High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California

Prepared by:
The High Energy Seismic Survey Team

For:
The California State Lands Commission and
The United States Minerals Management Service
Pacific Outer Continental Shelf Region

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HIGH ENERGY SEISMIC SURVEY REVIEW PROCESS REPORT

Sections 1 thru 3

INTERIM OPERATIONAL GUIDELINES FOR HIGH-ENERGY SEISMIC SURVEYS OFF SOUTHERN CALIFORNIA

Section 4

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1.0 OVERVIEW AND BACKGROUND

1.1 Overview

This Report describes a coordinated process for the review of high energy seismic survey permit applications for the geographic area from Monterey Bay National Marine Sanctuary south to the Mexican border in State and Federal waters (hereafter referred to as the "Study Area"). The process is one of the products of a two-year consensus-building effort among stakeholders, the High Energy Seismic Survey Team (HESS Team), convened by the Minerals Management Service (MMS) in September, 1996. High energy seismic is defined as *acoustic data acquisition for the purposes of mineral resources exploration and/or development. It is considered to be the use of airgun arrays for the geophysical data acquisition commonly referred to as 2D and 3D seismic, but excludes seafloor investigative processes such as side scan sonar and shallow hazards surveys*.

The HESS Team review process is designed to achieve several purposes:

a) provide a "roadmap" to applicants and the public regarding each agency's role and requirements;

b) improve communication and coordination among the participating agencies during each process phase; and

c) clearly identify and provide opportunities for the public to give input to the agencies on the issues to be addressed in the permit review process.

The timeframe suggested in the flowchart (Plate 1) that accompanies this Report reflects each agency's best estimates of the time that would be necessary to process an application under the scenario that 1) a site specific EIS or EIR would not be required; 2) the project would not affect the state's coastal zone, and; 3) the project qualifies for an Incidental Harassment Authorization from the National Marine Fisheries Service. The actual timeframe involved may vary depending on the complexity and potential environmental impacts of the seismic survey project proposed, and an individual agency's workload at the time the application is submitted. Additional time might be required to address concerns raised during the review process. The flowchart also includes timeframes for reviews that are set by statute. In addition, the flowchart shows the sequence of reviews where a given agency's action is contingent on the decisions of another agency.

The proposed process is not intended to pre-empt or supersede any applicable statutory or agency regulations or be a permit streamlining effort. However, it is possible that if the process proceeds as outlined, it would result in a more time efficient and effective review than has occurred in the past. The agencies have committed to keeping each other informed of their progress and to working within the projected timeframe to the extent feasible. It is anticipated that the process will be updated, as needed in the future. Section 3 of this report sets forth the actual process and timeframes allowed by law. .

1.2 Background

In 1988, the California State Lands Commission (CSLC) considered an application from a consortium of companies for a high energy seismic survey permit in State waters. In response to the substantial controversy surrounding issues raised by commercial fishermen, recreational divers and the environmental community, the CSLC denied the application and determined that an Environmental Impact Report (EIR) must be prepared before it could consider future survey application. The CSLC decision was litigated and, in 1990, the California Court of Appeals affirmed the CSLC's decision.

In the early 1990s, increasing concern and substantial controversy surrounded the environmental effects of high energy seismic surveys in both State and Federal waters. In particular, these concerns included potential acoustic impacts of noise on the physiology and behavior of marine mammals, impacts on commercial fishing, recreational diving and fish eggs and larvae. Significant controversy regarding the effects of underwater noise on marine organisms was generated by a Scripps Institution of Oceanography proposal to conduct the Acoustic Thermometry of Ocean Climate (ATOC) experiment offshore California. This project as well as others conducted by the Department of Defense increased the public awareness of noise related issues.

In 1995, Exxon U. S. A., Inc., operator of the Santa Ynez Unit (SYU), submitted a proposal to the MMS to conduct a 30-day high energy seismic survey of the Santa Ynez Unit. The survey encompassed 16 leases and covered 117 square miles offshore Santa Barbara County. This was the first high energy seismic survey conducted offshore since 1988. The regulatory review of the project took eight months to complete because of concerns expressed regarding the scope of environmental review, Coastal Commission jurisdiction, adequacy of mitigation requirements, the late timing of public participation, and the need for better agency cooperation. This substantially increased the project review time more than the two to four week project reviews in the 1980s.

In 1996, MMS saw the need to develop a process that meets the needs of all interested parties. In early 1996, MMS polled stakeholders for an expression of interest in forming a team to develop recommendations for improving the process that regulatory agencies follow in reviewing high energy seismic surveys. A broad cross-section of individuals representing government agencies, the offshore oil and gas industry, the geophysical industry, the commercial fishing industry, marine research, and environmental organizations met in June, 1996. From this gathering the High Energy Seismic Survey (HESS) Team was formed. The Team procured the services of Ms. Alana Knaster of The Mediation Institute to facilitate all Team meetings. The first meeting was held on September 30, 1996. The goals set by the Team were to reach consensus on the application review process, including environmental review, and develop a set of potential mitigation measures for high energy seismic surveys proposed in the State of California and Federal waters within the Team's proposed study area.

2.0 SUMMARY OF THE REVIEW PROCESS

The following description of the review process of high energy seismic surveys emphasizes the consideration of applications that could be received over the next few years. On March 5, 1998, the HESS Team recommended to the Regional Director of MMS and the Executive Officer of the CSLC that a Joint Program Environmental Impact Statement/Environmental Impact Report (PEIS/EIR) be prepared. The decision to prepare the PEIS/EIR has been deferred for future consideration. In the interim, proposals to conduct seismic surveys in Federal waters will be reviewed pursuant to the National Environmental Policy Act of 1969 (NEPA) and the California Environmental Quality Act (CEQA) guidelines and receive the appropriate level of NEPA/CEQA review. Prior to completion of the PEIS/EIR an EIR will be required for any high energy seismic surveys in State waters. If and when the Joint PEIS/EIR is approved by the MMS and certified by the CSLC, a Negative Declaration (ND) tiering on the PEIS/EIR may suffice to meet the requirements of CEQA to consider survey applications for work conducted in state waters, thus reducing the amount of time required to obtain project approvals through an EIR. Additionally, high energy seismic surveys occurring in both State and federal waters may be considered for review under a joint Environmental Assessment/Negative Declaration (EA/ND).

Historically, when sensitive or controversial issues and concerns are exposed late in a review process, unnecessary frustration, costs and delays can be incurred by all parties involved. To facilitate communication of all stakeholders, identify potential technical and environmental issues early in the review process, and to have an orderly and informed review process, the HESS Team recommends that a series of "pre-application" meetings should occur. At these meetings, all agencies and other stakeholders will be exposed to the proposed operation before any formal permit applications are filed. This interaction helps to identify any controversial issues that can then be addressed early in the process. The process described below provides applicants with a predictable and reliable framework for high energy seismic surveys off the southern California coast.

The large flowchart (Plate 1) describes the review process for a survey proposed in Federal waters only. Figures 2 and 3 in section 3.5 describe the process for surveys that enter State of California waters. At this time, the State will require an EIR for high energy seismic surveys conducted within or entering state waters. The process for reviewing surveys in State waters under an EIR is discussed in Section 3.5.

2.1 Pre-application Phase

The top level of Plate 1 describes the Pre-application Phase. In this phase, after initial consultation with either the MMS or CSLC (or both), two coordination meetings are to be held. The purpose of the first meeting, arranged by the lead agency(s) (MMS and/or CSLC), is to provide an opportunity for the applicant to discuss the proposed project with all of the government agencies that may have regulatory authority over the project. For most surveys in Federal and/or State waters those agencies may include: 1) the MMS, 2) the National Marine Fisheries Service (NMFS), 3) the CSLC, 4) the California Coastal Commission (CCC), 5) the local Air Districts, and 6) local planning department(s).

To facilitate an understanding of a proposed project, MMS and the CSLC will request that the applicant fill out the HESS-1 Form (Appendix 1) for distribution at the first pre-application meeting. The HESS-1 Form contains most of the information that the MMS and/or CSLC will need to begin their environmental review and will also help other agencies understand the scope of the proposed project. Additionally, it will provide the applicant with insight into what should be considered in planning a survey. The first meeting will provide an opportunity for the applicant to ask agencies questions about their respective review processes and requirements and also for agencies to ask the applicant questions to clarify the proposed survey. At the end of the first meeting agencies will identify fishers and other nongovernment individuals that should be notified of the second meeting.

A second pre-application meeting with not only the agencies that attended the first meeting, but also with the public, will be held after the applicant has had a chance to assimilate all of the information gained at the initial meeting. Prior to this second meeting, the applicant should distribute a revised copy of the HESS-1 Form to all that will be in attendance. MMS and/or the CSLC will identify parties not present at the first meeting that may be interested in attending the second meeting or who may like to receive a copy of the HESS-1 Form. The purpose of the second meeting is to surface public and other agency concerns and make sure they are addressed before submitting a final copy of the HESS-1 Form or permit applications. At the second meeting, the applicant should describe the proposed survey and the agencies will answer the public's questions about each agency's process for handling the proposed survey application or plan.

Following the second meeting the applicant will need a chance to assimilate any new information or

address concerns raised at the second meeting before submitting the final HESS-1 Form to the MMS and any applicable permit or approval forms to other agencies. During this assimilation period, applicants are encouraged to work with the agencies and the public to resolve concerns before they submit their final application(s) for the proposed project.

By adhering to the review process, which encourages enhanced agency/public cooperation, the environmental and/or permit review process time may be substantially shorter than the time frames that legally apply to some agencies.

2.2 Environmental Review Phase

The Environmental Review Phase allows for all agencies with project review and approval authority to review the proposed project, under each agency's respective review procedures. Agencies having specific review and approval authority include: MMS, NMFS, CSLC, CCC, and applicable local Air Districts. Other government agencies that may be involved with this phase of the project review and may need to approve portions or aspects of the proposed project under their authority include: U.S. Military, Channel Island National Marine Sanctuary, U.S. Fish and Wildlife Service, United States Coast Guard, United States Army Corps of Engineers, California Department of Fish and Game, and local county planning agencies.

After the applicant submits a proposal or application to the appropriate agencies, each agency will determine if the submitted information is complete to start their respective reviews.

The first step of the review process, following the pre-application phase will be for each agency to determine the level or type of environmental reviews appropriate for each proposed survey. This includes the determination of the appropriate NEPA and/or CEQA review required, consideration of the proposed project for California Coastal Commission permit and/or Federal consistency review, level of authorization required under the Marine Mammal Protection Act, and local Air District determination for the need for a permit. Section 3.0 of this report should be reviewed for more detailed information on individual agency review processes. Appendix 2 provides a general review of NEPA and CEQA.

2.3 Project Decision and Monitoring Phase

The final phase of the process, if the project is approved, consists of survey start-up and monitoring, survey completion, and survey review. Once the survey begins it will be monitored for compliance with the approved mitigation. If not in compliance, the survey will be halted by the agency with jurisdiction until compliance is attained. After the survey is completed, MMS will request that the applicant attend a survey review meeting with the MMS, all interested agencies and the interested public to discuss the survey and areas that can be improved for future surveys. All reports requested by the agencies as a condition of survey approval should be made available to the agencies and the interested public prior to the survey review meeting.

3.0 PERMIT AND REVIEW AGENCIES

FEDERAL AGENCIES

3.1 Minerals Management Service

3.1.1 Agency Authority

MMS is responsible for regulating mineral exploration and development operations in the Federal Outer Continental Shelf (OCS). The OCS off California includes those submerged lands located seaward of the three-mile State of California boundary. Regulations governing seismic exploration for oil and gas on the OCS are found under Title 30 of the Code of Federal Regulations Parts 250 & 251 (30 CFR 250 & 30 CFR 251).

The MMS is the lead agency for all seismic surveys for mineral exploration located in Federal waters. For surveys located in both Federal and State of California waters, MMS and the CSLC will share the lead. Pursuant to 30 CFR 250, all high energy seismic surveys conducted by or on behalf of a lessee in support of an OCS Exploration or Production Plan require approval from the MMS. All high energy seismic activities not under a lease require a geophysical permit from the MMS before the survey can begin. An application (if needed) for a geophysical permit should be submitted to the MMS at the same time that the final HESS-1 Form is submitted.

3.1.2 Review Process

For projects proposed in State and Federal waters, and prior to the completion of a Program EIS/EIR, an EIR will be required by the State. The MMS will determine the level of environmental review necessary for that portion of the survey in Federal waters. A joint EA/EIR or EIS/EIR may be prepared. See Section 3.5.2. for more information regarding CSLC requirements. The process described below applies to projects in Federal waters only.

MMS will begin its environmental review once an applicant has completed the preliminary review phase and its final proposed project (HESS 1-Form or application) is found to be acceptable by reviewing agencies. Upon completion of an acceptable environmental review by MMS and other reviewing government agencies along with interested public input, MMS will make a decision regarding the approval of the proposed HESS project.

The process for the MMS environmental review of a proposed HESS project is shown in Plate 1 and described below.

The first step in MMS's environmental review process will be to determine the level of NEPA review appropriate for the proposed survey. Figure 1 shows the three levels of environmental review required under NEPA and the general steps for each of the review processes.

If the proposal constitutes a major Federal action significantly affecting the human environment an EIS must be prepared. An EIS will take one to two years to complete and will follow the steps outlined in Figure 1.

Proposed projects may also be considered under Categorical Exclusion or Environmental Assessment reviews. A Categorical Exclusion Review[1] (CER) may only be prepared for projects that:

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[1] A"Categorical Exclusion"(CE) as defined by NEPA means a category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by the Federal agency. (40 C.F.R. 1508.4)

a) meet the Department of Interior's Exclusion Criteria (shown in Appendix 3),

b)do not need an Incidental Harassment Authorization as determined by NMFS,

c)do not conflict with commercial fishing, and

d) do not effect coastal zone resources as determined by CCC.

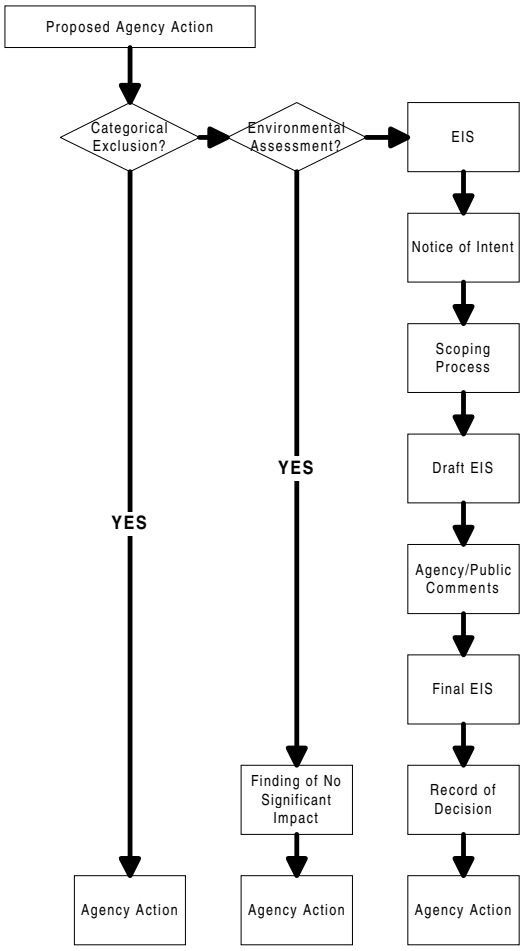

Figure 1: NEPA Environmental Review Process: An Overview

Source: Bass, R.E. and Herson, A.I., Mastering NEPA: A Step-by-Step Approach Solano Press Books, Point Arena Ca, 1993.

In accordance with the HESS process, MMS will:

a) Notify permit agencies and the HESS Executive Committee[2] that a CER is being considered.

b) Ask the permit agencies and the Executive Committee to respond quickly.

c) Make a determination whether to move forward with a CER based upon the responses received.

d) Notify permit agencies and the Executive Committee regarding the decision whether or not MMS will proceed with a CER

The permit agencies and members of the Executive Committee may raise concerns regarding MMS's CER decision with the MMS project coordinator. The decision can be appealed to the MMS Regional Director and the MMS Director.

Properly mitigated proposed surveys, not appearing to have significant effects on the human or natural environment, will be assessed through an Environmental Assessment (EA). An EA is a document which provides sufficient evidence and analysis for determining if the proposed action would have a significant impact. An EA aids MMS and other federal or State agencies in determining when an EIS or similar State environmental document is necessary.

If the decision is made to prepare an EA, a draft EA will be prepared. The draft EA is based on information provided by the applicant and addresses environmental considerations and concerns

[2] The HESS Executive Committee includes one representative from MMS, a federal resource agency, state government, offshore oil industry, seismic industry, local government, and an environmental interest group.

expressed at the pre-application and subsequent meetings. A copy of the draft EA will be circulated to all agencies and the interested public for a 30-day comment period. After the comment period MMS will distribute a composite copy of all comments received on the draft EA and summarize the actions to be taken including whether or not any substantial changes are to be made to the EA. If a commentor requests a meeting/conference call, one will be held as soon as possible. MMS will finish the EA once the issues are resolved and if 1) NMFS concurs that the impacts will be insignificant, 2) the CCC finds that the survey, as proposed, will have no effects on the coastal zone or is consistent with California's Coastal Management Program, and 3) a draft permit is obtained from the air district (if needed).

Following the completion of an EA, MMS will determine whether or not a Finding of No Significant Impact (FONSI) can be issued. However, if the EA finds that there may be a significant impact as a result of the proposed action, then a Finding of Significant Impact (FOSI) document is prepared. Proposed actions, under a FOSI determination, will require the applicant or federal agency to prepare an EIS. Alternatively, the applicant may revise the proposed project, and request that a revised project be assessed under a revised EA.

If a FONSI is issued, MMS will decide whether to approve the proposed project. The decision on whether or not to approve the proposed project will be based upon technical information, environmental issues, and public input and will be conditioned upon receipt of all other necessary approvals and permits.

For information about conducting high energy seismic surveys in federal waters call Drew Mayerson at (805) 389-7750.

3.2 National Marine Fisheries Service

3.2.1 Agency Authority

The National Marine Fisheries Service (NMFS) is a part of the National Oceanic and Atmospheric Administration NOAA (within the U.S. Department of Commerce) and is responsible for the management, conservation, and protection of living marine resources in the U.S. Exclusive Economic Zone. The mission of NMFS is stewardship of living marine resources for the benefit of the nation through science-based conservation and management and promotion of the health of their environment. The NMFS's management authority is established under several federal mandates including the Magnuson-Stevenson Fishery Conservation and Management Act, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA).

Under the MMPA, NMFS is responsible for protecting whales, dolphins, porpoises, seals, and sea lions. NMFS must protect all such animals, regardless of their population status. The MMPA establishes a prohibition on the "taking" of all marine mammals in U.S. waters wherein "take" means to harass, hunt, capture, or kill any marine mammal. Despite these prohibitions, the MMPA provides several exceptions to the taking prohibition including taking resulting from:

a) commercial fishing operations;
b) scientific research;
c) public display;
d) native subsistence; or

e) non-commercial fishing activities.

The MMPA establishes two processes for authorizing the incidental "take" of marine mammals for non-commercial fishing activities (e.g., seismic surveys).

3.2.2 Review Process

The following is a brief description of the process for applying for small-take regulations or Incidental Harassment Authorizations (IHA). Specific guidance may be found under section 216.101-216.108 of the Code of Federal Regulations.

Under sections 101(a)(5)(A)-(C) of the Marine Mammal Protection Act MMPA, NMFS may issue regulations for activities that occur within a specified geographical region for a period of not more than five years, which allow the incidental, but not intentional, *taking* by U.S. citizens while engaging in that activity of "small numbers" of marine mammals. After notice in the Federal Register (FR) and opportunity for public comment (usually 45 days), "small-take regulations" may be issued if NMFS determines the taking will have a negligible impact on the affected species or stock and only after NMFS has complied with National Environmental Policy Act (NEPA) and ESA (see below). A "negligible impact" is an impact resulting from the activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival. Small take regulations prescribe permissible methods of taking, means of effecting the least practicable adverse impact on the affected species or stock and its habitat, and requirements pertaining to the monitoring and reporting of such taking. A "letter of authorization" is required to conduct activities under the small-take regulations. The issuance of "small-take regulations" usually requires approximately 12 months.

Under section 101(a)(5)(D) of the MMPA, NMFS may authorize the incidental taking by *harassment* of small numbers of marine mammals for activities that occur within a specified geographical region for a period of up to one year. An IHA may be issued by NMFS if such activities will have only a negligible impact on the affected species or stocks (see above). The IHA prescribes methods of taking by harassment, means of effecting the least practicable adverse impact on the affected species or stock and its habitat, and requirements pertaining to the monitoring and reporting of such taking. The issuance of an IHA is considered an expedited process because the MMPA mandates several relatively short time frames for processing applications. Within 45 days of receiving a complete IHA application (see flowchart on Plate 1), NMFS must publish a proposed IHA in the FR for a public comment period of 30 days if it considers the project consistent with section 101(a)(5)(D) requirements. In contrast, applications determined to be incomplete or inappropriate for the type of taking requested, will be returned to the applicant with an explanation of why the application is being returned. Not later than 45 days after the close of the public comment period, NMFS must determine whether issuance of the IHA is appropriate. If, subsequent to the public review period NMFS finds the issuance of an IHA is appropriate and after NMFS complies with the requirements of NEPA and the ESA (see below), NMFS will issue an IHA to the applicant and publish a notice in the FR notifying the public of the IHA issuance. This process usually takes at least 120 days, but may take substantially longer if the applicant does not provide information sufficient for NMFS to comply with NEPA (see below).

