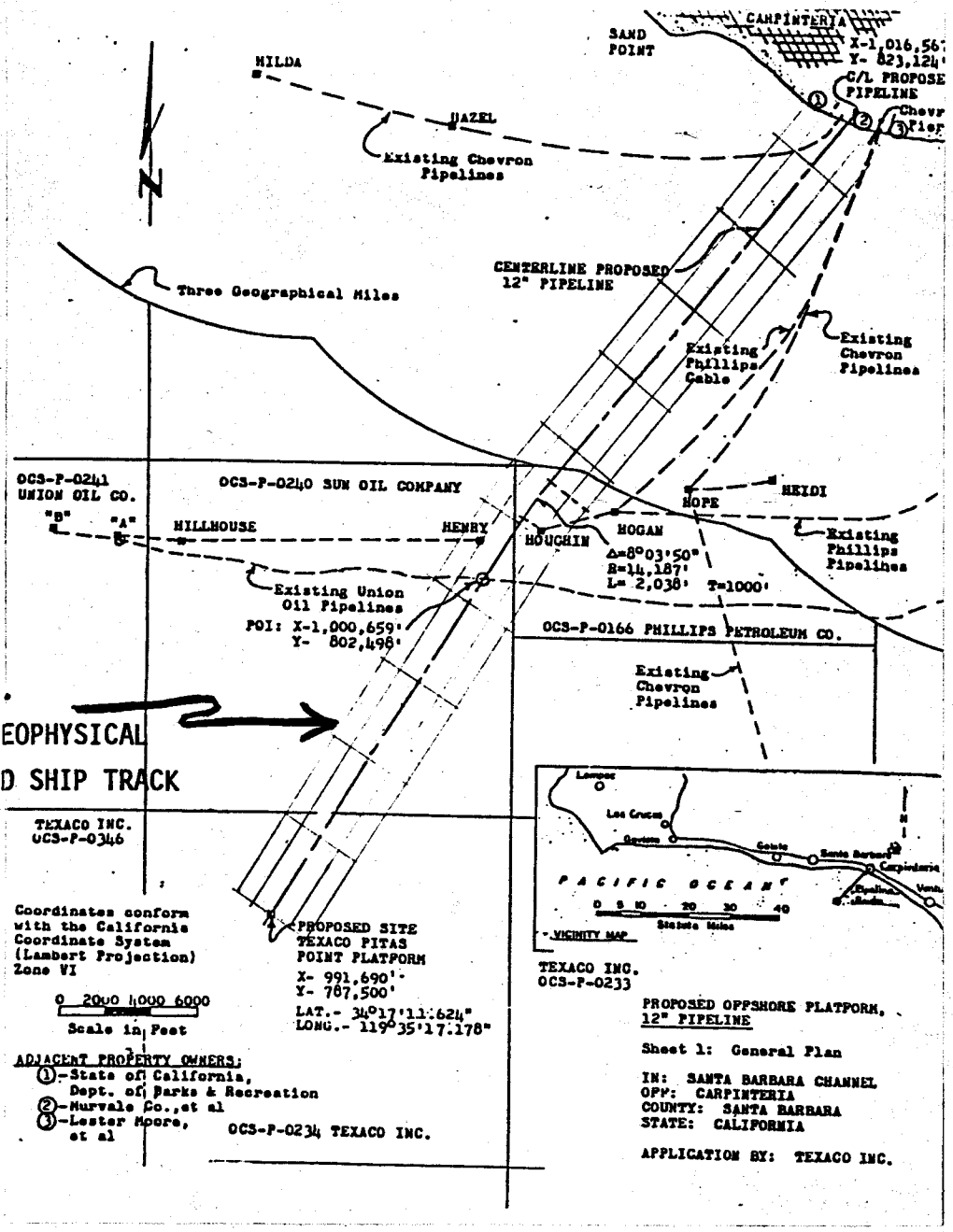
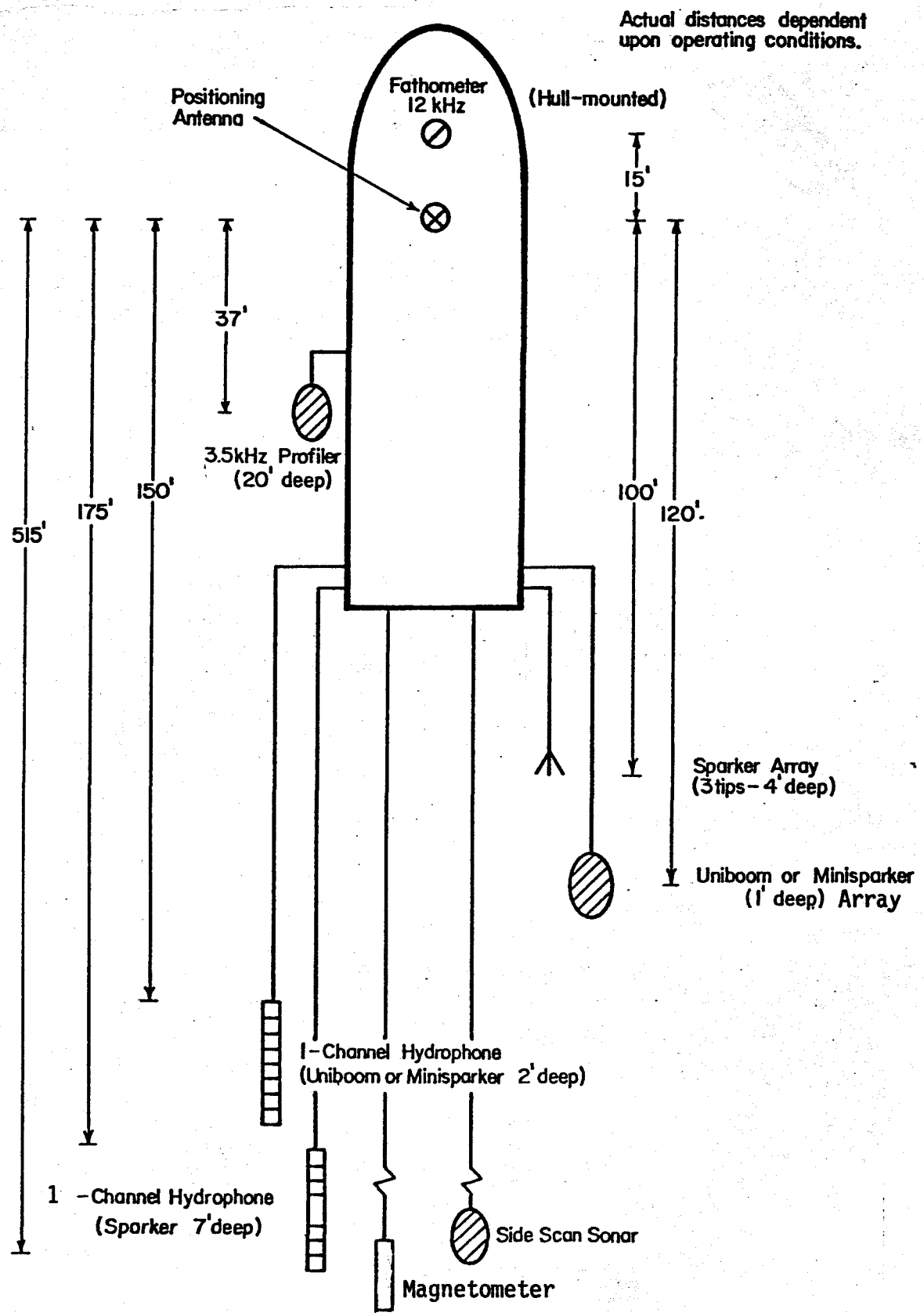


Figure 3-1.
PROPOSED GEOPHYSICAL SURVEY GRID SHIP TRACK

Figure 3-2. R/V SEAMARK

Typical Survey Systems Arrangement



Electrical Power - 1-30 KW AC generator powered by 3-71 GM Diesel
1-75 KW AC generator powered by 6-71 GM Diesel
1-100 KW AC generator powered by Caterpillar Diesel

R/V Seamark - This vessel is 109 feet in length and, having ample accommodations, Seamark easily operates 24 hours a day for periods of up to 2 weeks. The vessel is a twin-screw diesel, welded steel construction, with pilot house-controlled engines. The bridge is well equipped with the necessary and appropriate navigation and communication gear and adequate space is allocated to the special navigational positioning electronics a few feet from the helm.

General Specifications:

Length - 109 feet (33.2 meters)
Beam - 24 feet (7.3 meters)
Draft - 8.5 feet (2.6 meters)
Gross Registered Tonnage - 177 tons
Main Propulsion - Twin Screw, each shaft driven by a V8-71 GMC Diesel
Electrical Power - Two 30 KW Generators
- One 60 KW Generator
110V and 208V available

Survey Equipment Descriptions

The geophysical survey equipment (with the exception of the magnetometer) and vessel are all owned and operated by our subcontractor, Nekton, Inc. Following are brief descriptions of the six profiling systems we will use:

High Resolution Analog Sparker System

1. Capacitor Bank and Firing System: Designed and constructed by Nekton, Inc., and permanently installed on R/V Seamark. Variable power output from 3 to 30 kilojoules. Power discharged

to the sea through from one to six electrodes. The flexibility in selecting power outputs is ideal for survey areas with varying water depths and geologic conditions.

2. Hydrophone: Two-channel streamer constructed by Nekton, Inc. Data will be recorded from one channel, with the second channel as a spare. Each channel consists of 20 Teledyne geophones in a linear tapered array.

3. Graphic Recorder: EPC Labs Model 4600 modified with Nekton's ESR-II control board. The ESR-II provides backup for the real-time processing functions of the ESQ-II controller.

Multitip Minisparker System

1. Acoustic Energy Source: Nekton, Inc., capacitor bank and firing system. Variable power output from 1,500 to 6,000 joules. Nekton has developed a tow unit adjustable to 12, 30, or 45 electrode tips.

2. Hydrophone: Nekton, Inc., single-channel streamer containing 15 Teledyne geophones wired in parallel.

3. Graphic Recorder: EPC Labs Model 4600 modified with Nekton's ESR-II control board. The ESR-II provides backup for the real-time processing functions of the ESQ-II controller.

4. Filter/Amplifier: Ithaco Model 4302 Dual 24 dB/octave filter to provide precise band pass filtering of seismic signals.

3.5 kHz Subbottom Profiling System

1. Acoustic Energy Source/Receiver: ORE Model 1036 towed transducer. Variable power output from 2 to 10 kilowatts.

2. Signal Amplifier/Filter: ORE Model 140 transceiver.

3. Graphic Recorder: EPC Labs Model 4600 modified with Nekton's ESR-II control board. The ESR-II provides backup for the real-time processing functions of the ESQ-II controller.

4. Water Column Bubble Detection: Provides good bubble detection capability in conjunction with the 12 kHz fathometer.

Side-Scan Sonar - Seafloor Mapping System

1. Acoustic Energy Source/Receiver: EG&G Model 272 dual channel towfish. Operated at 105 ±10 kHz with beam pattern 1.2° x 50°.

2. Signal Amplifier/Filter/Processor: EG&G SMS 960 microprocessor-based system. The SMS 960 applies automatic spatial corrections for slant range and survey speed such that the record is a true plan view. Automatic amplitude corrections are also applied such that the darkness of the record relates directly to the backscattering strength of the seafloor material. The SMS 960 also stores minimally processed data on digital magnetic tape for reprocessing through the system or image enhancement by computer.

3. Tow Cable: 1,800-foot double-armored steel cable. Optional vane depressor for deep towing.

12 kHz Fathometer

1. Acoustic Energy Source/Receiver: Hull-mounted 12 kHz UQN transducer operated at 800 watts power output.

2. Graphic recorder: Gifft Model 1C-19-T modified to permit reverse printing for proper line orientation.

3. Water Column Bubble Detection: Provides good bubble detection capability when used in conjunction with the 3.5 kHz profiler.

GeoMetrics Marine/Airborne Proton Magnetometer - Model G-801/3

This is a versatile high performance marine/airborne proton magnetometer system. Outputs include a five-digit front panel display, simultaneous duel channel analog, and five BCD data characters. Operation is on AC or DC power. Complete typical system includes console, appropriate airborne and/or marine sensor, single or dual channel analog recorder, and ancillary equipment.

Dart Corer

Seven hundred pound Dart core body 3-foot - 2.75-inch ID barrel with plastic liner and wench with 2,000-foot cable.

3.2.3 Water Quality

Water quality in the project area will be affected by the emplacement and erection of the platform and pipeline, the discharge of various wastes associated with operations, and a possible accidental event such as an oil spill.

Setting the platform on the seafloor would cause an increase in water column turbidity resulting from stirring and suspension of bottom sediments. Driving of piles within each of the jacket legs may result in the vibratory suspension of sediment. The action of laying the pipeline would also cause some disturbance and suspension of bottom sediments. The magnitude and extent of the resulting turbidity will depend on the nature of the substrate, grain size of the sediment, the prevailing current, and the duration of the activities. Adverse impacts can result when bottom materials are resuspended and pollutants remobilized into the water column.

Substances discharged during operations will result from two types of activities: (1) the routine day-to-day activities, and (2) the occasional massive emission events such as an oil spill which results from equipment failure, poor operation technique, or a variety of events.

One of the main purposes of the water quality study will be to characterize offshore oil drilling and production platform fluid wastes--then focus on the impact these wastes will have on the existing water quality and evaluate technology available for development of mitigation measures.

Offshore platforms waste stream can be classified as to:

1. Produced water;
2. Deck drainage;
3. Drilling waste;
4. Sanitary waste; and
5. Domestic waste.

The produced water is the major potential liquid waste source on a platform. This waste stream includes:

1. Hydrocarbons;

2. Suspended solids;

3. Wet stimulation materials (mud acidizing, matrix acidizing, fracturing);

4. Scale inhibitors;

5. Corrosion inhibitors; and

6. Miscellaneous additives.

Deck drainage may contain emulsitives and is erratic in occurrence, volume and oil content, because the volumes vary greatly. These conditions make it impossible to handle deck drainage with the same equipment as produced waters.

There are two drilling wastes that must be considered in the project:

1. Water-base drilling mud; and
2. Drilled cuttings.

The water-base drilling mud contains a wide variety of materials. Table 3-1 contains some common water-base mud systems.

Few studies have been done to investigate the drilling mud effect on the ocean water quality. Drilling mud discharge seems to generally have a local water quality effect that is attenuated at increasing distances from the discharge source. Mud and drill cuttings settle to the ocean floor and may eventually be transported to the deep ocean floor or basins.

As discharged material settles, associated trace materials may undergo an ion-exchange process causing movement of dissolved constituents from the drilling mud to the surrounding water column or vice versa. Settling solids from drilling operations may have suspended solids adsorbed into them, may be adsorbed into the surface of aquatic organisms, or may be ingested with food particles.

The dilution of the drilling discharge plume, resulting from drilling mud and drill cutting discharge depends on the kind of mud used, its discharge rate, the water depth, surface and subsurface currents and ocean physical characteristics.

Ocean water quality may be degraded by the following drilling mud and cuttings chemical and physical properties:

1. Increased trace material concentration:
   - Barium: used as a weighing material
   - Chromium: used as a dispersant
   - Lead: present in drilling fluids and lubricants.
2. High dissolved oxygen demand.

Table 3-1

SOME COMMON WATER BASE MUD SYSTEMS FREQUENTLY USED IN OFFSHORE WELLS

MUD SYSTEM	LIQUID PHASE	SOLID	THINNERS	pH CONTROL	OTHER
		0-2,500 Feet			
Natural Mud	Freshwater or sea water	Bentonite, formation clays		Caustic soda (NaOH)	
		>2,500 Feet-Total Depth			
Caustic-quebracho or "red" mud	Freshwater	Bentonite, formation clays, barite	Quebracho or tannins	NaOH	Sodium Acid pyrophosphate (SAAP), soda ash (Na_2CO_3), sodium bicarbonate ($NaHCO_3$), specialties
Lignosulfonate mud	Freshwater or sea water	Bentonite, formation clays, barite	Chrome lignosulfonates, lignites	NaOH	SAAP, Na_2CP_3 $NaHCO_3$, Specialities
Polymer mud	Freshwater	Formation clays, polymers, asbestos		NaOH	Surfactants, specialities Potassium Chloride (KC1)

Other materials may be added to any mud system to combat specific hole problems. To combat lost circulation, a variety of fibrous or bulky solid materials may be added. In deep wells, oil may be added (forming an oil-in-water emulsion system) to combat sticking of drill string or for other reasons. When oil is added, small amounts of defoamers, surfactants, or emulsifiers often are added also. Oil-contaminating muds are not discharged to the sea.

Source: Study of Pollution Control Technology for Offshore Oil Drilling and Production Platforms, Exxon Research and Engineering Company.

3. Raised temperature.
4. Increased light attenuation.
5. Reduced hydrogen ion concentration (elevated pH).
6. High concentrations of organic carbon, total nitrogen and phosphorous.

The major potential pollutants from sanitary and domestic waste include:

1. Soaps and detergents
2. Food particles
3. Urine and feces
4. Paper

The sewage wastes will be treated before they are discharged into the ocean. Treated sewage may have a significant effect on the ocean water quality in the immediate area of sewage discharge. This impact would result from the treated sewage exerting a slight increase in the oxygen demand, nutrients, residual chlorine and light attenuation.

For this project, the NPDES permit application filed with the EPA will be reviewed as to impact on the existing water quality and sediments.

Water quality may be further degraded as a result of an accidental oil spill or oil leaks into the ocean. While chronic spills represent constant insidious pollution to the ocean, major spills represent the major environmental concern for offshore oil production.

Finally, degradation of water quality caused by the proposed drilling and production operations must be viewed in the context of cumulative water quality degradation caused by all human activities in the Santa Barbara Channel area.

3.2.3.1 Tasks

1. Outline necessary information to be obtained to fully evaluate the impacts of drilling and production in the project area on water quality.

2. Determine the existing data base of present water quality conditions in the project area by reviewing all pertinent published and unpublished reports and contacting water quality chemists who have worked in the project area.

3. Determine the types of waste generated by offshore platforms during drilling and production operations.

4. Determine the constituents of these wastes and their rate of generation.

5. Evaluate the probable impacts of the construction, production, and drilling operations on water quality.

6. Work with oil spill team to evaluate probable impacts from accidental oil spill.

7. Recommend procedures for mitigating adverse impacts by evaluating current waste handling practices.

3.2.3.2 Methodology

A description of existing water quality conditions in the project area will be developed by reviewing all the published and unpublished literature available for the Santa Barbara Channel area. This available literature includes studies by BLM contractors on water column chemistry and sediment chemistry as part of the Southern California Bight program, studies by Cal COFI in the California current, the Allan Hancock Foundation's oceanographic surveys for the California Water Quality Control

Board, and studies of chemical parameters of the Santa Barbara Channel related to the 1969 oil spill. The literature review will be accompanied by personal interviews with water quality chemists who have worked in the project area.

Once the probable water quality characteristics in the project area have been determined, impacts on water quality will be assessed by reviewing all the data available on the effects of drilling and production operations on water quality. The types of wastes to be generated will be determined as well as the constituents of these wastes and their generation rates. Some information is available on the fates and effects of drilling muds and cuttings (Ray and Shinn, 1975; Sheen Technical Subcommittee, 1976; Shinn, 1974). Considerable information has also been published on oil spills (for example, NAS, 1975; Kolpack, 1971; Foster et al., 1971).

The EA/EIR will present a detailed discussion of existing water quality conditions in the proposed project area. The value of inputs to the area caused by the proposed offshore operations will be detailed. The spatial extent of water quality impacts will be estimated. Discussions of all probable impacts associated with the proposed operations will be presented in enough detail to adequately assess all the water quality impacts. All primary and secondary long-term and short-term probable impacts on water quality will be thoroughly discussed. Cumulative impacts of this project in relationship to other human activities in the Santa Barbara Channel area on water quality will be discussed. Alternatives will be examined. Mitigation measures will be developed for those impacts that cannot be eliminated by project alternatives. Data gaps will be identified. Finally, a detailed monitoring plan will be presented if deemed necessary to evaluate water quality parameters before, during, or after the proposed drilling and production operations.

3.2.4 Air Quality

In analyzing the air quality aspects of resuming drilling operations by Texaco, Inc., in the Santa Barbara Channel off Carpinteria, extensive use of existing information sources will be made.

The basic approach to air quality analysis is to:

1. Determine the existing air quality and meteorological conditions.

2. Determine emission sources and calculate emissions.

3. Compare impacts with State and Federal standards and determine consistency with State Implementation Plans (SIP).

4. Discuss mitigation measures for identified impacts.

The Department of Interior has jurisdiction over activities dealing with the development and production of petroleum from OCS waters (beyond 3 miles from shore). Since most of the emissions associated with this project will be from sources located in OCS waters, the Department of Interior rules and regulations will be applicable. The Department of Interior has adopted rules (45 FR 15128) implementing the mandate from the Outer Continental Shelf Lands Act Amendments of 1978 (P.L. 95-372) which indicates the OCS activities must comply with National Ambient Air Quality Standards whenever OCS activities significantly affects the air quality of any State. In addition, the Department of Interior has proposed revisions (45 FR 15147) to the new rules applicable to OCS waters off California which has a separate, more stringent set of exemption formulas and significance levels.

3.2.4.1 Tasks

AeroVironment, Inc. (AV), will perform the air quality analysis associated with the EA/EIR as subcontractor to CCP. The specific tasks to be performed are as follows:

1. Characterization of Existing Environment - This task involves the characterization of the existing air quality, meteorology, and climatic conditions in the project area. AV's existing data base from the OCS Lease Sale 48 project and other available reports will be used. AV is currently operating an air quality monitoring station near the shoreline in Carpinteria.

2. Emission Calculations - Process equipment and procedures will be identified. Emission sources and quantities of SO_2, NO_x, CO, H_2S, RHC, and particulates will be determined. The worst-case hourly, daily, and annual emissions will be calculated based on emission factors obtained from a review of the information available from the extensive literature on OCS activities. Emissions will be calculated for three different phases of this project--platform installation, drilling and development, and production.

3. Impact Analyses and Report Preparation and Responses to Comments and Public Hearings - Impacts will be quantified and compared to State and Federal ambient air quality standards, Federal PSD regulations, and the OCS significance levels. The impact of the proposed action on areas of nonattainment of the air quality standards will be assessed and discussed. A discussion of consistency with the SIP will be made. A technical report detailing the assumptions, methodology, and results of the analysis will be prepared. This task includes responding to comments on the reports and coverage of both public hearings.

3.2.4.2 Methodology

Existing Environment

AV has a detailed knowledge of the existing air quality and meteorology conditions in the Santa Barbara Channel area. AV's previous work for the BLM in connection with the air quality aspects of the Environmental Impact Statement (EIS) for OCS Lease Sale 48 (AV, 1977; BLM, 1979) as well as other recent information (Trijonis et al., 1976; Taylor, 1977; Santa Barbara, 1976; ASPO, 1977; OCS PTF, 1977; UCLA, 1976) has kept them abreast of information about the Southern California coastal area. In addition, AV is presently performing air quality analysis for an EIS (as a subcontractor to CCP) for some offshore developments in California State Lands waters off of Oxnard.

The wind flow pattern in the Santa Barbara Channel area is dominated by the land/sea interface. Normal flow is generally inland during the day and seaward at night. DeMarris, et al. (1965) indicates that the normal air flow throughout the year is almost along the coast on the southward facing coastline south of Point Conception.

Needed information will be gathered from previous EIRs and current projects such as the proposed Point Conception LNG terminal.

Emissions Calculations

Detailed calculations will be conducted to quantitatively assess the emissions generated during three phases of this project--platform installation, drilling and development, and production. Emission calculations to be made will include sources such as the shipment of materials to and from Port Hueneme, crew and supply boats, and helicopters serving the project. The air quality aspects from drilling and well testing operations will be addressed. Such calculations will be made by first compiling an inventory of all potential sources and then determining the worst-case emission rate from each on an hourly, daily, and yearly basis

for each of the criteria pollutants. Emissions of the offshore treatment of production will be addressed.

Information must be compiled with regard to fuel types, power ratings, fuel consumption, etc., for each source evaluated. Factored into these calculations will be any proposed control technology, such as vapor recovery, applied to the various emission sources. Calculations will be made not only on point sources, but will also include fugitive sources such as sumps, valves, etc. The emission rates thus obtained may then be compared with that allowed under applicable rules and regulations.

The above calculations will be performed using standard emission factors and/or other available data (EPA, 1978; ARB, 1977; and other EIRs). These emissions will then be compared to similar operations for which information is available. Since AV has performed work of a similar nature on proposed Lease Sale 48 for the BLM, a considerable data base is already readily available (BLM, 1979). Air pollution control technology will be evaluated against similar processes.

Impact Analysis

The results from the initial emission calculations task will be used to model air quality impacts onshore. The results will be compared with all applicable local, State and Federal air quality standards including the levels of significance used by the Department of Interior in their proposed OCS rules. PTMTP will be used to determine inert pollutant impacts while EKMA will be utilized for the photochemical impacts. The project will also be evaluated for consistency with the AQMP for Santa Barbara County. The AQMP specifies the strategies required to bring the County into attainment of all Federal standards. Because of the sanctions specified in the Clean Air Act of 1977 for areas which do not reach attainment, the consistency of all projects with this plan is very important. The modeling techniques are consistent with the techniques used in the Santa Barbara AQMP.

The Santa Barbara APCD does not have existing rules and regulations, nor legal jursidiction, on emissions in OCS waters (beyond 3 miles from shore). The Department of Interior's rules apply for emissions in OCS waters. The emissions and impacts from this project will be compared with requirements specified in their rules. Since offsets are allowed by Department of Interior rules as part of the mitigation of impacts from OCS activities, AV will review recently completed offset availability analyses in the Santa Barbara area (as part of an EIS for Union Oil Company activities in State Lands waters).

3.2.5 Noise Environment

Noise, which only a few years ago was considered to be an essential by-product of technological progress, is now regarded as a major form of environmental pollution and a significant public health hazard. As a result, almost every department of the Federal Government is responsible for some aspect of noise control or evaluation; many state governments have passed noise-related legislation and established noise control responsibility in state agencies; and, especially in the past 2 years or so, there has been a proliferation of noise control ordinances and regulations by local governmental bodies. For example, the Occupational Safety and Health Act (OSHA) states that protection against the effects of noise shall be provided when sound levels exceed the following:

Duration Per Day, Hours of Exposure	Sound Level, dBA Slow Response	Dosimeter Reading
8	90	100
6	92	100
4	95	100
3	97	100
2	100	100
1	105	100
½	110	100
¼ or less	115	100

The question of noise has, therefore, become an important consideration in planning, in construction practices, and in the industrial environment.

The purpose of the noise assessment is to examine the existing noise environment and the impact of the proposed oil development on the noise environment. The following tasks are designed to assess the intensity and resulting impacts of the noise sources, the relative impacts of the alternatives and develop feasible mitigation measures. We have segregated the tasks into two categories: Offshore Noise Environment and Onshore Noise Environment.

3.2.5.1 Tasks

Offshore Noise Environment

1. Noise environments on oil platforms will be predicted by examining past experiences and data accumulated on similar offshore structures. Major noise sources are tools, power and maintenance machinery, and heliport.

2. The offshore noise levels will be compared to the OSHA standards for permissible noise exposure.

3. Noise control measures such as the installment of acoustical partitions and other noise abatement procedures applicable to oil platform operation will be presented for any adverse noise impacts associated with offshore drilling.

Onshore Noise Environment

1. The current noise environment may have already been assessed in recent EIRs. If not, the current noise environment will be measured and recorded.

2. The contribution to the current noise environment due to projected construction and operation programs will be predicted based on past EPA and other studies on similar construction and operation projects.

3. If a heliport is to be built at the terminal for connection with the offshore platforms, its noise impact will be predicted following standard practice.

4. The construction and operational activities will generate some additional traffic on the roadways leading to the site. The increased noise levels due to this increased traffic will be evaluated utilizing a complex proprietary noise computer model. Noise contours (65 and 70 dBA) will be generated for the roadways in the study area.

5. The noise levels in the study area will be compared to applicable Federal, State, and local standards.

6. An array of noise abatement measures will be presented for any adverse noise impacts associated with the construction and operation of the project, as well as noise due to the generation of additional traffic.

3.3 BIOLOGICAL STUDIES

3.3.1 Marine Resources

The Santa Barbara Channel is rich in marine resources. Commercial fishing vessels, sports party boat and skiffs are operated throughout the area. Sport catches in the Santa Barbara Channel are dominated by rockfish and bass, while commercial landings include anchovies, jack mackeral, white seabass, rockfish, bonita, and flatfish. From Rincon Point, south of Santa Barbara, to Point Conception lie the largest and most dense strands of giant kelp on the southern California coast. For almost 80 kilometers, a nearly unbroken band of giant kelp dominates a zone from 5 to 25 meters in depth, and covers the surface for up to 1 mile offshore. South of Rincon Point, the kelp beds are highly variable. The coastline is transitional in nature as it is subjected to waves

approaching from almost any storms. The southwest exposure of the Pitas Point coastline differentiates these beds from the protected beds of Santa Barbara County to the west.

Impacts on Santa Barbara Channel marine life that might result from the proposed offshore oil development include disturbance to the benthos from the emplacement of pipelines and the construction of the platform, alteration of habitat by the proposed structures, effects of drill cuttings, drilling muds, and waste substances associated with operations, attraction of fishes (artificial reef effects), disturbance to marine life by noise and activity, and effects of leakage or spill of oil and/or gas during operations or as an accident or blowout.

A certain number of benthic organisms would be directly disturbed by the erection of the platform and the emplacement of the pipeline. Platform construction and pipe laying would also result in turbidity and the possibility of burial and smothering.

The construction of the platform and the associated pipeline will modify the habitat for marine organisms in the area. Oil platforms are well known to act as artificial reefs (Mearns and Moore, 1976). These platforms rapidly become covered with such organisms as mussels, anemones, and scallops which encrust natural rocky reefs (Carlisle, Turner, and Ebert, 1964). Large populations of fishes congregate around these structures. Huge numbers of normally rocky bottom starfish are found under the platforms (Wolfson et al., 1978). The artificial reef nature of the platform might be considered a positive environmental impact of the proposed development. The effect of the platform and pipeline on the natural soft bottom community in which they will be placed should also be considered, however. CCP personnel have shown that many soft bottom animals can be severely impacted by the emplacement of artificial structures in their environment (Davis, 1978). Effects of artificial structures on the soft bottom community can be detected at least as far away as 100 meters from some structures. The pipeline, too, will act as a long, low artificial reef and will probably have some of the same

artificial reef effects as the platform. Kelp plants and abalone have been found growing on subsea pipelines in the Santa Barbara area (B. Evans, personal communication). The direct effect of the presence of oil platforms on planktonic organisms is unknown. It is conceivable that the large number of plankton-feeding invertebrates and fishes associated with oil platforms could have an important impact on the plankton communities in currents flowing past the platform.

The principal commercial fishing activity that would be affected by the platform and pipeline would be trawling. Purse seining would less likely be affected by the fixed restricted area because of the widespread distribution of pelagic species such as anchovy and mackeral.

The discharge of drill cuttings and drilling muds can cause a smothering effect on the burrowing and attached benthos in areas where the material gradually settles as a layer of significant thickness. Fine particles can clog the respiratory organs and filter-feeding mechanisms of many marine animals.

There could be impacts on plankton from drill cuttings, drilling muds, and sewage and production water waste discharges. Field studies have indicated that drill cuttings do not significantly increase the water turbidity around the platform (Ray and Shinn, 1975). However, drilling muds discharged overboard or entrained with the discharged drill cuttings will usually create a turbidity plume extending down-current from the discharge point. The local increased turbidity caused by the plume could decrease phytoplankton photosynthesis by obstructing light penetration in the plume area. The turbidity could also have a smothering effect on some zooplankton species in the surface layer of the water column in the plume area and could result in temporary clogging of the filter feeding mechanisms of some zooplankters resulting in decreased filtering and feeding efficiency. In addition, some drilling mud components can be toxic to marine organisms. McAuliffe and Palmer (1976) have summarized the published toxicity data for drilling fluid components. Lethal concentrations of any toxic components of the drilling

mud discharges would probably occur only near the discharge point from the platform. Sewage and production waste discharges from the platform could also cause local impacts on the plankton passing by the discharge sources. Sewage discharges are regulated by OCS orders and EPA NPDES permits. Although the sewage effluent will be diluted rapidly by mixing with ocean water, impacts could include stimulation of phytoplankton productivity around the discharge points or photosynthetic depression by the chlorinated effluent.

Fishes are apparently attracted to the drill cuttings as the particles drift down through the water column and they may sample the cuttings as food objects (BLM, 1979). The possible toxic effect on the fishes of the drill muds and cuttings has not been determined.

Oil spilled during operations could have a deleterious impact on all marine life with which it comes in contact. If a major oil spill did occur, the potential impacts on the sensitive biological communities of the Ventura and Santa Barbara wetland areas, the rocky intertidal, the kelp beds, and the northern Channel Islands would be a serious concern.

The potential effects of oil pollution on a fishery have been summarized by Jackson (1968):

1. Harm the living resources on which the fisheries are based.
2. Interference with fishing gear and operations.
3. Harm to consumers of contaminated marine products.
4. Adverse effects on market of actual or feared reduction of quality of products.

Spilled oil, discharged drilling muds, and trace metal pollutants may have long-term impacts on marine food webs. Any increase or decrease in phytoplankton or benthic productivity as a result of offshore operations, could be expected to affect higher trophic levels in the food web.

Straughan (1971) estimated the bird population of the Santa Barbara Channel to be 85,000 between April and May 1969. In addition, the northern Channel Islands are important breeding grounds for a number of marine bird species including the endangered Brown Pelican.

Impacts on marine birds from offshore oil production in the Santa Barbara Channel could result from acute and chronic oil spills, increased human disturbance, interference with feeding caused by turbidity plumes, and the potential for an increased contamination of the ecosystem and the birds' food supply.

The Santa Barbara Channel area is considered the single most significant area in terms of possible impacts on marine mammals within the Southern California Bight (BLM, 1979). All of the northern Channel Islands except Anacapa have pinniped breeding areas on their shores and all have haul-out areas. Pinnipeds have been observed to haul-out near the Chevron Oil pier. The Channel itself serves as a major migration corridor for cetaceans.

Marine mammals could be impacted by acute or chronic oil spills as a result of offshore oil operations, increased human activities and disturbance, and ecosystem contamination. Turbidity plumes might interfere with feeding in a localized area. Cetaceans are in danger of being hit by boats, especially those species which depend on a reasonably normal acoustic environment for spatial or social orientation and thus would be more liable to being struck in the vicinity of a ship's noise. The noise of the platform itself may have an effect on marine mammals. CCP is currently working as a contractor for the Naval Ocean System Center's program to determine the effect of noise of oil operations on marine mammals.

While a major oil spill as a result of offshore oil operations is unlikely, if such a spill occurred and impacted the Channel Islands, the effects on some marine mammal populations could be disasterous.

3.3.1.1 Tasks

1. Outline necessary information to be obtained to fully evaluate the impacts of the proposed offshore oil operations in the project area on marine resources, marine birds, and marine mammals.

2. Determine the existing data base by reviewing all pertinent published and unpublished reports and contacting biologists and fishermen who have worked in the project area.

3. Conduct a biological survey by continual visual coverage as specified by BLM requirements.

4. Map the significant biological resources in the area.

5. Identify and describe the structure of the biological communities that may be affected directly or indirectly by the proposed offshore operations.

6. Identify all rare, endangered or sensitive species in the area.

7. Consider all human use of biological resources and work with socioeconomic study team to assess economic impact of the proposed project on sport and commercial fisheries and the tourist industry.

8. Recommend procedures for mitigating adverse impacts.

3.3.1.2 Methodology

A description of marine communities in the project area will be developed by reviewing all the published and unpublished literature available for the Santa Barbara Channel area. CCP has recently reviewed all this

literature as part of its preparation of the EIR for Resumption of Exploratory Drilling Operations in State Oil and Gas Lease PRC 3314.1, Ventura County. Beacuse of the Biology Team's previous experience in the general project area, the literature reveiw for the EA/EIR can be accomplished with maximum efficiency. The literature review will include assessment of sport and commercial fisheries within the project area. In addition, literature review will be accompanied by personal inverviews with marine biologists who have worked in the project area. For example, Stephen Newswanger of Santa Barbara City College has been collecting data for years on mollusk populations in the Santa Barbara area. A particularly useful source of information will be the faculty and graduate studies of the University of California at Santa Barbara. To obtain first hand information on fisheries, we will consult California Department of Fish and Game officials as well as John Richards, the Sea Grant Marine Advisor for the Santa Barbara area. Another useful source of information on local fisheries and aquaculture will be Win Swint, a Santa Barbara abalone driver and abalone farmer. Mr. Swint has worked with CCP before and is extremely familiar with local fishing and agriculture activities.

Once a general description of the marine life in the project area has been prepared from the literature review, the marine biological survey of the pipeline route will be performed. As specified by BLM, the principal means of investigation will be continuous visual coverage. A Hydro Products TC 125 Television Camera will be towed behind the boat. This television system can be optimized for maximum viewing in water and can actually "see" farther than a diver. Dr. Davis will be onboard during the video survey and she will view the transects through a Hydro Products SC 303 TV System Control Unit. Dr. Davis has previously performed similar video transects in the Santa Barbara Channel as part of her evaluation of the impacts of Platforms Hilda and Hazel on soft bottom benthic communities. A video system is preferred to a 35 mm. movie system because it allows the scientist to view the transect while it is being performed. If something of particular interest appears, that area can be covered in more detail. In addition, an area of particular interest can be marked and Dr. Davis can investigate any such

areas further by SCUBA diving. The video camera cannot be towed through a kelp bed. If a kelp bed is on the pipeline survey route, Dr. Davis and and associate marine biologist will cover that area by SCUBA diving. The video camera will be accompanied by a still 35 mm. camera with color film. During the field survey, data will also be taken on seabird and marine mammal activities within the survey area.

Should additional surveys of box core samples be necessary, CCP has full capabilities to take those samples and have them analyzed. The BLM requirements state "If box core samples are required, they shall be taken so as to be compatible with standard sampling procedures used during BLM's baseline studies." For infaunal work, CCP uses scientists who actually participated in BLM's baseline program, so compatibility with the BLM program would pose no problem.

The information from the biological field survey will be used to generate approximate population densities of benthic and pelagic macroorganisms along the pipeline route. Percent coverage of benthic species will be summarized, and a map which shows the areal distribution and densities of species along the pipeline route will be prepared.

Once the marine communities in the project area have been delineated and mapped, probable environmental impacts will be assessed by reviewing all the data available on environmental effects of drilling, production, and pipeline operations. These available data include studies on the effects of drill muds and cuttings (Ray and Shinn, 1975; McAuliffe and Plamer, 1976), studies on the artificial reef effects of vessels, pipelines, and structures (Gooding and Magnussen, 1967; Davis, 1978) and studies on the effects of oil spills (Foster et al., 1971; Straughan, 1971; etc.).

The EA/EIR will present a detailed discussion of the existing biological environment in the proposed project area. Community structure and ecology of the area will be discussed. Any sensitive or unique marine communities or species will be identified. The existing environment in the area most likely to be impacted by the project will be compared with

other coastal areas. The importance of the project area to the California coast will be discussed and the uniqueness of the biological communities will be evaluated. Discussion of all probable impacts associated with the proposed action will be presented in enough detail to adequately assess the environmental impacts. All primary and secondary long-term and short-term probable impacts will be thoroughly discussed. Alternatives will be examined. Mitigation measures will be developed for those impacts that cannot be eliminated by project alternatives. Data gaps will be identified. Finally, a detailed monitoring plan will be presented if deemed necessary to evaluate biological conditions before or during the proposed offshore oil opreations.

3.3.2 Terrestrial Biota

The terrestrial biota along the onshore portion of the gas pipeline will be impacted during construction. The main area of potential concern is the coastal bluff habitat south of the Southern Pacific Railroad right-of-way; additional biotic resources north of this corridor include landscaping and other features within the industrial Chevron facilities. Misfunction or catastrophic accident would produce impacts similar to construction during repair; significant fire/explosion hazard could occur in surrounding areas.

Alternative project elements include limited oil production. Mishaps associated with this production might release an oil spill. Similarly, oil might accidently be released in a blowout from geological formations encountered down the gas well. Such a spill could have potential impact on low-lying terrestrial habitats such as coastal salt marsh, river mouth, and beach/sand dunes between perhaps Goleta and Point Mugu; spilled oil and cleanup operations both may produce impact. For example, Endangered Belding's Savannah sparrow breeding populations at Goleta Slough, Carpinteria Slough (El Estero), McGrath Beach State Park, Ormond Beach, or Mugu Lagoon (Massey, 1979) could be adversely impacted by oil.

3.3.2.1 Tasks

1. Assemble existing data base of EA/EIR and related scientific literature pertinent to terrestrial biota of region and project area.

2. Identify and describe the biotic communities that may be affected by normal construction and operation or accidents associated with the proposed gas production project (including oil production potential).

3. Identify and assess the status of rare, endangered, threatened, or otherwise sensitive species in the area through literature review and personal contact with informed professionals (California Department of Fish and Game, U.S. Fish and Wildlife Service, etc.).

4. Map biotic communities in the vicinity of the proposed onshore facilities using existing reports and site reconnaissance.

5. Map locations of sensitive species and habitats in the project region using existing reports, professional consultations, and field reconnaissance (updating secondary sources).

6. Evaluate biological impacts of proposed Texaco project.

7. Recommend procedures for mitigating adverse impacts.

3.3.2.2 Methodology

A description of biological communities in the project area will be developed by reviewing all the published and unpublished literature available for the greater Santa Barbara area. CCP is currently completing a detailed EIR for Resumption of Exploratory Drilling off Ventura. As part of this project, CCP has reviewed all the available literature on

coastal communities in the Ventura-Santa Barbara area. Serge Matlovsky, the Biology Team terrestrial biologist, received his degree at the University of California at Santa Barbara and has mapped vegetation and documented baseline conditions on over 50 square miles of Santa Barbara coast. In addition, he was the terrestrial biologist for Dames and Moore on the EIR for Resumption of Drilling Operations on Platform Holly and for the construction and operation of both the Chevron 10-inch wastewater outfall (shown in RFP) and the proposed Chevron Land and Development Company development on the bluffs in the immediate project area. Because of the Biology Team's previous experience in the Ventura and Santa Barbara areas, the literature review for the EA/EIR can be accomplished with maximum efficiency.

Other reports to be used as source documents (besides W-C Chevron EIR mentioned in the RFP) include OCS lease sale documents (regional perspectives), Chevron Land and Development Company EIR (for the City of Carpinteria) Commercial and Residential development (at Baillard Avenue) on land immediately (east) adjacent to Chevron Processing Facility. This report includes intertidal zone and beach survey (qualitative), terrestrial biology and land use. Another source document is Chevron Oil - 10-Inch Wastewater Outfall EIR. This project included a pipeline (shown in RFP) across bluff and into subtidal to dispose of produced brines. The report includes terrestrial biology from Carpinteria State Beach (west) to pier (east).

The CCP terrestrial biologist, Mr. Matlovsky, will augment the personal interviews and literature search with a field survey. During the field survey biotic communities around the proposed onshore facilities will be mapped and critical habitats for sensitive species will be identified.

3.4 SOCIOECONOMIC STUDIES

There are several areas of potential recoverable gas/oil reserves in the Santa Barbara Channel area. Several oil companies individually or in

teams are planning or engaged in recovery operations in these areas. Onshore land uses and associated impacts may affect a large segment of the Santa Barbara Channel coast. A key issue for the CCP proposed program will be consistency with Coastal Act Policies and Local Coastal Plans produced by the jurisdictional entities in the area, most importantly Santa Barbara County and the City of Santa Barbara.

This portion of the study will address the socioeconomic impacts of the proposed project upon the local community and secondary impacts upon the five southern coastal counties. The existing social and economic environment will be described including current growth trends. A community profile, derived from these descriptive data, will provide the frame of reference used in the assessment of potential impacts. By superimposing the anticipated effects of the proposed project upon existing conditions, the significance of the effects can be evaluated and appropriate mitigation measures developed.

The socioeconomic profile of the surrounding area will include population, housing, employment, and economic characteristics. The existing petroleum industry infrastructures of the region will be described.

Impacts related to platform and pipeline construction, gas drilling, and gas production will be evaluated. The proposed project may increase the demand for housing and public services in the City of Carpinteria. Subsequent gas production and related onshore facilities may affect the local economy and the regional petroleum infrastructure.

Citizen concerns about offshore oil operations will be evaluated and addressed. Special consideration will be given to aesthetic impacts of the proposed construction.

Land uses along the Carpinteria coastline will be described. Conformance with the planning objectives of the Carpinteria Local Coastal Plan and the Carpinteria General Plan will be discussed. Conformance of the proposed project with Coastal Act policies regarding access and aesthetics will be discussed.

A regional overview of land and water uses along the Santa Barbara coastline will be presented. These uses include recreation, industry, and energy production. Offshore uses include recreational boating, commercial fishing, shipping, and military use.

3.4.1 Tasks

The tasks of the economic impact assessment are to determine types of economic implications the Texaco gas platform pipeline installation and onshore tie-in may have on the City of Carpinteria and Santa Barbara County. These areas of economic impacts are:

1. Industry and employment;
2. Government; and
3. Taxes.

The tasks of the social and land use studies will be to:

1. Analyze the existing social/cultural environment of the affected area and related planning objectives;

2. Identify the impacts of the proposed project; and

3. Develop mitigation measures for avoidable impacts and determine unavoidable impacts.

3.4.2 Methodology

A CCP technical specialist will meet with Santa Barbara County and City of Carpinteria planning staff members to identify potential problem areas. Existing literature will be reviewed. The proposed project will be evaluated for conformance to local and regional planning goals. Data will be collected from General Plan Amendments, Local Coastal Plans, and existing EIRs for the area concerning oil drilling and production. The Santa Barbara County Local Coastal Plan details policies concerning the

production, processing, and transportation of gas and oil. Impacts to existing land and water uses will be evaluated and mitigation measures recommended.

3.5 CULTURAL RESOURCES

3.5.1 Terrestrial

The description of the proposed project suggests that both direct and indirect impacts to terrestrial cultural resources may occur. Figure 3-3 (Exhibit Ia of RFP) and Figure 3-4 (Exhibit II) show two cultural resource sites on or very close to the pipeline right-of-way, although the two figures are not in agreement. Two other sites appear from previous survey work to be located within 2,000 feet of the proposed gasline. These sites appear to belong to both prehistoric and historic time periods. A concordance of published and archival data, including previous EIRs or feasibility studies, would set the stage for the development of suitable management recommendations.

3.5.1.1 Tasks

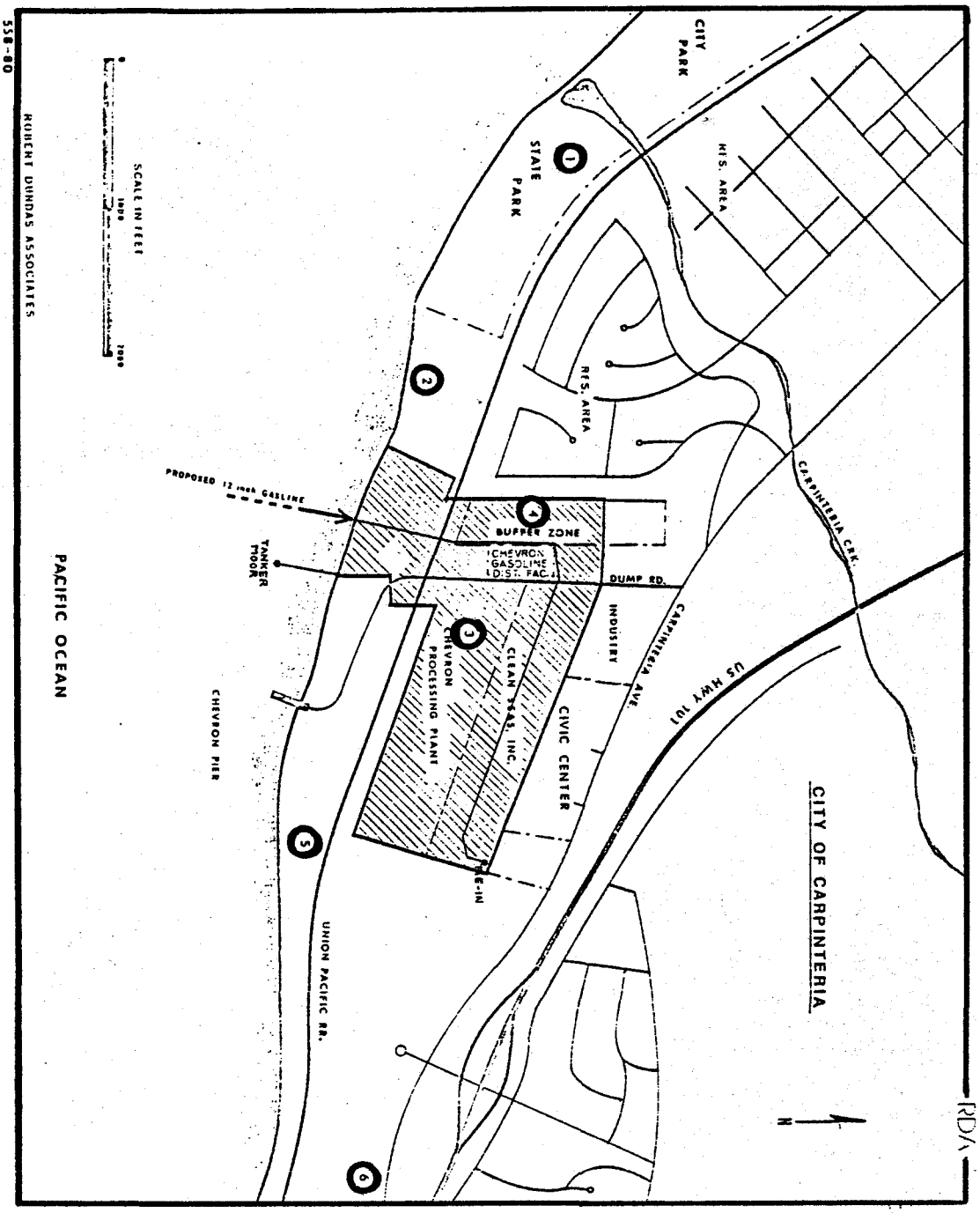
1. Execute a records check and a literature search.

2. Resurvey the pipeline right-of-way.

3. Consult appropriate representatives of the professional archaeological community , and of the local Native American community.