Since the issuance of small-take regulations or an IHA is a federal action, NMFS must also comply with the requirements of the NEPA and the ESA when considering whether to issue these authorizations. For

these reasons, NMFS encourages applicants to provide sufficient information on the impact of the taking of marine mammals on the human environment, including a detailed discussion of possible alternatives. Applications submitted to NMFS without this information may take longer to process. At the time of publishing either a proposed small-take regulation or a proposed IHA in the FR, NMFS will usually make a draft EA or EIS available for public review and will request comments. Before NMFS issues a final small-take rule or final IHA, NMFS will consider comments received on the proposal, and either issue or adopt the EA and sign a Finding of No Significant Impact, issue a new draft EA or EIS, or adopt and/or release a final EIS.

Under section 7 of the ESA, NMFS must also ensure that any action it authorizes is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of any listed species. Thus, before NMFS publishes a final small-take regulation or a final IHA, NMFS will also determine whether the activity will affect listed species or critical habitat under its jurisdiction (e.g., most marine mammals, sea turtles, some salmon populations). If such a determination is made, NMFS will issue a biological opinion as to whether the action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat before it decides whether to issue a final small-take regulation or final IHA.

For information about conducting NMFS review process for high energy seismic surveys within the study area call Tina Fahy at (562) 980-4016.

3.3 Channel Islands National Marine Sanctuary

Channel Islands National Marine Sanctuary (CINMS), located off the coast of Santa Barbara, California, is a special protected marine environment administered by the National Oceanic and Atmospheric Administration (NOAA).The CINMS was designated in 1980 in accordance with Title III of the Marine Protection, Research and Sanctuaries Act. This 1252 square-nautical-mile area includes the nearshore and offshore waters surrounding San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands. Sanctuary boundaries extend from mean high tide to six nautical miles offshore surrounding each of the islands. Certain activities are prohibited within sanctuary waters including exploring for, developing, and producing hydrocarbons except pursuant to leases executed prior to March 30, 1981, altering or constructing on the seabed, drilling through the seabed, discharging or depositing substances, operating commercial vessels within one nautical mile of the islands, and disturbing marine mammals and birds by flying motorized aircraft under 1000 feet (for a complete description of CINMS regulations, see 15 CFR Section 922.71 (a-b)).

CINMS will be invited to the first pre-application meeting for high energy seismic surveys proposed in or near the Sanctuary.

For more information about the Channel Island National Marine Sanctuary call Ed Cassano at (805) 966-7107.

3.4 United States Military

The Coast Guard will publish a Notice to Mariners using information supplied by the applicant.

The U.S. Navy, U.S. Air Force, U.S. Marines, and U.S. Coast Guard occasionally will conduct military

operations in areas that conflict with a proposed survey. Additionally, the U.S. Navy operates a submarine detection monitoring system that routinely schedules listening periods when seismic survey vessels must shut down. With ample notification, seismic operators can schedule their survey around these brief (1-2 day) interruptions. Thirty days prior to the survey, the applicant shall send notices to the following military installations with a map showing the limits of the survey and the survey dates.

For more information about the United States Military contact:

Commanding General Marine Corp Base
DEP AC/S OPS Trng
Marine Corp Base
Camp Pendleton, CA 92055-0001

Commander
11th Coast Guard District
Marine Safety Division
501 W. Ocean Blvd. #6170
Long Beach, CA 90822-5399

Ronald A. Wilson
WTR/DORA
Vandenberg AFB, CA 93437-5000

Oil Liaison Officer
Commanding Officer
FACSFAC, San Diego
NAS, North Island
San Diego, CA 92135

Air Space and Surface Liaison Officer
Pacific Missile Test Center
Point Mugu, CA 93042

STATE AGENCIES

3.5 California State Lands Commission

3.5.1 Agency Authority
CSLC is responsible for management of the State's tide and submerged lands, or sovereign lands, from the ordinary high water mark to the seaward limit of State jurisdiction. The CSLC consists of the Lieutenant Governor, State Controller and the State Director of Finance. CSLC is the Lead Agency under the CEQA. All seismic surveys in State waters must be approved by the Commission.

In September 1988, the CSLC, after public hearings, found that it was necessary to prepare an EIR to address the potential environmental impacts of high energy geophysical surveys before issuing permits for new surveys. This decision was affirmed by the California Court of Appeals in Meridian Ocean

Systems, Inc. vs. California State Lands Commission, 222 Cal.App.3d 153(1990).

No high energy geophysical surveys have been proposed in State waters since the Meridian case. The CSLC would review new survey applications in State Waters subject to the State Permit Streamlining Act (PSA) and CEQA.

3.5.2 CSLC Review Process

Under the PSA, once an application is received by the CSLC, staff has up to 30 days to determine whether it is complete, or request additional information. In addition to detailed technical and environmental information, a complete application must include a signed Reimbursement Agreement for applicable fees, staff costs, and the cost of preparation of the EIR. The EIR process is shown in Figure 2.

Where additional information is requested by staff, the applicant may take as much time as it needs to respond. CSLC staff has up to 30 days to review a resubmitted application and either deem the application complete or ask for clarification of the information submitted in response to the earlier request. In order to maximize the time available for the preparation of the EIR within the one year time frame, the applicant typically enters into a Reimbursement Agreement with the CSLC once the EIR consultant has been selected and the amount of the EIR contract is known. The process of deeming an application complete could take 3-6 months, or longer if the applicant does not respond to staff's request for additional information satisfactorily and promptly.

Once an application is deemed complete, the CSLC, as Lead Agency under CEQA, has one year to complete the preparation of an EIR. It must then act on the project within 180 days of its EIR certification as provided in the PSA. If the CSLC needs additional time to complete the EIR, it must obtain the applicant's consent to a one-time 90-day extension under CEQA. If such an extension is granted, the CSLC must act on the application within 90 days of its certification of the EIR, pursuant to the PSA.

Critical timelines for principal steps in the CEQA process include: Notice of Preparation, EIR public scoping - 30 day process; circulation of the Draft EIR for public review - 45 days (under special circumstances as few as 30 and as many as 60 days); and publication of the Final EIR prior to CSLC consideration for certification - 15 days.

If an application is submitted for a survey in both State and Federal waters, and a joint EIS/EIR is prepared in compliance with the NEPA and CEQA, the time limits described are waived, and the time line for survey consideration by the CSLC is negotiable. However, the CSLC must act on the proposed project within 60 days of its certification of the EIS/EIR.

The decision to prepare the PEIS/EIR has been deferred for future consideration. However, it is anticipated that if and when a PEIS/EIR is completed and certified under CEQA, many proposed surveys in State and/or federal waters may be considered by the CSLC subject to a Negative Declaration (ND) or a Joint Negative Declaration/Environmental Assessment (ND/EA). This process could significantly reduce the time required for CSLC action

If a ND is prepared for a survey in State waters only, as shown in Figure 3, the CSLC has up to 180 days to complete and approve a ND once an application is deemed complete and an additional 60 days to act on the project. A ND must be circulated for public review for 30 days (under special circumstances for as

few as 20 days).

If a joint ND/EA is prepared, the time line for its preparation and approval is negotiable, but the CSLC must act on the proposed project within 60 days of ND approval. In either case, the ND timelines may be extended one time by 90 days with the consent of the applicant.

If a permit application for a high energy geophysical survey contains complete information, does not raise issues of special concern, can be prepared expeditiously, and results in no significant comments on the ND by the close of the public review period, a project may be considered by the CSLC in as short a time frame as 4 months.

For more information about the CSLC review process call Dan Gorfain, Environmental Review, (916) 574-1889 or Al Wilard, Permit Review, (562) 590-5207.

3.6 California Coastal Commission

3.6.1 Coastal Commission Regulatory Authority

In 1976, the California State legislature enacted the California Coastal Act to provide for the conservation and development of the State's 1,100-mile coastline (PRC § 30000 et seq.). The 1976 Coastal Act made permanent the California Coastal Commission, an agency that had been established on a temporary basis by a 1972 citizen's initiative. Chapter 3 policies of the Coastal Act constitute the standards used by the 12 voting members of the Coastal Commission in its coastal development permit/federal consistency decisions.

The voting members of the Coastal Commission are appointed equally (four each) by the Governor, the Rules Committee of the State Senate, and the Speaker of the State Assembly.

A coastal development permit (CDP) is required for all development activities conducted within the coastal zone[3], including State waters (PRC § 30106 and 30600). Therefore, a geophysical survey proposed in State waters requires a CDP. To receive a CDP, the Coastal Commission must find the project consistent with the resource protection and public access policies of Chapter 3 of the Coastal Act.

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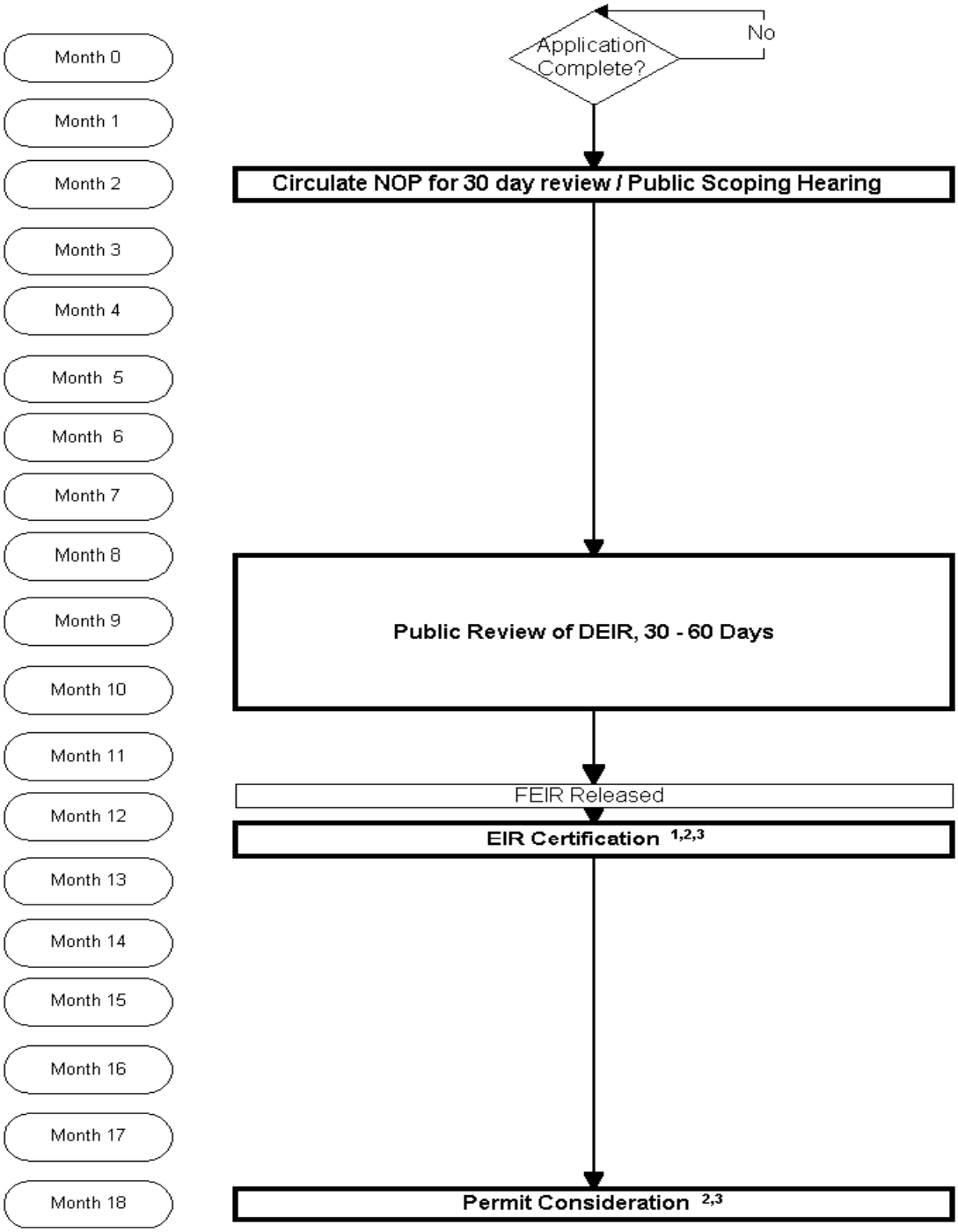
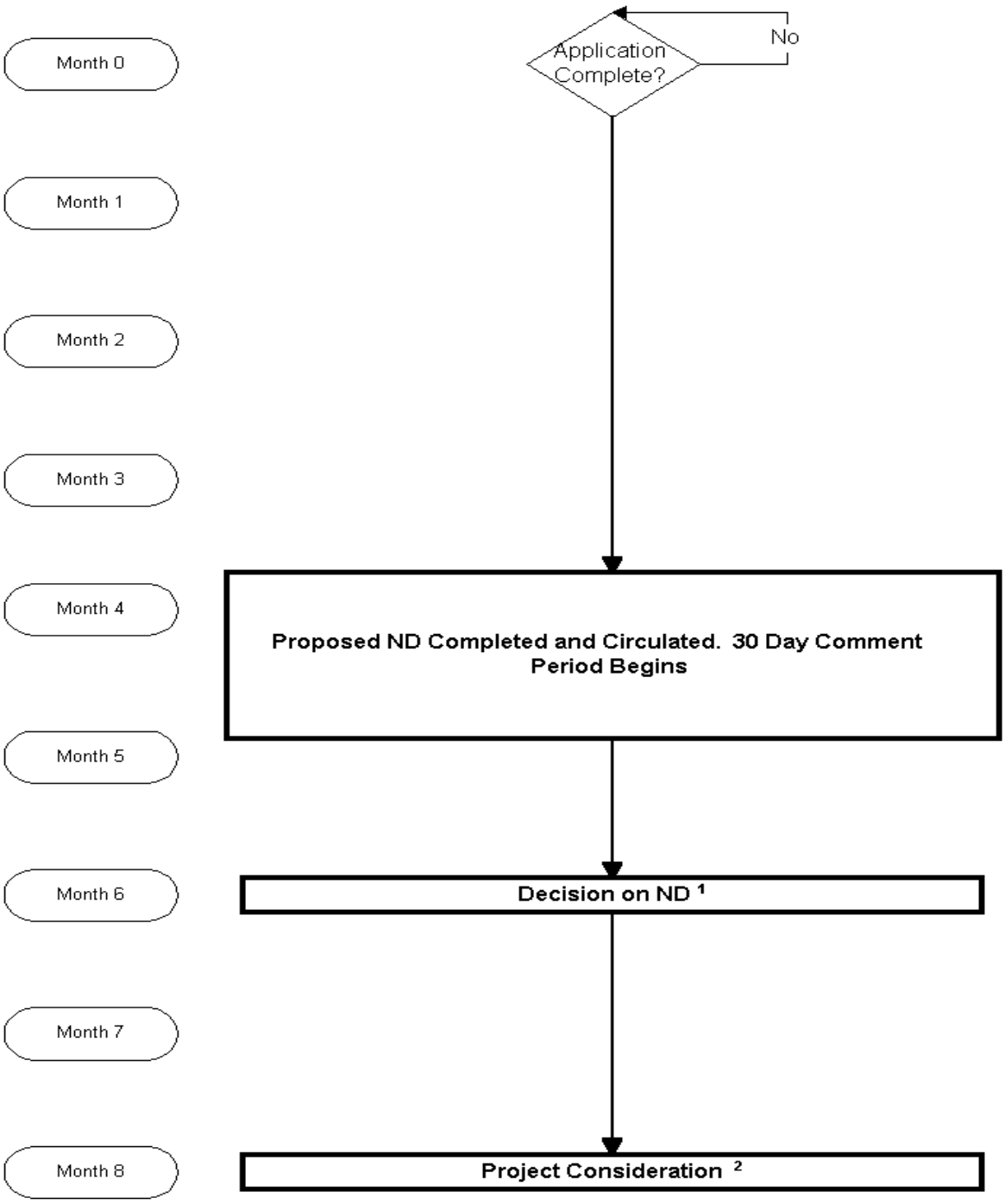
[3] The "coastal zone" means that land and water area of the State of California from the Oregon border to the border of the Republic of Mexico, extending seaward to the state's outer limit of jurisdiction and extending inland generally 1,000 yards from the mean high tide line of the sea. In significant coastal estuarine, habitat and recreational areas it extends inland to the first major ridgeline paralleling the sea or five miles from the mean high tide line of the sea, whichever is less, and in developed urban areas the zone generally extends inland less than 1,000 yards. (Coastal Act section 30103)



*Bold text boxes denote opportunities for public comment

Figure 2: Geophysical Permit Process Where an EIR is Required

1. CSLC may certify EIR a minimum of 15 days after the FEIR is released
2. One 90 day extension may be obtained by the Lead Agency at any point in the process, upon consent of the applicant.
3. Mmaximum regulatory time limits allowed by law.



***Bold text boxes denote opportunities for public comment**

Figure 3: Geophysical Permit Approval Where a Negative Declaration is Required

1. One 90 day extension may be obtained by the Lead Agency at any point in the process, upon consent of the applicant.
2. Mmaximum time limits allowed by law or regulation.

Under the Federal Coastal Zone Management Act (CZMA), the Coastal Commission also has federal consistency authority over federally permitted or funded activities "in or outside the coastal zone affecting any land or water use or natural resource of the coastal zone." (CZMA § 307(c)(3)(A) and (B)). Therefore, a geophysical survey proposed in federal waters that will affect resources of the coastal zone requires a federal consistency certification. The federal consistency review process is similar to the permit process because the Coastal Commission must find the project consistent with the Coastal Act's Chapter 3 policies. However, a Coastal Commission objection under Federal consistency may be appealed to the Secretary of Commerce.

A geophysical survey proposed in both State and Federal waters requires a joint CDP/consistency certification.

3.6.2 Coastal Commission Review Process

This subsection describes the Coastal Commission review process for surveys in or affecting the coastal zone[3].

3.6.2.1 Federal Consistency Process

Geophysical Surveys Conducted in Support of an OCS Plan[4]

If a proposed geophysical survey is associated with an existing federal OCS lease (and therefore described in an OCS plan), an applicant must provide to the MMS a certification that the proposed activity complies with and will be conducted in a manner consistent with California's Coastal Management Program ("CCMP"). At the same time, the applicant shall furnish to the Coastal Commission staff a copy of the certification (15 CFR 930.57).

The applicant's consistency certification is to state:

> The proposed activity complies with California's approved coastal management program and will be conducted in a manner consistent with such program.

Along with the consistency certification, the applicant shall submit to the Coastal Commission staff the following (15 CFR 930.58):

> a) A detailed description of the project that is adequate to assess its probable coastal zone effects. Maps, technical data, diagrams and other relevant material shall be submitted when a written description alone will not be adequate to describe the proposal;
>
> b) A brief assessment relating the probable coastal zone effects of the proposal to the relevant elements of the CCMP; and
>
> c) A brief set of findings derived from the assessment indicating that the proposed activity and its effects are all consistent with the CCMP.

Within three months of submittal of the consistency certification, the Coastal Commission must act or notify the applicant, the Assistant Administrator of NOAA, the MMS and any other involved federal

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[4] Lessees authorized to explore, develop, and produce leased deposits from Federal Lands are required to conduct operations under approved Exploration or Development Plans.

agencies of the status of its review. The basis for any delay must be explained. A final decision must be reached within six months. Unless the Coastal Commission objects to the proposal within that six-month period, concurrence is presumed.

Once the Coastal Commission has received a consistency certification and adequate supporting information, it will evaluate whether the project will affect resources of the coastal zone. If the Coastal Commission staff determines that the project will not affect resources of the coastal zone, it will issue a "no effects" letter.

If the staff determines that the project is likely to affect resources of the coastal zone, it will prepare a written staff recommendation for the Coastal Commission's consideration and vote.

In order to concur with a consistency certification, the Coastal Commission must find the project consistent with the CCMP. The Coastal Commission's review is focused on the enforceable policies set forth in Chapter 3 of the Coastal Act.
The Coastal Commission may concur with, or object to, the applicant's certification of consistency. The Coastal Commission may also object if the information contained in the applicant's submittal is incomplete. If the Coastal Commission objects, it must inform the applicant as to what measures, if any, would make the project consistent with the CCMP.

Geophysical Surveys Not Related to an Existing Federal Lease
The Coastal Commission staff will evaluate whether the proposed activity is reasonably likely to affect resources of the coastal zone. If the staff determines that the activity will not affect resources of the coastal zone, no further federal consistency review is necessary. If the staff determines that the activity is reasonably likely to affect resources of the coastal zone, the Coastal Commission has 30 days from project notification to seek from the federal Office of Coastal Resources and Management ("OCRM") permission to review the project for consistency with the CCMP.

The OCRM has 30 days to respond. If the OCRM determines that the proposed activity is not reasonably likely to affect resources of the California coastal zone, no further federal consistency review will be required. However, if the OCRM determines that the proposed activity is reasonable likely to affect resources of the California coastal zone, the applicant must submit a consistency certification to the MMS and the Coastal Commission.

The process for submitting and reviewing a consistency certification is the same as that described in the above section, with one exception. For geophysical surveys not associated with an existing federal lease, the consistency certification must be scheduled for the Coastal Commission's consideration and vote; a "No Effects" determination is not an option here. By granting the Coastal Commission authority to review the proposed activity, the OCRM made a determination that the project is likely to affect resources of the coastal zone and therefore a "No Effects" letter is not appropriate.

3.6.2.2 Geophysical Surveys Conducted in State Waters
If a geophysical survey is proposed in State waters, an applicant must submit to the Coastal Commission staff a completed coastal development permit (CDP) application. Upon receipt of a CDP application, the Coastal Commission staff has 30 days to review the application for completeness.

The permit application is to include but not necessarily be limited to an adequate description including maps, plans, etc. of the proposed development, project site and vicinity sufficient to determine whether the project complies with all relevant policies of the Coastal Act. The application must include sufficient information concerning land and water areas in the vicinity of the project site so that the Coastal Commission will be adequately informed as to present uses and plans. The description of the development shall also include any feasible alternatives or any feasible mitigation measures available that would substantially lessen any significant adverse impact that the development may have on the environment.

If the application is incomplete, the staff will notify the applicant of any additional information that must be submitted in order to evaluate the project for consistency with the relevant policies of the Coastal Act.

When the application is deemed to be complete, the Coastal Commission staff will prepare a staff recommendation and schedule the matter for the Coastal Commission's consideration. Staff is to schedule a CDP application for a Coastal Commission hearing within 49 days of determining an application as complete.

For information about the Commission staff review process call Alison Dettmer at (415) 904-5246.

LOCAL AGENCIES

3.7 Air Quality Authority and Jurisdiction Offshore California

3.7.1 Agency Authority

Section 328 of the Clean Air Act Amendments (CAAA) of 1990 transferred authority to regulate stationary sources of air pollution on the Pacific OCS (POCS) from the Minerals Management Service (MMS) to the Environmental Protection Agency (EPA). Section 328 of the Act requires that EPA establish requirements to control air pollution from OCS sources located within 25 miles of State's seaward boundaries that are the same as onshore requirements. The EPA promulgated 40 CFR Part 55 requiring Pacific OCS sources to be in full compliance with provisions of the OCS Air Regulations. EPA designated applicable onshore air agencies as the Corresponding Onshore Area (COA) for purposes of establishing requirements to control air pollution from POCS sources in order to attain and maintain federal and State ambient air quality standards. The designated COA's are the South Coast Air Quality Management District, Ventura County Air Pollution Control District, Santa Barbara County Air Pollution Control District, and the San Luis Obispo County Air Pollution Control District, which are all within the Study Area.

40 CFR Part 55.2 applies to vessels only when they are: (a) Permanently or temporarily attached to the seabed and erected thereon and used for the purposes of exploration, developing or producing resources therefrom.; or (b) Physically attached to an OCS facility, in which case only the stationary sources aspects of the vessels will be regulated. Pursuant to Section 328 of the Act, emissions from vessels servicing or associated with an OCS source shall be considered direct emissions from such a source while at the source, and while en route to or from the source when within 25 miles of the source, and shall be included in the "potential to emit" for an OCS source. The critical distinction in this definition determining air quality permit applicability is whether the HESS project can be determined to be "associated with" an existing OCS source or not. If it can be associated with an existing source, generally an air quality permit

is required. If not associated with an OCS source, an air quality permit would not generally be required, though other provisions/mitigation regarding the project emissions may be required through the CEQA and or NEPA process conducted by the other agencies.

The designated Districts onshore rules and regulations are varied based on the air quality attainment status of the COA, sources of air pollution within the geographical region, prevailing meteorology and topography and other factors. All HESS applicants should contact the COA that is geographically closest to the proposed survey to determine the applicable rules, regulations and permit requirements that the project may be subject to during the project planning stage.

3.7.1.1 Jurisdictions

The South Coast AQMD has been designated by the Administrator of the EPA as the COA for the following POCS facilities: Platforms Edith, Ellen, Elly and Eureka. Projects associated with the above existing facilities or that are located in OCS waters south of the Ventura County line and north of the San Diego County line should contact the South Coast AQMD at the earliest practicable date to determine permit applicability.

The Ventura County Air Pollution Control Air District Air District has been designated as the COA for the following POCS existing facilities: Platforms Grace, Gilda, Gail and Gina. Surveys associated with the above existing facilities or that are offshore Ventura County should contact the Ventura County Air Pollution Control Air District Air District at the earliest practicable date to determine permit applicability. Projects which are proposed for areas adjacent to the respective county lines should contact the adjacent District at the same time of notification to the COA.

The Santa Barbara County Air Pollution Control Air District has been designated as the COA for the following existing POCS facilities: Platforms Habitat, Harmony, Harvest, Heather, Henry, Heritage, Hermosa, Hidalgo, Hillhouse, Hogan, Houchin, Hondo, Irene, and Union A, B, and C. The Santa Barbara County Air Pollution Control Air District also has jurisdiction over Platform Holly which is in State waters. Surveys associated with the above existing facilities or surveys that are conducted offshore of Santa Barbara County should contact the Santa Barbara County Air Pollution Control Air District at the earliest practicable date to determine permit applicability. Projects which are proposed for areas adjacent to the respective county lines should contact the adjacent District at the same time of notification to the COA.

The San Luis Obispo County Air Pollution Control District has been delegated the authority to implement and enforce the requirements of 40 CFR Part 55. Presently, there are no existing POCS facilities located within the confines of San Luis Obispo County. Any projects proposed for waters off San Luis Obispo County should contact the San Luis Obispo County Air Pollution Control District at the earliest practicable date to determine permit applicability. Projects which are proposed for areas adjacent to the Santa Barbara county line should contact that District at the same time of notification to the COA.

3.7.2 Local Air Districts Review Process

3.7.2.1 Air Quality Information Needs for HESS Projects Impact Analysis

The general type of air quality information needed by both the MMS and the Air Districts to perform impact analysis and to determine permit applicability are listed below. Additional information may be

needed or required by the individual Districts and they should be contacted prior to submitting your application. Consult 40 CFR Part 55.4 for additional information needs and requirements that your project may be subject to from EPA.

The following information must be provided for each emission unit involved in the project:

a) description of emission source including manufacturer name and specifications including fuel type and usage, engine size and rating, pollutant specific emission factors and applicable units including appropriate references;
b) operational information including duration of project, time of year, load factors and applicable hourly and daily operating schedule;
c) include any applicable emission control equipment;
d) applicable calculation methodology; and
e) resultant peak and total emissions calculated for each criteria pollutant in both lbs/hr & day and tons/quarter & year.

The term 'emissions unit' for purposes of HESS type projects is defined as "any identifiable piece of equipment (both stationary and propulsive) or activity which is associated with the project which emits or would have the potential to emit any affected pollutant."

Examples of HESS emission sources (not explicit):

a) Stationary combustion sources
    Main engines - both primary and under shoot if applicable, scout boats
    Air compressor engines
    Generators
    Workboat engines
b) External combustion equipment
    Boilers
c) Other sources
    Helicopters

Additional information that may be required by Local Air Districts:

a) Emission offset package
b) Rule applicability for each emissions unit and process;
c) Existing and proposed process monitors needed to ensure compliance with the above rules;
d) Source testing data.

3.7.2.2 District Comparisons

Section 328 of the Clean Air Act Amendments requires that POCS air pollutant sources be regulated the same as would be applicable if the source were located onshore. Because OCS air requirements are based on onshore requirements, the different Districts have the liberty through their designation as COA's to implement and enforce 40 CFR Part 55 regulations consistent with requirements that would be applied to onshore sources. The onshore rules and regulations are varied based on the air quality attainment status of the COA, sources of air pollution within the geographical region, prevailing meteorology and topography and other factors. Further clarification and interpretation of the individual District Rules and Regulations should be addressed through consultation with the applicable air agency. The primary distinction between Districts for HESS operations relates to the acquisition of emission offsets and how those emission

offsets are addressed and attributed to the project. The interpretation of the individual District emission offset provisions are best handled through consultation with the District which has the air regulatory authority for the specific project. MMS has developed a general list of questions relating to air quality regulation for HESS projects for greater clarification of the permit process as applied by the representative Districts. The questions and subsequent responses by the applicable District's may be found in Appendix 4. The South Coast AQMD has a unique regulatory approach referred to as RECLAIM which is a marketing incentives program for controlling air pollution. As this program is unique and contrary to the standard regulatory approach administered by the other Districts, the standardized questions may not be applicable to the South Coast AQMD and responses have not been included. The South Coast AQMD should be consulted at the earliest practicable date to address any potential HESS projects slated to occur within their jurisdictional boundaries.

3.7.3 Local Air District Permitting and CEQA Process Timelines

The following discussion is intended only as representative guidance of what may be expected in relation to obtaining an air quality permit for projects in federal waters, if needed, from the applicable Districts. *The most important factor affecting these timelines is the completeness of the application package submitted to the Districts.* All Districts are required to determine application completeness within 30 days of submittal. The procurement of emission offsets obligations may be required as part of your application package to be deemed complete and equal attention should be applied to that aspect as the availability and timing involved may be considerable. If the application is deemed incomplete, the 30 day clock starts over when the applicants submits all requested information. To ensure that the air quality permit process proceeds as expeditiously as possible, the applicant should arrange pre application submittal meetings with the applicable Districts at the earliest practicable date to better understand the types of information needs and requirements the project may be subject to. See section 3.7.2.1 above for the types of information needs that may be expected. The time it takes to complete the review will depend on the complexity of the project and verifiable project information. The maximum time limits allowed are governed by the California Permit Streamlining Act, CEQA and the California Health and Safety Code. However, a comprehensive and well coordinated approach to providing the necessary information for Districts to review and process the permit may result in considerably less time than the statutory requirement. A CEQA analysis must be prepared for all projects requiring permits within Santa Barbara County and is developed in conjunction with the permit process. Consistent with the discretionary authority delegated to the APCD by the U.S. Environmental Protection Agency in September 1992 and pursuant to the Outer Continental Shelf Rule, 40 CFR Part 55, the Santa Barbara APCD's environmental review of OCS sources will focus only on air quality issues.

Ventura APCD issues permits for stationary sources. Vessel emissions connected with a platform or other permitted source are evaluated and incorporated into permit conditions for the platform or other source and a permit emission cap is established. Ventura APCD does not regulate marine vessels and therefore would not issue a permit for seismic boats not associated with a platform. However, any permit application in connection with a platform would be evaluated to determine if the cap were exceeded. If so, offsets would be required. For details, check with the agencies. Generalized flowcharts depicting the HESS review process for District air permits and the CEQA process for Santa Barbara APCD can be found in the Figures 4 and 5 below.

When the project is in State waters, the district is considered a responsible agency under CEQA. The district will consider issuing a permit subsequent to Lead Agency final approval.

3.7.4 Local Air District Contacts and Addresses

The following is a list of primary District contacts and where they may be reached.

Ventura County Air Pollution Control District
669 County Square Drive
Ventura, California 93003
c/o Mr. Kerby Zozula
telephone: 805/645-1421
fax: 805/645-1444
e-mail: kerby@vcapcd.org

Santa Barbara County Air Pollution Control District
26 Castilian Drive B-23
Goleta, California 93117
c/o Mr. Terry Dressler
telephone: 805/961-8800
fax: 805/961-8801
e-mail:dresslert@sbcapcd.org
www.apcd.santa-barbara.ca.us/~apcd

San Luis Obispo County Air Pollution Control District
3433 Roberto Court
San Luis Obispo, California 93401-7126
c/o Mr. David Dixon
telephone: 805/781-5912
fax: 805/781-1002
e-mail: engineer@sloapcd.dst.ca.us
www.sloapcd.dst.ca.us

South Coast Air Quality Management District
21865 E. Copley Drive
Diamond Bar, California 91765-4182
c/o Ms. Teresa Van Andler
telephone: 909/396-3663
fax: 909/396-3324
e-mail: tvandler@aqmd.gov
www.aqmd.gov

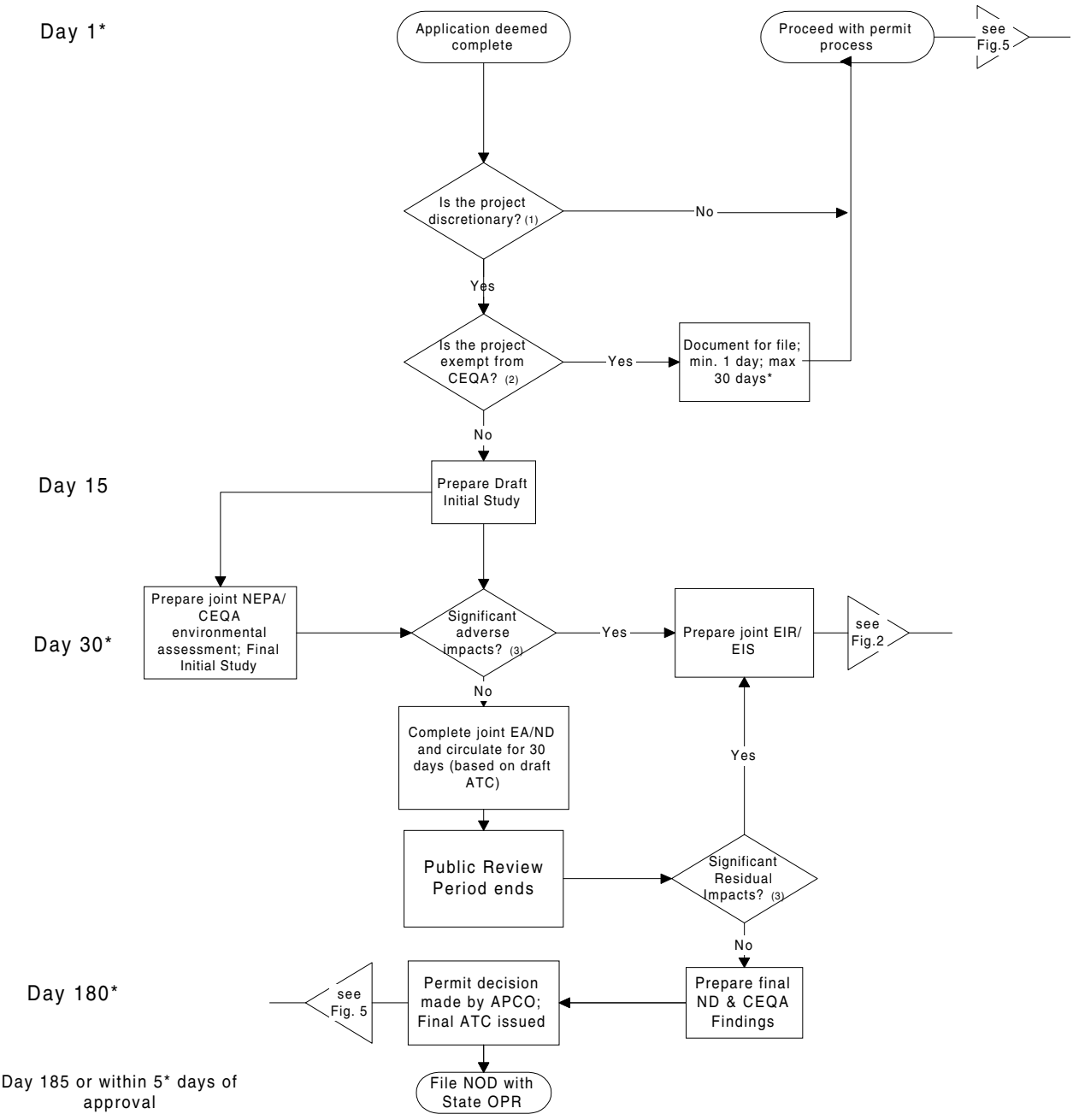

Figure 4: CEQA PROCESS FOR AIR QUALITY PERMITS

FOOTNOTES:

(1) Ventura APCD issues permits for stationary sources. Vessel emissions connected with a platform or other permitted source are evaluated and incorporated into permit conditions for the platform or other source and a permit emission cap is established. Ventura APCD does not regulate marine vessels and therefore would not issue a permit for seismic boats not associated with a platform or other sources. However, any permit application in connection with a platform or other sources would be evaluated to determine if the cap were exceeded. If so, offsets would be required.

(2) General Exemption, Statutory or categorical exempt pursuant to State CEQA Guidelines

(3) Exceeds thresholds of significance after mitigation

* Statutory deadlines; Calendar days after application completeness. **180 day deadline only applies to NDs.** EIR deadline is 365 days. These deadlines may be waived for joint NEPA/CEQA documents.

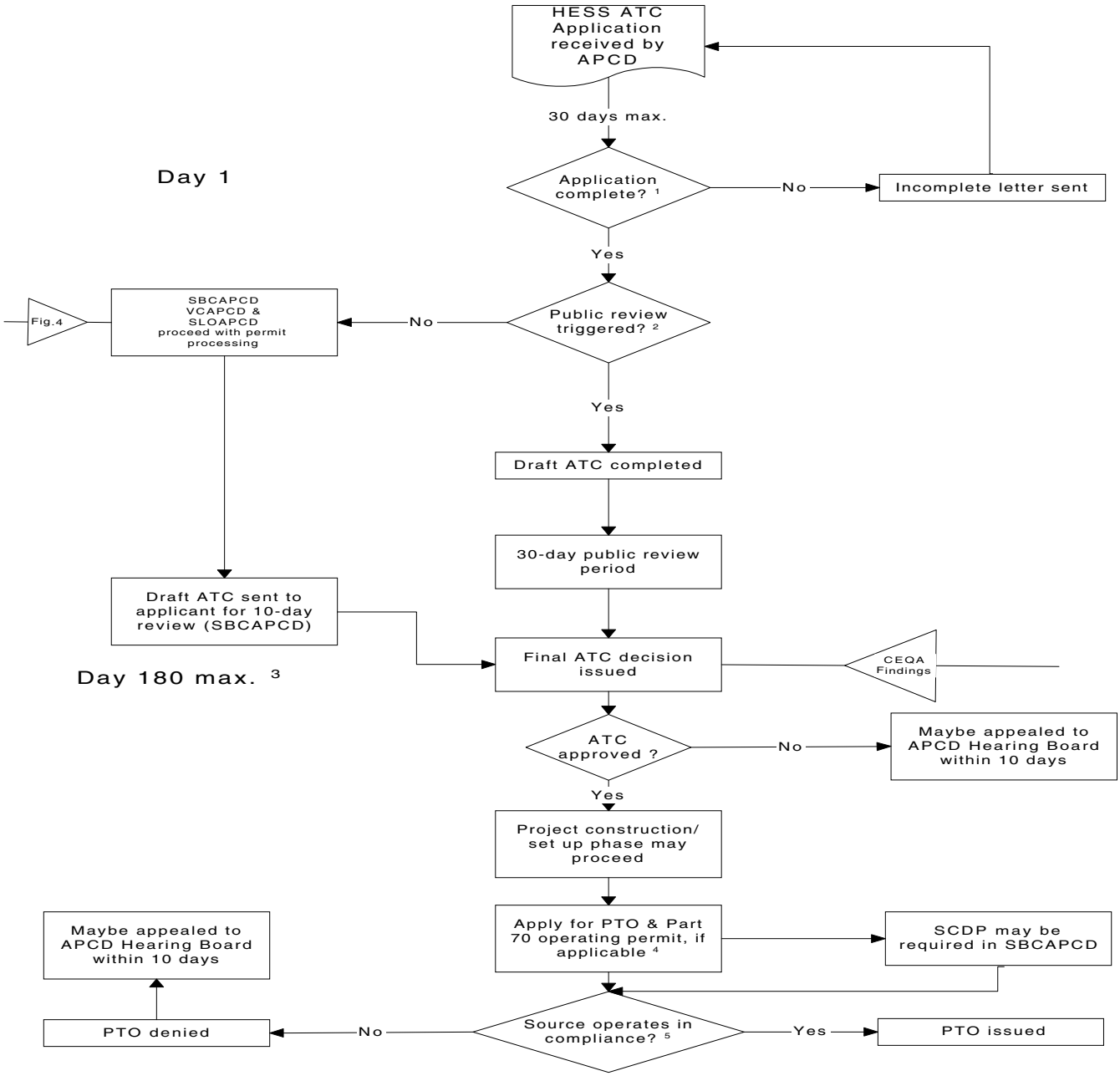

Figure 5: APCD ATC/PTO PERMIT PROCESS

FOOTNOTES:

1 If Offsets are required in SBCAPCD and they are not already registered, then a PTO for the offset source must be provided prior to the application being deemed complete (SBCAPCD Rule 204.E.5).
2 **Public review triggers:** SLOAPCD: not applicable (no stationary sources) ;VCAPCD: If emissions >15 TPY (CO >100 TPY) or if offsets are required; SBCAPCD: If AQIA or offsets required.
3 Statutory deadlines if ND; actual processing time may be longer (EIR) or shorter. If an air district is a responsible agency, Permit Streamlining Act allows 180 days after lead agency approval of project.
4 Part 70 application must be deemed complete prior to source testing.
5 A combined ATC/PTO may be issued if no source testing is required (SBCAPCD and VCAPCD).