4. Determine the impact of the proposed development on the cultural resources that have been located.

5. Check SHPO for National Register Nominations in process for these or closely adjacent sites.



KNOWN CULTURAL AND ARCHEOLOGICAL SITES

(1) *MISHOPSHNOW VILLAGE* (Sensitive arcneological site) SBa-7

(2) *ASPHALTUM SEEP* (Designated cultural resource)

(3) *ARELLANES* (Sensitive archeological site) SBa-6

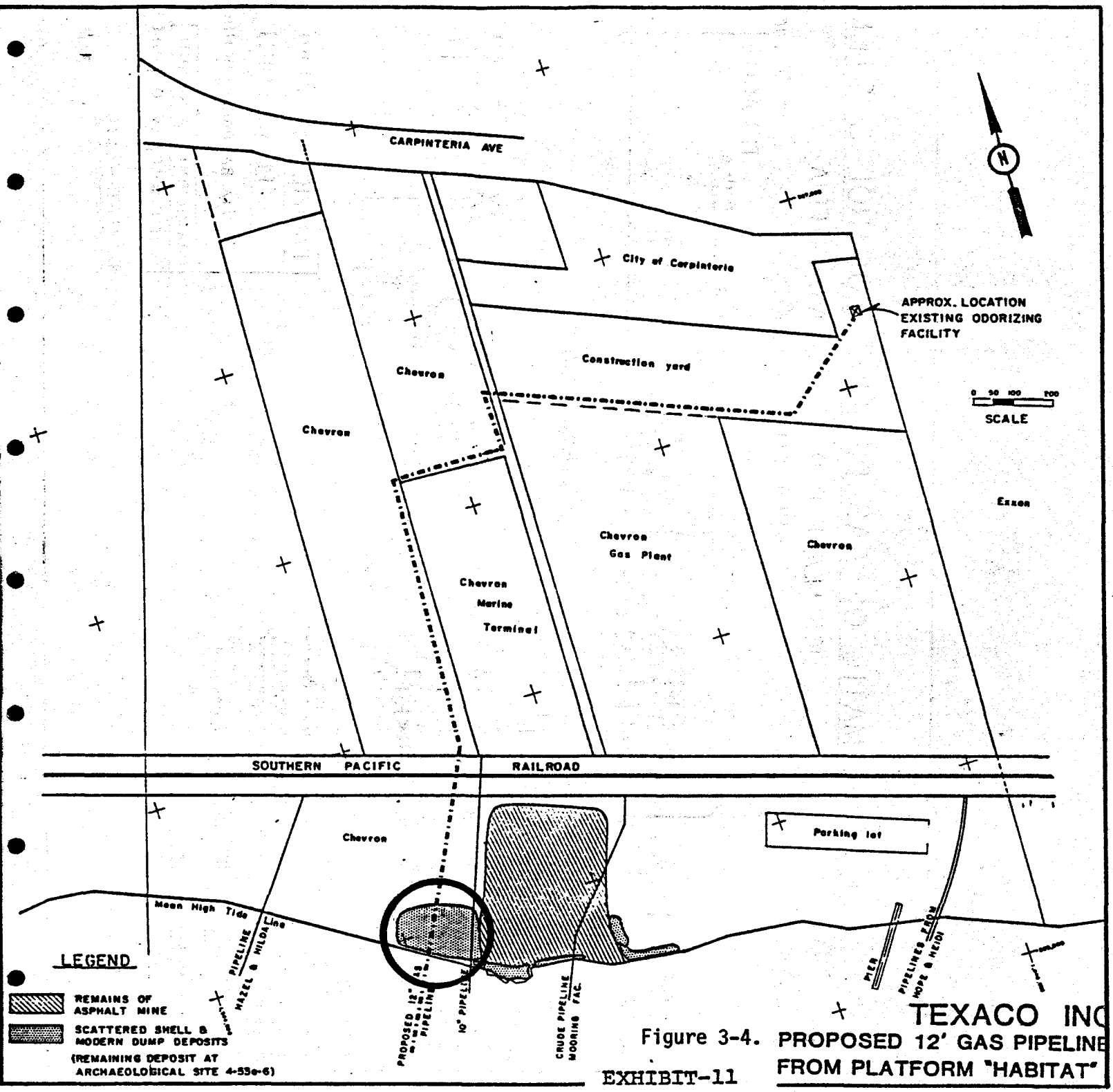
(4) Potentially sensitive archeological site (unconfirmed) Site of former *HIGGEN'S RANCH*

(5) *HISTORIC REFUSE* Site SBa-1670

(6) *PALEONTOLOGICAL DEPOSIT*

Figure 3-3. VICINITY MAP

EXHIBIT Ia



TEXACO INC

Figure 3-4. PROPOSED 12' GAS PIPELINE FROM PLATFORM "HABITAT"

EXHIBIT-11

6. Develop a set of recommendations for dealing with adverse impacts to the cultural resources which might be affected by the project.

3.5.1.2 Methodology

Shorelines are sensitive areas all up and down the coast. Mr. Zahniser will conduct an on-the-ground survey of the pipeline right-of-way for terrestrial cultural resources. The project area would be transected at a maximum 5-meter interval; all resources would be documented and mapped according to California recording conventions. A literature search of published data and a records check at University of California, Santa Barbara would be conducted before the field survey. Existing sites would be verified on-the-ground, and site records will be upgraded if necessary. The significance of any cultural resources would be addressed in the cultural resources report and recommendations would be included to ensure that "sites of cultural significance will not be adversely affected" by the project. Dr. Lois Roberts will inspect and evaluate the historic site(s). Her data will be displayed against the larger picture of Spanish, Mexican, U.S. and California history in order to judge the significance of any historic delitrus located in the project area. Dr. Jeanne Munoz will advise CCP about which Native Americans as individuals or groups claim jurisdiction over the project area, and she will summarize the kinds of concerns which they have historically had for these resources. Her advice would be extremely valuable in negotiating effective Native American involvement in decisions relevant to the management of the resources. Telephone calls to appropriate Native American individuals/organizations, as well as to others familiar with the sites (local residents?) would begin the process of developing good working relationships as planning for the project proceeds.

3.5.2 Marine

A cultural resources investigation will be done along the pipeline right-of-way and in the platform area. The object of the survey will be

to identify significant sites within the potential impact area of the proposed project.

3.5.2.1 Tasks

1. Literature and documents search.

2. Remote-sensing survey.

3. Identification and evaluation of seafloor anomalies and extinct, archaeologically sensitive, subbottom landforms.

3.5.2.2 Methodology

Literature search will include a review of all published and unpublished articles pertaining to the underwater prehistoric and historic archaeology of the Pitas Point-Carpinteria area, marine geology, and nautical history. Documents research will include search of the pertinent portions of ethnographic accounts, records of previous geophysical surveys, well/pipeline records, and shipwreck records. Literature and documents search will be used to generate sets of expected observations and to interpret results of the geophysical survey.

A geophysical survey will be returned of the pipeline route. The marine survey archaeologist will be onboard the vessel to ensure that all equipment is properly tuned and that hard copy readouts are of adequate quality. He will also ensure the complete annotation of records for possible sources of noise. The location of anomalies on the side-scan and magnetometer records will be done as they are printed out and a "Signal of Interest Record" (Figure 3-5) will be completed for each signal.

The Signal of Interest Records will be utilized by the marine survey archaeologist in consultation with the geophysical consultant for mapping signal sources. Signals will be described and interpreted by reference

Possible Anomalous
Return No._____

Figure 3-5
SIGNAL OF INTEREST RECORD

1. Record No._____ 2. Survey Name_____
3. Date of Record_____ 4. Line/Previous S/P_____
5. Description of Signal

   Magneteometer: Amplitued_____ Sign_____ Length_____

   Side-Scan: Inferred Length_____ Width_____ Height (+) or

   Depth (-)_____ Scale Distance from Line_____

6. Associated Signals: Record No._____ Mag. or Sode-Scan_____
7. Criteria of Possible Anomalous Return

   a. Individual or clustered magnetic residuals which lack corresponding acoustic images. Yes___ No___

   b. Side-scan sonar image or image clusters which have shadows without corresponding magnetic residuals Yes___ No___

   c. Side-scan sonar image which has both shadow and corresponding magnetic residual signal Yes___ No___

   If yes to any criterion, assign number (upper right corner of form) and proceed.

8. Field Inrerpretation of Possible Anomalous Return

   a. Associated with drilling/exploration? Yes___ No___
   If yes, drillsite no._____

   b. Associated with routes for transport of oil exploration equipment? Yes___ No___

   c. Assoxiated with known shipwrech locations? Yes___ No___

9. Post Field Survey Notations: _____

_____

_____

_____

_____

10. Post Field Survey Interpretations _____

_____

_____

_____

_____

11. Form Completed by_____

to field conditions, drilling and shipwreck records, and by size and/or shape of the possible object.

Subbottom topographic features which may be archaeologically sensitive will be identified and described.

A signed narrative survey report will be submitted which reports survey instrumentation, assesses adequacy of survey records, describes operation and data-gathering procedures, describes methods and results of interpretation, evaluates significance of anomalies, and suggests methods for mitigating impacts.

Section 4

SCHEDULE AND COST

4.1 SCHEDULE AND DELIVERABLE PRODUCTS

CCP will divide the proposed project effort into six tasks extending over a 6-month period. If the project starts the first week of October, CCP will be able to deliver the Draft EA/EIR by mid-January 1981. Table 4-1 depicts the approximate schedule of each task.

Task 1 - Prepare a detailed project study outline
Task 2 - Conduct field survey
Task 3 - Prepare preliminary draft reports
Task 4 - Submit Draft EA/EIR to Lead Agencies
Task 5 - Attend two public hearings
Task 6 - Respond to written and oral comments
Task 7 - Submit Final EA/EIR to Lead Agencies

Progress reports will be submitted to the Lead Agencies on the 15th day of each month documenting results and efforts of the work completed during the previous calendar month.

Tables 4-2 and 4-3 depict costs and man-days by task, respectively.

Table 4-1. PROJECT SCHEDULE

Date	Deliverable Products
October 1980	Project Start Up
November 1980	Project Description
November 1980	Detailed Report Outline
December 1980	Literature Search
December 1980	Fieldwork
January 1981	Draft EA/EIR
February 1981	Public Hearing
February 1981	Response to Draft EA/EIR
March 1981	Final EA/EIR
April 1981	Public Hearing

Table 4-2. COSTS

Labor	Man-Days	Rate/Hr.		Total
M.D. Chambers	29	$18.15	$ 4,210	
N. Davis	88	13.60	9,574	
R. Townsend	3	15.00	360	
R. Flick	6	17.50	840	
S. Matlovsky	15	13.50	1,620	
L. Brown Brayton	54	9.30	4,017	
J. Keith	5	15.00	600	
J. Zahniser	17	13.50	1,836	
L. Roberts	2	13.50	216	
R. Brown	3	8.00	192	
J. Munoz	2	13.50	216	
D. Costa	3	13.50	324	
H. Wiener	3	11.50	276	
Technical Secretary	40	8.50	2,720	
Illustrator	20	9.50	1,520	
TOTAL			$28,521	
PAYROLL BURDEN 95%			27,094	
TOTAL PAYROLL COST AND OVERHEAD				$ 55,615
DISBURSEMENTS:				
Travel and Per Diem			$ 3,500	
Other Direct Costs			1,500	
Report Preparation			3,800	
Mileage			1,000	
TOTAL			$ 9,800	
10% HANDLING CHARGE			980	
TOTAL DISBURSEMENTS				10,780
SUBCONTRACTORS:				
Engineering Geologic Services/Nekton, Inc.			$68,690	
AeroVironment, Inc.			14,993	
Reese-Chambers Systems Consultants			4,500	
S. Horne/Marine Archaeology			3,800	
TOTAL SUBCONTRACTORS				91,983
SUBTOTAL PAYROLL, DISBURSEMENTS AND SUBCONTRACTORS				$158,378
10% PROFIT				15,878
TOTAL PROJECT COST				$174,256

NOTE: If CCP is required to deliver 50 copies of the Draft EA/EIR and 50 copies of the Final EA/EIR, the cost will be an additional $1,100.

CCP

Table 4-3. MAN-DAYS BY TASK

	Project Management	Fieldwork	Draft EA/EIR	Public Hearing	Response to Comments	Final EA/EIR	Public Meeting	Total	Percentage
M.D. Chambers	10		15	2			2	29	12
N. Davis	25	4	35	2	10	10	2	88	38
R. Townsend			3					3	1
R. Flick			5		1			6	2
S. Matlovsky		2	10		2	1		15	7
L. Brown Brayton	5		35	2	5	5	2	54	23
J. Keith			5					5	2
J. Zahniser		2	5		5	5		17	7
L. Roberts			2					2	1
R. Brown			3						1
J. Munoz			2					2	1
D. Costa			3					3	1
H. Wiener			3					3	1

Section 5

PROJECT MANAGEMENT PROGRAM

5.1 OBJECTIVES OF MANAGEMENT PROGRAM

The primary objective of this contract is to prepare a complete, unbiased, defensible EA/EIR that complies both with the letter as well as the intent of the controlling environmental legislation, as well as to address the concerns of other public agencies and the interested citizenry. In order to satisfy this objective within the established budgetary and temporal constraints, the technical efforts conducted within the scope of this study must be supported and controlled by a viable management program.

In order to successfully promote the primary objective, the management program must establish procedural components that address the elements of the primary objective given above.

5.2 DATA MANAGEMENT

The extent to which the EA/EIR is complete, unbiased, and defensible will be dependent upon the thoroughness of the research and the management of the resulting information.

5.2.1 Detailed EA/EIR Outline

The first step in dealing with this requirement is the development of a complete and detailed outline for the EA/EIR. This outline will be

developed using inputs of many concerned viewpoints, will ensure that all areas of concern will be addressed and, thus, will ensure that the EA/EIR will be complete and unbiased.

The outline also serves as a framework for the data management function in that it allows the relevance of a particular piece of information to be located precisely. The preparation of this outline, and the extent of outside involvement in its preparation, is discussed more completely in the project schedule.

5.2.2 Documentation

In addition to the detailed definition of the scope of the research, the information generated by this study will be thoroughly documented. This documentation is absolutely necessary in regard to the defensibility of an EA/EIR, as legal challenges to such statements commonly involve procedural questions as often as they do substantive issues.

All written sources investigated will result in a Reference Review Form (Figure 5-1). These sources include books, articles, other publications, written correspondence and catalogues.

This form allows for all pertinent information concerning the source itself, a summary of the contents, and notes concerning the useful information concerning the contract. There is a place (Area[s] of Interest) for noting which of the Task Elements this information pertains to. In the case of written correspondence, catalogue sheets, or photo-copied information, the Reference Review Form will be used as a cover sheet for the material.

Any significant verbal communications will be documented on Contact Sheets (Figure 5-2). The Contact Sheets allow for the documentation of the same basic information as noted on the Reference Review Forms.

Figure 5-1
REFERENCE REVIEW FORM

CONTRACT_____
DATE_____
BY_____

AREA(S) OF INTEREST_____

BIBLIOGRAPHY ENTRY_____

ABSTRACT_____

USEFUL INFORMATION_____

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Figure 5-2
CONTACT SHEET

PERSON CONTACTED_____ DATE_____

BY_____ CONTRACT_____

AREA(S) OF INTEREST_____

DISCUSSION_____

In addition to these documents, the permanent record will also contain the minutes of all meetings held in connection with the research.

5.3 COST AND SCHEDULE CONTROL

The efforts of the Project Team will be strictly controlled with respect to the time and cost requirements of the project. This will be accomplished by adopting control methods that have been proven in the management of large and complex systems. The Control Program developed by CCP for this environmental study will provide the tools necessary to keep the program on schedule and within budget.

In 1967, the Department of Defense adopted the Cost and Schedule Control Systems Criteria (DODI 7000.2) which set forth requirements that must be satisfied in order for a contractor's internal management system to be considered acceptable. The criteria may be summarized as requiring a management system to display:

1. Organization - Define contractual effort and assign definite responsibilities for work.

2. Planning and Budgeting - Plan, schedule, and budget the work.

3. Accounting - Accumulate costs of work and material.

4. Analysis - Compare planned and actual expenditures and progress and analyze variances.

5. Revisions - Incorporate changes and develop estimates of final costs.

These criteria are gaining general acceptance through the Federal Government, are being adopted in a slightly altered form by the Department of Energy (DOE Interim Management Directive 0208), and are expected to

become standard requirements by all public agencies for all programs in the future. The Management Program proposed by CCP satisfies these requirements, and will ensure that this study is put on a sound, defensible, management footing.

5.4 COST AND SCHEDULING STANDARDS

At the beginning of the project, standards of cost and time requirements will be adopted for each work element. An activity is the smallest practical division of the work for each component of the research, and constitutes a job or task that takes time and consumes resources. The activities for each of the research components will be defined, given a budget, and assigned a schedule requirement.

A master schedule network diagram, based on the detailed EA/EIR outline, will be prepared by CCP showing all activities, and their interrelationships, from initial phases through preparation of the final report. This network diagram will be presented to the Lead Agency, along with the detailed outline, and will be one of the deliverable items.

5.5 MONTHLY CONTROL CYCLE

Each month the progress on each activity, and its cost to date, will be noted and compiled for each study element. This information is used to determine the expected completion date of each element and its expected completion cost. The progress information will then be analyzed to determine if there will be any adverse effects upon completion schedule for the study, and this analysis would be reviewed with the Lead Agency. Cost data will be used for internal control of the efficiency of the study (Figures 5-3 and 5-4).

Figure 5-3
MONTHLY COST SUMMARY (EXAMPLE)

PERIOD ENDING_____

ACTIVITY CODE[1]	ACTIVITY DESCRIPTION[1]	ESTIMATED TOTAL COST[2]	PERCENT COMPLETE TO DATE[3]	ESTIMATED COST TO DATE[4]	ACTUAL COST TO DATE[5]	VARIANCE (%)[6]	TOTAL ESTIMATED COST[7]
Example:							
2.A	Research Item X	$60,000	40	$24,000	$26,000	+8.33	$64,998
5.B	Prepare Report Z	20,000	40	8,000	6,000	-25.00	15,000

NOTES:

[1]Activity codes (five-digit number) and description are identifiers that correspond to elements of the schedule and budget adopted as control standards.

[2]Estimated Total Cost: Authorized budget expenditure for that particular activity.

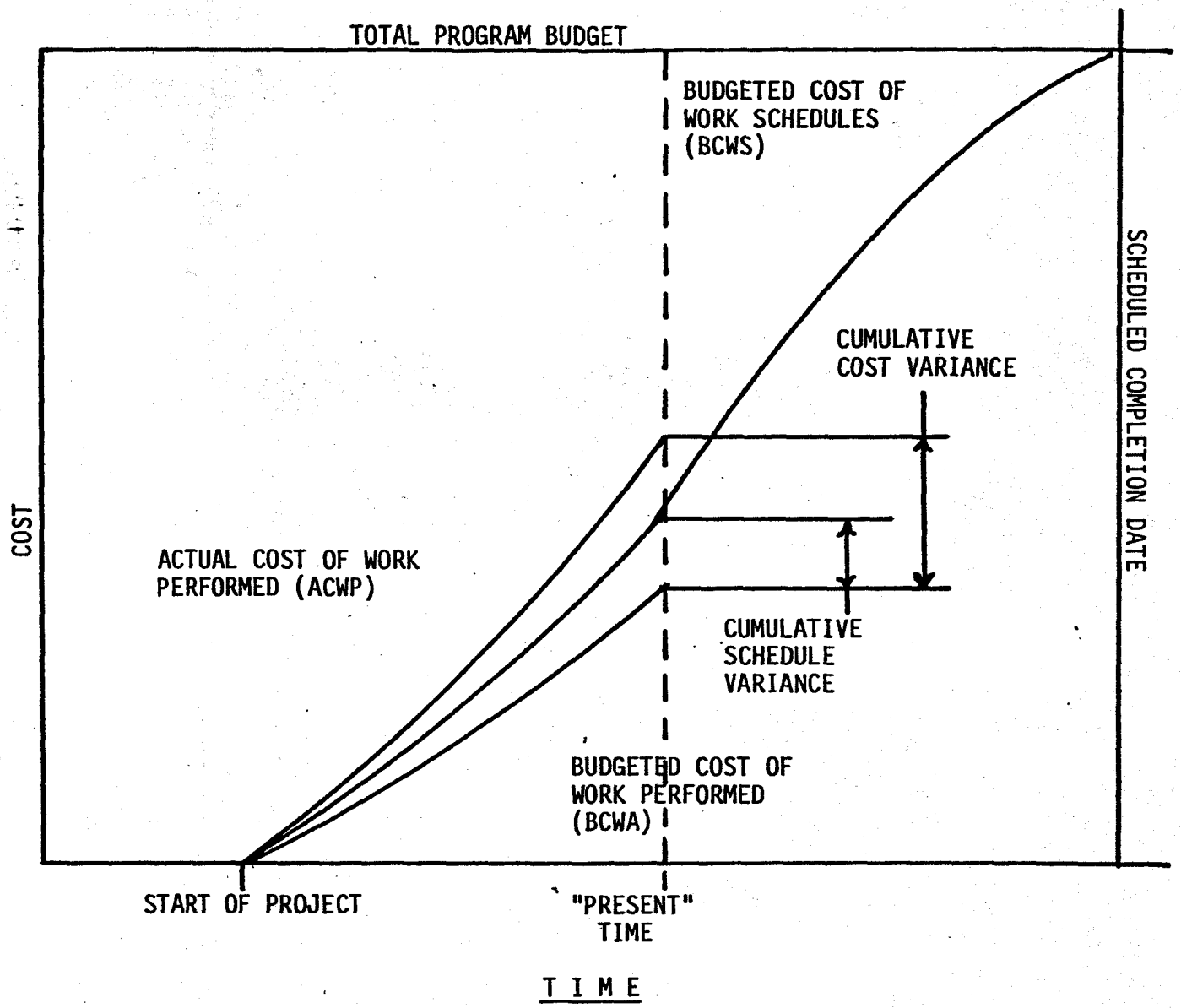
[3]Percent Complete to Date: Progress on reporting date stated as a percentage completion of that activity.

[4]Estimated Cost to Date: Estimated total cost x percent complete gives authorized budget for progress to date.

[5]Actual Cost to Date: Actual charges claimed by the research contractor against that research activity.

[6]Variance: (Actual Cost to Date ÷ Estimated Cost to Date) - 100%, gives percentage over or under estimate for that activity.

[7]Total Estimated Cost: Estimated Total Cost x (100% + Variance); gives projected total cost for that activity at 100% completion, summation gives the projected total cost for each component and for the enntire contract as a grand total.



NOTE: The ACWP curve is above the BCWP curve denoting cost overrun. Also, the BCWP curve is under the BCWS curve, indicating the program would be behind schedule.

Figure 5-4
GRAPHICAL PRESENTATION OF PROGRESS FOR THE ENTIRE PROGRAM

5.6 COMMUNICATIONS AND LIAISON

The Project Manager has, as one of her primary duties, the responsibility of ensuring proper coordination and flow of information among and between the members of the Project Team, including subcontractors, and the Project Management.

The Project Manager will maintain regular and continuous contact with these parties, and will be responsible for facilitating communications as she feels is necessary to meet the requirements of the contract.

Section 6

PROJECT TEAM

6.1 PROJECT TEAM

6.1.1 Introduction

CCP is very pleased with the Project Team that has been assembled to conduct this EIR. These scientists, engineers, and planners are experts in those disciplines that are critical to the successful completion of the study, and many of them are recognized experts in their fields of endeavor.

6.1.1.1 Project Directorate

Dr. Noël Davis will act as Project Manager for this EIR. In this capacity, Dr. Davis will provide overall administrative coordination and corporate review, and ensure that the study is conducted in the best interests of the client. Dr. Davis has previously managed several complex, interdisciplinary studies including CCP's Oceanographic Baseline Study of the Point Arguello Boathouse Area for the U.S. Air Force and CCP's Environmental Impact Report for Resumption of Exploratory Drilling Operations by Shell Oil Comapny on State Oil and Gas Lease PRC 3314.1 in Ventura County.

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6.1.1.2 Study Team

The members of the Study Team, arranged by specific discipline, are as shown in Figure 6-1.

6.1.2 Resumes of Project Team Members

Resumes giving complete presentation of the background and experience of the Project Team appear in the following pages.

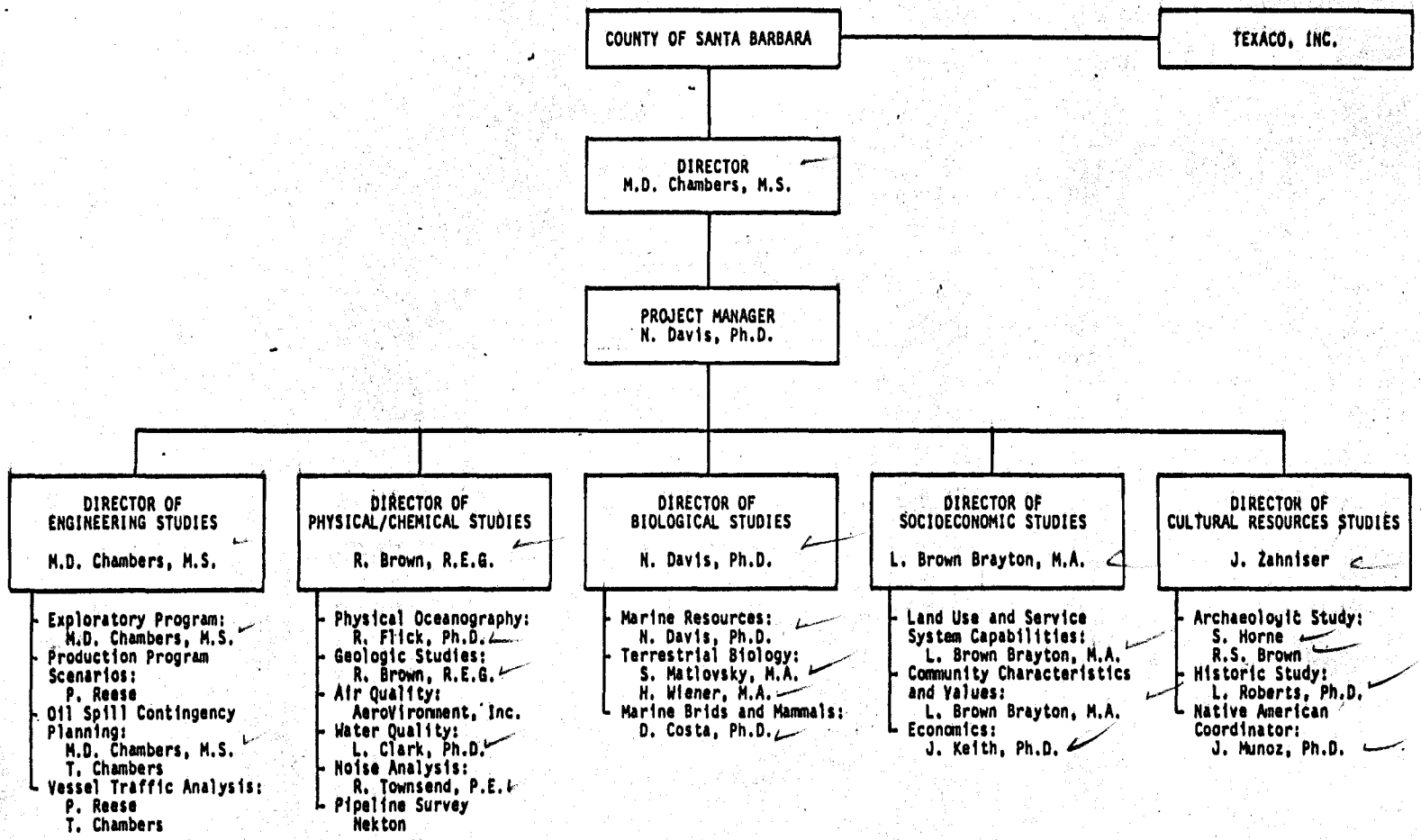

Figure 6-1. CCP PROJECT STUDY TEAM

M.D. CHAMBERS, M.S., P.ENG. - GENERAL MANAGER

Mr. Chambers received his Masters in Civil and Environmental Engineering from Utah State University in 1972, emphasizing Water Resource Systems. Mr. Chambers is a Registered Professional Engineer in Alberta and is a full member of the California Association of Environmental Professionals.