3.7.5 Recommendations

A. Early planning: Planning for HESS projects should include air quality issues that may be associated with a project at the earliest practicable date. The air quality permit process in California may be a time consuming and expensive process if overlooked in the earliest stages of the planning process.

B. Pre-meetings with Air Districts: Early coordination with the applicable air agencies is essential to expediting the air quality permit review process. Consultation with the Districts will identify all information needs and better clarify the air quality permit process. Pre-application submittal meetings will help to ensure that the HESS application package will be received by the District and deemed complete in the allocated time which will afford the greatest likelihood of receiving a decision on an air quality permit in a timely manner.

C. Complete application package: The prior two steps are essential in submitting to the air agency the most complete application package necessary for them to determine potential air quality impacts and compliance with their rules and regulations. A complete application package will generally include all the project and equipment specifications necessary for analysis to determine permit applicability, CEQA air quality impact review, and emission offset information to receive a decision the most expeditious manner.

3.8 Local Planning Agencies

3.8.1 Agency Authority

Historically, land use in the California coastal zone has been regulated by local governments under the provisions of State Planning and Zoning Law. This enabling legislation mandates local governments to prepare general plans and zoning ordinances to ensure orderly physical growth and development within their jurisdictions as well as the protection of public health, safety, and welfare.

Additionally, each county and city along the California coast is required by the California Coastal Act to prepare a Local Coastal Program (LCP). The LCP consists of a local government's land use plans, zoning ordinances, zoning district maps, and implementing actions which, when taken together, meet the requirements of, and implement the provisions and policies of the Coastal Act at the local level. The land use plan refers to the relevant portions of a local government's general plan, or local coastal element, which are sufficiently detailed to indicate the kinds, location, and intensity of land uses, the applicable resource protection and development policies and, where necessary, a listing of implementing actions. The zoning ordinances and district maps are the legal tools for implementing the land use plan. The Coastal Act requires LCPs to contain and consider not only local issues, but those of more regional and state-wide importance.

Once these land use plan and zoning components of the LCP have been certified by the California Coastal Commission, the review authority for new development within the coastal zone is returned to local government. These local governments, in issuing coastal development permits, must make the finding that the development is in conformity with the approved LCP.

Although high energy seismic survey work would typically occur offshore, and therefore outside of the direct jurisdiction of local planning agencies, survey work may involve onshore support activities which

must be considered to determine whether a local permit is required. The HESS-1 Form prompts the applicant for project information such as onshore support facilities necessary to perform the survey work, the estimated size of the workforce, and proposed location of any staging areas or beach access points needed. Use of existing facilities would not likely require the need for a local permit, however, a case-by-case determination would be made during the initial pre-application meetings between the applicant and all potentially affected agencies. Local permit(s) may be also required if the seismic survey is part of a larger project under consideration, with the potential to affect on- and/or nearshore resources. Once again, the need for a local permit would be made based on the project description presented during the pre-application meetings.

3.8.2 Local Planning Agency Review Process

The permitting process for local planning agencies differs with each jurisdiction. Should a local permit be necessary, the applicant should consult with the affected agency to understand that agency's specific processing requirements and timing for permit issuance.

For San Luis Obispo County call John Euphrat at (805) 781-5194
For Santa Barbara County call Dianne Meester at (805) 568-2520
For Ventura County call Nancy Settle (805) 654-2465

INTERIM OPERATIONAL GUIDELINES FOR HIGH-ENERGY SEISMIC SURVEYS OFF SOUTHERN CALIFORNIA

Section 4

Prepared By:
The High Energy Seismic Survey Team

For:
The California State Lands Commission
and
The U.S. Minerals Management Service,
Pacific Outer Continental Shelf Region

February 18, 1999

4.1 Introduction

The following interim operational guidelines were developed based on the recommendation by the HESS Team that a Programmatic EIS/EIR would be prepared for the study area as defined. Now that the decision to prepare the PEIS/EIR has been deferred for future consideration, it is important to emphasize that these guidelines are interim and will be reviewed and may be modified when a PEIS/EIR addressing the unique resources of the study area is completed, or a project specific NEPA and/or CEQA analysis is completed. These guidelines will be subject to project-specific environmental review. Moreover, these guidelines are focused on potential impacts to marine mammals and may not address the full array of potential impacts that may be generated by a proposed survey. Finally, these guidelines shall be reviewed and updated by the HESS Executive Committee as new information becomes available, but no less than annually. To insure that you have the most recent version, contact either MMS or the California State Lands Commission.

This document is intended as a protocol for identifying mitigation measures to be applied to high-energy seismic surveys conducted in Federal and State waters off southern California. It was developed by a subcommittee of the Pacific OCS Region High-Energy Seismic Survey (HESS) Team with input from the Team as a whole. It is understood that these guidelines are advisory. Reviewing agencies will make decisions on appropriate mitigation based on the best current information available during project-specific reviews.

The identified measures incorporate the best available current information on the potential effects of high-energy seismic sound on marine mammals, the biology of marine mammals in southern California waters, and mitigation and monitoring techniques specific to southern California waters. Much of this information is derived from the recommendations made by a panel of nationally recognized experts on marine mammals and acoustics, which was convened at an MMS-sponsored workshop in June 1997 (Appendix 5). The measures recommended are keyed to two major factors: 1) the seasonal occurrence and distribution of marine mammals believed to be most sensitive to the potential effects of seismic sound (Appendix 6), and 2) the projected duration of proposed seismic surveys.

4.2 Mitigation and Monitoring Measures

4.2.1 Safety Zones and Zones of Potential Harassment

Background. While it is still unknown whether marine mammals that are very close to an airgun array would be at risk of temporary or permanent hearing impairment, it is recognized that there is a potential for such impacts within a few hundred meters of a seismic source (Richardson et al., 1995). In order to avoid exposing marine mammals close to a seismic source to sound levels that could cause hearing or other damage, safety zones have been designed (see Section 4.2.4.1 for safety zone monitoring requirements). For a number of seismic surveys conducted in U.S. waters, NMFS (1995, 1997, 1998) has established safety zones to prevent harm to marine mammals from exposure to impulsive devices with peak amplitudes at frequencies below 250 Hz.

4.2.1.1 Safety Zones

Safety zones are defined by the radius of received sound levels believed to have the potential for at least temporary hearing impairment.

The HESS workshop panel, while recognizing differences among species in hearing sensitivity to low frequency sounds, concluded that they were “apprehensive” about levels above 180 dB re 1 µPa (rms) with respect to overt behavioral, physiological, and hearing effects on marine mammals

in general. Therefore, the 180-dB radius, as initially defined by transmission loss model and verified on-site, is recommended as the safety zone distance to be used for all seismic surveys within the southern California study area.

4.2.1.2 Zones of Potential Harassment

The zone of potential harassment will be defined in applicable permits as the area beyond the safety zone in which marine mammals are subject to acoustic disturbance and, thus, subject to "take" by level B harassment as defined by the Marine Mammal Protection Act (MMPA).[5]

The expert panel convened at the HESS workshop (Appendix 5) concluded that behavioral responses by marine mammals to seismic sounds would most likely occur at received levels above 140 dB re 1 µPa (rms). As discussed in Richardson et al. (1995), however, the limited evidence available indicates that there are differences in responsiveness to seismic sounds among marine mammal groups, with baleen whales, and perhaps sperm whales, being the most sensitive and eared seals the least. Since the 140-dB isopleth generally will be tens of kilometers from the seismic source, only a small portion of such an area can be visually monitored from a vessel; monitoring will merely sample the populations of marine mammals subject to acoustic harassment by this definition.

4.2.2 Source Array and Transmission Loss Models

Proposals for seismic surveys should identify the specific transmission loss model to be used. Such state of the art models should take into account the array geometry. Modeling should be based upon previous applicable sound propagation studies for the area, if they exist. If they do not exist, then a more conservative approach should be taken (Local propagation is not as critical when assessing dB levels of 180+. It is more important for assessing the distances related to 160 dB and 140 dB).

4.2.2.1 Model Verification

As recommended by the workshop panel, pre-survey verification of transmission loss models will not be required. Instead, verification should be performed at commencement of the survey. Verification may not be required if previous analysis of data from the same airgun array operated in the same location has validated the transmission loss model to be used. The applicant can demonstrate that they qualify for this exception based upon a review by an expert. The field verification report should be submitted within 72 hours after the verification test end. Should unforeseen circumstances make this impossible, e.g. equipment failure, bad weather, an extension of the verification report period could be requested from MMS, in consultation with NMFS.

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[5]On April 30, 1994, the President signed Public Law 103-238, the Marine Mammal Protection Act (MMPA) Amendments of 1994. One part of this law added a new subsection 101(a)(5)(D) to the MMPA to establish an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. The MMPA defines harassment as:

> "...any act of pursuit, torment, or annoyance which (a) has the potential to injure a marine mammal or marine mammal stock in the wild; or (b) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering."

The verification procedure is intended to be relatively small-scale in area, focusing on the accuracy of the applied transmission-loss model over sound levels down to approximately 160 dB. Two acceptable method*s* for verifying the transmission loss model have been identified. The first is that described in Greeneridge Sciences (1998) (Appendix 7). This level of effort employs a small vessel, a vertical hydrophone array, shipboard recording/analyzing equipment, and conductivity-temperature-depth (CDT) measuring instruments. The second acceptable method for verifying the transmission loss model could be conducted by the geophysical contractor using the seismic vessel's hydrophone array and recording/analyzing equipment.

4.2.3 Ramp-Up

Background. Ramp-up has become a standard mitigation measure for seismic operations in many areas (NMFS, 1995, 1997, 1998; Richardson, 1997; JNCC, 1998), as well as for other activities involving high-energy sound sources such as the Acoustic Thermometry of Ocean Climate (ATOC) study (Richardson et al., 1995) and the U.S. Navy's low-frequency active (LFA) sonar research (Marine Acoustics, Inc., 1997). This has occurred in recognition of the potential risk that immediate hearing damage could occur to a nearby marine mammal if a high-energy sound source, such as an airgun array, were turned on suddenly. The ramp-up procedure generally involves the gradual increase in intensity of a sound source from some basal level to full operating intensity over a period of several minutes. It is assumed that marine mammals will find the sound aversive and will move away before hearing damage or physiological effects occur (Richardson et al., 1995; Richardson, 1997).

This has primarily been a common sense measure, since there have been no comprehensive studies of the effectiveness of ramp-up procedures (Richardson et al., 1995; Richardson, 1997). Richardson et al. (1995) and the HESS workshop panel have recommended that the effectiveness of ramp-up be studied, and such a study is currently being considered by MMS.

Recognizing this, the following ramp-up protocol is recommended (after NMFS, 1998):

At the commencement of operations or anytime that the array has been powered down, the airgun array should be ramped up to full operating levels starting with the smallest airgun and adding power at a rate of approximately 6 dB per minute.

4.2.4 Shipboard Monitoring

In general, ship-based observers employed during seismic survey operations serve one or both of two functions: 1) monitoring designated safety zones around the seismic airgun array during ramp-up and full operation, and providing the basis for real-time mitigation (airgun shutdown); and 2) collecting data on the species, numbers, and behavior of marine mammals observed in both identified zones, the estimated number of animals that may have been "taken" by harassment, and any behavioral responses to the seismic survey activities.

Each of these functions requires a different level of effort. Table 1 summarizes the levels of shipboard monitoring recommended for four identified seismic survey scenarios. These scenarios include small (0-6 days), medium (7-15 days), large (16-30 days), and multiple (31+ days) surveys.

4.2.4.1 Safety Zone Monitoring

Safety zone monitoring, at a minimum, should be conducted during surveys of all four scenario levels. This level of effort will include the following requirements:

1) A minimum of two observers. All observers should be certified by NMFS as marine mammal observers. Additionally, NMFS suggests that a third person, possibly a crew member, should be made available to serve as data-logger and short-term relief.

2) One observer on duty whenever the airgun array is operating, day or night, and beginning at least 30 minutes prior to ramp-up of the array. Individual watches should not last longer than 4 hours.

3) From the vantage point on the vessel with the best view of the safety zones, the observer scans the water immediately around the vessel, concentrating on the area within the safety zones. Data on all observations made within these areas should be recorded.

4) Observers have authority to require shut down of the airgun array whenever marine mammals are observed in a safety zone.

5) For daylight observations, provide observers with 7x50 reticulated binoculars. Conduct nighttime observations using equipment previously demonstrated to be effective in monitoring the presence of marine mammals in the safety zone at night.

The HESS workshop panel indicated that *"continuous operation (24 hours a day) of the survey would serve to complete the survey as quickly as possible. However, operations at night involve a trade-off regarding the ability to visually detect animals in the study area and the advantages of achieving continuous operation. There is a possibility that night vision could be enhanced through thermal and acoustical recognition. Night operation requires a case-by-case evaluation. Factors to consider include seasonality (hours of daylight, weather, migration patterns), priority of animals of concern, air quality, fishing impacts, and economics."*

6) When operating under conditions of reduced visibility due to adverse weather conditions, operations may continue unless, in the judgement of the shipboard observers, the safety zone cannot be adequately monitored and observed marine mammals densities have been high enough to warrant concern that an animal is likely to enter the safety zone. Observers have the authority to permit operations to resume or continue under reduced visibility conditions, based on periodic reevaluation that takes into account the densities of observed marine mammals and variations in visibility allowing for intermittent monitoring of the safety zone

To strengthen the authority of observers to require shutdown, more specific guidance regarding shutdown criteria to be applied in any specific project should be specified by the National Marine Fisheries Service in the proposed authorization. Such project-specific criteria may include the probabilities that individuals of particular species may enter the safety zone.

To address the ongoing concerns about the adequacy of existing equipments and its ability to monitor in the safety zone at all times (nighttime and reduced visibility) efforts should be made to test and determine the efficacy of available state-of-the-art equipment. By the next meeting of the

Executive Committee, MMS will report on the efforts to obtain access to and to test equipment that should assist in monitoring for marine mammals during nighttime operations and under conditions of reduced visibility. Examples may include advanced infrared equipment and millimeter waves radar. Consistent with the Approach for Handling New Information Post-HESS Team Process, the Executive Committee would make recommendations to the HESS Team regarding revisions to the protocols.

Conversely, if information becomes available that demonstrates that marine mammals of concern will avoid the safety zone when the vessel is shooting steadily, or that ramp-up methods are effective in moving marine mammals of concern away from the safety zone, it may be possible to remove the conditional requirements that an array be shut down at times of reduced visibility.

4.2.4.2 Safety Zone Monitoring Plus Data Collection

In addition to safety zone monitoring, data collection should be conducted during seismic surveys lasting 7 days or longer (medium to multiple surveys; Table 1) or whenever first- or second-priority species (except for the elephant seal) are present in or near the survey area (Appendix 5). Data collection would involve the recording of observational data on all marine mammals sighted from the seismic vessel, both within and beyond the safety zone(s). This would include information on the species, numbers, and behavior of the observed animals; any behavioral responses to the seismic survey activities; and, if required by the conditions of an Incidental Harassment Authorization (IHA), estimates of the numbers of animals "taken" by harassment. This level of effort will include the following requirements:

1) A minimum of three observers. All observers should be certified by NMFS as marine mammal observers.

2) One observer on duty at all times during daylight hours and at night whenever the airgun array is operating, beginning at least 30 minutes prior to scheduled ramp-up of the array (4-hour watches).

3) During daylight, the observer scans the area around the vessel from the highest practical vantage point; at night, the observer scans the area in and near the safety zones. The information collected should include data such as species, numbers, behavior, distance from the seismic vessel, and direction of movement. NMFS is currently standardizing its methodology for shipboard data collection. When available, this standard methodology should be adopted for ship-based observations during seismic operations. A copy of the observation database should be provided to MMS for analysis and archival.

4) Observers have authority to require shut down of the airgun array whenever marine mammals are observed in a safety zone.

5) For daylight observations, provide observers with 7x50 reticulated binoculars. Conduct nighttime observations using equipment previously demonstrated to be effective in monitoring the presence of marine mammals in the safety zone at night.

The HESS workshop panel indicated that *"continuous operation (24 hours a day) of the survey would serve to complete the survey as quickly as possible. However, operations at night involve a trade-off regarding the ability to visually detect animals in the study area and the advantages of achieving continuous operation. There is a possibility that night*

vision could be enhanced through thermal and acoustical recognition. Night operation requires a case-by-case evaluation. Factors to consider include seasonality (hours of daylight, weather, migration patterns), priority of animals of concern, air quality, fishing impacts, and economics."

6) When operating under conditions of reduced visibility due to adverse weather conditions, operations may continue unless, in the judgement of the shipboard observers, the safety zone cannot be adequately monitored and observed marine mammals densities have been high enough to warrant concern that an animal is likely to enter the safety zone. Observers have the authority to permit operations to resume or continue under reduced visibility conditions, based on periodic reevaluation that takes into account the densities of observed marine mammals and variations in visibility allowing for intermittent monitoring of the safety zone

To strengthen the authority of observers to require shutdown, more specific guidance regarding shutdown criteria to be applied in any specific project should be specified by the National Marine Fisheries Service in the proposed authorization. Such project-specific criteria may include the probabilities that individuals of particular species may enter the safety zone.

To address the ongoing concerns about the adequacy of existing equipments and its ability to monitor in the safety zone at all times (nighttime and reduced visibility) efforts should be made to test and determine the efficacy of available state-of-the-art equipment. By the next meeting of the Executive Committee, MMS will report on the efforts to obtain access to and to test equipment that should assist in monitoring for marine mammals during nighttime operations and under conditions of reduced visibility. Examples may include advanced infrared equipment and millimeter waves radar. Consistent with the Approach for Handling New Information Post-HESS Team Process, the Executive Committee would make recommendations to the HESS Team regarding revisions to the protocols.

Conversely, if information becomes available that demonstrates that marine mammals of concern will avoid the safety zone when the vessel is shooting steadily, or that ramp-up methods are effective in moving marine mammals of concern away from the safety zone, it may be possible to remove the conditional requirements that an array be shut down at times of reduced visibility.

4.2.4.3 Additional Data Collection

Under certain circumstances, such as during longer, more extensive surveys, it may be considered advisable to provide for a second observer boat. Depending on the circumstances, this could be done as part of the a monitoring and data collection aerial survey effort (see Section 4.2.5.2). This measure is recommended for consideration under these circumstances, rather than as a standard monitoring measure.

This provision could involve deployment of two additional observers aboard a second vessel to conduct daylight observations in the vicinity of the seismic operations (area, search pattern, duration of observations, and frequency to be determined). This could involve either the scout boat or a separate, designated vessel.

4.2.5 Aerial Surveys

In general, the objectives of aerial surveys conducted in conjunction with seismic operations are: 1) to obtain pre-survey information on the numbers and distribution of marine mammals in the seismic survey area; 2) to document changes in the behavior and distribution of marine mammals in the area during seismic operations; and, in some cases, 3) to obtain post-survey information on marine mammals in the survey area to document whether detectable changes in numbers and distribution have occurred in response to the seismic operations.

For seismic surveys off southern California, two types of aerial surveys, identified as monitoring and research surveys, are recommended. Table 2 summarizes the types of aerial surveys that are recommended for four identified seismic survey scenarios. These scenarios include small (0-6 days), medium (7-15 days), large (16-30 days), and multiple (31+ days) surveys. Aerial survey types are described as follows:

> 1) Monitoring - Conducted to determine if seismic operations are having a detectable, negative effect on marine mammal populations. Examples might include disruption of a species' migration, ~~or~~ exclusion of a species from an important feeding area. This type of survey would focus on a specific area where sensitive species were known to be present. Animals within the zone of harassment would also be documented.
>
> Thus, such aerial surveys are the most effective when the marine mammal species of interest are: a) migrating along a more-or-less well-defined corridor (e.g., gray whales along Pacific coast); or b) seasonally concentrated in an area for important biological purposes, such as feeding or reproduction (e.g., blue and humpback whales off southern California).
>
> 2) Monitoring and Data Collection - Conducted to document the numbers and distributions of marine mammals in an area of seismic operations, in order to obtain information on changes in behavior and distribution of species in the area and to estimate the number of animals "taken" within the entire seismic survey area.

All aerial surveys should be flown in a two-engine, fixed-wing aircraft. At a minimum, the survey crew should consist of two observers, one data recorder/observer, and a pilot. Surveys should be flown at an altitude of 1000' ASL and a speed of 100 kts. Standard equipment should include a GPS navigational system tied to an onboard computer and an intercom system connecting all crew members.

NMFS is currently standardizing its methodology for data collection during aerial surveys. When available, this standard methodology should be adopted for aerial surveys flown in conjunction with seismic operations. All observers should be certified by NMFS as marine mammal observers.

The aerial survey grid to be flown will be specific to each seismic survey operation. The pattern of transect lines should maximize the area within the seismic study area that can be searched effectively for marine mammals during a one-day flight series.

4.2.5.1 Monitoring Surveys

For future seismic surveys in the southern California study area, aerial monitoring surveys could most profitably be undertaken and are recommended for seismic surveys lasting 7 days or longer

(medium to multiple surveys; Table 2) when marine mammals that have been identified as first- and second-priority species of concern (except for the elephant seal; see below) are known to be present in substantial numbers in or near the survey area. These periods include, but are not restricted to:

1) during the gray whale migration period (approximately mid-December through mid-May); and

2) when blue and humpback whales are present and foraging in the Santa Barbara Channel and Santa Maria Basin (roughly June to October). This probably would also be the period of greatest fin whale abundance in these waters.

Monitoring surveys of elephant seals and third-priority species would be less productive. Elephant seals, identified as second-priority species, are abundant in local waters, but their behavior at sea (diving deeply and spending up to 90 percent of their time submerged) makes them very difficult to survey from the air. The third-priority odontocetes and pinnipeds are generally common and widely distributed through area waters during most months of the year. It is unlikely that aerial surveys would be able to detect significant changes in numbers and distribution of these species, thus, aerial surveys targeting these populations would not be recommended. Thus, aerial surveys targeting third-priority species would not be recommended unless indicated by future information on numbers and distribution in the area of interest.

In summary, although termed monitoring surveys, these flights also would provide a mechanism for mitigating potential effects on marine mammals; would focus on specific, first- or second priority species; and would be conducted over a limited area.

Monitoring survey design should include the following:

1) At least one aerial survey would be flown prior to the beginning of seismic operations (within one week of start-up of pre-testing of airguns and streamers on-site). This survey would establish a baseline for the numbers and distribution of the species of concern in the area, and, possibly, identify areas of particular sensitivity.

2) One or more surveys would be flown during the seismic operations and the actual survey grid should be determined on a case-by-case basis, depending on factors such as the length of the planned seismic operations, the timing and location of the initial survey activities, the numbers and distribution of priority species in the survey area, and the results of the pre- and first survey*s*. Surveys would focus on areas where sensitive species were known or predicted to be present.

The protocol for these surveys could also include pre-determined thresholds for changes in the behavior of the target species, which could trigger additional survey effort or suspension of seismic operations.

4.2.5.2 Monitoring and Data Collection Surveys

In contrast to the straight monitoring aerial surveys described in section 4.2.5.1, the primary purpose of monitoring and data collection aerial surveys would be research--the collection of information intended to aid in the assessment of potential, large-scale effects on the relative distribution and abundance of marine mammals in the ensonified area. As a result, these surveys

would be designed to detect statistically significant changes in those parameters. Such surveys could be flown when seismic operations are conducted during periods and in areas where first- and second-priority species are not expected to be present, but where the length of the planned activities would make it difficult to predict changes in marine mammal distribution and abundance in the area over the course of operations (i.e, during multiple surveys lasting 60 days or longer; Table 2). Rather than focus on specific species, these surveys would encompass all marine mammals in the area. They would also involve coverage of a wider area than monitoring surveys, including the area of seismic operations and, for comparison, a control area of similar size and species composition, located outside the zone of potential harassment defined for that seismic survey.

The basic monitoring and data collection aerial survey design would be similar to that of the monitoring surveys and would include:

1) At least one aerial survey would be flown prior to the beginning of seismic operations (within one week of start-up of pre-testing of airguns and streamers on-site) and one following (within one week after the end of operations).

2) Several surveys would be flown during the seismic operations, with the number and survey grid to be determined on a case-by-case basis, depending on factors such as the overall length of the planned seismic operations, the timing and location of survey activities, and the results of previous surveys.

4.2.6 Passive Acoustic Monitoring

Considering the current development of passive acoustic monitoring technology, and the substantial expenses involved in deploying such systems, passive acoustic monitoring is not recommended for inclusion in the mitigation protocol. However, it is recognized that passive acoustic monitoring methods may be incorporated into the protocol in the future, as more feasible systems become available.

There is one partial exception to this recommendation. A recent study (Barlow and Taylor, 1997) indicates that sperm whales may be detected much more effectively by a towed passive acoustic array than by shipboard observers. Thus, if there is evidence indicating that sperm whales may be present in substantial numbers in an area proposed for a seismic survey, the use of passive acoustic monitoring should be considered.

4.2.7 Other Recommendations

No other mitigation or monitoring methods are recommended for inclusion in the protocol at this time. Again, this may change as new information and/or monitoring technology becomes available.

Table 1. Levels of shipboard monitoring recommended for seismic surveys conducted off southern California.

Scenario Type	Duration	*Monitoring Type*	*Monitoring Trigger*
Small Survey	0-6 days	Safety Zone Monitoring	All surveys.
		Data Collection	If first- or second-priority species are present.[1]
Medium Survey	7-15 days	Safety Zone Monitoring and Data Collection	All surveys.
		Passive Acoustic Monitoring	If sperm whales are present.[2]
Large Survey	16-30 days	Safety Zone Monitoring and Data Collection	All surveys.
		Passive Acoustic Monitoring	If sperm whales are present.[2]
Multiple Surveys	31+ days	Safety Zone Monitoring and Data Collection	All surveys.
		Passive Acoustic Monitoring	If sperm whales are present.[2]

[1]First-priority species currently are identified as gray, blue, humpback, and fin whales. The second-priority species to be considered include the sperm whale and the remaining baleen whale species (but exclude elephant seals).

[2]Passive acoustic monitoring is not generally recommended. However, if sperm whales are known to be present in substantial numbers in the seismic survey area, the use of passive acoustic equipment for monitoring should be considered.

Table 2. Types of aerial surveys recommended for seismic surveys conducted off southern California.

Scenario Type	Duration	Monitoring Type	Monitoring Trigger
Small Survey	0-6 days	None	
Medium Survey	7-15 days	Monitoring	If first- or second-priority species are present.[1]
Large Survey	16-30 days	Monitoring	If first- or second-priority species are present.[1]
Multiple Surveys	31+ days	Monitoring and Data Collection	

[1]First-priority species currently are identified as gray, blue, humpback, and fin whales. The second-priority species to be considered include the sperm whale and the remaining baleen whale species (but exclude elephant seals).

4.2.8 References

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Marine Acoustics Inc. 1997. Draft Environmental Assessment for low frequency sound scientific research program in the Southern California Bight, September/October 1997. Prepared for National Marine Fisheries Service, Office of Protected Resources, 1315 East-West Highway, Silver Spring, MD. 54 pp.

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APPENDIX 1
HESS-1 FORM

Form HESS-1 is to be filled in by applicant in preparation for preliminary meetings. It is recognized that, during this time period, information provided by the applicant is based upon the most likely scenario. The form contains most of the information needed by the MMS to begin an environmental and operational review of the project. Other agencies may need additional forms and information. It is the responsibility of the applicant to work with each agency to make sure that all information needed by that agency is completed. In cases where actuals are not known, please provide the maximum case. For example, if cable length is unknown at this time, but the range will be between 2 and 3 miles long, use 3 miles as the cable length.

(note whether preliminary or not)

General

The following is preliminary information Yes___ No___

Type of Survey: 2D_____ 3D_____ VSP[6] _____ Check Shot[6] _____

Location of survey: (include map)

State waters:___ Federal waters:___ Both:____

Distance to shore: ____ Miles

Water depth Range: _____feet (meters) to ____feet (meters)

County(s):_____

Nearest prominent geographic feature:_____

Field (if applicable):_____

Associated platform (if applicable)_____

Proposed dates of survey: Begin_____ End_____

Survey hours of operation:_____

Vessel, Source, and Streamer Information *(Form will be changed to reflect uncertainty in this information, given that vessel contracts are not always firm at this early stage.)*

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[6]The full process may not be necessary. The applicant will be informed subsequent to the first pre-application meeting as to the appropriate review process. The HESS Executive Committee will be invited to the first pre-application meeting to ensure that public concerns are considered.

The following is preliminary information Yes___ No___

Vessel parameters (if known): Name:_____ Length (m):_____

(if 2nd vessel will be used) Name:_____ Length (m):_____

Streamer parameters: Quantity:_____ Length (m):_____Width (m):_____

Vessel footprint (including vessel, airgun arrays, and streamers) (km^2):_____

Source parameters: No. of arrays:_____ No. of guns:_____ Volume (liters):_____

RMS sound pressure level (in dB re 1 uPa-m)*:_____

How was this number obtained (e.g. gun manufacturer, field testing, etc)*:
_____
_____

Impact Calculations

The following is preliminary information Yes___ No___

Model used to estimate transmission loss (e.g.., X log R):_____

Basis for model used? (e.g.., previous measurement in this area, (cite source)):
_____
_____
_____
_____
_____

Distance from source to: 180dB RMS re 1 uPa-m:_____(meters)

160dB RMS re 1 uPa-m:
_____(meters)

Marine mammal impacts:

The following is preliminary information Yes___ No___

List the species of marine mammals that may be impacted and how concerns will be addressed (attach separate sheet if necessary and cite appropriate references):

Will an IHA (Incidental Harassment Authorization)be required?_____

If yes, when will the application be filed?_____

Air Quality Considerations

The following is preliminary information Yes___ No___

Is the project associated with an existing facility?_____

If yes, which one?_____

Are emission offsets required?_____

If yes, have they been procured?_____

Please provide the following information on each emission unit[7] for the impact analysis (attach answers to this form):

1. Describe the emission source[8], including manufacturer name and specifications. Include fuel type and usage, engine size and rating, pollutant specific emission factors and applicable units including appropriate references.

2. Operational factors including load factors and hourly and daily operating schedule.

3. List any applicable emission control equipment.

4. Applicable calculation methodology.

5. Resultant peak emission calculated for each criteria pollutant in both lbs/hr, lbs/day, tons/quarter, and tons/year.

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[7]For the purposes of a high energy seismic survey an emission unit is defined as any identifiable piece of equipment (both stationary and propulsive) or activity which is associated with the project which emits or would have the potential to emit any affected pollutant.

[8]Examples of high energy seismic survey emission sources:

1) Stationary combustion sources including the main engines from the primary vessel and any secondary vessels to be used, including scout boat(s), 2) air compressor engines, 3) generators, 4) work boat engines (if applicable).

External combustion equipment including boilers

Other sources such as helicopters and planes used for aerial surveys

If a permit from the APCD or AQMD is required then the following may also be required:

1. Rule applicability for each emissions unit and process.

2. Existing and proposed process monitors needed to ensure compliance with the above rules.

3. Source testing data.

Fishing and Diving Considerations

The following is preliminary information Yes___ No___

If project is off San Luis Obispo, Santa Barbara, or Ventura Counties, has the Joint Oil Fisheries Liaison Office been contacted?:
_____

Have you identified the fishers and divers to be notified of the survey?
_____ Please provide notification list.

What are the fisher concerns (if any):

How will they be addressed?

Proposed Mitigations

Please describe each applicable mitigation and how it will be used.

SCOUT BOAT:

RAMP UP OF AIR GUNS:

PROPOSED SAFETY ZONES (include species for each zone):

SOURCE VERIFICATION:

MONITORING OF SAFETY ZONES (include number of NMFS qualified observers to be onboard and equipment to be used):

DAYTIME:

NIGHT:

LOW VISIBILITY:

AERIAL SURVEYS:

PASSIVE ACOUSTIC MONITORING:

OTHER:

Other Consideration

The following is preliminary information Yes___ No___

Identify onshore support locations/facilities (if any)

For supplies:

For crew:

Number of individuals to be involved in the survey in the survey

Local work force:

Non-local workforce

Any onshore staging areas Yes_____ No_____

Any beach access required Yes_____ No_____

APPENDIX 2
NEPA and CEQA Review

The following are general federal and state environmental review requirements for carrying regulation under the National Environmental Policy Act and California Environmental Quality Act.

National Environmental Policy Act (NEPA)
NEPA (Public Law 91-190) was promulgated in 1970. It requires all administrative agencies of the Federal Government to consider the environmental impacts of their actions in the process of project development and decision-making. Further, NEPA allows other officials, Congress, and the public to independently evaluate the environmental consequences of government action. Finally, NEPA directs all Federal agencies to carry out their duties to the fullest extent possible in order to preserve and protect the environment and public health, safety, and productivity.

The threshold question regarding whether or not an EIS is required depends on the proposed action under consideration. If the proposal constitutes a major Federal action significantly affecting the environment an EIS must be prepared. Federal Action means both the actions that a Federal agency undertakes and those actions an agency has the discretion to permit or approve. The standard "significantly affecting the quality of the human environment" means having an important or meaningful effect (direct or indirect) upon a broad range of aspects of the natural and physical environment and the relationship of people with that environment.

To determine if an EIS is required an Environmental Assessment (EA) may be prepared. The EA is a concise document which provides sufficient evidence and analysis for determining if the proposed action would have a significant impact and aiding the lead agency in determining when an EIS is necessary. If an EA concludes that there will be no significant effect on the human environment then a Finding of No Significant Impact (FONSI) document is prepared. Through the EA and the FONSI enforceable mitigation measures (permit conditions), monitoring programs, or other requirements can be imposed on the proposed action. However, if the EA finds that there may be a significant impact as a result of the proposed action, then a Finding of Significant Impact (FOSI) document is prepared. Proposed actions, under a FOSI determination, will require the applicant or federal agency to prepare an EIS for the proposed project to be approved under NEPA. Alternatively, the applicant may revise the proposed project, and request that the revised project be assessed under a subsequent EA.

California Environmental Quality Act (CEQA)
CEQA was enacted in 1970 in response to growing concern over environmental protection and has four basic purposes: to inform the public and governmental decision-makers of potential environmental effects of proposed activities; to identify ways to reduce or avoid environmental damage; to prevent damage by requiring changes in projects through alternative projects and/or mitigation measures; and to make the public aware if an approved project will have significant environmental effects. CEQA regulations are found in the Public Resources Code, Section 21000, et seq.) and the CEQA Guidelines (California Code Regulations, Title 14, Section 15000, et seq.).

Any activity proposed, funded, or permitted by a state or local public agency which has the potential for resulting in a physical change in the environment, is considered a "project" by CEQA. Unless a project is statutorily or categorically exempt from CEQA review, either a Negative Declaration (ND) or Environmental Impact Report (EIR) must be prepared to assess potential impacts to the environment. Generally, an EIR is required if a project (individually or

cumulatively) has a significant effect on the environment. If there is no substantial evidence that a project may cause a significant effect on the environment, then an ND may be prepared.

In 1988 Legislation added Mitigation Monitoring requirements to CEQA. These requirements were added to assure that mitigation measures imposed in an environmental document are monitored for proper compliance and to analyze the effectiveness of the measures. This program requires public agencies to monitor projects they have approved so that specified mitigation measures are not ignored, avoided, or modified.

Normally, the CEQA process entails three separate phases. The first phase consists of preliminary review of a project to determine whether it is subject to CEQA. The second phase involves preparation of an Initial Study to determine whether the project may have a significant environmental effect and the preparation of a ND if no significant effects will occur. The third phase is the preparation of an EIR if the project may have a significant environmental effect (CEQA Guidelines Sec. l5002(k).

Appendix 3
Department of Interior's Exceptions to Categorical Exclusions

Department of Interior
NEPA Procedures
Department Manual, Part 516
(National Environmental Policy Act of 1969)

Chapter 2 Appendix 2.

The following exceptions apply to individual actions within categorical exclusions (CX). Environmental documents must be prepared for actions which may:

2.1 Have significant adverse effects on public health or safety.

2.2 Have adverse effects on such unique characteristics as historic or cultural resources, park, recreation or refuge lands, wilderness areas, wild or scenic rivers, sole or principal drinking water aquifers, prime farmlands, wetlands, floodplains, or ecologically significant or critical areas, including those listed on the Department's National Register of Natural Landmarks.

2.3 Have highly controversial environmental effects.

2.4 Have highly uncertain and potentially significant environmental effects or involve unique or unknown environmental risks.

2.5 Establish a precedent for future action or represent a decision in principle about future actions with potentially significant environmental effects.

2.6 Be directly related to other actions with individually insignificant but cumulatively significant environmental effects.

2.7 Have adverse effects on properties listed or eligible for listing on the National Register of Historic Places.

2.8 Have adverse effects on species listed or proposed to be listed on the List of Endangered or Threatened Species, or have adverse effects on designated Critical Habitat for these species.

2.9 Require compliance with Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), or the Fish and Wildlife Coordination Act.

2.10 Threaten to violate a Federal, State, local or tribal law or requirement imposed for the protection of the environment.

APPENDIX 4
HESS (High Energy Seismic Survey) Air Scenarios & Questions

This Appendix includes San Luis Obispo, Santa Barbara, and Ventura APCD's response to questions prepared by MMS. The responses reflects the opinions of the APCD agencies and does not necessarily reflect consensus by the HESS Team.

1. Could you briefly explain your present delegation authority for air quality on the OCS?

SBCAPCD Response: The Santa Barbara County APCD has been delegated the authority to implement and enforce 40 CFR Part 55 and its Rules and Regulations on the OCS under 40 CFR Part 55 14.e.3.ii.E and District Rule 903.

VCAPCD Response: The Ventura County APCD has been delegated the authority to implement and enforce 40 CFR Part 55 and its Rules and Regulations on the OCS under 40 CFR Part 55 14.e.3.ii.E and District Rule 72.1.

SLOAPCD Response: The San Luis Obispo APCD has been delegated the authority to implement and enforce 40 CFR Part 55 and its Rules and Regulations on the OCS under 40 CFR Part 55 14.e.3.ii.E and District Rule 215.

2. Would permits be required for the following situations

a. Collection of data to enhance an existing offshore facility. (associated with) Would this require a new ATC/PTO or be covered under the existing permit?

SBCAPCD Response: Yes, permits are required for operations associated with existing facilities. New permits are issued as the APCD views the operations as one time occurrences and not part of the continuing operations of the existing facility (permit).

VCAPCD Response: VCAPCD would first make a determination if the project was associated with a facility. If the answer is yes, they would then determine if the projected vessel emissions exceed the vessel emission limit cap for that facility. Each facility contains a vessel emission cap in their permit to operate. If the projected emissions in conjunction with the actual boat emissions are greater than the cap, a permit would be required. If the new emissions are still within the cap, no new permit would be required with the exception of the onboard stationary equipment.

SLOAPCD Response: This would be considered an "exploratory OCS source" under the definition of that term in 40 CFR 55.2. The source would be "temporary" and cause the emission of air contaminants while gathering information. Emission sources which provide the motive power for any vessel would not be required to obtain a permit. Emission sources which do not provide motive power for any vessel may be required to obtain a permit if their emissions are not controlled in an equivalent manner to the District's New Source Review (NSR) program, Rule 204, Requirements. If a permit is required, the District's authority over the operation of an exploratory OCS source would be gained through District Rule 202.A.2 as it is listed in Appendix A to 40 CFR 55. Also note that the construction or modification of a source outside of the District's jurisdictional boundaries would not require an authority to construct.

b. Collection of data not in support of an existing facility. Would a Notice of Intent be required from EPA for this scenario? (Not associated with)

SBCAPCD Response: They would first determine if any association can be made with an existing facility for purposes of permit authority. If no association can be made, they state that they have no regulatory authority to regulate vessels not associated with a permitted offshore facility. No Notice of Intent is required if not permitted.

VCAPCD Response: No permit is required if not associated with an existing facility or attached to the seabed. No Notice of Intent is required to EPA as there is no OCS source associated with this activity.

SLOAPCD Response: For HESS operations, in the same manner as noted above. The District's responses to these questions do not necessarily reflect its approach to exploratory oil or gas well drilling. Yes, a Notice of Intent is required under 40 CFR 55.4.a.

3. Would different permits be required for work in state waters vs. Federal waters?

SBCAPCD Response: The permitting requirements must be the same for operations occurring onshore or offshore and are thus not any different for operations in state or federal waters.

VCAPCD Response: There is no distinction between permits in state or federal waters. Additionally, there are no state platforms in Ventura County waters that could be associated with a survey.

SLOAPCD Response: The permitting requirements would be the same in state waters, within 3 miles of shore, and Federal waters, between 3 miles of shore and 28 miles from shore. EPA should be contacted for permit requirements beyond the 28 mile boundary.

4. Would this work fall under a temporary operation? What are your requirements for classification as a temporary operation?

SBCAPCD Response: SBCAPCD requirements for temporary operations are projects that are 60 days or less in duration and have a total deminimus *aggregate* emission level of 1 ton for all criteria pollutants.

VCAPCD Response: There is no such definition as a temporary operation. VCAPCD refers to equipment in these situations as portable. The term portable means that this type of equipment is not considered as stationary equipment. Portable equipment does need a permit and generally can only be at a source for 1 year or less.

SLOAPCD Response: Yes, this work fall under a temporary operation. Our requirements make no distinction between permanent and temporary except in Rule 220 which concerns portable equipment registration. Consequently, we use Rule 220.C.10.a. criteria of being in operation for less than six months as being a temporary source. This is strictly an interpretation of our rules by the Air Pollution Control Officer, lacking any explicit distinction.

5. What are your deminimus levels? If a project is exempt from permit, what level of mitigation to minimize potential impacts to coastal areas would satisfy the APCD?

SBCAPCD Response: BACT emission thresholds are 25 lbs/day Potential to Emit of any criteria pollutant. Any project with a net emission increase of 10 tons/yr (55 lb/day) of any non-attainment pollutant must offset that NEI at ratios contained in the regulations based on the location of the source of the offsets in relation to the proposed project. SBCAPCD level of significance is 25 tons/yr per project. Thus projects deemed exempt by the APCD are mitigated to below the 25 ton level of significance would satisfy the APCD.