Mr. Chambers is an expert on water resources, environmental and feasibility studies, and has extensive experience in technical management and interdisciplinary collaboration on complex resource and engineering research projects. As General Manager of CCP, he has overseen several environmental and engineering research programs. In his capacity as General Manager, Mr. Chambers combines technical involvement in the various projects with overall administrative control where he oversees project schedule control, quality assurance and client liaison.

Prior to founding CCP, Mr. Chambers managed the Alberta-based operations for F.F. Slaney and Company and was responsible for administration of project assignments focused on determining impacts of various developments on environmental systems.

He served as Manager and Coordinator of multidisciplinary field investigations to provide Gulf Oil Canada, Ltd., with environmental data for developing a gas plant in the Hans Bay/Parsons Lake area of the Northwest Territories. He also participated in environmental impact assessment and provided testimony before the Federal Power Commission for the proposed Northwest Alcan Pipeline Project in Canada. He also had a key role in the preparation of an Oil Spill Contingency Plan for the supertanker route to Kitimat Harbor and offshore drilling operations in the Beaufort Sea.

Mr. Chambers managed several environmental programs that included socioeconomic as well as biophysical investigations to determine the effects of major petrochemical plant development projects.

He has prepared guidelines for assessment of environmental impact studies in the Province of Alberta and for the $40 million Alberta Oil Sand Environmental Research Program. He provided overall coordination and technical expertise in engineering, hydrology, and environmental systems analysis for both projects.

The environmental studies conducted by Mr. Chambers have involved programs valued from several thousand dollars to programs in excess of several hundred thousand dollars. The reports generated by Mr. Chambers' programs have been thoroughly defensible and his testimony on behalf of his clients has been extremely effective.

M.D. Chambers (Continued)

Earlier, Mr. Chambers served as Principal and Co-Principal Investigator at the Utah Water Research Laboratory, Utah State University, where he participated in the development and application of mathematical models for the water resource system. Mr. Chambers has also been a key contributor to projects dealing with subjects such as water as a factor in energy resource development and plans to develop a regional approach to a multi-objective planning for water-related resources. Other studies involved development of carrying capacity as a regional environmental management tool.

Mr. Chambers is the author of many articles and reports on water resource development alternatives, environmental impacts, pollution studies and computer modeling of resource systems.

NOEL DAVIS, Ph.D. – PROJECT MANAGER

Dr. Noël Davis, Director of Biology at Chambers, received her undergraduate education at the University of California at Los Angeles where she majored in Zoology. She was presented a special Undergraduate Research Award in 1970. She graduated in 1971 Magna Cum Laude, Phi Beta Kappa, and Highest Honors in Zoology. She obtained her Ph.D. in Biological Oceanography from Scripps Institution of Oceanography in 1978.

Dr. Davis has a strong background in both biological oceanography and terrestrial ecology. She is experienced in designing sampling programs and carrying out fieldwork. Her undergraduate research at UCLA included an underwater study of a sand dollar bed community and an investigation of the toxic effects of photosynthesis inhibitors on marine invertebrates. At Scripps Institution of Oceanography, she was involved in a wide variety of marine ecological research. She has studied the response of natural marine communities to several different kinds of disturbances including a sand slump, artificial reefs, and oil drilling platforms. She has participated in underwater surveys of Tanner and Cortes Banks for the U.S. Bureau of Land Management and of the Malibu Area of Special Biological Significance for the California Department of Fish and Game.

She has worked as a consultant for Science Applications, Inc. on their Southern California Bight Program, an extensive program which integrated studies in biological, chemical, and physical oceanography and which was designed to assess the effects of offshore oil operations on the southern California marine environment. She was a diver and associate scientist on the Science Application field team which conducted an underwater monitoring study on Tanner and Cortes Banks.

In addition, prior to joining Chambers, Dr. Davis was employed as a lecturer at San Diego State University where she taught "Population Biology," "The Natural History of Plants and Animals," and "Ecology Laboratory." The ecology laboratory exphasized sampling techniques and field identifications of southern California plants and animals.

Since joining Chambers, Dr. Davis has served as Project Manager for a marine biological baseline survey at Point Arguello. She has also participated in three environmental assessments for reclamation plans for Corona-based open-pit mines, an environmental impact report for a housing development on the Visbeek Ranch in the San Clemente Area, and a program to assess the effect of housing developments on oak trees. She was responsible for the evaluation of environmental concerns of offshore mining for Chamber's Economic Feasibility Study of Outer Continental Shelf Mining for Sand and Gravel and Phosphorites for the U.S. Geological Survey. In addition, she was Principal Investigator for a marine biological baseline study off Oil Platform Emmy and a monitoring program for wastewater discharge off Huntington Beach. Both these studies were performed under contract to Aminoil USA, Inc. Most recently, Dr. Davis

evaluated the marine biological impacts for Chamber's Environmental Assessment to Address Continuing Operations of the Naval Air Station, North Island Special Area, San Clemente Island and served as Project Manager for Chambers' EIR for resumption of exploratory drilling operations, State Oil and Gas Lease PRC 3314.1 Ventura County. In addition, Dr. Davis is currently managing CCP's interview program to determine the proximity of large marine mammals to oil and gas platforms.

ARTHUR RICHARD BROWN - DIRECTOR OF PHYSICAL/CHEMICAL STUDIES

Mr. Brown is a graduate of the University of Oklahoma, where he was awarded a B.S. Degree in Geology in 1959. In 1968 he received the Degree of M.A. in Geological Sciences from the University of California at Riverside. He is a Registered Geologist (No. 631) and a Certified Engineering Geologist (No. 1043) in the State of California.

Mr. Brown has more than 19 years of professional experience as a geologist and engineering geologist. He has a broad range of field experience in the Western United States, Greece and in the Philippines. He has participated in a variety of projects involving basic geologic mapping, groundwater studies, geologic and foundation investigations for residential developments, landslide investigations, siting and safety analysis for nuclear power plants, exploration for petroleum, geothermal and mineral resources, and geotechnical investigations for underground facilities. Mr. Brown has performed several important, challenging managerial assignments, including the field management of the Kastraki Reservoir Landslide investigation in Western Greece for the Public Power Corporation of Greece. He also served as Geotechnical Manager of the Athens Metro Project in Athens, Greece. On this subway feasibility project, Mr. Brown directed investigations that led to the determination of the groundwater conditions and engineering geology of central Athens. Mr. Brown has been responsible for water well pumping tests and hydrogeologic evaluation of acquifers in Santa Barbara County. He was geophysical interpretator for the LNG site selection project. For the LNG project he did seismic reflection interpretation of sites offshore Camp Pendleton and in the Santa Barbara Channel. In addition, Mr. Brown was recently Project Engineering Geologist for the emergency repair of the Bluebird Canyon Landslide, Laguna Beach, California.

Mr. Brown is a member of the Geological Society of American, the Association of Engineering Geologists, and the American Association of Petroleum Geologists. He has served as vice president of the South Coast Geological Society.

LINDA L. BROWN BRAYTON - DIRECTOR OF SOCIOECONOMIC STUDIES

Ms. Brown Brayton received her M.A. Degree in Social Sciences from California State University, Fullerton in 1977. Her areas of specialization were Urban Geography, Environmental Sociology, and Ethnic Studies. She also obtained a B.A. Degree and a Secondary Teaching Credential from the same university. While a graduate student, Ms. Brown Brayton did considerable research in the areas of urban renewal and minority group relations.

Prior to joining Chambers, , Ms. Brown Brayton was employed by the City of Brea. As a Junior Planner, she participated in current and advanced planning activities and conducted numerous research projects. Ms. Brown Brayton drafted a Security Ordinance, a Noise Ordinance, a Condominium Conversion Ordinance, and revised the Special Resource Information Book for the City of Brea.

Ms. Brown Brayton has participated in numerous environmental assessments for Chambers as Project Manager and as a technical specialist. She has coordinated and managed Environmental Impact Reports for a diversity of projects including residential, commercial, industrial, and recreational developments.

Planning activities conducted by Ms. Brown Brayton for Chambers include the following:

- Planning Administrator in the City of Stanton Community Development Department on a consultant basis for a period of 7 months. Client: City of Stanton.
- Preparation of Justification of Proposal documents for Annexation of a County Island. Client: City of Stanton.
- Processing of required permits and application for a commercial development in the City of La Mirada. Client: Shapell Industries.
- Processing of required permits and applications for a 28-unit condominium project in the City of Buena Park. Client: Group Realty Services.
- Processing of required permits and application for a concrete batch plant in the City of Hanford. Client: Charles Oliver.

Ms. Brown Brayton has served as Project Manager for numerous environmental assessments which include:

- An EIR for a commercial center located in the City of Brea. Client: City of Brea.

Linda Brown Brayton (Continued)

- Initial Studies for residential and commercial projects. Client: City of Carpinteria.
- EIR for a 700-unit condominium project involving a General Plan Amendment and a Zone Change. Client: City of El Monte.
- EIR for a 94-acre parksite. The project site was utilized as an uncontrolled landfill for 40 years. Client: City of Santa Barbara.
- EIR for a relief trunk sewer line. Client: City of Huntington Beach.
- EIR for a planned residential development requiring a zone change. Client: City of San Juan Capistrano.
- EIR for a residential care facility for ambulatory senior citizens. Client: City of Brea.
- EIR for a Master Plan of the Historic Downtown Area of San Juan Capistrano. Client: City of San Juan Capistrano.

Ms. Brown Brayton participated as a member of the project study team in the preparation of the following environmental documents:

- Draft Environmental Statement for the feral animal removal program at San Clemente Island. This document addressed potential impacts related to the removal of feral goats, pigs, cats, and deer from San Clemente Island.
- Scope of Work document for the EIR/EIS concerning the 1984 Summer Olympic Games. This document was prepared to outline the parameters of environmental assessment necessary to satisfy the requirements of NEPA, CEQA, the Corps of Engineers Guidelines, and the City of Los Angeles Environmental Guidelines.

Professional Memberships:

Association of Environmental Professionals

JACK L. ZAHNISER - DIRECTOR OF CULTURAL RESOURCE STUDIES

Mr. Zahniser received his M.A. in Anthropology from the University of Arizona in 1965. His professional experience has included teaching, administration and research. He has designed and operated educational field programs in both Arizona and New Mexico and is familiar with the local logistical problems of conducting archaeological studies under these conditions. Mr. Zahniser also created and operated the Catalina Laboratory for Archaeology, under whose aegis the first such fieldwork was done in more than a decade. For the past 4 years, he served the Anthropology Department at California State University at Fullerton as a graduate coordinator. He also founded and advised Public Antiquities Salvage Team (PAST) which has completed more than 100 EIRs in the last 5 years.

Mr. Zahniser has been in charge of archaeological investigation for numerous EIRs in the southern California area. His most recent EIR work has been concentrated in Orange, Los Angeles, Santa Barbara, and San Luis Obsipo Counties. A continuing professional interest has been the archaeology of southern Arizona and the Tucson Basin, where his contributions to the study of the "Hokokam" continue to be cited. During the last year, he has served as Project Director for an initial archaeological reconnaissance of Fort Hood, central Texas, in collaboration with Dr. Fred Briuer and Dr. Alan Skinner. He is just now completing, as Principal Investigator, a major evaluation of the archaeological resources of the 165,000+ acres of Fort Hunter Liggett, the Presidio of Monterey, and Fort Ord, all in Monterey County. In other recent projects he has served as Co-Principal Investigator for test-level excavations in the Visbeek Ranch in San Clemente, California, and as Principal Investigator of several sites in the Pismo Beach area. He is currently working on documenting impacts to archaeological sites on San Clemente Island, for the U.S. Navy.

REINHARD E. FLICK, Ph.D. - PHYSICAL OCEANOGRAPHY

Dr. Flick received his B.S. in Physics from Cooper Union in 1970. He received his Ph.D. in Physical Oceanography from Scripps Institution of Oceanography in 1978. His dissertation was a study of shoaling waves.

Dr. Flick is an assistant research oceanographer with the Shore Processes Laboratory of Scripps Institution of Oceanography. His work on Shore Processes makes him especially qualified to evaluate the physical effects of coastal developments. His extensive background on studies of ocean currents enable him to evaluate the transport and movement of the materials released into the water. His work as part of Scripps Shore Processes Laboratory also qualifies him to study sedimentation and marine geological effects. Dr. Flick was responsible for the Physical Oceanography portion of CCP's EIR for resumption of exploratory drilling operations, State Oil and Gas Lease PRC 3314.1.

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LEIGH CLARK, Ph.D. - WATER QUALITY

Dr. Clark received his Ph.D. in Chemistry from the University of Washington in 1963. He has been an Associate Professor of Chemistry at the University of California at San Diego where he was presented several teaching awards. Dr. Clark is the author of numerous scientific papers. His research has included a spectroscopic study of the biphenyl molecules. He has served as a consultant to the National Institute of Health and the National Science Foundation.

Since joining CCP, Dr. Clark has overseen the taking of chemical samples at the Point Arguello Boathouse area at Vandenberg Air Force Base, California. He also interpreted the results of the chemical analyses done on these samples.

ROBERT F. TOWNSEND, P.E. - NOISE STUDIES

Mr. Townsend is a graduate of the University of Arizona in Tucson and is a Registered Professional Engineer in the States of California (C17887) and Arizona. Mr. Townsend first entered professional service with the City of Tucson, where he was involved in water treatment. He remained in the Tucson area until 1964 working for several consulting firms, the Pima County Highway Department, and then forming his own firm from 1962 until 1964. His experience includes:

- Developing and implementing criteria for commercial and residential design, checking of subdivision plans, and inspection of facilities under construction.
- Land use planning, site planning, subdivisions layout and design.
- Soils and groundwater investigation and engineering and foundation design in conjunction with numerous commercial and industrial projects.
- Hydraulics, sanitation, and chemistry associated with design and operation of wastewater works.
- Groundwater studies for the Corps of Engineers to determine reasons for irregular taxiway behaviour.

In 1964, Mr. Townsend moved to southern California. After a short period doing land planning for Development Consultants, Inc., Mr. Townsend joined the Federal Housing Administration in Santa Ana, California. In his work at the FHA, Mr. Townsend was predominantly involved in the engineering review of proposed developments within his area of responsibility, emphasizing potential soils problems such as bearing capacity, slope stability and seismic exposure.

Mr. Townsend left the FHA in 1969 for 1 year to set up a complete soils investigation and testing department for Southern California Testing of Irvine, California. He subsequently returned to Federal employ with the Office of Indian Programs in San Francisco. While he was with the OIP, Mr. Townsend sought to upgrade the quality of the engineering, consulting, and construction conducted for the Indian nations. His work there exphasized water resources, groundwater studies, and soils and geotechnical engineering problems.

In 1977, Mr. Townsend joined Chambers, bringing with him his wealth of experience in geotechnical, structural and land use engineering. Since joining Chambers, he has undertaken a wide variety of engineering investigations, design problems, and contruction projects, including:

- Design management and field inspection for a turnkey commercial building designed and constructed by Chambers.

- Design management and field inspection for a turnkey water pollution control facility for a ready-mix concrete plant designed and constructed by Chambers.
- Established horizontal and vertical control and supervised construction surveys for the two previously-mentioned projects.
- Land use planning and engineering for several commercial and residential developments.
- Soils investigations to determine causes of soils movements.
- Hydrologic and soils investigations as relevant to several environmental impact statements conducted by Chambers.

L. SERGE MATLOVSKY - TERRESTRIAL BIOLOGIST

Mr. Matlovsky received his B.A. Degree in Environmental Biology and Botany from the University of California, Santa Barbara in 1970. He received his M.A. Degree in Plant Ecology from the same institution in 1973. Mr. Matlovsky is an expert in the identification, mapping, and analysis of vegetation including rare and endangered species in various California habitats (coastal, valley, mountain, deserts). He has mapped the vegetation/habitats and analyzed the biota throughout hundreds of square miles of California using aerial reconnaissance, aerial photography, ground-truth investigations, and secondary sources research.

Mr. Matlovsky has extensive experience with California coastal ecosystems. He wrote the biology baseline and impact sections of the Air Force candidate environmental statement and reference document for the Space Shuttle Program at Vandenberg Air Force Base. This study involved the preparation of ecosystem models for the natural ecosystems on Vandenberg Air Force Base. Mr. Matlovsky was also responsible for the preparation of an environmental impact report for an emergency communications facility on the Russian River. In addition, he has studied the impacts of a natural gas pipeline on grassland and marsh habitats in the San Francisco Bay area and researched coastal sand dune and salt marsh vegetation at the mouth of the Santa Maria River.

His specialties include the identification of rare/endangered species, photo-documentation, remote sensing, and terrestrial ecology. Mr. Matlovsky mapped vegetation and monitored condition of plants at selected locations to document baseline conditions of agricultural, naturalized, and native vegetation on 50 square miles of Santa Barbara South Coast. Tasks included aerial photography procurement/interpretation, identification of plants and their maladies (pest attack, fungus or other disease, nutritional imbalance, air pollution injury, drought, etc.), and on-the-ground photographic documentation of observations.

Over the past 5 years, Mr. Matlovsky has conducted numerous biological studies for consulting firms and has participated as a technical specialist for various environmental impact reports in southern California. In connection with these studies, he has researched the status and effects of removal of selected populations of several rare/endangered/special interest plant species in the sand dunes just north of Vandenberg Air Force Base and in the Santa Ynez Mountains to the east. This work also included literature research, professional contacts, and field reconnaissance elucidating important factors and methods of revegetation/erosion control and protection of the native flora in coastal sand dunes, foothills, and mountains.

Since joining CCP, Mr. Matlovsky has managed CCP's EIR for Feral Animal Removal on San Clemente Island and performed the terrestrial biology studies for CCP's EIR for resumption of exploratory drilling operations, State Oil and Gas Lease PRC 3314.1, Ventura County.

HARRY WIENER, M.A. - WILDLIFE ECOLOGIST

Mr. Wiener has a broad and varied background in the areas of terrestrial biology and statistical analysis. He has been studying the herptofauna of California since 1960. As an undergraduate, Mr. Wiener logged hundreds of hours in nearby deserts collecting and identifying reptiles. His senior project requirements were fulfilled by his study of relic populations of Xantusia vigilis and Callisaurus draconoides, both desert species found on the coastal side of the San Bernardino Mountains. During his undergraduate studies, he also assisted Dr. A. Szijj at California State Polytechnic University, Pomona, in Dr. Szijj's study of Brewer's Blackbirds in the Salton Sea area. His experience included both fieldwork and statistical analysis. Mr. Wiener received a B.S. in Zoology from California Polytechnic University, Pomona.

As a graduate student at California State University at Long Beach, Mr. Wiener was a participant in a field survey of the herptofauna of Baha California. The resultant publication was entitled "A Handlist of the Herptofauna of Baja, California, Mexico and Adjacent Islands" (Loomis et al, 1974). Mr. Wiener was awarded his M.A. in Biology in 1979.

More recently, Mr. Wiener was employed as a field biologist for the University of Southern California. He designed and executed a field study to determine the ecology, population size and breeding structure of feral populations of Mus musculus. His fieldwork included a survey of mammals common to the study area located in the coastal hills of central California.

Since joining Chambers, Mr. Wiener has taken part in both the fieldwork and data analysis of the Marine Baseline Study at Point Arguello. His duties at Chambers have also included field surveys to supplement compilation of Environmental Impact Reports, data anlaysis for feasibility studies, and fieldwork to determine water demand of oak trees.

DAN COSTA, Ph.D. - MARINE MAMMALOGIST

Dr. Costa received his Ph.D. from the University of California at Santa Cruz in 1978. He is an expert on the ecology and physiology of marine mammals and birds. His doctoral studies were under the direction of Dr. Kenneth Norris, the foremost Marine Mammalogist on the West Coast. Dr. Costa's thesis research involved an investigation of the ecological energetics and water balance of the California sea otter and the northern elephant seal.

Dr. Costa is a member of the American Society of Mammalogists and has presented papers on the ecology of marine mammals at many scientific meetings.

Most recently, Dr. Costa has been a Research Associate at the Physiological Research Laboratory at Scripps Institution of Oceanography where he investigated effects of oil on marine mammals. In addition, Dr. Costa has traveled to Alaska and Antarctica to study marine mammal populations in Polar Regions.

As an employee of CCP, Dr. Costa was in charge of marine mammal observations for CCP's study of the marine biology of the Point Arguello Boathouse area, and provided technical input to CCP's interview program to determine the proximity of large marine mammals to oil/gas platforms.

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JOHN E. KEITH, Ph.D. - ECONOMIST

Dr. John Keith is an economist with a wide range of experience in inter-regional planning of resource allocations. Dr. Keith received his M.S. Degree in Range Science from Utah State University in 1971 and his M.A. Degree in Economics in 1972 from Utah State University. He also holds a Ph.D. Degree in Economics from the same university, which he earned in 1973. He has acted as research assistant for the Range Science Department at Utah State University, research economist for the Utah Water Research Laboratory, and most recently was a research assistant professor for the Utah Water Research Laboratory.

Dr. Keith is a member of several outstanding scientific and professional societies. In addition, he has an impressive list of papers and publications covering a wide range of economic aspects of resource planning. His most current publications include:

- "Regional Development: An Econometric Study of the Role Water Development in Effectuating Populations and Income Changes."
- "The Economic Efficiency of Inter-Basin Agricultural Water Transfers."
- "Economic Aspects of Groundwater Mining in the U.S."

STEPHEN PHILIP HORNE - MARINE ARCHAEOLOGIST

Mr. Horne received his M.A. in Anthropology from the University of California at Santa Barbara in 1973. He is currently finishing his Ph.D. requirements at the same institution. His doctoral dissertation is on the ethnohistory, historic ethnology, and archaeology of the Inland Chumash. He has previously published a number of papers on the Chumash including an investigation of Chumash subsistence and the use of Chaparral fire, a study of an intervillage network of the Inland Chumash, and an analysis of Chumash rock art from Sierra Madre Ridge.

Mr. Horne hsa extensive experience as an underwater archaeologist within the project area. He has presented a paper to the Society for California Archaeology on underwater archaeology of the Santa Barbara Channel. He served as underwater archaeologist for the survey for the Carpinteria Standard Oil Pipeline. He was responsible for onshore and offshore cultural resources surveys for Union Oil Company's Hueneme Unit Project. He was underwater surveyor on the Point Conception Breadwater Survey and was underwater archaeologist on the Corral Canyon Pipeline Survey. He also served as underwater archaeologist for the Santa Barbara Museum of Natural History's Cojo Bay Survey.

For the past 2 years, Mr. Horne has been an Advisory Anthropologist for the Santa Cuze Island Native Preserve. He has also done numerous cultural resource reports for the U.S. Department of Agriculture, Forest Service.

RODERICK S. BROWN - ARCHAEOLOGIST

Mr. Brown received his B.A. Degree in Anthropology from California State University at Long Beach. He also attended the University of Arizona Graduate Field School in Archaeology.

Mr. Brown began his career in Archaeology in 1968 as a student laboratory and field assistant in archaeology and physical anthropology at Santa Ana College, and as a volunteer with the Pacific Coast Archaeological Society. In 1971, he conducted independent archaeological and ethnographic fieldwork with the Seri Indians in Bahia Kino, Sonora, Mexico.

Prior to his association with CCP, Mr. Brown was Field Director on the CalTrans Highway 101 (Blood Alley) Project, a joint venture with DMJM and Environmental Research Archaeologists. He was responsible for proposal preparation, project costing, crew hiring, equipment design and procurement and computer data management system design. He has also served as Field Director on projects in Virginia, Kansas and California; the latter involving a comprehensive archaeological survey of Fort Hunter-Liggett, California, U.S. Army Corps of Engineers, for Environmental Research Archaeologists.

Since joining CCP, Mr. Brown has served as Field Director for testing and mitigation on several sites in California, and has assisted in the preparation of proposals and reports.

LOIS J. (WEINMAN) ROBERTS, Ph.D. - HISTORIAN

Dr. Roberts received her Ph.D. in History from the University of California at Los Angeles in 1970 under the direction of John Caugry. Since then Dr. Roberts has taught and carried out research in California, United States, and Latin American History. She began her studies of maritime history in 1968 at the Port of Guayoquil. She has had a consistent interest in commerce and shipping history, understands Spanish documents, the colonial history of California, and the major eras of historical change since the advent of the Americans in the California area in 1848. She has experience in ranch and plantation history of Spanish land grants, boundary marking, inheritance, local property records, land use, Spanish customs and values visavis large land holdings. Dr. Roberts has extensive professional experience in research and writing economic history.

Dr. Roberts has also performed in the capacity of Principal Investigator on two maritime studies: the Maritime History of the Porteblay Beach, Port of Guayoquil, and the Historic Resource Study of the Channel Islands National Monument. She has also performed as the Historical Specialist on the Southern California Bight Project.

JEANNE MUÑOZ, Ph.D. - NATIVE AMERICAN COORDINATOR

Jeanne Muñoz received an M.A. in Anthropology from California State University at Long Beach in 1970, and a Ph.D. from University of California at Rieverside in 1980. Her dissertation was an ethnohistoric study of the Fresno River Indian Reservation during the Gold Rush era.

Dr. Muñoz' areas of expertise include ethnohistoric and ethnographic research of the Native Americans of California, with an emphasis on indian-white relations at the time of and during the early years of initial contact between the two groups, and on such relations at the present time. She has prepared ethnogeographic, ethnohistoric, and ethnographic reports, as well as historic resource reports and historical overviews.

A second area of expertise is that of serving as liaison between the various scientists and administrators connected with an archaeological project and the Native Americans of that project area. This includes elicitation of Native American attitudes and values regarding the project and desires with those of the investigators, arranged for Native American participation in the project (as field crew, as observers, as interpreters of artifacts, site features, etc.), and sensitizing both groups to the other's belief system.

Dr. Muñoz has 10 years' experience as a professional cultural anthropologist. During this time, she has worked as a prehistoric and historic archaeologist (field, laboratory, analysis, and report writing) in Orange and Los Angeles Counties. She has conducted historic ethnohistoric and ethnographic research in Calaveras, Fresno, Lake, Los Angeles, Madera, Ornage, Riverside, San Diego, Santa Clara, Stanislaus, Tulare, Tuolumne, and Ventura Counties. She has served as liaison between Native Americans and archaeologists in the south central Sierra Nevadas and in the San Francisco Bay area. She has worked on projects sponsored by local, State and Federal agencies, and on projects sponsored by private industry.