VCAPCD Response: We do not use the term deminimus when describing thresholds. They stated that there are two different thresholds that they abide by as detailed in Rule 26, New Source Review. The first is a BACT threshold. This applies to new or modified sources which fall under New Source Review. This limit is 0 for all criteria pollutants except CO. By law, any facility with a new or modified emission source is required to install BACT. The second threshold relates to offsets. This applies to sources 5 tons or greater for ROC and NOx, and 15 tons for PM and SOx. The rule has been rewritten and will be offset at a ratio between 1.1 - 1.3 to 1. These are offsets based on a rolling 12 month period (tons/year) which are good for the life of the facility. Thus, most projects which would require a permit will be subject to both the BACT and Offset thresholds. Additionally, any increase of pollutants of 15 tons or more (100 tons CO) will require a public review under Rule 26, New Source Review. For projects not associated with the facility, standard combustion engine controls such as timing retard, enhanced intercooling and turbocharging would satisfy BACT requirements.

SLOAPCD Response: District Rule 204.A requires RACT (Reasonably Available Control Technology) for sources which have the potential to emit less than 25 pounds per day of any criteria air contaminant and BACT (Best Available Control Technology) for those with the PTE (Potential to Emit) of 25 pounds per day or more. Emission offsets under Rule 204.B would not be required for a temporary source. If a temporary OCS source should somehow win an exemption from the District's permit requirements in Rule 202, we would ask that RACT or BACT still be applied according to our NSR control thresholds.

6. What are your requirements in relation to the regulation of vessel emissions? What about equipment that is run off the main engines? Are these emissions included in a potential to emit for the existing facility?

SBCAPCD Response: The vessel emissions are considered as Potential to Emit and are included with any other additional emissions for the new ATC/PTO only. The existing facility permit associated with the newly permitted operation is not revised to reflect the new permit. Equipment that is run off the main engines were included in the equipment lists of the permit for the SYU 3-D Survey, but emissions from those devices are not counted as they are contained within the main engine emissions.

VCAPCD Response: They state the law is clear that they have no authority to regulate vessel emissions, though they may include those emissions in their vessel emissions cap for the facility. They additionally stated they would not permit the equipment running off the main engines as they are not individual emission sources. The emissions would be included in the potential to emit if the project is associated with the facility.

SLOAPCD Response: The definition of "stationary source" in District Rule 105.A.77, states that marine vessel emissions, which load or unload at the source, are considered part of the source while operating in District and coastal waters. If a marine vessel is not operating in concert with a stationary source and is not anchored, emissions caused by engines which are dedicated to

providing motive power to a vessel have not been considered subject to District permit or control. All other emissions, such as engines for producing electrical power or compressing air, are considered subject to District permit and control. The definition of "OCS source" in 40 CFR 55.2 includes vessel emissions as being part of an OCS source when that vessel is temporarily attached to the seabed (anchored) and used for exploration.

7. Please provide a timeline on the permitting and CEQA process? How would a permit with corresponding CEQA review tier off the proposed programmatic document?

SBCAPCD Response: Permitting - 30 days (completeness determination)
180 days - (max time to issue permit following completeness determination under a ND, may be 365 days if an EIR is required)

The value of the Programmatic Document in relation to a CEQA review of the permit would be most beneficial to SBAPCD if the master document analyzed the smallest volume of emissions per time (daily) with the broadest range of likely vessels. Thus, if the vessels partaking in the survey were prior analyzed for both their equipment and project duration impacts, there would be a greater likelihood of a CEQA permit review reference to the programmatic.

VCAPCD Response: Permitting - 30 days (completeness determination)
180 days - (max time to issue permit following completeness determination; may be 365 days if an EIR is required.) ATC is good for 2 years.

Ventura APCD issues permits for stationary sources. Vessel emissions connected with a platform are evaluated and incorporated into permit conditions for the platform and a permit emission cap is established.

Ventura APCD does not regulate marine vessels and therefore would not issue a permit for seismic boats not associated with a platform or other sources. However, any permit application in connection with a platform or other sources would be evaluated to determine if the cap were exceeded. If so, offsets would be required. For details, check with the agencies. Generalized flowcharts depicting the HESS review process for District air permits and the CEQA process for Santa Barbara APCD can be found in the Figures 4 and 5 below.

SLOAPCD Response: A complete permit application will be acted on within 180 days. More typically, permits to operate are issued within 60 days of a complete application. If an EIR is required under CEQA, the District would issue its permit to operate after the EIR is certified and in coordination with the lead agency. The CEQA review would use basic project data provided in the HESS programmatic document as input to the air quality analysis. Any mitigation required through CEQA review would be incorporated into the permit conditions.

8. In a hypothetical situation where the operation may cross county boundaries, how do you foresee the permitting issues being worked out between the APCD's.

SBCAPCD Response: They stated that the authority would rest with the permitting agency and any potential jurisdictional issues would be worked out through early consultation between the affected APCDs.

VCAPCD Response: If a survey passed geographical borders and was associated with a facility which required a permit, the authority would rest with the permitting authority of the project. Thus if the project was permitted by SBAPCD and passed into Ventura County waters, then they would not have any issues with the project. If the project was not associated with a facility, then they would also not have a problem since they have no authority to permit it anyway.

SLOAPCD Response: We would prefer that the affected APCD's coordinate their requirements for permit and emission controls.

9. What role, if any, does the ARB play in this process for mobile sources? For other sources? (e.g. California Portable Equipment Registration Program)

SBCAPCD Response: It presently is not applicable to the OCS. The APCD believes that the equipment on the vessels are considered "stationary sources" and thus would not be subject to the portable equipment program if it was applicable to the OCS. The APCD additionally believes that the horsepower ratings of the equipment on the vessel would exceed the limits expressed in the rule.

VCAPCD Response: ARB does not regulate vessels. In relation to the portable equipment registration program, this is California law which presently does not apply to the OCS. This law would require operators of portable equipment to register their equipment with the APCD's and would not be required to obtain a permit.

SLOAPCD Response: ARB does not regulate vessels. Note that portable equipment registration in lieu of permitting under section 2450 to the California Code of Regulations would also be an option, but exploratory sources may not be eligible for that program.

10. Would these type of projects fall under federal General Conformity provisions? What are your conformity standards and are there guidelines for determining conformity?

SBCAPCD Response: Santa Barbara is presently classified as a serious non-attainment area and thus would require General Conformity analyses if the federal project exceeded 50 tons.

VCAPCD Response: This is a federal law which states that federal projects must conform to state and local general plans. In the APCD's case, federal projects must not affect the ability of an area to come into compliance with the air standards. Conformity standards are based on the nonattainment classification status of the affected area. For example, Ventura would have a conformity level of 25 tons, Santa Barbara = 50 tons, SLO = 100 tons, and South Coast = 5 tons. Thus, general conformity needs to be addressed in both the programmatic document and subsequent specific project EA's.

SLOAPCD Response: As we understand federal conformity requirements, compliance with the District's permit and emission control requirements should satisfy these standards. Specifically, a permit must be obtained and RACT or BACT, depending on emissions, must be applied.

Appendix 5:

Summary of Recommendations Made by the Expert Panel at the HESS Workshop on the Effects of Seismic Sound on Marine Mammals, Pepperdine University, Malibu, California, June 11-12, 1997.

[Click here to go to recommendations]

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FINAL

DRAFT PANEL RECOMMENDATIONS
HIGH ENERGY SEISMIC WORKSHOP
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QUESTIONS II. *Under What Conditions Can Modeling Be Used as a Reliable Approach for Determining the Propagation Characteristics of Sound Energy from a High-Energy Airgun Array to Define, for Example, Areas for Protection of Marine Mammals? How Technically Feasible, Reliable, and Cost Effective Is Pre-Survey Field Verification, and When Should it Be Considered?*

QUESTION IV. *What Are the Appropriate Safety Zones and Zones of Influence for an Array in the Study Area, Beyond Which Impacts, as Defined Above, Decrease to an Acceptable Level.?*

A. What Evidence Supports or Refutes the Use by NMFS of the Following Interim Acoustic Criteria for Marine Mammal Harassment: 70 dB over Threshold Defines Behavioral Reaction; 80-100 dB over Threshold Defines Annoyance or Temporary Threshold Shift (Tts); 130 dB over Threshold Defines Pain; 155 dB above Threshold Defines Permanent Threshold Shift (PTS). In the Opinion of the Panel, Are These Ranges Justified, Based on Information from Research Conducted to Date?

The Panel does not feel that we know enough about marine animal hearing processes and structures to be certain that these values are justified for establishing marine mammal harassment zones. The essential problem is that there is a large area of unknowns for both physiological and behavioral responses of marine mammals.

Panel recommends the following re zones of influence for seismic impulses:

Given what is known from the currently best available data and until additional information specific to marine mammals can be obtained, the consensus of the panel is that exposures to levels greater than 180 dB re 1 micropascal rms are likely to have the potential to cause serious behavioral, physiological and hearing effects.

Re +/- 10 dB differential exposures to different species: The Panel recognizes that more serious effects may occur in some species differences between animals that hear well at low frequencies; but at this particular time, panel hesitates to further qualify the 180dB threshold recommendation until there is more information on such species.

The panel also notes that, for behavioral reasons, there is less likelihood that large whales would be exposed to levels above 180 dB, but because of their expected better sensitivity to low frequency sound and their level of population endangerment, there needs to be extreme caution to prevent guidelines re incidental exposure of these whales.

Below 180 dB effects

At levels below 180 dB, but where seismic sound levels are above background levels, there needs

High Priority Mammals for Protection

Blue whale
Humpback whale
Fin whale
Gray whale[3]

Second Priority Mammals (High probability of good low frequency hearing)

Sperm whale
Elephant seal
Other Mysticetes

Third Priority Mammals(relatively poor low frequency hearing and unendangered)

Other Odontocetes
Other Pinnipeds

D. *Are there mitigating measures that could be used to allow seismic surveys to be conducted during the gray whale migratory period (or when blue and humpback whales are foraging in the study area)?*

There is a lack of critical knowledge and data concerning the reaction of most species to a seismic survey. One form of mitigation is to gather the kind of information that can only be gained while conducting an actual survey that may be used in designing mitigation measures for future surveys. Operational seismic surveys should be considered in areas of high priority animals as long as the operation is primarily driven by specific scientific goals related to bonafide scientific research. For example, a limited survey might be done during Gray whale migration under specific and proper scientific supervision and permitting for the purposes of accurately determining animal responses to known variations in sound levels and pulse sequences.

QUESTIONS VI. What Approaches for Monitoring or Mitigation Efforts in the Zone of Influence Are Most Effective? How Technically Feasible, Reliable and Cost Effective Are Each Of These Approaches?

Panel responded to this question first by establishing objectives for a monitoring program:

- implement mitigation
- estimate take
- monitor species for potential far-field impacts

Aerial Surveys

Aerial surveys are a valuable tool for examining a broader area than near field. One can search a

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[3] not because of its current population status, but because a large segment of its entire population could be exposed at one time.

large geographic area in a short time. Aerial surveys are a sampling tool that helps to identify concentrations of animals. Detectability is dependent on many variables. Pre-survey aerial surveys may provide information necessary for implementation of mitigation measures including delay of the initiation of a survey, if warranted. Survey information is also used in the immediate timeframe to estimate harassment in the far field. Replicates are necessary over the area to clarify whether animals have been harassed.

Passive Acoustic Monitoring

This approach is worth exploring and evaluating as a monitoring tool to implement mitigation measures. If animals are detected within the 180 dB zones, where harmful auditory or physiological effects might occur, then this should be the criterion for shutdown. There have been difficulties using passive acoustic monitoring at a fixed location, although valuable data have been obtained in this way in some situations. One preferred approach is to tow an array from an adjacent vessel that is standing-off a mile. Passive acoustic monitoring can be used to check for the presence of animals 1-3 miles in front of the seismic vessel. This tool can be used for research re real time vocalization and avoidance behavior. Another potential research approach is the use of pop-ups or other fixed-location recording systems.

Observers

At a minimum, there should be observers on the seismic vessel who are located at the highest reasonable observation point. They may use either regulator binoculars with reticles or "big eye" binoculars, but should consider the need for adequate coverage of the nearby "safety zones as well as the distance that needs to be visually covered. Even with these tools, one still needs an observer scanning the water with the naked eye. Panel suggests having multiple observers at one time (3). It is important to distinguish the behavior observation roles of observers from their mitigation roles. Should utilize observers with experience.

Observers also can provide important research information. Therefore, we need a mechanism for recording distance, and position of the animals (reticle and "big eye") This data is important to collect for future planning and permitting. Shipboard observers are not as valuable at night, in fog and in extreme weather (wind over Beaufort 3 and especially over Beaufort 5). Observers are also valuable on a scout boat. They should be able to see further ahead on the path of the seismic boat and can observe more far field behavior.

Evaluating the effectiveness of monitoring

- Shipboard observers-- Protocol needs to be designed to include a self-evaluation component re. distances and distributions of animals recorded. Were you effective in spotting? Track occasions when animals were seen and you did not shut down. Report should indicate what animals were seen, where, changes over time.

- Passive acoustic monitoring-- Effectiveness can be based on whether one is detecting many animals that were not picked up by visual observers and if there is a good overlap of animals detected with known occurrence in the area. Can also compare with aerial surveys.

- Aerial surveys-- Effectiveness is based upon whether you can gather enough data. Need to consider lateral distribution of sightings. May utilize an independent observer trial; also can compare sighting rates by observer. Procedures- use center or belly observer as well as lateral observers.

Can compare shipboard observations, acoustic and aerial survey information.

Effectiveness of Ramp Up

As indicated above, the Panel believes ramp-up procedures are effective in alerting mammals to the presence of the seismic sound source. One would start at the ambient noise level and work up to a full array. If a vessel is firing at a reduced level, it is still advisable to begin with a short ramp up when going back fully on line. The Panel did not suggest that one could reduce the number of shipboard observers if ramp-up is proven effective.

QUESTION VII. ***Are There Other Approaches for Reducing Impacts or Deterring Mammals From Entering a Zone of Impact That Might Be Effective? How Technically Feasible, Reliable, And Cost Effective Are Each of These?***

A. *Can the source level be reduced for seismic surveys conducted in the study area, given that target formations in this area are shallower than in other regions?*

The surveys should be conducted at the minimum sound level for obtaining the required information. Using source levels over the minimum may need documentation reviewable by the public to warrant or verify the need for their use.

B. *Are bubble curtains or some other type of broadside source dampening method practical?*

Bubble curtain physics are theoretically sound, but implementation is difficult at the present time.

C. *Are acoustic deterrents feasible as mitigation measures (e.g. pingers towed by the scout boat)?*

The panel does not support the use of acoustic deterrents. Pingers and other active acoustic deterrents are not considered good mitigation measures because they add additional noise and it is not clear that they provide any additional benefit as a deterrent when there is already a strong noise source (the airguns).

D. *What is the experience to date with mitigating measures adopted for seismic surveys?*

Pre-survey aerial surveys have been used to identify concentrations of sensitive species. This has been used to require delay, modification or shut down of a survey. On-board visual observers have been effective and have resulted in compliance with a shutdown requirement. Observers have been placed both on the survey vessel and on oil platforms in the vicinity of the project. However, not all marine mammals are detected visually before they are within the safety radius.

E. *Are there other mitigation measures that have not been considered, but would be effective?*

Passive acoustic technologies show considerable promise. For example, DIFAR buoys provide the direction of the sound. Two such buoys will also provide distance, but not depth information. Each DIFAR buoy costs about $500. and operates in a range of 10 to 2400 Hz. The buoys last up to 8 hours before they scuttle. The buoy transmit their data to a central unit where the data is analyzed.

Combining passive acoustic arrays and aerial surveys should increase knowledge of what animals are present in the survey area, and when they are present, but the methodology is expensive. Enhanced visual techniques should also be considered.

(Further details on several of the mitigation measures identified in the response to Question VII are provided under Question VI. above).

to be studies to determine the occurrence and nature of behavioral reactions. The panel recognizes that there may be responses at received levels down to below ambient noise levels, but thinks that the most likely significant response range is above 140 dB given prior data from bowheads and gray whales. This is a another key area for research and it is important to consider an analysis that would clarify differences between simple response and significant impacts in this sound range (140dB to 180dB). [1]

To obtain this information, the panel strongly recommends experiments in controlled conditions using a seismic source to test effects on pinnipeds and small cetaceans on behavioral and physiologic effects. Considerable thought should be given to the experimental design (to be consistent with work already done).

Behavioral Effects of Concern (based on the assumption that changes in these behaviors could have an effect on individual survival and/or reproduction that could impact the population)

- Feeding
- Social Behavior
- Migration
- Avoidance
- Abandonment of Critical Habitat

Additional Panel Comments on Behavioral Effects:

1) Decisions about effects of concern from any single exposure should be made in the context of effects on the status of populations, not on effects to individuals. While there is speculation about these behavioral effects, the panel agrees that there is a need for conservatism in setting exposure guidelines.

2) One has to look at the total ocean exposure context in evaluating potential behavioral effects. Ideally, one should address cumulative effects in the regulatory environment such as other sound sources and the number of seismic operations over a given timeframe. It is difficult to evaluate the effect of one added source in the context of an animal's total exposures. We can focus our attention on known events-research studies, seismic surveys other identified projects, but these are insignificant in comparison to ship noise, pile driving, etc. while this is beyond the scope for the HESS team, the Panel expressed some concern about the cumulative effects issue.

3) Further comments on behavioral reactions:
- avoidance includes displacement of animals staying in an area as well as displacement of animals migrating.

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[1]The measure of response does not necessarily signify a biological concern.

-- social disruption should be studied with respect to changes in group size, feeding, resting and diving behaviors

Useful measures that may be indications of disturbance may include

- changes in heart rate
- changes in communications
- changes in surface activities e.g. surfacing/dive cycles, breaching, fin and tail slapping,

Components of an Experimental Design

1) Comparisons of behavior when not operating versus operating
2) Close to animals versus far away
3) Before and after a seismic survey (need to factor in seasons)
4) Control group has to be studied at the same time as the experiment
5) Examine numbers of animals seen around the boat versus at a distance/at various sound level versus when seismic array is not operating
6) Do they habituate? Can we test known individuals to determine this?
7) Method could include an aerial survey that would determine distribution, numbers, group size and instantaneous behavior. To ascertain effects on diving, one would have to be over the animals for an extended timeframe. Might do this from oil platforms.

B. Can Modeling provide sufficiently accurate results to define safety zones for protection of marine mammals? Is pre-survey field measurement necessary? (Also answer to Question II)

Pre-survey verification is not necessary. Companies should utilize a good, site specific propagation model developed in advance; then add safety buffer; do actual measurement during the seismic program and adjust accordingly. Inside a kilometer, a model of sound propagation will be fairly accurate.

- Go to the best sources of information on the study area to obtain site specific bottom bathymetry, composition and water column velocity information and plug this into the model.

- Re: extrapolating from one area to another and across season-- for any model check, one has to have local sound velocity profiles. Do not have to re-do bottom loss. Revisit sound velocity profiles mid-survey.

- Re: accuracy for sound modeling-- one should look at hot spots, e.g.. 8 and 16 miles away.

- Tissue models have not been developed for marine mammals for impulse sounds, but land mammal ear models do exist for impulse noise effects that may be adaptable.

QUESTION V. ***What Changes in Survey Operational Design Might Result in Reduced Impact (E.g. Ramp-Up, Hours of Operation, Seasonal Limitation)?***

A. In order to best mitigate potential effects on marine mammals, what is the best design for survey operations?
B. What are the advantages of continuous firing at a reduced level vs. Shutting down the array at the end of a seismic line or for maintenance? Does continuous firing lead to greater overall harassment?

The ideal solution would be to conduct surveys when animals are not within the study area. However, since some animals are always present in the study area, seasonally based prohibitions should be provided for the animals most sensitive to sound and to those at the highest level of endangerment (See "C" below). The seasonal presence of most species is reasonably well known. Because seasonal prohibition is not always practical, surveys need to include shutdown criteria based on a distance for the most sensitive and/or endangered animals (See "C" below). Continuous operation (24 hours a day) of the survey would serve to complete the survey as quickly as possible. This might be advantageous in comparison to intermittent surveys which last for a longer time period. However, no set timeframes have been established for this concept.

Operation at night involves a trade-off regarding the ability to visually detect animals in the study area and the advantages of achieving continuous operation. There is a possibility that night vision could be enhanced through thermal and acoustical recognition. Night operation requires a case-by case evaluation,. Factors to consider include seasonality (hours of daylight, weather, migration patterns) priority of animals of concern, economics. Ramp up is a desirable mitigation measure. The firing should continue during a turn, but at a lower level.

C. *Which Species of Marine Mammals in the Study Area Need to Be Considered When Scheduling Seismic Surveys? Is There Any Time of Year When the Only Appropriate Mitigation Is Total Avoidance? If So When and for What Species? Why?*

The marine mammal species in the study area which need to be considered when scheduling seismic surveys are prioritized according to the following factors:
1) the sensitivity of the marine mammal to sounds from air guns
2) the level of endangerment of the marine mammal

Conservatism was employed in assessing the sensitivity and level of endangerment. The feeding and mating behavior and migration patterns, as well as the areas and sizes of significant populations of the mammals were considered in addition to the current information on auditory sensitivity levels. [2]

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[2] There are differences in species between sensitivity and vulnerability. A large range makes a sensitive species less vulnerable. A less sensitive species becomes more vulnerable if all of its population is exposed, e.g. the gray whale.