In addition, she has taught a variety of undergraduate anthropology classes.

PROFESSIONAL RESUME
OF
ARTHUR RICHARD BROWN

SUMMARY

Mr. Brown is a graduate of the University of Oklahoma, where he was awarded a Bachelor of Science degree in Geology in 1959. In 1968 he received the degree of Master of Arts in Geological Sciences from the University of California at Riverside. He is a Registered Geologist (No. 631) and a Certified Engineering Geologist (No. 1043) in the state of California.

Mr. Brown has more than 19 years of professional experience as a geologist and engineering geologist. He has a broad range of field experience in the western United States, Greece and in the Philippines. He has participated in a variety of projects involving basic geologic mapping, ground-water studies, geologic and foundation investigations for residential developments, landslide investigations, siting and safety analysis for nuclear power plants, exploration for petroleum, geothermal and mineral resources, and geotechnical investigations for underground facilities. Mr. Brown has performed several important, challenging managerial assignments, including the field management of the Kastraki Reservoir Landslide investigation in Western Greece for the Public Power Corporation of Greece. He also served as Geotechnical Manager of the Athens Metro Project in Athens, Greece. On this subway feasibility project, Mr. Brown directed investigations that led to the determination of the groundwater conditions and engineering geology of central Athens. In addition, Mr. Brown was recently Project Engineering Geologist for the emergency repair of the Bluebird Canyon Landslide, Laguna Beach, California.

In 1979, Mr. Brown began his independent consulting practice of engineering geology in Southern California. In 1980, he formed ENGINEERING GEOLOGIC SERVICES which offers a wide variety of professional geological, geotechnical engineering, planning and management services. To complement the expertise of the key personnel, the firm draws on the exceptional capabilities of a number of well known independent consultants.

ARTHUR RICHARD BROWN

Addendum to Resume

EXPERIENCE IN SELECTED PROJECT CLASSIFICATIONS

Site Selection

Hard Rock Silo Development Program, Phase One, Minuteman Missile siting concept which evaluated all large areas of hard, relatively unfractured granitic rocks in the 48 states, with Ken O'Brien and Associates for U.S. Air Force, SAMSO. (Engineering Geologist)

Hard Rock Silo Development Program, Phase Two, Minuteman Missile siting concept which evaluated potential sites in the Laramie Range, Wyoming, with Ken O'Brien and Associates and Bechtel Corporation for U.S. Air Force, SAMSO. (Engineering Geologist)

Philippine Nuclear Power Plant Project, site selection and PSAR, site selection studies of potential plant sites on Bataan Peninsula, Philippines, with Ebasco Overseas Corporation for the National Power Corporation of the Philippines. (Principal Engineering Geologist and Geotechnical Quality Assurance Supervisor)

MX Project, site selection and basing mode selection studies for environmental impact assessment in the 17 Western States of the U.S., with Woodward-Clyde Consultants for Henningson, Durham and Richardson, Inc. for the U.S. Air Force, SAMSO. (Project Geologist and Project Coordinator)

Geohydrology and Water Resources

Davis Power Project, pumped storage reservoirs, watertightness investigation, Canaan Valley, West Virginia for Ebasco Services Incorporated. (Principal Engineering Geologist)

Kastraki Reservoir Study, landslide and slope stability investigation, Acheloos River, Western Greece, with Ebasco Services Incorporated for the Public Power Corporation of Greece. (Field Manager and Overseas Office Manager)

Athens Metro Project, ground water study of central Athens, Greece with DeLeuw, Cather International, Inc. - Wilber Smith and Associates, Inc. for the Ministry of Transport and Communications, Republic of Greece. (Geotechnical Manager)

Water Well Pumping Tests and Hydrogeologic Evaluation of Aquifers, Santa Barbara County, California, various clients. (Consulting Engineering Geologist)

Faults and Earthquakes

San Fernando Earthquake Project, geologic mapping of landslides and liquifaction features, Sylmar, California for Fugro, Inc. (Consulting Geologist)

Shearon Harris Nuclear Power Plant Project, fault investigation of movement history on the Jonesboro Fault, North Carolina. (Principal Engineering Geologist)

Philippine Nuclear Power Plant Project, site selection and PSAR fault investigation of Capones Island, South China Sea, Philippines. (Principal Engineering Geologist)

Southwest Ocean Outfall Project (SWOOP), offshore seismic reflection profiling interpretation west of San Francisco, California with Woodward-Clyde Consultants for PBQ&D, Inc. (Project Geologist - Geophysical Interpretor)

Santiago Creek Dam, fault rupture and seismic stability investigation. (Project Geologist)

Humbolt Bay Nuclear Power Plant, review of offshore seismic reflection profiling, with Woodward-Clyde Consultants for Pacific Gas and Electric Company. (Project Geologist - Geophysical Interpretor)

LNG Site Selection Project, seismic reflection profiling interpretation of offshore sites, Camp Pendleton and Santa Barbara Channel, California, with Woodward-Clyde Consultants for Public Utilities Commission. (Geophysical Interpretor)

Hillside Development Investigations of two residential sites on the San Andreas Fault, San Mateo County, California. (Consulting Engineering Geologist)

Bluebird Canyon Landslide Project, investigation of fault-control of west side of the landslide, with Leighton and Associates for the City of Laguna Beach, California. (Project Engineering Geologist)

Tunnels, Subways, Sewer Outfalls and Mines

Culver-Baer Mercury Mine, underground mine mapping, Sonoma County, California for Geothermal Resources International, Inc. (Exploration Geologist)

Kastraki Reservoir Study, geologic mapping of four exploration adits for slope stability investigation and in situ direct shear test locations, Acheloos River, Western Greece, with Ebasco Services Incorporated for the Public Power Corporation of Greece. (Project Field Manager)

Athens Metro Project, subsurface boring investigation of subway study corridors in central Athens, Greece with DeLeuw, Cather International, Inc. and Wilber Smith and Associates, Inc. for the Ministry of Transport and Communications, Republic of Greece. (Consultant and Geotechnical Manager)

Southwest Ocean Outfall Project (SWOOP), detailed geophysical interpretation of an area west of San Francisco Peninsula using high resolution seismic reflection profiling to determine the location of major active faults, with Woodward-Clyde Consultants for PBQ&D, Inc. and the City of San Francisco, California. (Geophysical Interpretor)

Nuclear Power Plants

San Onofre Nuclear Power Plant Project, Units 2 and 3, regional structural and stratigraphic section compilation, Camp Pendleton, California for Fugro, Inc. (Consulting Geologist)

Shearon Harris Nuclear Power Plant Project, investigation of fault movement history on the Jonesboro Fault, North Carolina with Ebasco Service Incorporated for Carolina Power and Light. (Principal Engineering Geologist)

Philippine Nuclear Power Plant Project, site selection and PSAR, Bataan, Philippines with Ebasco Overseas Corporation for the National Power Corporation of the Philippines. (Principal Engineering Geologist and Geotechnical Quality Assurance Supervisor)

Humbolt Bay Nuclear Power Plant Project, offshore geophysical review, with Woodward-Clyde Consultants for Pacific Gas and Electric Company. (Project Geologist and Geophysical Interpretor)

Landslides

Kastraki Reservoir Study, landslide and slope stability investigation, Acheloos River, Western Greece, with Ebasco Services Incorporated for the Public Power Corporation of Greece. (Project Field Manager and Overseas Office Manager)

Philippine Nuclear Power Plant Project, site location and PSAR, photogeologic mapping of landslides and landslide susceptibility evaluation, Bataaan Peninsula, Philippines, with Ebasco Overseas Corporation for the National Power Corporation of the Philippines. (Principal Engineering Geologist and Geotechnical Quality Assurance Supervisor)

Twelve Hillside Development Investigations in the Santa Cruz Mountains, San Mateo County, California, for Purcell, Rhoades and Associates. (Consulting Engineering Geologist)

Bluebird Canyon Landslide Project, emergency landslide stabilization, Laguna Beach, California, with Leighton and Associates for the City of Laguna Beach, California. (Project Engineering Geologist)

Five Hillside Development and Slope Stability Investigations in the City of Laguna Beach, California, for Leighton and Associates. (Engineering Geologist)

Dams and Reservoirs

Davis Power Project, pumped storage reservoirs, watertightness investigation, Canaan Valley, West Virginia for Ebasco Services Incorporated. (Principal Engineering Geologist)

Kastraki Reservoir Study, landslide and slope stability investigation, Acheloos River, Western Greece, with Ebasco Services Incorporated for the Public Power Corporation of Greece. (Project Geologist, Field Manager and Overseas Office Manager)

Santiago Creek Dam Project, fault rupture and seismic stability investigation, Northern Santa Ana Mountains, Orange County, California, with Woodward-Clyde Consultants for Irvine Ranch Water District and Serrano Irrigation District. (Project Geologist)

Environmental Impact Assessments

MX Project, site selection and basing mode selection studies for environmental impact assessment in the 17 western States of the U.S.A., with Woodward-Clyde Consultants for the U.S. Air Force, SAMSO. (Project Geologist and Project Coordinator)

San Marcos Quarry Project, surface erosion, sedimentation and watercourse alteration impact investigation, San Marcos, California, for Robert Prater Associates. (Engineering Geology Consultant)

Geothermal Resources

Clearlake Geothermal Exploration Mapping, Lake County, California, for Geothermal Resources International, Inc. (Geothermal Exploration Geologist)

Rowan Steam Field, subsurface geological investigation, The Geysers, Sonoma County, California, for Geothermal Resources International, Inc. (Geothermal Exploration Geologist)

Kelley Hot Springs, Geothermal Exploration Well, Modoc County, California, for Geothermal Resources International, Inc. (Well Site and Geothermal Exploration Geologist)

Surprise Valley, geothermal exploration reconnaissance, Modoc County, California, for Geothermal Resources International, Inc. (Geothermal Exploration Geologist)

Philippine Nuclear Power Plant Project, evaluation of geothermal potential of Bataan Peninsula, Philippines with Ebasco Overseas Corporation for the National Power Corporation of the Philippines. (Principal Engineering Geologist)

ARTHUR RICHARD BROWN

Addendum to Resume

EXPERIENCE IN SELECTED PROJECT CLASSIFICATIONS

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Geohydrology and Water Resources

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Kastraki Reservoir Study, landslide and slope stability investigation, Acheloos River, Western Greece, with Ebasco Services Incorporated for the Public Power Corporation of Greece. (Field Manager and Overseas Office Manager)

Athens Metro Project, ground water study of central Athens, Greece with DeLeuw, Cather International, Inc. - Wilber Smith and Associates, Inc. for the Ministry of Transport and Communications, Republic of Greece. (Geotechnical Manager)

Water Well Pumping Tests and Hydrogeologic Evaluation of Aquifers, Santa Barbara County, California, various clients. (Consulting Engineering Geologist)

Geologic Map of the Ord Mountains Quadrangle, San Bernardino County, California: U.S. Geological Survey, Miscellaneous Geologic Investigations Map I-427, (with Thomas W. Dibblee, Jr.).

Geologic Map of the Grays River Quadrangle, Wahkiakum and Pacific Counties, Washington: Washington Division of Mines and Geology, Map MG-4, 1968 (with Edwarde W.Wolf and Edwin H. McKee).

Structural History of the Southeastern San Jacinto Mountains, California: Presented at the Cordilleran Section meeting of the Geological Society of America, Tucson, Arizona, 1968.

Geology of a portion of the San Jacinto Mountains, Riverside County, California: A thesis submitted in partial satisfaction of the requirements for the degree of Master of Arts in Geology, University of California, Riverside, December, 1968.

Landslides and the Geologic Structure, Kastraki Reservoir, Acheloos River, Western Greece - A Comparison with the Geologic Structure at the Vaiont Reservoir, Northern Italy: Presented to the South Coast Geological Society, Tustin, California, July 2, 1980.

Experience in selected project classifications is provided in the attached lists.

Employment History

1979-present	President, ENGINEERING GEOLOGIC SERVICES 296 College Park Drive, Seal Beach, CA 90740
1979	Engineering Geologist, Leighton and Associates, Irvine, CA
1978	Consulting Geologist, San Mateo County, CA
1977-1978	Project Geologist, Woodward-Clyde Consultants, Orange, CA
1975-1976 and 1971-1974	Principal Engineering Geologist, Ebasco Services, Inc., New York, Athens, Greece and Bataan, Philippines
1974	Geotechnical Manager and Consultant, Deleuw, Cather, International, Inc., Athens, Greece
1971	Consulting Geologist, Long Beach, CA
1969-1970	Engineering Geologist, Ken O'Brien and Associates, Long Beach, CA
1969	Geothermal Geologist, Geothermal Resources International, Clearlake, CA
1966-1968	Petroleum Geologist, Standard Oil Company of California, Bakersfield, CA
1961-1965	Professional level and geologic training assignments with the U.S. Geological Survey, University of California and Kaiser Steel Corporation

Professional Societies

Geological Society of America
Association of Engineering Geologists
Geological Society of Greece
American Association of Petroleum Geologists
South Coast Geological Society, Vice President - 1980

Publications and Papers

Preliminary Geologic Map of the Merced Peak Quadrangle, California: U.S. Geological Survey, Mineral Investigations Field Studies Map MF-281, 1964 (with Dallas L. Peck and others).

Geologic Map of the Rodman Mountains Quadrangle, San Bernardino County, California: U.S. Geological Survey, Miscellaneous Geologic Investigations Map 10430, 1964 (with Thomas W. Dibblee, Jr.).

CARROLL L. HOYT

Petroleum Geologist, Business Administrator

B.S., Geology, Graduate Studies, University of Washington

President, General Manager and Director

Mr. Hoyt has sixteen years experience in geology, field operations and marine geophysics. He joined Nekton in 1974, and as chief executive officer, he has had principal responsibility for the design and execution of high resolution geophysical surveys offshore California and Alaska, and for submersible operations throughout U.S. waters. As General Manager, he is directly involved in all daily operations of the company including planning, equipping, staffing and executing both surface and subsurface marine programs.

PROFESSIONAL ATTAINMENTS

-- Author, numerous reports, articles and papers.
  Wrote and published a weekly stock market newsletter.
  One published geological paper.
-- Leader, geological field parties, three summers in Alaska.

PROFESSIONAL SOCIETIES

-- Alaska Geological Society
-- Deep Submersible Pilots Association
-- A.A.P.G. - Pacific Section
-- Marine Technological Society

CHRONOLOGY

1950-1955:	University of Washington; B.S., Geology (Cum Laude).
1954:	Oregon State College; Geological Field Methods.
1955-1957:	University of Washington Graduate School; Advanced Study in Geological Sciences.
1957-1966:	Mobil Oil Corporation; Senior Geologist.
1966-1968:	Walston & Company (Stockbrokers); Registered Representative.
1968-1970:	Crilley and Company (Stockbrokers); Vice President and Director.
1970-1971	Petroleum Consultant.
1971-1974:	McCulloch Oil Corporation; Director of Communications.
1974-Date:	Nekton, Inc.; President, Director and General Manager.

GERALD I. SHILLER

Geological Oceanographer

M.S. University of Southern California

Senior Marine Geologist

Mr. Shiller joined Nekton, Inc., in 1972 and has been active in all survey operations. He is a qualified operator of and has directed all seismic and sampling systems aboard the research vessels. He directs submersible operations and acts as pilot, observer, photographer and video cameraman. He has been involved in extensive projects requiring planning, interpretation and reporting of seismic, sedimentologic, and oceanographic data.

Mr. Shiller's professional interests range from marine geology to fluvial sedimentation to aeolian erosion.

PROFESSIONAL ATTAINMENTS

- Author of thirty geologic drilling hazards reports.
- Published three papers in the field of sedimentology.
- Chief scientist or participant in over fifteen oceanographic expeditions.
- Qualified scuba diver (over 100 dives) in seafloor investigations.
- Made over 100 dives in deep submersibles as pilot or observer.
- Member California Committee for Marine Environmental Survey Standards.

PROFESSIONAL SOCIETIES

Geological Society of America
Society of Economic Paleontologists and Mineralogists
Deep Submersible Pilots Association

CHRONOLOGY

1965-1969:	Occidental College: B.A., Geology
1969-1972:	University of Southern California; M.S., Geology
1971:	Southern California Coastal Water Research Project: Assistant Research Geologist
1972-Date:	Nekton, Inc.; Marine Geologist; Geological Operations Manager, Senior Marine Geologist

W. Phillip Reese

Consultant in Maritime Transportation
and Naval Combat Systems Test and Analysis

Summary of Experience

Over 19 years of experience as a systems analyst, with major emphasis on maritime transportation and U.S. Navy multi-element, complex system tradeoff and cost-effectiveness studies, frequently employing computer simulations as analysis and calculation aid. Program manager for numerous major U.S. Navy and Commercial operations research and systems analysis projects.

Major Project Experience

- Prime contractor and consultant to the Ports of Los Angeles and Long Beach, California in the development of a risk management plan for the handling, transportation, and storage of hazardous cargos at and through the ports.

- Consultant and West Coast manager for National Maritime Research Center for development of maritime risk management program for the Santa Barbara Channel, focused on the offshore oil development activities and vessel traffic in the Channel. Client was the California Coastal Commission.

- Consultant and senior analyst on study and development planning for ports, waterways, and terminals for receipt of crude oil purchased for storage in the Strategic Petroleum Reserve for the U.S. Department of Energy.

- Consultant and lead analyst on engineering and economic feasibility study for marine transportation of oil and gas from the National Petroleum Reserve of Alaska to East and Gulf Coast U.S. ports for the U.S. Maritime Administration.

- Program manager for study of maritime aspects of alternate sites, both onshore and offshore, for a California import terminal for LNG. Study for California Coastal Commission.

- Program manager for development of maritime aspects of Environmental Impact Report for an LNG receiving terminal at Point Conception, California, for California Public Utilities Commission. Primary emphasis was on maritime risk management.

- Program manager for generation of long-range and master development plan for the commercial Port of Hueneme, California. Primary emphasis was on land use planning.

- Consultant and program manager for development of a maritime risk management program structure handbook for National Maritime Research Cener, U.S. Department of Commerce. Program structure covers risks to life, property, and the maritime environment.

Major Project Experience (Continued)

- Program manager and lead analyst in conduct of Southern California coastal vessel traffic study for the Office of Environmental Quality of Santa Barbara County, California.

- Program technical manager for major, multi-year analytical assessment program for U.S. Navy development, evaluation, cost and effectiveness analysis, test, and installation of Navy surface ship combat systems and system elements.

- Manager and system analyst for numerous U.S. Navy test and evaluation programs, tactical employment guideline developments, and cost-effectiveness tradeoff analyses.

Employment Experience

1979-Present Reese-Chambers Systems Consultants

As principal of small consulting firm, supported major maritime transportation firm in port and terminal operations analysis for U.S. Department of Energy Strategic Petroleum Reserve. Assisted prime contractor in integration of petroleum shipping and land-side pipeline and storage system operations. Conducted engineering and operations research of marine terminals on U.S. Gulf Coast, and developed throughput capacity analyses for both fill and withdrawal of the petroleum reserves by marine transportation. Also provided consultant support in analysis and computer simulation development for maritime systems for shipment of oil and gas from National Petroleum Reserve of Alaska to U.S. ports. Consultant to U.S. National Maritime Research Center in conduct of maritime risk management program for California area waters. Program was done in cooperation with U.S. Coast Guard and California Coastal Commission.

Supported the Ports of Los Angeles and Long Beach as prime consultant in the development of a hazardous cargo risk management plan, as an integral part of the Ports' master planning process. Study covered liquid and dry bulk commodities such as crude oil, petroleum products, and chemicals.

Technical consultant and manager for West Coast activities for National Maritime Research Center, U.S. Maritime Administration, in development of maritime risk management program for the Santa Barbara Channel in California. Program examined vessel traffic, routing, and control, traffic lanes and safety fairways, placement of exploratory and production offshore oil-related structures, aids to navigation, communication, and procedures for risk mitigation in the Channel.

1976-1979 John J. McMullen Associates, Inc., Oxnard, California/New York, N.Y.

As Director, Operations Analysis and Planning, responsible for accomplishment of projects related to development research and operations analysis. Tasks included port studies and vessel traffic projections, energy and energy transportation studies, analytical assessments of a number of major Navy ship systems, modeling and simulation.

Employment Experience (Continued)

Program Manager for the development of a comprehensive maritime risk management program structure for the National Maritime Research Center of the Maritime Administration, in response to the Port and Tanker Safety Act of 1978. Program establishes a complete structure for the identification of risks to life, property, and the marine environment, describes specifics of each of the large number of analysis methodologies and resources applicable to each risk category, and discusses the nature and scope of risk management and mitigation measures available. Elements of this overall structure are applicable to virtually any maritime project.

Project Manager of the vessel traffic, risk analysis and management, and maritime factors sections of the Environmental Impact Report for the LNG terminal at Point Conception, generated under the cognizance of the California State Office of Planning and Research and the California Public Utilities Commission. Vessel traffic and maritime factors assessment conducted for all of Southern California, and involved considerable interaction and liaison with the U.S. Coast Guard, the ports of California, many county agencies, and commercial shippers and shipping companies. Served as expert witness in hearings concerning maritime operations and risk mitigation in California area waters.

Project Manager for the California Coastal Commission in the analysis of all maritime factors affecting the feasibility, ranking, risks, mitigating factors, and reliability of onshore and offshore LNG terminal sites. Project involved the evaluation of meteorological and oceanographic conditions, vessel traffic and casualty potentials, mitigating factors such as operational procedures, aids to navigation, and shipboard or facility equipment. The results of this work have served as the basis for decisions in maritime areas relative to LNG facility site selection in California.

Developed a special vessel traffic analysis for Santa Barbara County. Project involved an analysis of West Coast shipping with computer-aided simulation to identify possible casualty situations. Required as a basis the assimilation of information relating to West Coast shipping trends and vessel movement data in every major port on the West Coast.

Directed a Growth Projection Analysis and Master Plan Development for the Port of Hueneme, California. The Projection Analysis explored possible business opportunities for an expanding port facility, taking into account existing facilities and potential growth. Study explored the types of vessels most suitable to the area and projected shipping requirements parallel to port development. A Land Use Plan and Environmental Impact Report were developed in accordance with the California Coastal Act of 1976.

Led a major effort in support of the U.S. Coast Guard in defining methodologies by which the Coast Guard can select and test shipboard systems for its new classes of cutters in recognition of wartime contingency planning and the new 200-mile coastal zone limits. Procedures and

Employment Experience (Continued)

points of U.S. Coast Guard interaction with the U.S. Navy's Planning, Programming, and Budgeting cycle were defined, with a U.S. Coast Guard System Management Plan being the task output.

In charge of test planning and program documentation and the generation of installation and test and evaluation procedures for the NAVAIR Reserve Merchant Ship Defense System (RMSDS). RMSDS is a program which provides a complete ASW helicopter facility aboard a commercial container ship.

1971-1976 Naval Ship Weapon Systems Engineering Station, Port Hueneme, California

As Head of Systems Effectiveness Division/Advanced Systems Test and Analysis Department, was Technical Director and Manager of U.S. Navy multi-organization Anti-Ship Missile Defense (ASMD) Analytic Assessment Program (AAP) from its inception in 1970. The AAP is the analytic basis on which the Navy's procurement program for surface ship combat effectiveness improvement, a $3.7 billion, ten-year program is based. Responsibilities also included test and evaluation planning for the AEGIS System Engineering Development Model, evaluation of command and control (Combat Direction System) alternatives for DDG, DEG, and DE Class ships for NAVMAT, effectiveness and employment assessment of STANDARD MISSILE-2 on DLG Class ships for NAVORD, the development of tactical employment guidelines for the use of HARPOON on FF-1052, CG-25, and DDG Class ships, and the employment of STANDARD ARM on DDG Class ships.

As Head of Operations Analysis Branch, directed planning and conduct of ASMD Analytic Assessment program, which was carried out by a multi-organization Navy team for OPNAV, including six Navy laboratories and several contractors. This multi-year program evaluated candidate shipboard combat system suite improvements for cost-effectiveness in Anti-Ship Missile Defense, and provided the basis for the OPNAV FYDP ASMD Program. In addition, conducted numerous specific analyses including an AAW improvement program for the DD-963 Class ships for OP-097; development of Tactical Employment Doctrines for the Interim Surface-to-Surface Missile (ISSM).

1960-1971 Applied Physics Laboratory, Johns Hopkins University, Laurel, Maryland

As Assistant Project Engineer for surface ship systems, conducted or participated in numerous effectiveness and engineering analyses of U.S. Navy surface ship systems. Also participated in the Laboratory's program of technology transfer from the field of engineering to the field of medicine, in cooperation with Johns Hopkins Hospital.

Education

Bachelor of Science, Engineering, University of Maryland (1960)

Master of Science, Engineering, Numerical Science (Mathematics and Computer Usage), Johns Hopkins University, Maryland (1966)

Numerous U.S. Government courses in Computer Technology and Usage, System Analysis, Contracting and Procurement, Personnel Relations, and Government Procedures (1970-1976)

Security Clearances

Secret, U.S. Navy, Washington, D.C. (1961-1971)

Secret, U.S. Navy, Naval Ship Weapon Systems Engineering Station, Port Hueneme, California (1971-1976)

Top Secret, U.S. Navy, Port Hueneme, California (1974-1976)

Secret, U.S. Navy, DCAS, Oxnard, California (1976-1979)

Timothy J. Chambers

Consultant in Naval Combat System Test
and Analysis and Maritime Transportation

Summary of Experience

Over 10 years of experience as a systems analyst with major emphasis on U.S. Navy and maritime transportation multi-element, complex system tradeoff and effectiveness studies, frequently employing computer simulations as analysis and calculation aid. Program manager for numerous major U.S. Navy research and systems analysis and testing projects.

Major Project Experience

o Prime contractor and consultant to the Ports of Los Angeles and Long Beach, California in the development of a risk management plan for the handling, transportation, and storage of hazardous cargos at and through the ports.

o Consultant and West Coast manager for National Maritime Research Center for development of maritime risk management program for the Santa Barbara Channel, focused on the offshore oil development activities and vessel traffic in the Channel. Client was the California Coastal Commission.

o Program manager and lead analyst for development of Automated Management Information System for use in planning and execution of combat suite development and installation aboard U.S. Navy ships for Naval Sea Systems Command.

o Program technical manager for test and evaluation of Navy weapon systems including NATO Sea Sparrow RIM-7M, Chaparral, Dual-Mode Redeye, and Hornet missile systems, and Target Acquisition System (TAS) radar.

o Program technical manager and lead analyst for survivability test and analysis of Navy TOMAHAWK missile against hostile surface forces.

o Program manager and senior analyst for development of numerous data extraction, reduction, and analysis programs for use in Navy test and evaluation programs including DDG Tactical Data System, Hippocket, Target Acquisition System radar, and HARPOON missile system.

o Manager and system analyst for numerous other U.S. Navy test and evaluation programs, tactical employment guideline developments, integration studies, and cost-effectiveness tradeoff analyses.

o Consultant on study and development planning for ports, waterways, and terminals for receipt of crude oil purchased for storage in the Strategic Petroleum Reserve for the U.S. Department of Energy.

o Consultant on engineering and economic feasibility study for marine transportation of oil and gas from the National Petroleum Reserve of Alaska to East and Gulf Coast U.S. ports for the U.S. Maritime Administration.

Employment Experience

1979-Present Reese-Chambers Systems Consultants

As principal of small consulting firm, supported major maritime transportation firm in port and terminal operations analysis for U.S. Department of Energy Strategic Petroleum Reserve. Also provided consultant support in analysis and computer simulation development for maritime systems for shipment of oil and gas from National Petroleum Reserve of Alaska to U.S. ports.

Supported the Ports of Los Angeles and Long Beach as prime consultant in the development of a hazardous cargo risk management plan, as an integral part of the Ports' master planning process. Study covered liquid and dry bulk commodities such as crude oil, petroleum products, and chemicals.

Technical consultant and manager for West Coast activities for National Maritime Research Center, U.S. Maritime Administration, in development of maritime risk management program for the Santa Barbara Channel in California. Program examined vessel traffic, routing, and control, traffic lanes and safety fairways, placement of exploratory and production offshore oil-related structures, aids to navigation, communication, and procedures for risk mitigation in the Channel.

1968-1979 Naval Ship Weapon Systems Engineering Station, Port Hueneme, California

As Branch Head for the Systems Analysis Branch, was responsible for conducting numerous test and evaluation programs, software development projects, shipboard combat system integration studies, cost-effectiveness tradeoff analyses and tactical employment guidelines developments. Test and evaluation projects included NATO Sea Sparrow RIM-7M, Chaparral, Dual-Mode Redeye, and Hornet missile systems, and Target Acquisition Systems (TAS) radar. Software development included data extraction, reduction, and analysis as well as system simulations. Integration studies included complete combat systems into U.S. Navy ship classes including destroyers, cruisers, auxiliaries, and carriers. Cost-effectiveness tradeoff analyses were performed to determine the best combat suites for all classes of Navy surface ships. Served as a senior analyst on the NAVMAT Analytical Assessment Program, which formed the basis for the present Navy Weapon System Procurement and Installation Plan. Tactical employment guideline development included both guidelines for individual weapon systems, such as HARPOON and ISSM, and complete combat systems such as those on destroyers, cruisers, auxiliaries, and carriers.

Education

Bachelor of Science, Mathematics, Northeast Missouri University, Kirksville, Missouri (1966)

Bachelor of Science, Education (Mathematics and Physics), Northeast Missouri University, Kirksville, Missouri (1966)

Master of Science, Mathematics, University of Toledo, Toledo, Ohio (1968)

University of California at Santa Barbara; Numerous courses in Business Administration (1968-1970)

Numerous U.S. Government sponsored courses in Computer Technology, System Analysis, Contracting and Procurement, Personnel Relations, and Government Procedures (1968-1979)

Security Clearances

Secret, U.S. Navy, Naval Ship Weapon Systems Engineering Station, Port Hueneme, California (1968-1979).

RESUME

David M. Wilbur
Manager, Environmental Analysis
AeroVironment Inc.

Educational Background

B.S., Mathematics, Harvey Mudd College, 1968
M.S., Computer Science, University of Southern California, 1971
M.S., Environmental Engineering, University of Southern California, 1974

Professional Experience

Mr. Wilbur is involved in the technical management of air quality studies at AeroVironment. Recent examples include: management of development and validation of a regional dispersion model (AVKERN); management of the development and application of previous versions of AV's complex terrain models; management of the takeover and expansion of an air quality network in Kern County, California, from five to thirteen stations; regional analysis of offshore oil development in California and coal development in Utah; air quality permit analysis in California; and impact studies for urban transportation facilities. The AVKERN development project included an intensive field experiment in Kern County that resulted in the quick mobilization of twenty people on the basis of weather forecasting. It also included the round-the-clock measurement of SO_2 (with two mobile vans) and of the upper-air wind and stability structure at three additional sites (two tethersondes and one Doppler Acoustic Radar), in addition to air quality and meteorological information at thirty fixed stations in this study area of 2500 square miles. He was responsible for program design, preparation, mobilization, implementation, and utilization of this field experiment.

Mr. Wilbur has also been involved with model validation experiments in various capacities ranging from management, data analysis, model validation and application. These experiments involved dispersion models which ranged from highway (line sources) to single and multiple source complex terrain models. Thus, he has a thorough understanding of all aspects of model validation experiments from program design through implementation to data reduction and actrual data use in model validation.

A particular area of his technical expertise is the environmental effects of electric power generation. He has devoted considerable attention to the interrelationships between air quality and the engineering aspects of power plants and other energy-related developments, including the subject of plume impingement. Previously, while at Bechtel Corporation, Mr. Wilbur was responsible for environmental engineering studies conducted for several fossil and nuclear fueled electric generating stations. He was also responsible for various parts of the licensing applications for these projects.

Professional Memberships

Air Pollution Control Association

RESUME

Sara J. Head
Atmospheric Scientist
AeroVironment Inc.

Educational Background

B.S., Atmospheric Sciences, University of California at Davis, 1975.

Professional Experience

Ms. Head is primarily involved with performing air quality impact analyses. Her responsibilities include project management, tasks such as meeting schedule and budgetary goals, interacting with clients, and preparing reports.

Her experience and training is in the following areas: atmospheric dispersion modeling, meteorological characterization, and emission estimates. She has modeled point, line and area sources in flat and complex terrain for both microscale and regional analyses. Also, she has modified computer programs for improvements to various models, and interpreted model results, mapped pollutant concentrations, and evaluated impacts.

Ms. Head has estimated emissions from urban transportation systems, parking structures, oil refineries and fields, power plants, coal mines, and industrial fuel combustion. She has applied the latest EPA-recommended method for computing motor vehicle emissions for a number of highways and roads, and also projected emissions to future years using growth factors.

While attending the UCD, Ms. Head worked as a research assistant and was involved with a micrometeorological study of the South Pole and a wind streamline analysis for use in determining pollutant dispersal in Northern California.

Professional Memberships

Air Pollution Control Association

6.2 ORGANIZATION BACKGROUND AND CAPABILITIES

6.2.1 Background

CCP is an organization of professional engineers, scientists, planners, and administrators. CCP can provide a wide range of professional consulting services to industry and government. The CCP staff has extensive experience in assisting its clients in meeting the requirements of the various Federal, State and local government agencies which administer environmental legislation. By assembling a highly qualified professional staff, conducting thorough and expert investigations, and producing reports of superior technical excellence and credibility, CCP has developed a reputation for integrity earned by very few firms in the industry. In every case where CCP personnel have testified before government agencies on behalf of clients, their statements have withstood the objections of opponents. Those government bodies before which CCP has testified include the California Coastal Commission, The U.S. Federal Power Commission, and many state and local planning agencies.

The technical and managerial personnel that form the CCP professional staff are assembled in project teams designed to meet the specific needs of clients. Administrators on the CCP staff have overseen a wide variety of complex projects and have thus gained valuable experience in project administration and control. These management concepts are applied in all CCP programs in order to successfully complete projects with technical excellence, on schedule, and within budget.

Mr. M.D. Chambers, M.S., P.Eng., founder of CCP, has an extensive background in the administration of complex research programs and in the management of interdisciplinary collaboration on projects of a diverse nature. Mr. Chambers has conducted environmental studies associated with many types of projects including an oil terminal at Kitimat Harbor, British Columbia; the NAP Line Gas Pipeline Project; and the Alberta Tar Sands Development. These studies have ranged in value from a few thousand to several hundred thousand dollars.

The CCP technical staff includes planners, engineers, marine and terrestrial biologists, oceanographers, geologists, hydrologists, archaeologists, historians, sociologists, and economists. In addition to this working talent, CCP makes selective use of independent consultants who are recognized authorities in these fields in order to guarantee that CCP studies will be of the highest quality and credibility.

6.2.2 Stability

Chamber-Mix Concrete, the parent company of CCP, has been in business in Stanton, California since 1939. CCP, in conjunction with the parent company, does an annual dollar volume of over $3.5 million in sales. Therefore, CCP has the financial capability to perform large and small studies as well as the technical and managerial expertise as demonstrated in the remainder of this Statement of Qualifications.

6.2.3 Facilities

The CCP office in Stanton has office space to accommodate project teams, as well as field equipment and laboratory. In addition, CCP maintains a 33-foot Lures (boat) at Dana Point, California, and a twin-engine aircraft for field studies and logistical support. All of these facilities and equipment are available as necessary to conduct studies.

CCP has established a Word Processing Center to ensure that the documentation and reports resulting from CCP work are of the highest quality. The Word Processing Center allows high capacity, excellent reproduction quality, and the ability to accommodate revisions and editing in a minimum amount of time.

6.2.4 Services Provided by CCP

The following descriptive material demonstrates the range and depth of the services offered by CCP.

Environmental Impact Assessment

CCP is qualified to supply environmental information and prepare the necessary reports (environmental impact report, environmental impact statement, technical support reports, etc.) to meet legislative requirements for any given project. CCP has proven expertise in investigation, documentation, and reporting on the following:

- Air Resources
- Water Resources
- Soils and Geology
- Vegetation
- Terrestrial & Aquatic Biology
- Regional Carrying Capacity
- Oceanography and Marine Biology
- Land Use
- Community Structure
- Noise Impact
- Socioeconomics
- Cultural Resources
- Traffic & Transportation
- Paleontology

Environmental Protection Planning

CCP can determine necessary and practical design modifications to eliminate or minimize adverse environmental impacts.

Social and Economic Studies

CCP professionals have a strong background in identifying and analyzing the social, health, economic and community concerns associated with a proposed development project.

Cultural Resources Inventory

CCP can provide research data and impact analysis based on archaeological, historic resource surveys, excavation and field and laboratory analysis. Special strengths include the development of statistically oriented sampling strategies, the use of remote sensing, and other special reconnaissance and site recording techniques and the accumulation and manipulation of data specifically for the design of cost-conscious management plans.

Biological Resource Inventory

CCP offers a complete environmental service for studying the distribution, population dynamics and interrelationships of plants, invertebrates, fishes, and wildlife. The approach is provided by a multidisciplinary team of scientists. The firm has had extensive experience in the identification and classification of plant communities. A specialty area is the effects of changes in plant communities on wildlife and aquatic populations.

Water Resources and Hydrology

CCP has developed a systematic procedure for solving the complex problems of water development projects. This procedure includes evaluation of the land and water uses and quality for past, present, and future conditions.

Noise Assessment

Government regulation is specific with regard to noise pollution requirements. Monitoring, forecasting, and screening are necessary adjuncts to any environmental evaluation. CCP has done extensive work in this area. Our traffic model has gained widespread acceptance by local governments.

Oil Spill Contingency Planning

CCP professionals are completely familiar with the command structure, equipment and containment methods, and cleanup procedures that must be a part of any hydrocarbon development plan.

Marine Biology

CCP professionals are experts in the fields of underwater surveys, fisheries resources, marine mammalogy, marine avifauna, water quality investigations and physical oceanography. The CCP team of marine scientists, most of whom are expert divers, will provide the CCP client with

a full complement of marine studies services. CCP scientists are particularly experienced in working in rough, turbid, and hazardous ocean conditions, and CCP has designed special equipment for sampling under difficult ocean conditions. CCP has laboratory facilities for the identification of marine plants and animals. These facilities include a reference collection of local algae, adult and larval fishes, and invertebrates, as well as a complete library of keys to California species. In addition, CCP has a large collection of underwater slides of California fauna and flora. These slides aid in field and photographic identifications.

Physical Oceanography

CCP personnel are trained in designing water quality sampling programs and taking water samples in the field. Actual analysis is done by an outside laboratory selected by CCP chemists to meet current standards outlined in the American Standard of Testing Materials (ASTM). Interpretation of results is done by highly qualified CCP personnel who are experienced at making oceanographic measurements at sea. CCP retains on its staff scientists with a background in modeling oceanographic processes. CCP scientists also have experience in marine geology, including offshore mining studies.

A brief description of CCP projects is shown on the following pages.

RELATED PROJECTS

ENVIRONMENTAL BASELINE STUDY FOR
PROPOSED HARBOR AT VANDENBERG
AFB SPACE SHUTTLE PROGRAM . . . . . U.S. Air Force/SAMSO

Documentation of baseline environmental conditions and assessment of environmental impacts of expansion of harbor at Vandenberg AFB for the Space Shuttle Program.

ECONOMIC ENGINEERING AND
ENVIRONMENTAL FEASIBILITY STUDY OF
MARINE MINING FOR PHOSPHORITE NODULES . .U.S. Department of the Interior

Study of Continental Shelf geologic occurrence, complete market analysis, environmental impact analysis, investigation of technical feasibility of mineral recovery, transportation, and benefication, and discounted case flow economic analysis.

ECONOMIC, ENGINEERING AND
ENVIRONMENTAL FEASIBILITY STUDY
OF MARINE MINING FOR SAND AND GRAVEL. . .U.S. Department of the Interior

This study was identical to the above-mentioned project except that it concerned offshore sand and gravel mining.

RECLAMATION AND ENVIRONMENTAL IMPACT ASSESSMENT FOR OPEN-PIT MINING OPERATIONS IN ALLUVIAL FAN AREAS. . . . . C.L. Pharris Sand and Gravel
Foster Sand and Gravel
R.J. Noble Company

Performed environmental impact assessment and detailed reclamation planning services for major aggregate production operation in accordance with the Surface Mining and Reclamation Act of 1975. Project included investigation of topography, soil stability, flora and fauna, cultural resources, aesthetics, air and water quality, recreation, watershed management, and reclamation planning.

RECLAMATION PLANNING AND ENVIRONMENTAL
IMPACT ASSESSMENT FOR OPEN-PIT MINING
OPERATIONS IN STREAMBED AREAS . . . . . C.L. Pharris
.Sand and Gravel Company

This project was very similar to the afore-mentioned project except that the proposed mineral deposit was located in a streambed area where it was necessary to contend with wet season flooding and with impacts to a riparian habitat.

HISTORICAL RESOURCE STUDY
CHANNEL ISLAND NATIONAL MONUMENT. . . . . National Parks Service

Provided the client with completely documented narrative history of the Channel Islands. Included complete literature search as well as oral interviews and extensive site searches by land, air and water.

ENVIRONMENTAL IMPACT REPORTS. . . . . City of Brea, California

Environmental analyses performed for the above client encompass a variety of project types. Residential projects include a mobile home park with an industrial buffer zone, a 28-unit condominium project, and a residential care facility for ambulatory senior citizens. Nonresidential projects include a 2-acre shopping center, a professional office complex, and an industrial subdivision.

VISBEEK RANCH BIOLOGICAL
AND CULTURAL RESOURCE STUDIES . . .Nu-West Development Corporation, Ltd.

Conducted these studies for input to the land use planning for 2,000-acre Visbeek Ranch property in San Clemente. The biological study identified plant and wildlife communities and determined impacts of proposed development alternatives. Cultural resource studies identified archaeological and paleontological resources and analyzed their significance, and developed mitigation measures that would allow proposed development while adequately protecting significant resources.

PLANNING ADMINISTRATION . . . . . .City of Stanton, California

Under long-term contract to the City of Stanton, Chambers assumed total responsibility of the Planning Department. The Chambers' staff processed all site plans, discretionary actions related to land use, and environmental analyses. Chambers prepared all staff reports and represented the Planning Department at Planning Commission and City Council meetings.

MARINE BASELINE
STUDY - PLATFORM EMMY . . . . . .Aminoil USA, Inc., Western Division

An underwater survey was performed to determine the existing conditions of marine communities on the oil platform. This survey was done prior to dumping of drill cuttings at the site and will form a basis for future monitoring of marine communities. Densities of invertebrates both on and under the platform were assessed, and fish populations associated with the platform were enumerated. Sediment samples were taken for chemical analysis. In addition, conditions on and under the platform were documented by extensive photographic coverage.

CULTURAL RESOURCES MANAGEMENT PROGRAM . . . . . Forrest-Fox Realty

Chambers' archaeologists designed a protective/mitigation program for a large residential development in Oceano, San Luis Obispo County, California, on a site containing extensive evidence of Native American habitation.

ENVIRONMENTAL IMPACT REPORT
RECREATIONAL DEVELOPMENT. . . . . .City of Santa Barbara, California

Prepared an EIR to evaluate potential impacts of a 94-acre regional park. A large portion of the site was utilized as an uncontrolled landfill for 40 years. Areas of critical concern have been identified as traffic, geology, and land use compatibility.

ENVIRONMENTAL IMPACT
REPORT - PHASE II: RELIEF SEWER . . City of Huntington Beach, California

Developed a Focused EIR addressing the environmental impacts identified in the initial study: soils, geology, cultural resources, land use, archaeology, and public services. The document described environmental benefits and constraints resulting from the proposed project.

ENVIRONMENTAL IMPACT REPORT — City of San Juan
PLANNED RESIDENTIAL DEVELOPMENT . . . . . Capistrano, California

The comprehensive EIR detailed the environmental impacts and mitigation for a planned development bordering a flood control channel and involving the extension of new roads.

REQUIRED ENVIRONMENTAL — City of Los Angeles
DOCUMENTATION/SCOPE OF WORK — Department of Recreation and Parks
1984 SUMMER OLYMPIC GAMES . . . . . U.S. Army Corps of Engineers

The project included the inventory of all environmental subjects that could be affected by the conduct of the Olympic Games in the greater metropolitan Los Angeles area, and preparation of a work program that would address these subjects meeting all CEQA and NEPA requirements.

ARCHAEOLOGICAL EXCAVATION, SOLAR
HEIGHTS TRACT, PISMO BEACH, CALIFORNIA. . . . . .Jones and Wells

Conducted cultural resources inventory of a Pismo Beach residential development where evidence of native American habitation had been uncovered during grading operations. Participated in negotiations with planning officials and representatives of native American groups wherein mitigation measures were adopted that would allow the development of the client's property to continue.

STUDY INCORPORATION OF WILDLIFE
PRESERVES IN PLANNED COMMUNITY DEVELOPMENTS . . . . . Shapell Industries

Study of the existing wildlife habitat at the proposed community site, and investigation of methods of retaining portions of the natural habitat within for development as nature preserves.

STUDY OF IMPACT OF DEVELOPMENT
ON COASTAL LIVE OAKS AND VALLEY OAKS. . . . . .Western Estates Homes

Developed and implemented an integrated research program to study the effects of residential development on the water balance, physiological processes, and associated wildlife and insects of oak trees in the Thousand Oaks/ Westlake Village area.

PALEONTOLOGICAL RESOURCE STUDY
OF LOWER COLORADO RIVER SYSTEM. . . . . .U.S. Department of the Interior

Study to inventory the paleontologic resources of the lower Colorado River system and to determine the extent to which these resources have been affected by development of the river from the year 1900 to present. In addition, impacts of proposed development alternatives were determined.

ENVIRONMENTAL IMPACT REPORT
FOR A CONDOMINIUM DEVELOPMENT . . . . . City of El Monte, California

Prepared a report to address potential environmental impacts resulting from the conversion of an existing golf course to a 704-unit condominium development. The discretionary actions under consideration included a General Plan Amendment, Zone Change, Tentative Tract Map, and Variances.

TEST-PHASE INVESTIGATIONS OF THE Nu-West Develop-
CULTURAL RESOURCES: VISBEEK RANCH . . . . . .ment Corporation, Ltd.

This project is the result of a cultural survey conducted by Chambers in 1978. Results of the initial survey of the 1,700-acre portion of the Ranch outlines 17 sites. Each site will be tested as to extent, depth, variety of data, quantity of data, horizontal and vertical complexity, integrity, age, environmental context, and the research potential and significance.

TEST PHASE INVESTIGATIONS,
KUDEN & ELLSWORTH PROPERTIES. . . . . .City of Grover City, California

The analysis of two sites, one prehistoric and the other historic, located on two parcels of land under development for condominiums, and the development of specifications for mitigation phase programs.

INTERVIEW PROGRAM TO DETERMINE
PROXIMITY OF LARGE MARINE MAMMALS
TO OIL AND GAS PLATFORMS. . . . . Naval Ocean Systems Center

A method was developed to derive information on the proximity of large marine mammals to oil and gas platforms by interviewing oil platform workers. This study was part of a larger program by the Naval Ocean Systems Center to determine the effects of noise of offshore oil and gas operations on the behavior of marine mammals. CCP developed a questionnaire consisting of questions to determine the presence, identity, and behavior of marine mammals near oil platforms. CCP also developed a training program to instruct oil platform personnel in the identification of marine mammals. In addition, an analysis method was designed to derive the maximum amount of useful information from the program.

ENVIRONMENTAL IMPACT REPORT FOR RESUMPTION
OF EXPLORATORY DRILLING OPERATIONS STATE
OIL AND GAS LEASE PRC 3314.1, VENTURA COUNTY. . . State Lands Commission

The proposed project was a resumption of offshore drilling operations by Shell Oil Comapny as leasee of State Oil and Gas Lease PRC 3314.1, Pierpont Area, Ventura County, Shell proposed to drill from a semi-submersible drilling rig a 13,000-foot subsea exploratory well to test the lease for potential hydrocarbon accumulations. CCP examined all the potential environmental impacts involved with Shell's proposed exploratory drilling operations. Among the important issues studied by CCP were geologic hazards and conditions, oil spill potential and contingency plans, air quality aspects, impacts on water quality, impacts on marine and terrestrial biology, alteration of significant archaeological and cultural resources, navigation and anchorage hazards, economic impacts, cumulative impacts, and alternatives. Mitigation measures were suggested to alleviate negative impacts.

INITIAL STUDY TO DETERMINE THE
INVESTIGAITONS WHICH WOULD BE NECESSARY
TO ASSESS THE BIOLOGICAL IMPACTS OF San Diego
DEVELOPMENT NEAR THE FAMOSA SLOUGH WETLANDS . . . . . Housing Commission

An initial study was performed to determine the investigations which would be necessary to assess the biological impacts of a housing development near the Famosa Slough, a wetlands area in the City of San Diego. A list was prepared of studies which would be required by the concerned government agencies. Potential impacts of the proposed housing development on the slough were identified and mitigation measures identified. Methods to enhance the presently degraded environment of the Famosa Slough were also presented.

MONITORING PROGRAM FOR WASTEWATER
DISCHARGE OFF HUNTINGTON BEACH. . . . . .Aminoil USA, Inc.

A monitoring program was initiated in 1979 for a petroleum operations discharge. The program included diver transects, sediment sampling, core samples for infauna, and photographs of quadrats.

DRAFT ENVIRONMENTAL STATEMENT FOR FERAL
ANIMAL REMOVAL AT SAN CLEMENTE ISLAND . . . . . .U.S. Navy

The Draft Environmental Statement was prepared in accordance with Council on Environmental Quality (CEQ) regulations. The project described the feral animal removal program as resolved between the Navy and the Federal Court Action, and discussed alternative methods of removing the feral goats, deer, cats, and pigs. Effects on cultural and natural resources were documented.

ENVIRONMENTAL ASSESSMENT TO ADDRESS THE
CONTINUING OPERATIONS OF THE NAVAL AIR
STATION, NORTH ISLAND SPECIAL AREA, SAN CLEMENTE ISLAND . . . .U.S. Navy

The Environmental Assessment described the natural environment of San Clemente Island. The Navy's need for San Clemente Island for training, research, and operations was evaluated. Alternative scenarios were investigated including the impacts on the Island ecosystem if the Navy were to stop Island activity and feral animal management.

INTERIM CULTURAL RESOURCES MANAGEMENT
PLAN FOR SAN CLEMENTE ISLAND. . . . . .U.S. Navy

CCP personnel collected, organized, and computerized, with a new encoding dictionary commentary they designed for Island data, information about almost 1,900 sites. In addition, they designed and placed 23 sampling units in the unsurveyed 40 percent of the Island, which yielded 57 new sites. From these data, interim management recommendations were designed which will be in effect until further surface and subsurface work initiate National Register nominations and full protective/mitigative responses.

PREPARATION OF AN ENVIRONMENTAL
ASSESSMENT FOR EXPANSION OF
OCEANSIDE HARBOR. . . . . U.S. Army Corps of Engineers

The proposed harbor expansion involved dredging, jetty construction, and construction of new boatslips. All existing data on environmental conditions including biota, oceanographic conditions, water quality, traffic, air quality, noise, cultural resources/archaeology, soils, geology, and hydrology were gathered and assessed. Complete impacts of the proposed harbor development were evaluated and mitigation measures suggested. Impacts of alternative plans were considered.

Section 7

SUBCONTRACTORS

7.1 INTRODUCTION

In order to assemble the strongest possible Project Team, CCP has augmented its own internal resources with outside consultants. These consultants, which are presented in this section, represent the finest talent in their respective fields.

7.2 SUBCONTRACTOR RESPONSIBILITIES

7.2.1 AeroVironment, Inc.

AeroVironment, Inc. will be responsible for the air element of the Physical/Chemical Studies portion of the EA/EIR as described in the Technical Approach of this proposal.

7.2.2 Engineering Geologic Services and Nekton, Inc.

Engineering geologic services and Nekton, Inc., will br responsible for the geological and geophysical survey portion of the EA/EIR as described in the Technical Approach.

7.2.3 Reese-Chambers Systems Consultants, Inc.

Reese-Chambers are maritime consultants reponsible for the navigation hazards portion fo the study as described in the Technical Approach.

7.2.4 S. Horne - Marine Archaeologist

Mr. S. Horne will conduct the marine archaeology for the project.

7.3 ORGANIZATIONAL STATEMENTS OF QUALIFICATION

The following pages are comprised of statements by AeroVironment, Inc., setting forth the qualifications and background of their organization and personnel.

Corporate Description and Qualifications

AEROVIRONMENT INC.

AeroVironment (AV) applies diverse technologies in the fields of energy and the atmospheric environment -- United States and abroad. Commercial companies and government groups utilize AV products and services in the development and economical use of energy resources, helping to conserve fuel and minimize air pollution.