Appendix 6:

Sensitivity of Marine Mammals off Southern California to the Effects of Low-Frequency Sound.

The interim operational guidelines are based on the prioritized list of sensitive marine mammal species in southern California waters that was developed by the expert panel at the HESS workshop in June 1997. In prioritizing species in the area, the panel considered two major factors: 1) the known or implied sensitivity of a particular marine mammal to low-frequency sounds from airguns, and 2) the level of endangerment of the species or population. Feeding and mating behavior, migration patterns, and the areas and sizes of significant populations were considered in addition to levels of physiological sensitivity.

The prioritized list includes the following:

First Priority:	blue, humpback, fin, and gray whale.
Second Priority:	sperm whale, elephant seal, other mysticetes.
Third Priority:	other odontocetes, other pinnipeds.

It is recognized that the species identified and priorities may change as new information becomes available.

Appendix 7:

Final Report, Sound Levels of an Airgun Array Operating at Platform Harmony on 17 March 1998.

[Click here to go to report]

SOUND LEVELS OF AN AIRGUN ARRAY OPERATING AT PLATFORM HARMONY ON 17 MARCH 1998

FINAL REPORT

Prepared for:

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This report has been reviewed by the Pacific Outer Continental Shelf Region of the U.S. Department of the Interior, Minerals Management Service, Washington, D.C. and approved for publication. The opinions, findings, conclusions, and recommendations expressed in this report are those of the authors, and do not necessarily reflect the views of the Minerals Management Service. Mention of trade names or commercial products does not constitute endorsement or recommendation for use. This report has not been edited for conformity with Minerals Management Service editorial standards.

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TECHNICAL SUMMARY

STUDY TITLE: Environmental Mitigation Monitoring – Task 3.

REPORT TITLE: Sound Levels of an Airgun Array Operating at Platform Harmony on 17 March 1998.

CONTRACT NUMBER(S): 14-35-0001-30809.

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COMPLETION DATE OF REPORT: September 1998.

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QUALITY REVIEW BOARD (QRB): N/A.

KEY WORDS: underwater, acoustics, airgun, seismic, pulse, sound levels, measurements, transmission loss

BACKGROUND: Airgun array sounds are sufficiently intense to injure marine mammals if they are too close to the source. Marine mammal exclusion zones (safety zones) need to be defined for each operating airgun array. Zone radii can be estimated based on theoretical considerations, but those estimates must be validated early during operations.

OBJECTIVES: The project objectives were: (1) to verify the predicted safety zone radii around an eight-airgun, 760 in^3 array being used at Platform Harmony, Santa Barbara Channel, during a Vertical Seismic Profile test, and (2) to estimate the time following field measurements when a test report can be submitted.

DESCRIPTION: Underwater sounds were recorded on two hydrophones at depth 19 m and at distances from about 100 m to about 10 km. Two legs from the source were used: one to the southeast where the bottom sloped downward, and one to the northeast where the bottom sloped upward. The recordings were analyzed for acoustic pulse energy, pulse duration, instantaneous peak pressure, and for the root-mean-square (rms) pressure over the pulse duration.

SIGNIFICANT CONCLUSIONS: A better model is needed for describing received sound levels vs. horizontal distance from airgun arrays. With proper preparations, a field report on the measured safety zone radii should be available within three days of completing the measurements.

STUDY RESULTS: The average results showed that the highest levels were received over the upslope path and that the 190 dB re 1 µPa level was received at distance 110 m, the 180 dB level was received at distance 180 m, and the 160 dB level was received at distance 470 m. These measurement results compared with predicted radii of 20 m to the 190 dB level, 82 m to the 180 dB level, and < 1 km to the 160 dB level.

STUDY PRODUCT(S): Sound Levels of an Airgun Array Operating at Platform Harmony on 17 March 1998. Prepared for U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, CA. Contract No. 14-35-0001-30809.

MMS Pacific Region Planning Areas

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INTRODUCTION

Airguns are used in marine geophysical surveys to locate hydrocarbon deposits beneath the water. In operation, airguns release a volume of high-pressure air (~ 2000 psi) into the water to create a large amplitude pressure wave whose echoes from the sub-bottom layers reveal their structure. The source levels of airguns operating in large arrays can be large, with peak source pressures (at distance 1 m effectively) exceeding 250 dB re 1 μPa-m. A relatively small 600 in^3 array may produce a peak pressure at distance 1 m of 235 dB re 1 μPa (Richardson et al. 1995).

The high sound levels from the airgun pulses may disturb or injure marine mammals in the operating area. Marine mammals are protected under the Marine Mammal Protection Act, and some species are further protected under the Endangered Species Act. Knowledge of the sound fields around such strong sources is important for determining zones within which animals might be disturbed or injured.

Exxon Company, U.S.A., conducted a Vertical Seismic Profile (VSP) test on a well at Platform Harmony on the evening of 17 March 1998. Harmony is in the Santa Barbara Channel about 6 n.mi. SSE of Gaviota, California, in water almost 1300 ft deep. (See the map in Fig. 1.) Minerals Management Service (MMS) wanted measurements made of sound levels vs. distance from the airgun array. The objectives of the measurement program were twofold: (1) to verify predicted sound levels vs. distance from the source, and (2) to obtain estimates of a reasonable time in which to expect a report of the results of such verification measurements. This report presents the results of those measurements.

The airgun array consisted of eight airguns. Four were 40 in^3 units and four were 150 in^3 units for a total array volume of 760 in^3. The array elements were closely spaced and deployed to a depth of 10 ft. All eight airguns were actuated simultaneously for the VSP tests but smaller numbers of airguns were actuated intermittently to avoid surprising animals that might be swimming nearby.

Information from Exxon indicated that the VSP survey contractor (GECO-PRAKLA) had predicted that the 190 dB re 1 μPa sound pressure level (SPL) would be at distance 66 ft (20 m) and the 180 dB SPL would be at 270 ft (82 m). The basis for the predictions was the measurements of the performance of the 18-airgun array (volume 3959 in^3) used in the 1995 3-D survey of the Santa Ynez Unit. For that array, the 190 dB SPL was found to be at 77 m, the 180 dB SPL was found to be at 316 m, and the 160 dB SPL was found to be at 3,700 m.

Appendix B contains explanations of some of the acoustic concepts and terminology used in the report.

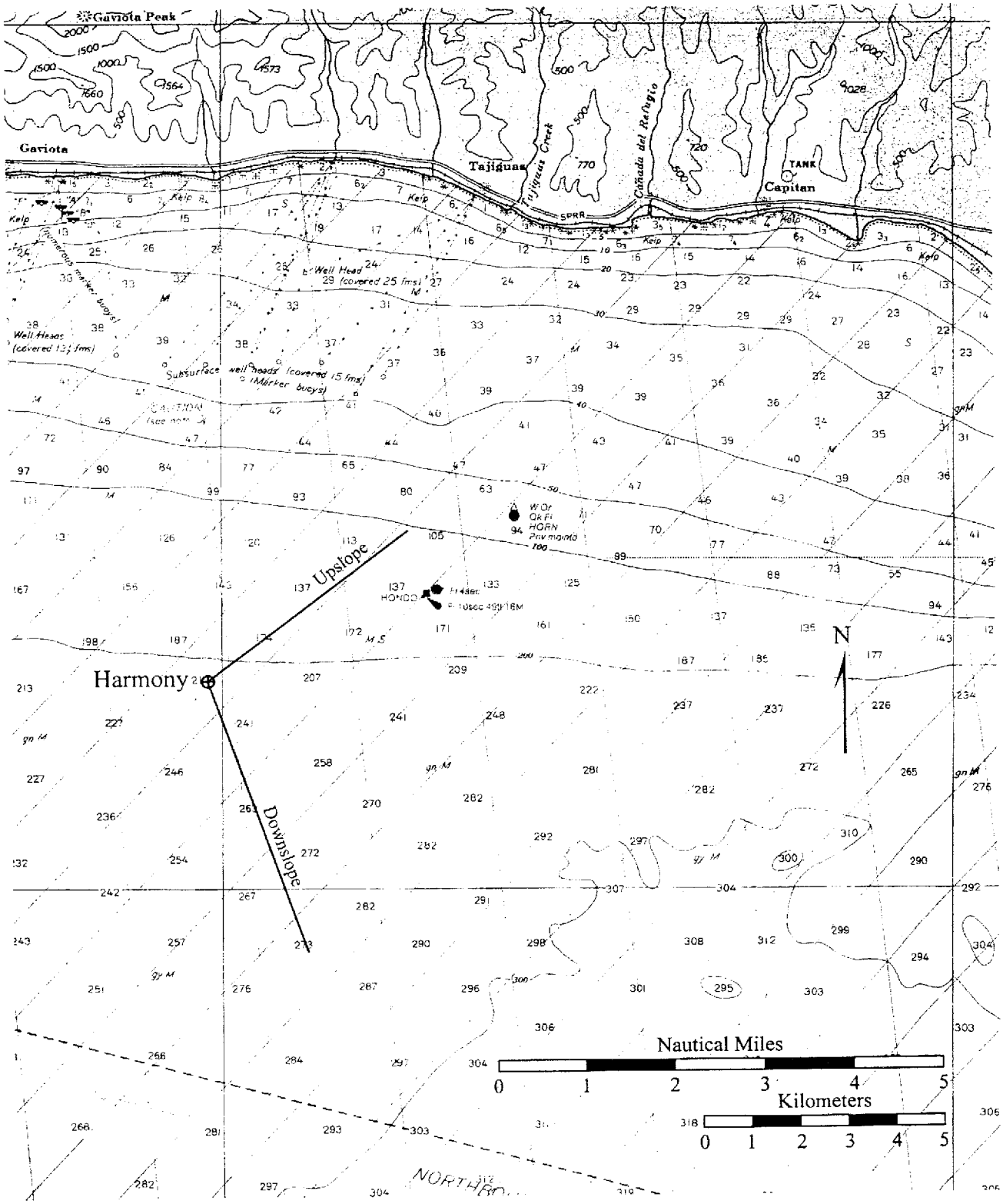

FIGURE 1. Map of Platform Harmony and the Santa Barbara County coast. The "downslope" leg was run in to Harmony from the southeast, and the "upslope" leg was run from Harmony to the northeast.

MATERIALS AND METHODS

The *M/V Spirit of Santa Barbara* was chartered for the sea tests. This 48-ft boat is often used for marine mammal studies in the vicinity of Santa Barbara and has been used successfully for a sound recording boat on several previous occasions. The boat was equipped with Global Positioning System (GPS) navigation and marine radar, both of which were used to determine distances to the airgun array boat (the source boat) *Toby Tide*.

The operations plan was to approach the source from the southeast, providing measurements over a slightly down-sloping bottom from source to receiver. The nominal distances desired were 10 km, 5 km, 2 km, 1 km, 500 m, 200 m, and if consistent with safe practice, 100 m. It was not important to be at those distances exactly as long as the actual distance was measured. Recordings at each station were to be a few minutes long, sufficient to record several airgun sounds. Conductivity-temperature-depth profiles were desired at the ends of the two legs and near the source, if practical. Those were to serve for deriving sound velocity profiles and sound ray paths to support propagation effects that might be observed in the data.

The received sounds were recorded from two hydrophones deployed at a depth of 19 ± 0.5 m. One hydrophone, an ITC model 6050C, was 100 times more sensitive than the other, an ITC model 1103. This permitted measuring the high levels at short range and the low levels at long range. The hydrophones were suspended from a 15-ft PVC pipe sparbuoy to decouple them from wave and boat motion. The hydrophone responses were calibrated over the frequency range from 5 to 20,000 Hz.

The hydrophone signals were amplified as necessary before being tape recorded on a SONY model PC208Ax digital audio tape (DAT) instrumentation recorder. The recorder bandwidth extended from 0 to 20,000 Hz. The recorder also recorded time of day and a memo channel of voice announcements from within the cabin. Data quality was assured by listening to the hydrophone signals with headphones and by monitoring the level meter built into the recorder.

Analysis was by computer programs, including standard and custom routines in MATLAB (a programming language) and in EXCEL worksheets. The data were transferred in digital form from the SONY DAT recorder to a PC without conversion to analog and back to digital, saving a step in which noise can be introduced by the extra sampling and quantization. Time series parameters were computed, including the instantaneous peak pressure in a pulse, the energy flux densities (in $\mu Pa^2 \cdot s$), pulse durations (the time over which the pulse energy accumulated from 5% to 95% of the total value), and the pulse sound pressure levels, which are computed from the root-mean-square pressure over the pulse duration. (See Appendix B for explanations of these terms.)

RESULTS

When all the recorded pulses were analyzed, the results showed a wide scattering of sound levels seeming to have little relationship to the distance from the source. This was the result of the airgun array being operated at partial strength between the times it was needed for the VSP tests. Partial operation was to help discourage sea lions and other marine mammals from venturing too close to the source. Thus, it was essential to identify those pulses that most likely came from the full airgun array. This was accomplished by (1) graphing the received pulse energy flux densities (henceforth, referred to as energies) vs. the time each pulse was recorded and (2) looking for groups of 2-4 pulses recorded together and at about the same level. The results for the two legs are presented in Figure 2. When viewed in this way, the selection of full-array pulses is clear. Henceforth in this report only the selected pulses shown in this figure will be used.

Appendix B contains a discussion of acoustical concepts and terminology to help the reader with the measurement quantities presented here.

PULSE ENERGY FLUX DENSITY

The same selected pulse energies plotted against time in Figure 2 are plotted against distance from the source in Figure 3. Distance is plotted on a logarithmic scale because the received energies would fall on a straight line if spreading loss accounted for all the attenuation in received energy with increasing distance. For example, if spherical spreading occurred (expected in a homogeneous boundaryless medium), the attenuation would follow a $-20 \cdot \log(R)$ rate (a loss of 20 dB per decade of distance). The energies appear to follow a relatively straight line. Also, there does not appear to be much difference between the downslope and upslope sound propagation cases here.

INSTANTANEOUS PEAK PRESSURE

The instantaneous peak pressures of the selected pulses are plotted against distance in Figure 4. Note that the decibels in this figure are referred to a unit of pressure, not to pressure-squared times time as in Figures 2 and 3. However, the peak pressures attenuate with increasing distance in much the same way as do the energies.

PULSE DURATION

Figure 5 presents the pulse durations vs. distance to the source for the two legs. As a general rule, the pulse duration is expected to increase with increasing distances. This is because reflected sound paths contribute energy to the received pulses, stretching them out in time. However, the frequency content of the pulse may also influence pulse duration. If sound propagation filtered out the low frequencies, leaving only higher frequencies, the pulse would be shorter. Based on the data in Figure 5, it may be that multiple reflected arrivals enhance the received signal at distances between 100 and 300 m, but that for longer ranges the lower frequencies have been diminished and the pulses become slightly shorter.

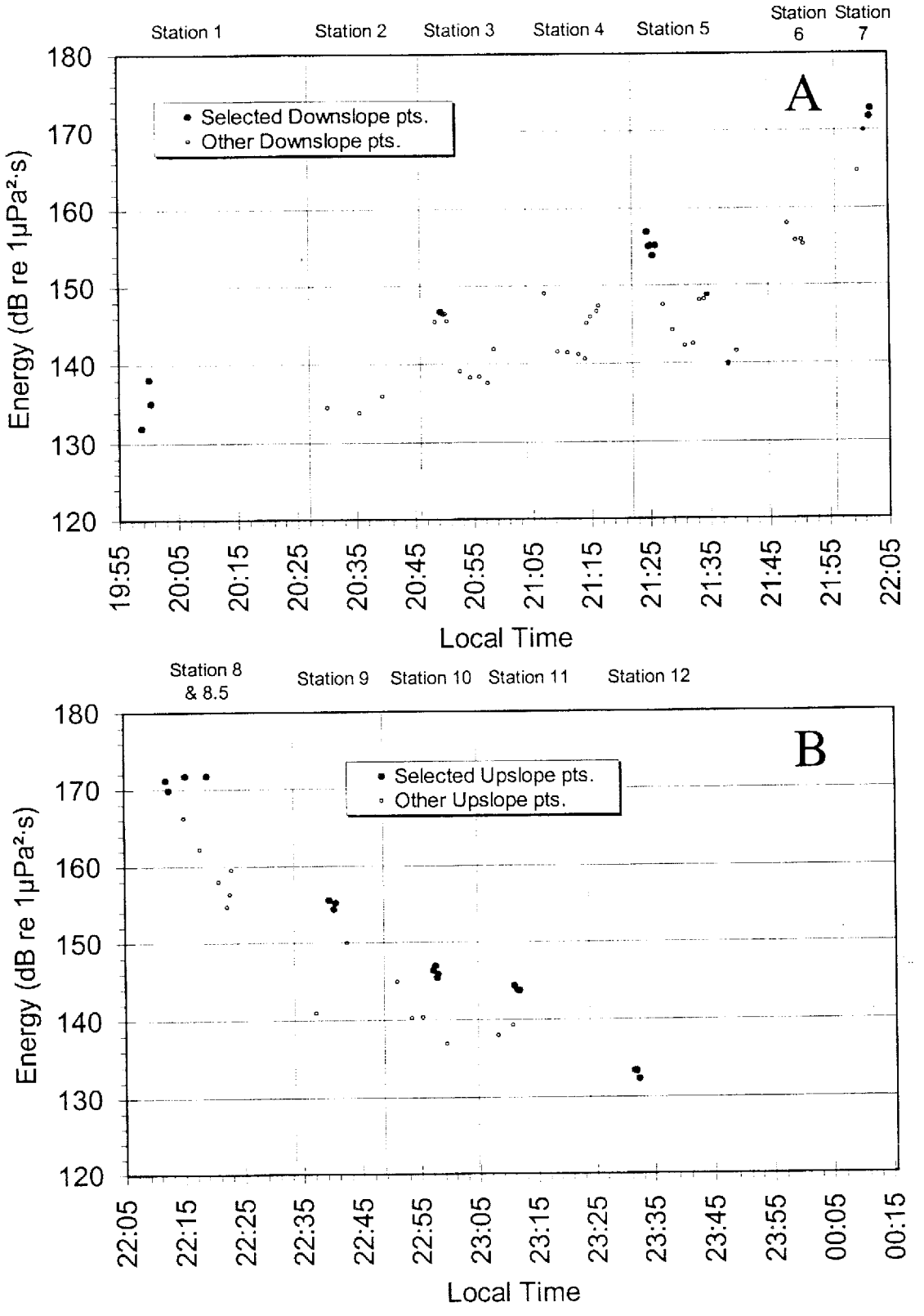

FIGURE 2. Received energy flux density vs. recording time. These graphs are presented to show all the received energies and those selected as having come from the full operating airgun array. (**A**) is for the downslope leg, and (**B**) is for the upslope leg.

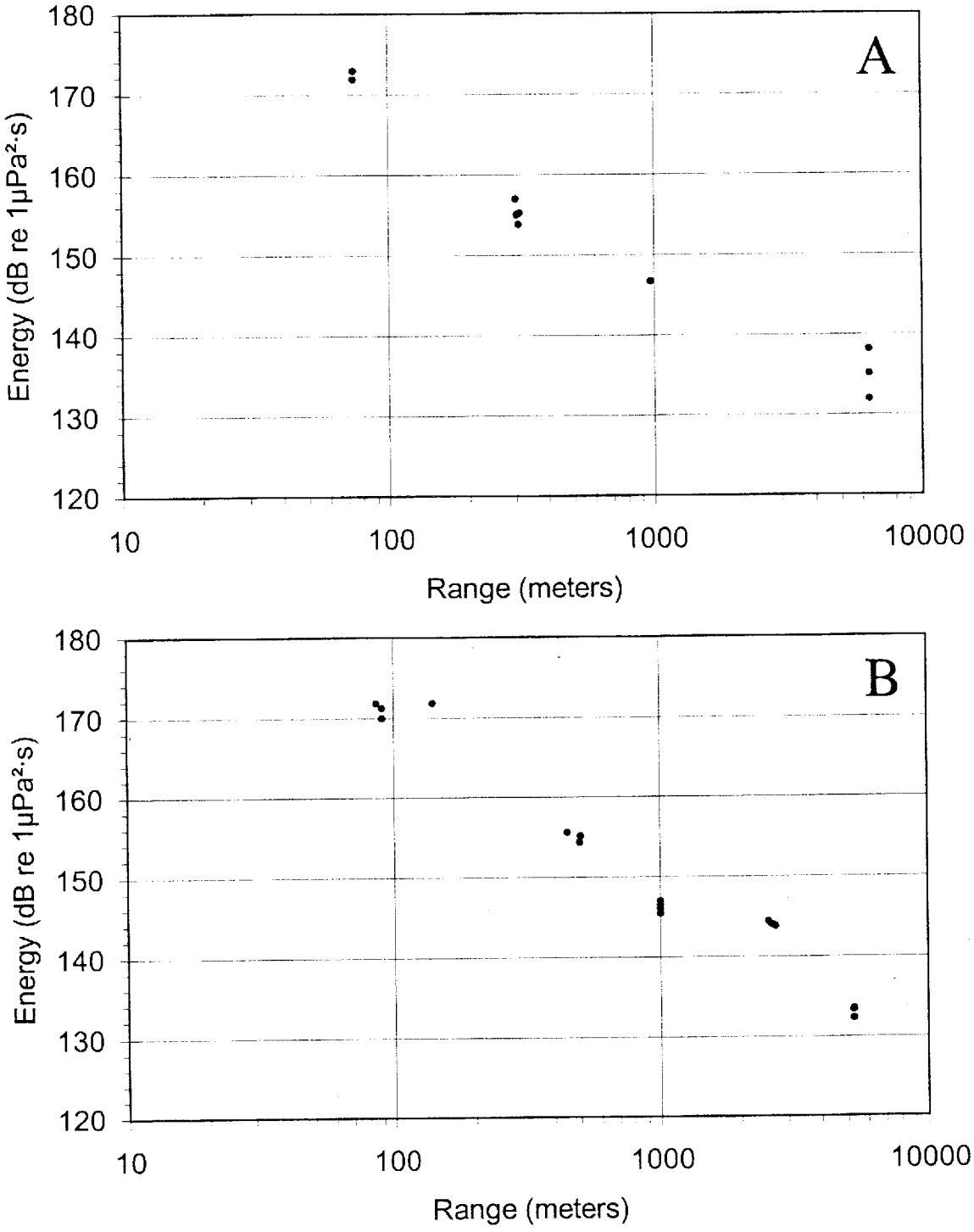

FIGURE 3. Received energy flux density vs. distance to the source. Only the selected data (from Fig. 2, taken to be from the full operating array) are shown. (**A**) is for the downslope leg and (**B**) is for the upslope leg.