In its **environmental** work the company applies multi-disciplinary skills to tasks ranging from the collection and analysis of data -- air quality, meteorology, visibility, noise and low-level nuclear radiation -- through mathematical modeling and impact assessments to the presentation of expert testimony before regulatory bodies and the public.

A complementary thrust of AV's activity applies advanced fluid dynamics, meteorology, and ocean engineering to major **alternative energy programs,** especially wind and ocean energy systems. Using innovative applied fluid mechanics, AV also provides design and research for industrial problems such as fuel conservation in vehicles and energy-efficient handling of fluid flows.

AV's **products** also relate to energy and the environment: sonic systems which take remote measurements of wind and other pollution dispersion variables, particulate samplers, and a patented line of add-on devices for trucks which reduce aerodynamic drag and, hence, fuel consumption.

The company was founded in 1971 as a California corporation. AV's founder, president and chairman of the board is Dr. Paul MacCready, a nationally recognized authority in atmospheric science and human-powered flight. Nobel Prize winner in physics, Dr. Murray Gell-Mann, is also a founding director. Other founding principals are Dr. Ivar Tombach, vice president of the Environmental Programs Division, and Dr. Peter B. S. Lissaman, vice president of the Aerosciences Division.

AV's comprehensive staff of over 100 engineers, scientists, and support personnel is organized into three divisions -- Environmental Programs, Aerosciences, and Products (see Organization Chart on Page C-4).

SENIOR STAFF

AV's senior people have managed and performed a variety of technical programs directed toward meeting national needs or solving client problems. They have authored numerous reports and papers; served on government, university, and industry boards and committees; and held office in a number of scientific societies. The backgrounds of AV's officers are described below.

- Dr. Paul MacCready, President

Dr. MacCready, AV's founder, is an internationally recognized authority on many aspects of engineering and science. He manages and provides key technical input to some of the company's largest projects in all divisions, and guides overall strategy, policy, and ventures into new areas. He is a member of the National Academy of Engineering, a Certified Consulting Meteorologist, a consultant and advisor to various government and university groups, and has been responsible for major programs, inventions, and instrument developments in weather modification, air pollution diffusion, turbulence measurement, energy conservation, and aviation. He has received world-wide recognition and aviation's most prestigious award, the Collier Trophy, for his conception, design, and development of human-powered aircraft -- first, the Gossamer Condor (now in the Smithsonian Institution's National Air and Space Museum) and then the Gossamer Albatross, which claimed aviation's largest prize when pedaled across the English Channel.

- Stanford H. Taylor, Executive Vice President

Mr. Taylor manages AV's diverse spectrum of activities throughout the world. He joined the company in 1977 and has managed the strategic, financial, and organizational aspects of AV's rapid growth of recent years. He has extensive experience in consulting activities and high-technology product businesses. He has been a vice president of Booz, Allen & Hamilton, Inc., management consultants. He was general manager of Analytical Systems for Abbott Laboratories and later was president of the Searle Analytic Division of G. D. Searle & Company -- both manufacturers of electronic-optical instrumentation.

- Dr. Ivar Tombach, Vice President, Environmental Programs Division

Dr. Tombach directs a staff of over 70 individuals, performing AV's air quality, noise, radiation, and meteorology programs, and contributes to the technical aspects of these programs. He has fundamental and applied expertise in air quality measurement and analysis, environmental instrumentation, and aerodynamics. Dr. Tombach has been technical manager for a number of major field studies of air pollution, atmospheric structure, and aircraft wake turbulence. He has also designed and developed several instruments currently being manufactured for air quality and meteorological research. Dr. Tombach currently serves on the Air Pollution Control Association's Technical Committees on Visibility, and Mobile and Remote Monitoring.

- Dr. Peter B. S. Lissaman, Vice President, Aerosciences Division

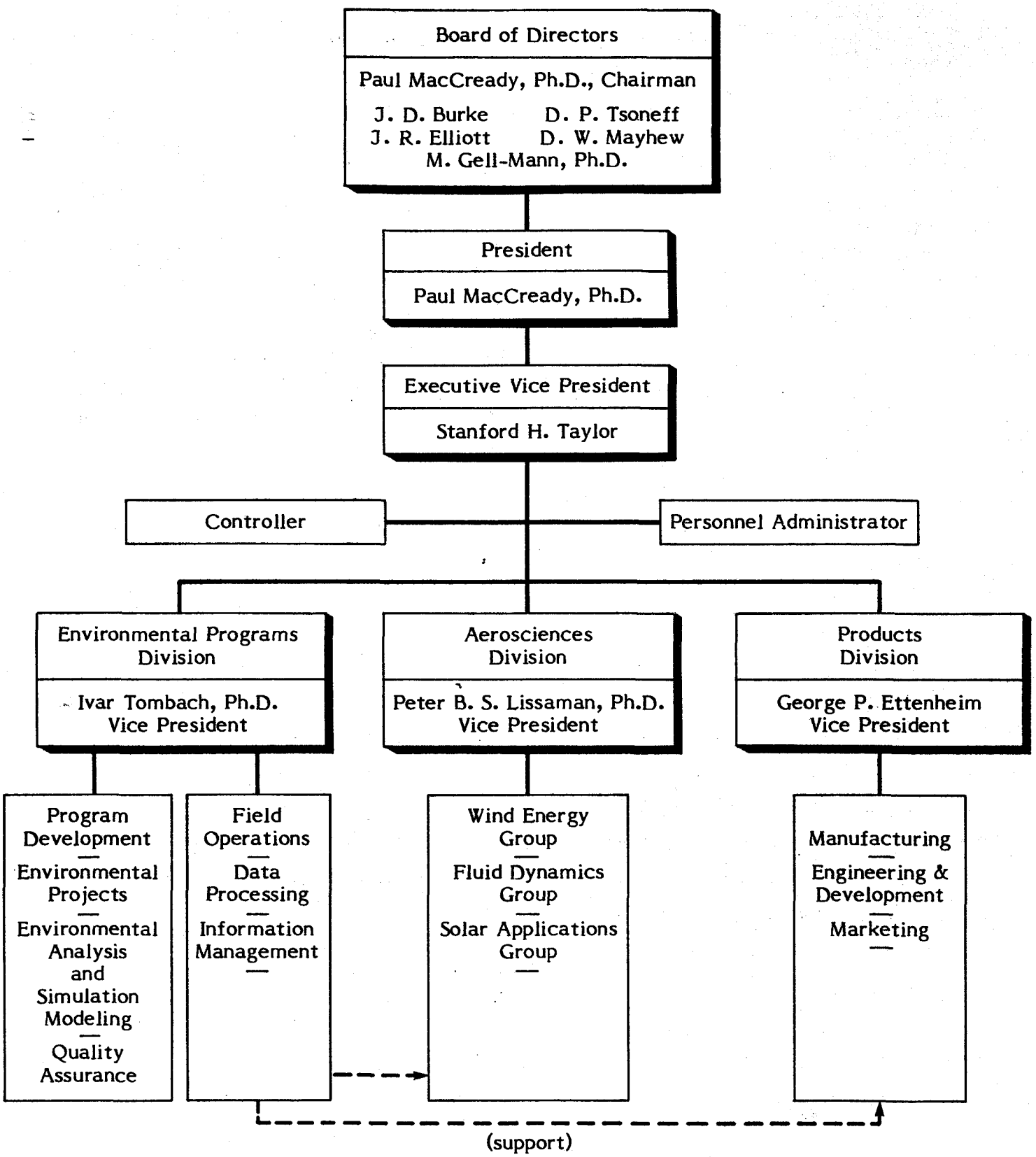
Dr. Lissaman is responsible for programs and developments in fluid mechanics and energy, including wind and ocean current energy research and design, theoretical and experimental work on airflow and turbulent diffusion (in ducts, in the atmosphere, around structures, and in vortex wakes), and the development of innovative aerodynamic techniques for optimized fluid movement and control. He invented the AeroBoost line of energy conservation devices which produce significant fuel savings by reducing air resistance of trucks, and participated with Dr. MacCready in the aerodynamic design of the Gossamer Condor. He has been chairperson for numerous United States and international symposia on wind energy.

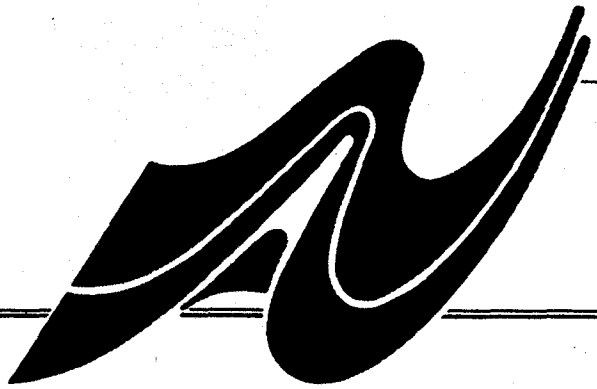
- George P. Ettenheim, Vice President, Products Division

Mr. Ettenheim has been involved for many years in the development, field testing, and utilization of ground and airborne meteorological instrumentation. As vice president of the Products Division, he is responsible for product engineering, manufacturing, and marketing with emphasis on new product development. He has authored a number of reports and papers involving meteorological field studies, and has written and directed seven technical films. He is a past president of the Weather Modification Association and currently serves on committees of the Air Pollution Control Association and the American Nuclear Society.

AEROVIRONMENT INC.

Organization





Environmental Programs Division

In the Environmental Programs Division, most of our work is in the study and analysis of the atmospheric environment and the contaminants within it. Under the direction of Dr. Ivar Tombach, this division has performed more than 150 projects funded by the federal government, several states and counties, and private companies. These projects have ranged from multi-year environmental baseline monitoring, modeling and analyses programs costing well over $1 million to smaller quick-response consulting jobs. The work has included:

- Air Quality Measurement – Monitoring visibility, gaseous, particulate, and radioactive contaminants throughout the United States; studies of pollutant chemistry and transport using airborne measurements; and tracer studies to simulate pollutant dispersion.

- Air Quality Modeling – Computer calculation of present and future concentrations of air pollutants -- both reactive and nonreactive -- on both local and regional scales, with particular emphasis on diffusion in complex terrain and in urban areas.

- Air Pollution Control – Evaluation of control strategies for air quality maintenance planning; innovative technology for the control of fugitive emissions; and evaluation and design of traditional equipment for air pollution control.

- Meteorological Research – Measurement and analysis of atmospheric motion and turbulence and their relation to large-scale atmospheric phenomena and structure.

- Low-Level Radiation – Measurement of low-level radon in mining and milling operations; radiation surveys; measurement of gamma dose rate; and evaluation of radiation exposure pathways.

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- Special Services – Quality assurance, data processing, and field operations services are available to clients independently of other tasks involved in environmental monitoring or assessment programs.

The Environmental Programs Division includes professionals in meteorology, air quality, air pollution control technology, aerodynamics, engineering, simulation modeling, physics, chemistry, and the overall aspects of environmental analysis and planning. The senior staff of AV includes four scientists with doctorates and two Certified Consulting Meteorologists. The staff supporting these professionals includes instrumentation technicians, field operations specialists, data analysts, and computer programmers.

The expertise of AeroVironment's staff is supplemented by affiliations with other groups and individuals with outstanding credentials in their fields. One of these groups is Air Pollution Associates, staffed by Drs. James Pitts, Arthur Winer, and Barbara Finlayson-Pitts, all distinguished in the field of photochemical pollution. A resident staff consultant, Dr. Stephen Friedland, is widely recognized for his work in the effects, measurement, and control of nuclear radiation.

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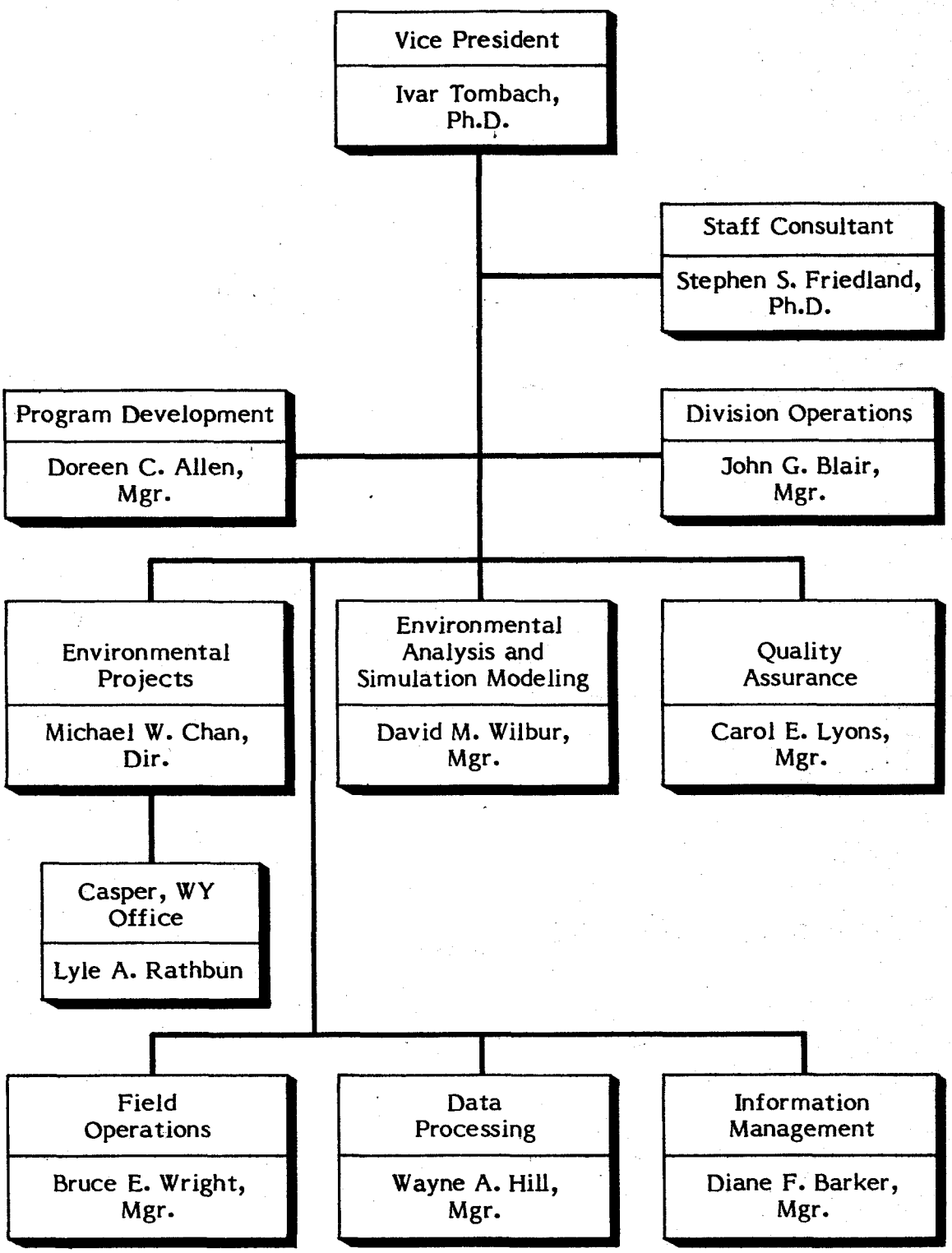
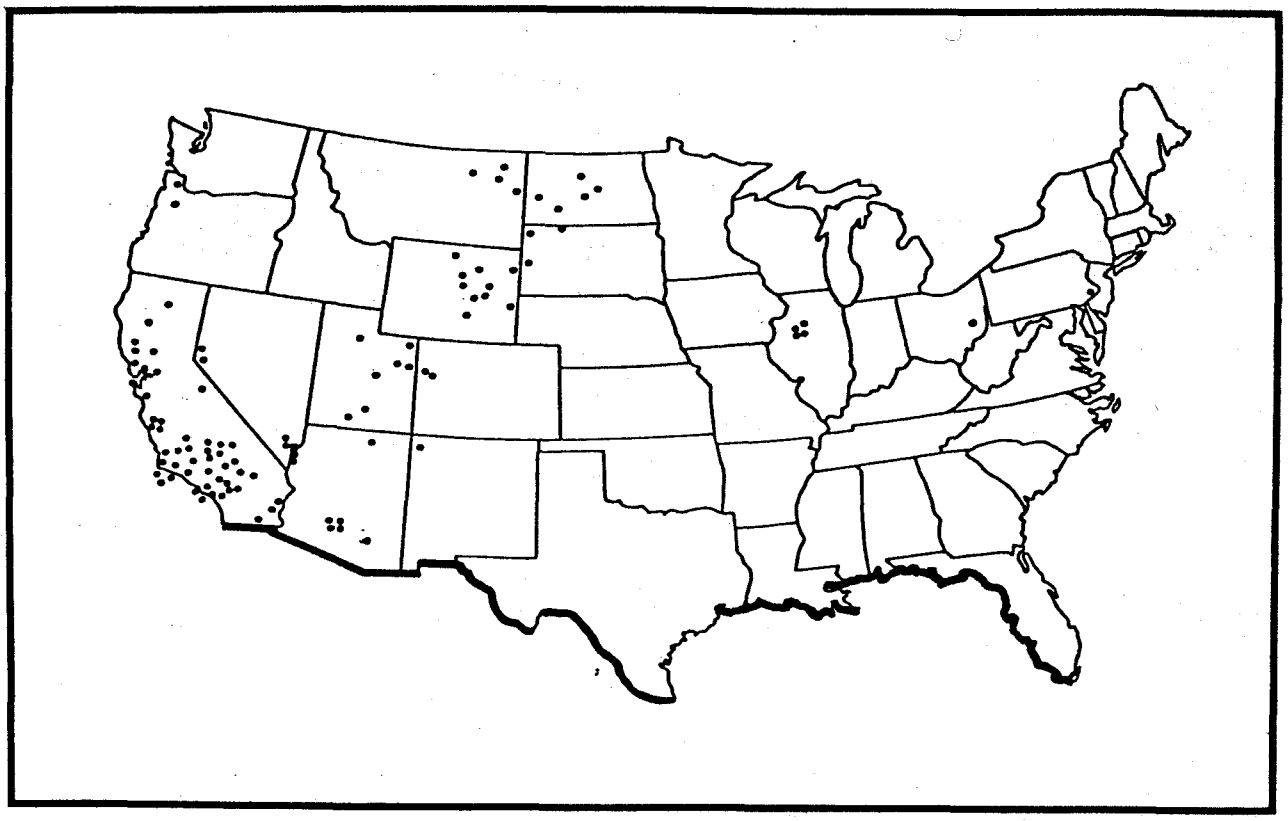
Environmental Programs Division Organization





LOCATIONS OF FIELD AND ANALYSIS PROGRAMS PERFORMED
BY AEROVIRONMENT'S ENVIRONMENTAL PROGRAMS DIVISION
(1972 through 1980)

EXPERIENCE

Utilities and Industrial Plants

AeroVironment's work for industrial processing facilities and power plants has ranged from simple impact assessments of two or three environmental parameters to basic plume diffusion research. We have performed monitoring and quality assurance, impact assessment modeling, model evaluation and development, emission control strategy development, and plume sampling using aircraft-borne instrumentation.

Many utility companies planning fuel conversions or new generating plants, as well as many industrial processing companies expanding their facilities, must comply with state regulations and EPA Prevention of Significant Deterioration (PSD) ambient monitoring guidelines. AV has helped numerous clients obtain permits for such developments, interacting directly and indirectly with federal and state agencies in California, Arizona, Oregon, Utah, Nevada, Wyoming, New Mexico, and Colorado.

In some special field projects, we have performed tracer studies to validate diffusion models, done basic research on atmospheric structure for model development and validation, and measured plume height using our own Acoustic Radar. AV's wide experience with the environmental problems faced by planners of industrial facilities shows that we are equipped with the appropriate hardware, software and talent.

Projects Performed for Utilities and Industrial Plants

Clients and Project Titles	Measurements		Emissions		Modeling	
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application
Electric Utilities						
Southern California Edison Company (SCE)						
Ozone and Visibility Measurement Program in Lucerne Valley, CA	X					
Plume Height Measurements		X				X
Aircraft-Based Measurements of Air Pollutants in the Ormond Beach Generating Station Plume		X				
Aircraft-Based Measurements of Meteorology and Air Pollutants in the Los Angeles Basin		X				
Relative Impacts of Particulate Sources in the Vicinity of the Mohave Generating Station			X	X		X
Fugitive Dust Offset Analysis				X		
Pacific Gas & Electric Company (PG&E)						
Tracer Diffusion Study and Model Evaluation at The Geysers Geothermal Power Plant		X				X
Air Quality and Meteorological Monitoring for a Coal-Fired Generating Plant	X	X				
Commonwealth Edison Company						
Plume Rise and Dispersion in Heterogeneous Air Masses					X	
Bechtel Power Corporation						
Diffusion of Power Plant Plumes in Complex Terrain	X				X	X

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Projects Performed for Utilities and Industrial Plants

Clients and Project Titles	Measurements		Emissions		Modeling		Analysis
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application	Data Analysis
Public Service Company of New Mexico							
Plume Height Measurements at Four Corners Generating Station, NM		X					
Electric Power Research Institute (EPRI)							
Visibility Measurement Technique Intercomparison in the Eastern United States	X						
Salt River Project							
Data Base Development and Visibility Characterization Study							X
Processing Plants							
Kaiser Engineers							
Photochemical Modeling of a Cement Plant Near Redding, CA						X	
Jacobs Engineering							
Air Quality and Noise Impact Assessment of Proposed Asphalt Topping Plant	X					X	
California Portland Cement Company (CPC)							
Air Quality Impact Assessment of Proposed Cement Kiln	X					X	
Handling Fugitive Dust at a Portland Cement Plant				X			
Air Quality Permit Application for Mill						X	
Kaiser Steel Corporation							
Calibration of SO_2 Analyzers	X						

Projects Performed for Utilities and Industrial Plants

Clients and Project Titles	Measurements		Emissions		Modeling	
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application
Riverside Cement Company						
Assessment of Fugitive Dust Losses from Storage and Handling of Clinker			X	X		
Continental Carbon Company						
Air Quality Impact Assessment for Bakersfield Carbon Plant						X
IBM Corporation						
Air Quality Monitoring in Tucson, AZ	X					
California Air Resources Board (CARB)						
Hydrocarbon Emissions Measurement at an Oil Refinery	X	X				

EXPERIENCE

Regional and Urban Air Quality Studies

The experience of the Environmental Programs Division in regional and urban air quality studies ranges from the study of individual parking structures to air quality maintenance analyses for entire urban areas, and includes impact assessments of major highway and airport developments. AV's impact assessments of alternative development plans or operating procedures are used by clients to evaluate environmental policy and control strategies. We have related our findings to applicable regulatory standards and State Implementation Plans and provided expert testimony, when needed. We have also interacted directly with the public, both orally at hearings and in writing.

AeroVironment has performed several regional air quality impact studies for urban areas. These studies have often required extensive field programs in order to validate air quality models and to determine baseline conditions. For example, in Reno and Las Vegas, Nevada, and in Phoenix, Arizona, we compiled emissions inventories and did extensive air quality and meteorological monitoring, forming large data bases which were handled by Aerovironment's computer facilities. These data bases were then used as input to various models to determine the future air quality impacts of alternative highway development scenarios.

Interpretive analysis of such data is a continuing activity of AV's Environmental Analysis group. Such analyses, on both local and regional scales, including both present measurements and future forecasts, and relating meteorological, emissions, and air quality parameters, have been major elements of all the monitoring and modeling studies mentioned above. The analyses are performed by computer programs operating on AV's in-house computer with the use of innovative techniques; only the large air quality models require the added assistance of a larger computer.

In the course of its monitoring activities, AV's staff has developed a strong capability and detailed procedures in air quality data validation. Because the work is frequently performed in conjunction with government air pollution control agencies, the validation process has led to comprehensive joint studies. In all such cases, the AV data and AV-developed procedures have proven themselves well.

Regional and Urban Air Quality Studies

Clients and Project Titles	Measurements		Emissions		Modeling		Analysis
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application	Data Analysis
General Studies							
U.S. Environmental Protection Agency							
Air Quality Maintenance Analysis in Phoenix, AZ			X	X	X	X	
Evaluation of Approaches for Measuring Ozone Transport into Urban Areas	X	X					
Philadelphia Oxidant Data Enhancement Study	X						
New Concepts of Control Applied to Urban Inhalable Particulates		X	X	X			
Study of Plume Transport and Persistent Elevated Pollution Episodes (PEPE)	X	X					
Oregon Department of Environmental Quality							
Relating Particulate Matter Sources and Impacts in the Willamette Valley During Field and Slash Burning				X			X
County of Santa Barbara, California							
Climatological and Air Quality Characterization and Impact Assessment for Various Growth Alternatives in the Santa Ynez Valley	X		X			X	
UltraSystems Inc.							
Air Quality Monitoring in Glendora and Azusa, CA	X						
Envista Inc.							
Air Quality Modeling of a Bus Terminal						X	
Air Quality Analysis of Coyote Hills West Development, Fullerton, CA			X			X	

Regional and Urban Air Quality Studies

Clients and Project Titles	Measurements		Emissions		Modeling	
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application
General Studies						
General Services Administration (GSA)						
GSA Parking Structure Air and Noise Impact Analysis		X	X			X
Housing Community Research Associates						
Phillips Ranch Microscale CO Impacts			X			X
U.S. Department of Interior, National Park Service						
Yosemite Valley Air Quality and Noise Study	X	X				
U.S. Air Force						
Carbon Monoxide Modeling at Vandenberg Air Force Base						X
Airports						
California Air Resources Board (CARB)						
Los Angeles and San Francisco International Airport Emission Control Strategy Study			X	X		
Los Angeles Department of Airports						
Palmdale Intercontinental Airport Impact Study	X	X	X	X	X	X
Analysis of Regional Effects of Palmdale Airport Development			X	X		X
U.S. Department of Energy						
Study of Air Quality Impacts of Aircraft Towing			X	X		X

Regional and Urban Air Quality Studies

Clients and Project Titles	Measurements		Emissions		Modeling	
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application
Highways						
California Department of Transportation						
Air Quality Study of Routes 85 and 87 in the San Jose Area	X	X	X		X	X
Air Quality Study of Routes 17, 80, and 93 in the Richmond Area	X	X	X		X	X
Arizona Department of Transportation						
Air Quality Impact Assessment of I-10 Freeway in Maricopa County, AZ	X	X	X		X	X
Utah Department of Transportation						
Utah Highway Air Quality Impact Assessment Proposed Projects Along the Wasatch Front	X	X	X		X	X
Jet Propulsion Laboratory (JPL)						
Tracer Study for a Three-Percent Scale Highway Tunnel		X				
Nevada Department of Highways						
Truckee Meadows and Las Vegas Valley Air Quality Studies	X	X	X		X	X
AVQUAL Model Validation Experiment, Carson City, NV		X	X		X	X
Oregon Department of Transportation						
Air Quality Impact Analysis for Proposed Freeway Interchange	X		X			X
Utah State Attorney General's Office						
Air Quality Impact Analysis of I-215 Southeast Belt Route, Salt Lake County			X			X

EXPERIENCE

Oil and Mining Operations

Baseline air quality and meteorological data collection and impact assessments for proposed mining developments have been routine for AV's Environmental Programs Division for several years. In support of construction and operating permit applications, we have designed and installed regional monitoring networks to do preliminary background atmospheric studies for coal, uranium, and oil shale mines in Wyoming, Utah, Colorado, and California. Emissions inventories have been estimated and used as input into diffusion models for determination of the potential impacts of proposed developments. We have developed and validated a diffusion model for mountainous terrain. AV has also been involved in fugitive dust and particulate control programs, in visibility assessments, in inhalable particulate monitoring programs, and in radiological monitoring, impact analyses, compliance testing, and operational safety programs.

The experience of the Environmental Programs Division in the air quality impact assessment of offshore oil development and tertiary oil recovery has been of value to both regulatory agencies and the industrial sector. We have designed and operated large monitoring and data acquisition systems for several energy programs and been involved in the development of and permit applications for Supplementary Control Systems (SCS's). Special field studies conducted by our staff have been valuable in quantifying plume rise, visibility, and diffusion in complex terrain. These data have been used to validate numerous proprietary air quality models developed by our technical staff.

Studies Involving Oil and Mining Operations

Clients and Project Titles	Measurements		Emissions		Modeling	
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application
Coal						
U.S. Department of Interior and U.S. Geological Survey						
Air Quality Impact Assessment of Coal Development in Central and Southern Utah			X	X		X
Alton Coal Mine Air Quality Study			X	X		X
Northern Energy Resources Company (NERCO)						
Meteorological and Air Quality Baseline Study for Proposed Antelope Mine Project, WY	X		X			X
Meteorological and Air Quality Study for Dave Johnston Mine, WY	X		X			X
Uranium						
The Cleveland-Cliffs Iron Co.						
Meteorology and Air Quality Background Study in the Pumpkin Buttes Area, WY	X		X			X
Radiological Monitoring and Site Survey, Pumpkin Buttes, WY	X	X				
Pathfinder Mines; United Nuclear; Cotter Corporation; Chevron Resources						
Radiological Monitoring Programs		X				
Cotter Corporation						
Servicing Meteorological Station and Data Reduction	X					

AEROVIRONMENT INC.

Studies Involving Oil and Mining Operations

Clients and Project Titles	Measurements		Emissions		Modeling	
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application
Oil Shale						
White River Shale Project						
Utah Environmental Baseline Monitoring and Data Collection	X	X				X
Occidental Oil Shale, Inc.						
Colorado Oil Shale Monitoring, Quality Assurance, Model Development and Validation Experiments	X	X		X	X	X
Paraho Development Company						
Air Quality Monitoring and Assessment for Oil Shale Permit Application	X	X	X			X
Offshore Oil Recovery						
U.S. Department of Interior, Bureau of Land Management						
Air Quality Analysis of Outer Continental Shelf Oil Lease Tract Along the Southern California Coast			X	X		X
Exxon Company, USA						
Air Quality Assessment for Oil Processing and Marine Terminal	X	X	X			X

Studies Involving Oil and Mining Operations

Clients and Project Titles	Measurements		Emissions		Modeling	
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application
Tertiary Oil Recovery						
Getty Oil Company						
AVKRIM Model Development and Validation for Kern River Oil Field, CA	X	X			X	X
NO_x Study in Bakersfield	X					
Plume Rise Study		X				X
Air Quality and Meteorological Monitoring at Lost Hills	X	X				
SO_2 Calibration at Bakersfield Station	X					
Western Oil & Gas Association (WOGA)						
Analysis of Alternative Approaches to Bring Kern County into Compliance with State SO_2 and Sulfate Standards				X		X
Chevron USA, Circle Oil Company						
Ambient SO_2 Monitoring at Tertiary Oil Recovery Operations	X					
Chevron USA						
Air Monitoring Station at Carpinteria, CA	X					
Double Barrel Oil Company Getty Oil Company Petro-Lewis Corporation Rainbow Oil Company Texaco Inc. Thomas Oil Company Standard Oil Company of California						
Modeling of Air Quality Impact of Steam Generators						X

Studies Involving Oil and Mining Operations

Clients and Project Titles	Measurements		Emissions		Modeling	
	Air Quality Monitoring	Special Field Study	Emissions Inventory	Emissions Control Strategy	Model Development	Model Application
Texaco, Inc.						
San Ardo Field Monitoring and Permit Application	X					X
West Side Operators						
AVKERN Dispersion Model Development		X			X	X
Westside Kern County Air Quality and Meteorological Monitoring	X	X				

Facilities

AeroVironment's home office is a modern 21,500-square-foot building in Pasadena, California. Our facilities include an inventory of special study instrumentation, computing and information management centers, an extensive technical library, a laboratory for air chemistry calibrations, a machine and electronics shop, and an equipment development and manufacturing area. AV has a permanent office in Casper, Wyoming, and field offices in Utah and the San Joaquin Valley of California.

EQUIPMENT

To serve clients requiring special field studies, AV maintains a wide variety of instrumentation and equipment for both ground-based and airborne measurements.

For measurements of air quality and meteorology, AV owns a number of instruments to measure each of the seven criteria pollutants (TSP, SO_2, CO, O_3, NO_2, non-methane hydrocarbons, and Pb), as well as gas chromatographs for measuring H_2S, and dichotomous samplers (which AV designed) for inhalable particulate matter. We also have a large number of anemometers, both mechanical and electronic, as well as u-v-w anemometers, turbulence meters, and various other meteorological sensors. For visibility measurement purposes, AV has several sensitive telephotometers, integrating nephelometers, as well as cameras and the laboratory equipment for photodensitometry.

Acoustic Radar and Doppler Acoustic Radar, developed and manufactured by AV, are readily available for the remote measurement of mixing height, wind velocity, turbulence, and other atmospheric variables.

AV has a mobile, self-contained air quality laboratory called Airlab. AV also has several portable heated and air-conditioned instrument shelters with workbench space and air sampling systems which can be sited in a study area and equipped with appropriate instrumentation. Towers of various types are also on hand.

AV operates a specially-instrumented aircraft for pollution and meteorological research. This aircraft, operated in association with Atmospherics Inc. of Fresno, California, has the capability for digital recording of most air pollutants and atmospheric parameters, as well as aircraft position and operating parameters. The AV/Atmospherics Group has the capability for radar tracking of this aircraft for experiment control, which also provides an additional margin of safety when more than one aircraft are in the area.

AV's airborne measurement capability also includes instruments for wind, temperature, humidity, turbulence, and ozone; these instruments can be lifted by tethered kite balloons (kytoons) or by free balloons. A wide variety of balloons, up to a 3,500 ft^3 kytoon, is on hand, backed by experienced handling crews. The larger kytoons also serve as elevated release platforms for tracer gases in plume dispersion research.

If a client has a particular program requirement for which there is no existing equipment, AV can design and fabricate innovative instrumentation to perform the job. In addition to AV's products, the instruments we have developed include an automatic sequential syringe sampler (patented); three different portable systems for airborne ozone measurement (developed under EPA sponsorship); an aircraft vortex wake sensor system; aerometric sensors for use with balloons; and special probes and signal processing circuitry for aircraft which have been instrumented to detect aircraft wakes, profile atmospheric structure, and survey gaseous and aerosol air pollution.

ANALYTICAL LABORATORY

AV's air quality and analytical laboratory supports ongoing field programs. The laboratory is equipped to calibrate all gas analyzers and perform some chemical analyses of collected samples. The laboratory has complete facilities for the processing and densitometric analysis of photographic exposures for studies of visibility; it also includes a microbalance for precise weighing of small samples of particulates. For elemental and chemical analysis of particulate matter samples, AV works with several universities and commercial laboratories; the methods used include PIXE, XRF, and ion chromatography, as well as more standard wet chemistry analytical procedures.

Our facilities for calibrating air quality instruments include National Bureau of Standards (NBS) traceable standards for most air contaminants; high-grade standard gases for in-the-field use; eight Monitor Labs Model 8500 calibrators; one Thermo Electron Model 101 calibrator; two Dasibi ozone monitors modified to be used as transfer standards; plus the necessary photometers and laboratory paraphernalia for wet chemical calibrations. Our quality assurance staff makes frequent cross-checks of all calibration devices, as well as cross-checks with external agencies to assure calibration quality. A variety of test equipment and reference standards for meteorological equipment is also on hand.

INFORMATION PROCESSING

AV's data processing facilities include three Hewlett-Packard minicomputers with a variety of peripherals, including disc drives, nine-track magnetic tape drives, a high-speed line printer, an on-line plotter, strip chart digitizer, paper tape reader and punch, cassette recorders, and typewriter. In addition, AV is upgrading to a model HP 1000/45 computer, adding multiple terminals for simultaneous multi-task processing. Our computing capability includes an extensive data base management system for the processing of data from in-the-field measurement programs.

Because certain computing efforts require larger facilities, AV has contractual agreements for the use of IBM 370-3032, Univac 1108, and dual VAX-11/780 computer systems with all common peripherals. Remote job entry terminals for the Univac 1108 and the VAX systems are located at AV's Pasadena office. The larger regional air quality models are run on these outside computers. Our computer model library includes an extensive collection of operational diffusion models -- including several models developed by AV's technical staff -- all available EPA models, and a number of models developed by other organizations.

Additional resources for the provision of information in AV are a battery of Xerox 850 word-processing units, telecopying equipment, library facilities, and direct access to Lockheed's DIALOG information retrieval system.

The following section briefly describes the relevant areas of AV's expertise, and contains brief descriptions of sample projects.

Specific Project Experience

Environmental Impact Statement Preparation

The air quality impact portion of an Environmental Impact Statement (EIS) calls for a combination of tasks ranging from baseline monitoring and construction of emissions inventories to projection of impacts far into the future using mathematical modeling. It can also include subsequent support in interacting with regulatory agencies and responding to comments from the public sector. AeroVironment has prepared the air quality portions of EIS's for a variety of clients proposing such projects as construction of urban freeways, development of an offshore oil lease tract, and development of a coal mine. AV's technical staff has extensive experience using the individual skills of monitoring, modeling, regulatory interaction, and report preparation which are needed in the preparation of EIS's. The following projects are exemplary of our work in this area.

- Air Quality Impact Analysis of Outer Continental Shelf Oil Lease Tract along the Southern California Coast

Client: U.S. DEPARTMENT OF INTERIOR, Bureau of Land Management, Los Angeles, California (N. Jay Bassin, 213/688-7104). Period of Performance: 4/77 to 7/77 and 10/78 to 2/79.

This study analyzed the potential air quality impacts of oil and gas development off the Southern California coast between San Luis Obispo and the Mexican border, in support of the preparation of an environmental impact statement (EIS) for Lease Sale 48 by the Bureau of Land Management (BLM).

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

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

Ambient air quality levels were then determined through appropriate diffusion modeling. The REM2 model was used to predict photochemical pollutant (O_3) concentrations, while the EPA models PTMAX, PTMTP, and CDM were used to predict inert pollutants (TSP, SO_2, NO_2, and H_2S) concentrations. Modeling results were compared with federal and state ambient air quality standards. The results were also used to assess probable impacts, unavoidable adverse effects, relationships between long- and short-term uses of the environment, any irreversible and irretrievable commitments of resources, and to evaluate mitigating measures.

As a continuation of this project, AV reviewed, assessed, and responded to all comments received by the BLM on the air quality aspects of the draft EIS, and wrote the air quality portions of the final EIS and Secretarial Information Document.

o Southern California Air Quality Model Validation Study

Client: U.S. DEPARTMENT OF INTERIOR, BUREAU OF LAND MANAGEMENT, Los Angeles, California (Kevin Golden (213) 688-6746). Period of Performance: 8/80-6/81.

The purpose of this study is to obtain field tracer experiment results which will be used to validate air quality dispersion models utilized in assessing air quality impacts from offshore emissions in Outer Continental Shelf waters. These will be two tracer experiments, in September 1980 and January 1981, where a tracer gas will be released in OCS waters. Meteorological and tracer gas measurements near shore and inland will be made to obtain the information needed to validate air pollution dispersion models.

o Air Quality Analysis for Exploratory Drilling Operations in California State Lands Waters

Client: STATE LANDS COMMISSION, Sacramento, California through subcontract with Mel Chambers Consulting, Stanton, California (Mel Chambers (714) 828-3324) Period of Performance: 8/80 to 11/80.

AV is responsible for the air quality analysis for an EIS for Exploratory Drilling Operations Offshore of Oxnard. This work includes air quality and meteorology characterization, emissions calculations, impact analysis and response to comments.

o Air Quality Monitoring in Carpenteria, California

Client: Chevron U.S.A., San Francisco, (Art Osegueda (415) 894-4483). Period of Performance: 11/79-1/81.

AV is operating a complete air quality monitoring station located near the shoreline in Carpenteria. The station is sited to be representative of the air quality coming from offshore areas. Parameters measured include wind speed and direction, SO_2, NO, NO_2, O_3, and temperature.

o Air Quality Impact Assessment of Coal Development in Central and Southern Utah

Client: U.S. DEPARTMENT OF INTERIOR, Geological Survey, Interagency Task Force on Coal, Salt Lake City, Utah (Dr. William Wagner, 801/524-4033). Period of Performance: 3/77 to 12/77.

This study was performed as part of a regional environmental impact asssessment and characterized the existing air quality, as well as assessed the regional impact of coal development. AV used existing topographic meteorological and air quality data in characterizing the existing environment. Emissions inventories were compiled for SO_2, NO_x, HC, CO, and suspended particulates for the proposed developments and other existing and proposed major sources.

These data were used as inputs to the AV Multi-Source Terrain Model (AVMSTM) and a modified version of the EPA Climatological Dispersion Model (CDM). The AVMSTM was used to calculate short-term concentrations and the CDM for annual averages. The

modeling results were used to determine potential interaction of pollutants from the proposed projects and existing sources. Visibility effects due to source interaction were also identified.

The air quality impacts were determined and mitigating measures proposed to minimize adverse effects. Also, impacts of alternatives to the proposed project were analyzed.

o Air Quality Impact Assessment of the I-10 Freeway in Maricopa County, Arizona

Client: ARIZONA DEPARTMENT OF TRANSPORTATION, Phoenix, Arizona (Jim Dorre, 602/261-7767), through subcontract from Gruen Associates, Los Angeles, California (Fred Pearson, 213/937-4270). Period of Performance: 2/76 to 4/77.

The overall objective of this study was to assess any possible effects on air quality in Phoenix which could result from each of seven alternatives proposed for the development of Interstate Route 10 through the Phoenix area.

This impact analysis was performed by means of mathematical models relating pollutant concentrations to emissions. Modeling was performed for both the microscale and the regional scale. The AVQUAL model was used to simulate the microscale air quality impacts, and proportional modeling incorporating Larsen's statistical techniques was used to determine the regional air quality. We also modeled ozone air quality impacts using REM2, a photochemical model. Input data for the modeling was provided, in part, by meteorological and air quality measurements AV performed in the Phoenix area for this study.

The AVQUAL model had been previously validated for the simulation of air quality near an at-grade roadway. To validate this model for elevated and depressed roadway applications, air quality, emissions, and meteorological data were collected at two freeway locations during a two-day experiment in Phoenix.

Modeling was performed for the initial analysis year and the long-range plan year, as well as for intermediate years. The modeling results were compared with national and

state Ambient Air Quality Standards, and were also used to assess probable impacts of the proposed project, probable adverse environmental effects, relationships between long- and short-term uses of the environment, any irreversible and irretrievable commitments of resources, and consistency with the SIP.

o Air Quality Impact Analysis for Jantzen Beach

AV assessed the potential impact of the proposed Jantzen Beach-Delta Park interchange located in the north Portland, Oregon area. Existing air quality, both built and no-build alternatives for the peak construction year, and a post-development were evaluated. AV's tasks included a literature review and ambient air quality monitoring for baseline conditions, developing emissions inventories for alternative scenarios, air quality modleing, and final report preparation.

Baseline air quality levels for the project were determined from historical data collected at a downtown site. These data were supplemented with a one-month site-specific measurement program for CO, particulate matter, and lead. Emissions were developed from daily traffic data provided by the Oregon DOT.

Local air quality impacts for each alternative were estimated using AV's line source model, AVQUAL, and regional impacts addressed using statistical relationships and the Empirical Kinetic Modeling Approach (EKMA).

Client: Daniel, Mann, Johnson & Mendenhall, Portland, Oregon, subcontractor to Oregon Department of Transportation, Highway Division. Period of Performance: 10/78 to 2/79.

Air Quality Impact Assessments

o Climatological and Air Quality Characterization and Air Quality Impact Assessment for Various Future Growth Alternatives in the Santa Ynez Valley

Client: SANTA BARBARA COUNTY, Santa Barbara, California (Albert F. Reynolds, 805/966-1611). Period of Performance: 2/74 to 6/75.

AV conducted a one-year climatology and air quality study of the Santa Ynez Valley for the County of Santa Barbara. AV's tasks included developing an emissions inventory for the Valley measuring air quality and meteorology at several sites for one year, and photochemical pollutant modeling for three alternative growth scenarios.

Emissions source data were obtained from a number of groups. The basic demographic and socio-economic data for the various growth alternates, as well as related vehicular activity data, were supplied by the Office of Environmental Quality of the County of Santa Barbara. Some supplementary vehicular data were obtained by AV from actual observations made in the Valley. Stationary point and area source emissions were provided by the California ARB. Forecasting of air pollutants was done using the Reactive Simulation Model (REM) using the meteorology actually observed during high ozone days.

o Air Quality Impact Assessment of Oil Processing Facility and Marine Terminal

Client: EXXON CO., U.S.A., Los Angeles, California, (Reynold Hillegeist (213) 552-5793). Period of Performance: 2-76 to 7/76.

Modeling of plume impacts using AV's plume and complex terrain (AVCTM) models and photochemical modeling of hydrocarbon emission impacts of a proposed petroleum processing facility near Santa Barbara, California.

The key personnel involved from AeroVironment on the air quality analysis are Mr. David Wilbur, Manager of Environmental Analysis, and Ms. Sara Head, Atmospheric Scientist.

Mr. Wilbur has extensive previous and current involvement with air quality analysis of petroleum development and production both onshore and offshore. He is project manager of a tracer gas experiment from OCS waters which will result in determining the dispersion and diffusion of emissions from OCS waters in the Santa Barbara area. In addition he previously was involved in the analysis and management of the air quality impact from Lease Sale #48 which included analysis in the Santa Barbara area. From these activities, he has developed a detailed knowledge of the air quality aspects of OCS activities. Mr. Wilbur, in his capacity as Manger of Environmental Analysis, has also worked on most of the recent modeling and impact studies, including environmental impact reports at AV. He has extensive enviromental report experience, including participation in the public hearings for several projects, including Kaiparowits, Sun Desert Nuclear Generating Station, and the OCS Lease Sale 48.

Ms. Sara Head performs much of the impact assessment and modeling work at AV. She is very familiar with EPA's modeling guidelines and has used and modified many of EPA's models. She is familiar with emissio;ns calculations, meteorological characterization, wind trajectory analysis, report writing, and all aspects of impact analysis. She has performed these duties many times including an assessment for an offshore marine terminal, OCS oil production activities, and onshore oil production impacts.

These two individuals will be supported by the excellent technical staff at AV. Their resumes follow.

Section 8

STATEMENT OF OFFER AND SIGNATURE

This proposal is a firm offer for a 90-day period. All work will be performed at a "not to exceed" contract price shown in Section 4.

M.D. Chambers of Chambers Consultants and Planners has read the contract, understands said contract's provisions, and is willing to be bound without qualification thereto.

Mr. M.D. Chambers, General Manager of CCP, 10557 Beach Boulevard, Stanton, California 90680, telephone (714) 831-9368 has the authority to negotiate on behalf of and to contractually bind the Company, and will act as the person who may be contacted by the Lead Agency during the period of proposal evaluation.

M.D. Chambers, General Manager

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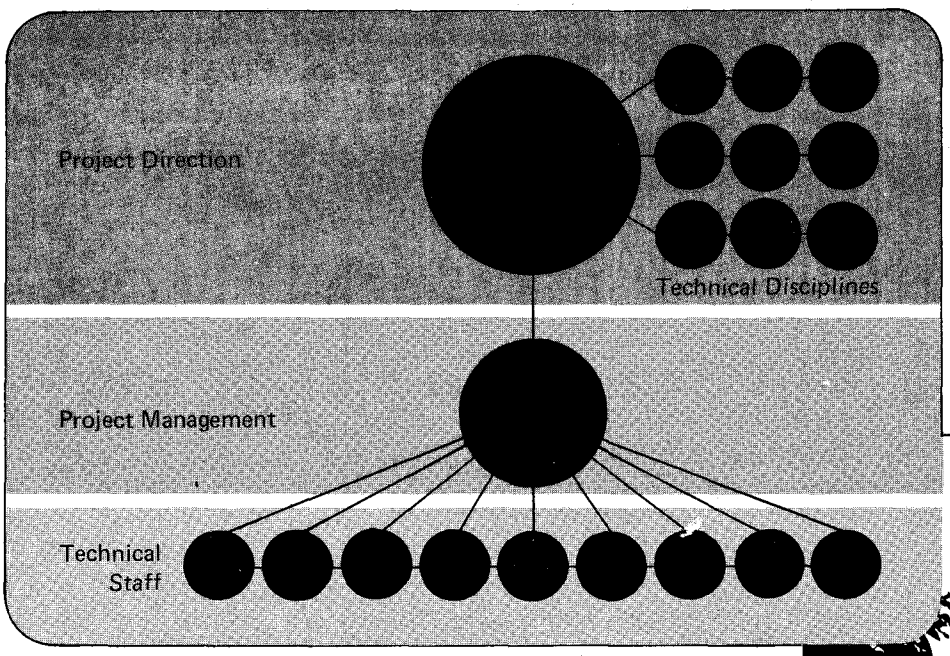

Engineers
Planners
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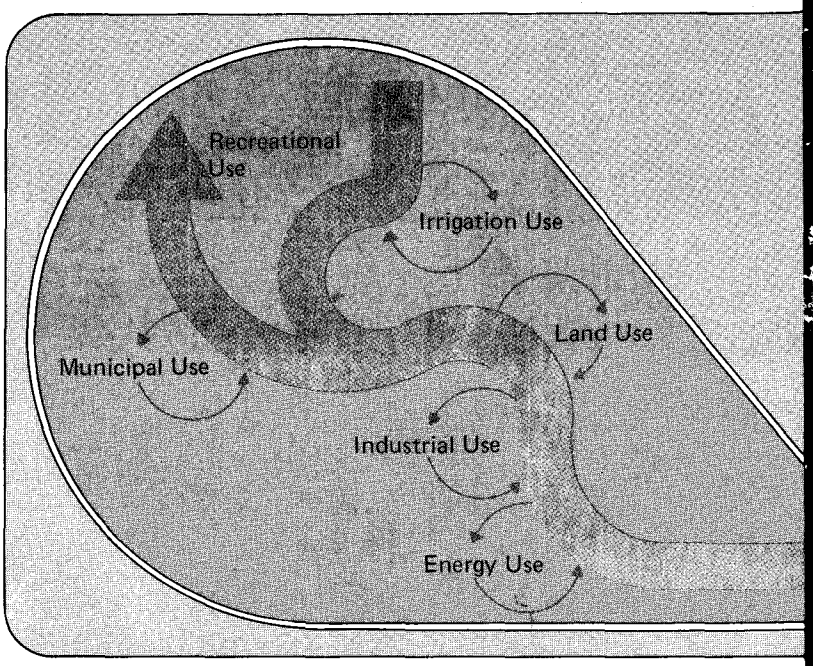

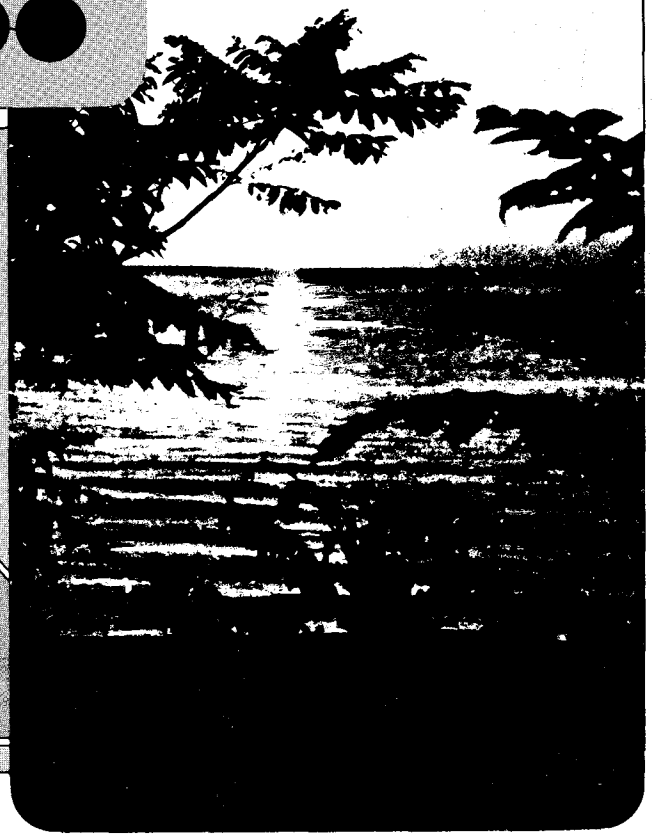

Chambers Consultants and Planners
P.O. Box 356 · 10557 Beach Boulevard
Stanton, California 90680
714/828-3324

Chambers Consultants and Planners
P.O. Box 441
Dolan Springs, Arizona 86441
602/767-3283

CCP North Group Ltd.
1235G – 40 Avenue N.E.
Calgary, Alberta, Canada
403/276-1784