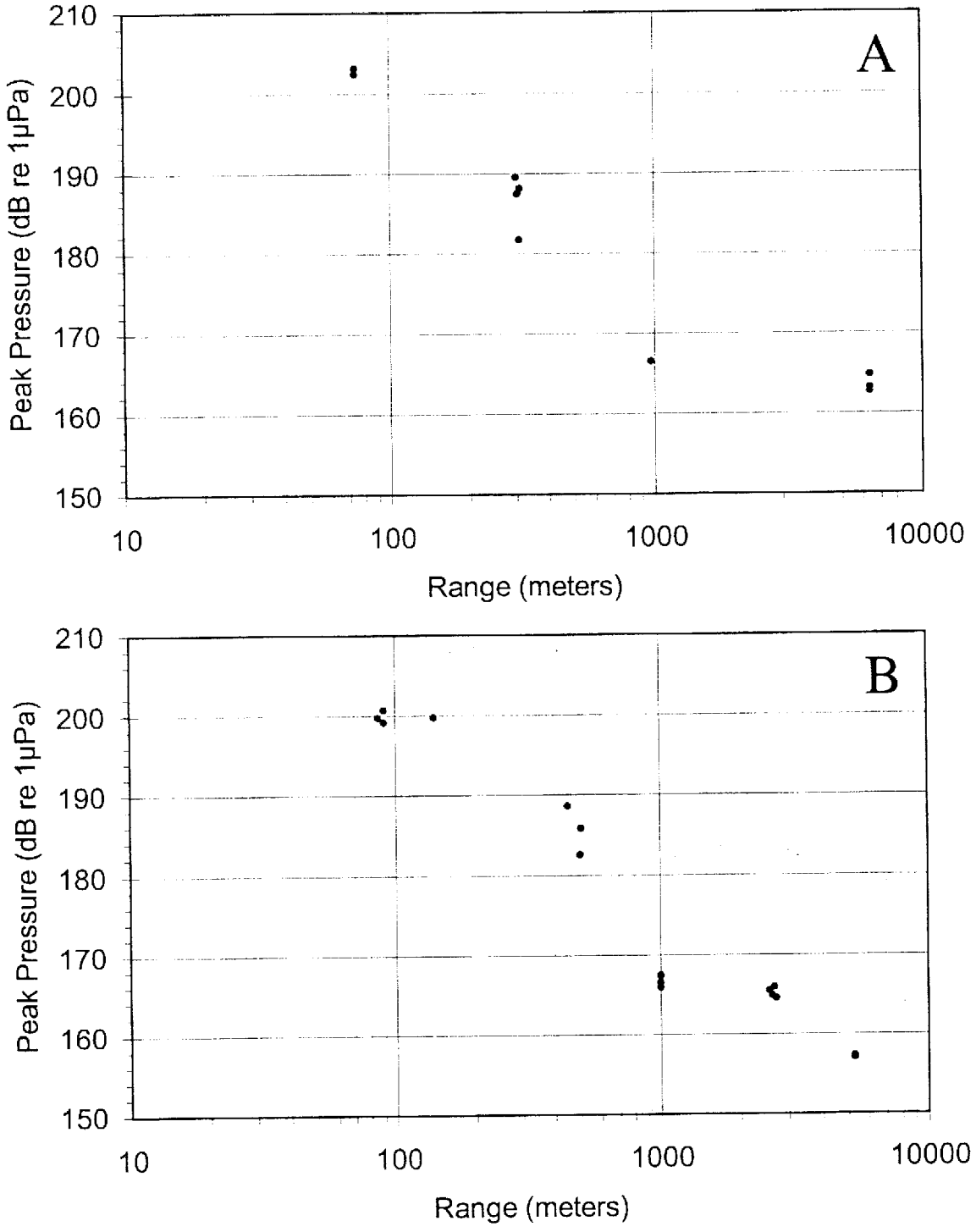

FIGURE 4. Selected received instantaneous peak pressures vs. distance to the source. (**A**) is for the downslope leg and (**B**) is for the upslope leg.

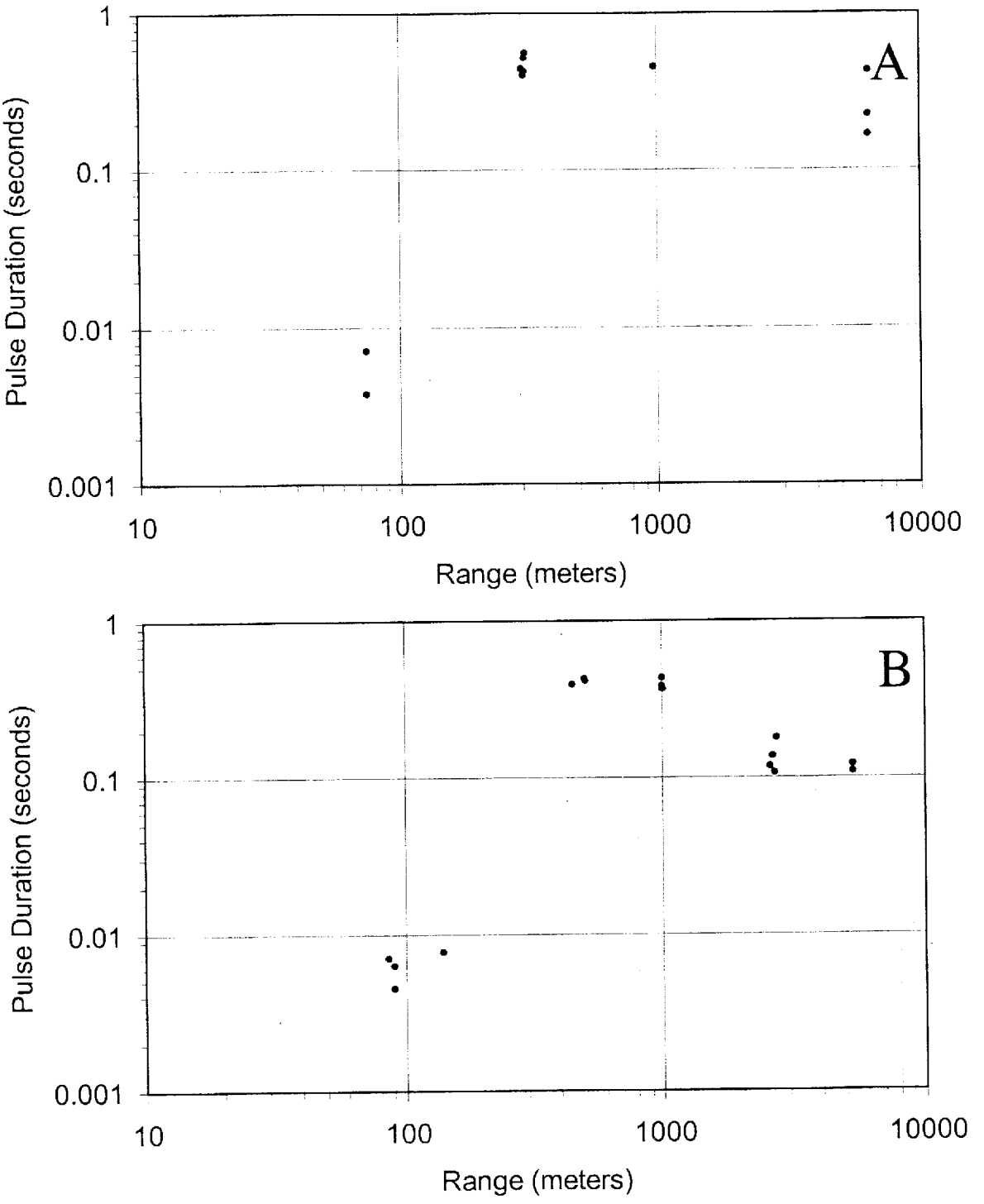

FIGURE 5. Selected pulse durations vs. distance to the source. (**A**) is for the downslope leg and (**B**) is for the upslope leg.

SOUND PRESSURE LEVELS

Figure 6 presents the sound pressure levels (SPL) vs. distance to the source. The SPL may also be referred to as the "average peak pressure level", or as the "mean square pressure level", or as the "root-mean-square pressure level". The SPL may be derived from the pulse energy by dividing by the pulse duration. Thus, errors in estimating the pulse duration (caused by confusing multipath signal arrivals or reverberation) will appear in the SPL values.

For pulses greater than about 0.1 s, represented by most of the selected pulses, the SPL measure is accepted as the important pulse measure to relate to influences on animal behavior and even injury to animals. Therefore this measure is of special interest and importance.

Figure 6 includes best-fit lines between the clusters of received levels between about 100 m and 300-500 m (depending on the survey leg). These lines are steeper (higher attenuation with increasing distance) than would be lines between more distant receiver stations. They also intersect the 190, 180 and 160 dB re 1 μPa levels considered important to marine mammal safety. For the downslope leg (Fig. 6A), the best-fit equation was

$$SPL_{downslope}\ (\text{dB re 1 } \mu\text{Pa}) = 306.5 - 59.57 \cdot \log(R) \qquad \text{Eq. (1)}$$

for R in meters, $70 < R < 300$ (extrapolation to shorter or longer distances is not legitimate). There were 7 measurements, the standard error was 1.6 dB and the coefficient of determination was 0.994.

For the upslope leg (Fig. 6B), the best-fit equation was

$$SPL_{upslope}\ (\text{dB re 1 } \mu\text{Pa}) = 289.0 - 48.23 \cdot \log(R) \qquad \text{Eq. (2)}$$

for R in meters, $80 < R < 500$. There were 7 measurements, the standard error was 3.8 dB and the coefficient of determination was 0.965.

The constants in Equations (1) and (2) are the values of SPL obtained if one substitutes $R=1$ into the equations. However, these values are not source level estimates; $R=1$ is well outside the applicable range of distances. The high constants and the steep slopes (almost -60 dB/decade in Eq. 1 and -48 dB/decade in Eq. 2) are the result of fitting the data between the applicable ranges. Within these ranges the received levels are experiencing the result of a marked lengthening of the pulse duration (see Fig. 5). Although the energies and peak pressures (Figs. 3 and 4) are transitioning smoothly, the duration increases steeply, resulting in longer averaging times and correspondingly lower SPL values. The explanation for the increasing duration may be that the bottom-bounce energy, which always lags the direct arrival, becomes relatively stronger with increasing distance over these ranges, effectively lengthening the pulse. The direct arrival energy begins to experience the shadow-zone effect of the downward refraction (see Appendix A), diminishing its amplitude slightly with respect to the bottom-bounce energy.

The VSP airgun array source level has been estimated by assuming spherical spreading (20log(R)) from the shortest ranges measured (74 and 90 m) back to distance 1 m. The assumption of spherical spreading is reasonable given the deep water (400 m) and the short distances (<74 m). This simple spherical spreading model does not account for the surface reflection

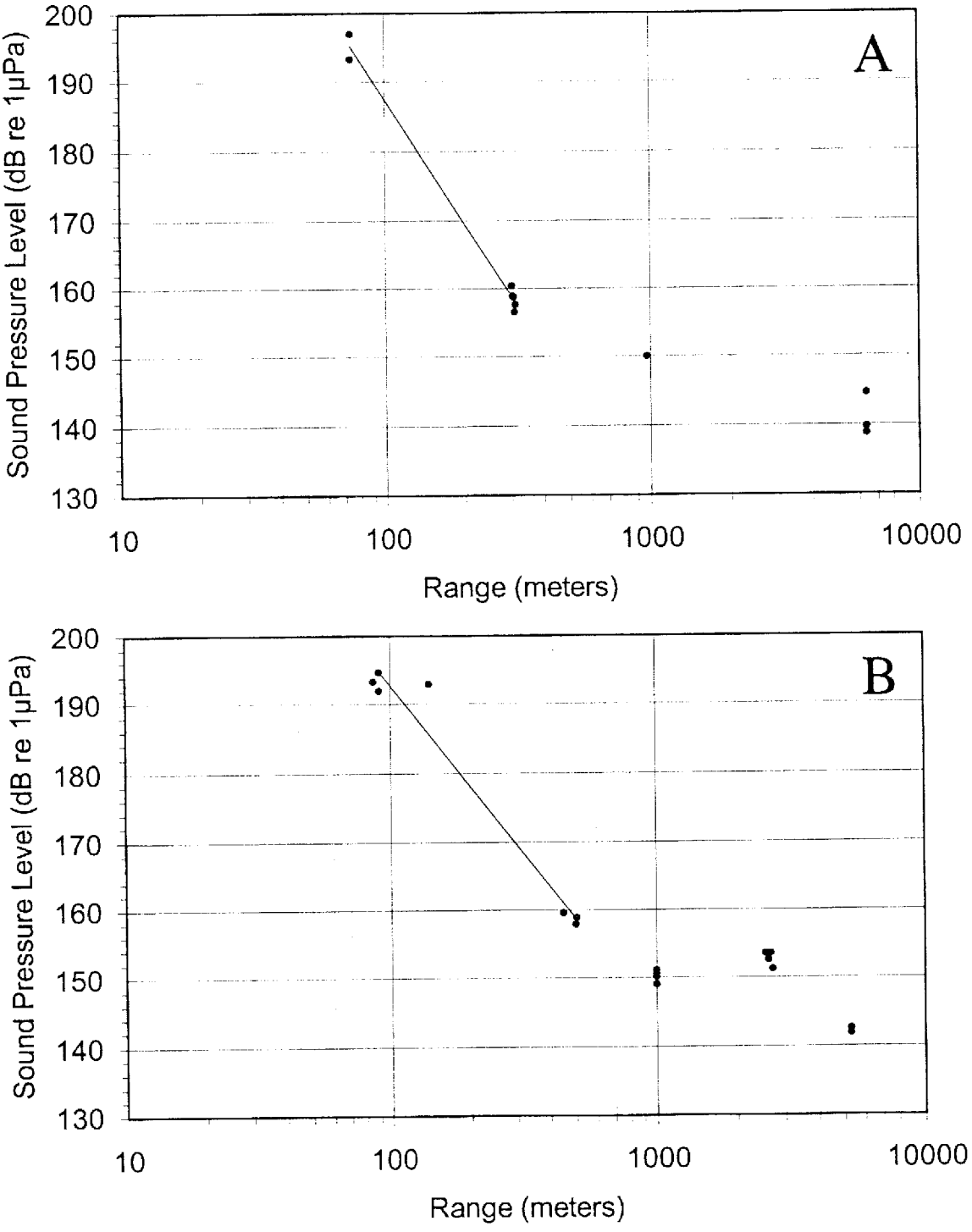

FIGURE 6. Selected pulse sound pressure levels vs. distance to the source. (**A**) is for the downslope leg and (**B**) is for the upslope leg.

effects, although they are present in the measurements at 74 and 90 m. Thus, the result is not a free-field source level. The result was the value 232 dB re 1 μPa-m. Based on measurements of the large, 3959 in^3 array, Geco-Prakla estimated that the vertical source level of the 760 in^3 array would be 222 dB re 1 μPa-m and that the horizontal source level would be 216 dB re 1 μPa-m. These low estimates probably are the result of using data from an array with widely-spaced airguns (the 3959 in^3 array) to estimate the source level of an array with closely-spaced airguns (the 760 in^3 array).

ONE-THIRD OCTAVE BAND SPECTRA

Figure 7 presents a graph of three received pulse sound levels in one-third octave bands from 20 to 20,000 Hz. The 74-m distance spectrum represents a short range and the other two represent the spectra at the ends of the downslope and upslope survey legs. In all cases, the levels are averaged over a one-second period, rather than the pulse duration, so the values correspond to the effective pressure levels over one second. The maximum level occurs in the 250 Hz band in all three cases. The rolloff from 250 Hz downward results from the shallow source depth of 3 m.

At the 5.3 and 6.3 km distances, the background noise spectrum levels equal the pulse levels in the one-third octave bands at 3150 Hz and at higher frequencies. Similarly, the pulse levels in the 20 to 31.5 Hz band are close to the background noise levels. The background noise for the 74-m case is higher than at the two distant stations because of the proximity to the platform and to the source boat *Toby Tide*.

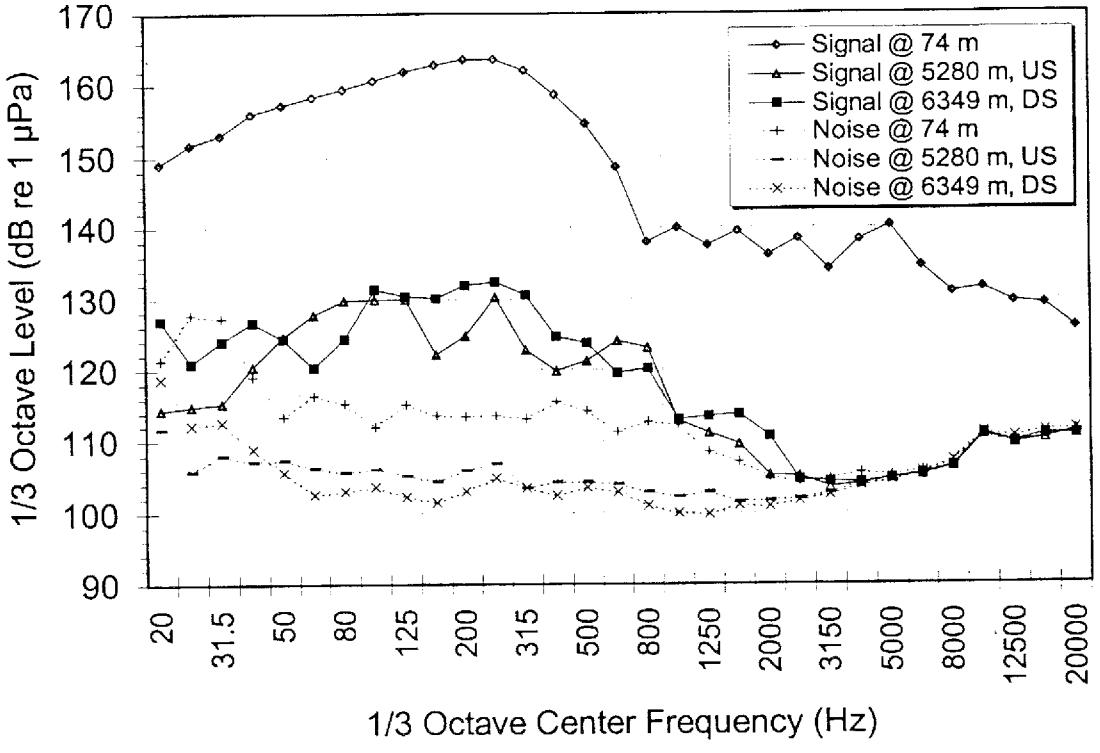

FIGURE 7. One-third octave band spectra for pulses received from the ends of the two survey legs (US = upslope, DS = downslope) and from near the source airguns. The corresponding background noise spectra are also plotted.

DISCUSSION

This section addresses the two questions that motivated this study: (1) are the predicted distances to the 190, 180, and 160 dB re 1 μPa SPLs validated by the measurements, and (2) what is a reasonable time required to prepare a report of the results following a field verification test?

ESTIMATED DISTANCES TO 190, 180 AND 160 dB re 1 μPa

Table 1 presents the results of evaluating equations (1) and (2) for the distances corresponding to 190, 180 and 160 dB SPLs.

Table 1. Distances to an SPL of 190, 180 and 160 dB re 1 μPa along the two propagation paths and the GECO-PRAKLA predictions.

Propagation Path or Predictions	-------- Distance (m) --------		
	SPL = 190 dB	SPL = 180 dB	SPL = 160 dB
Downslope	90	130	290
Upslope	110	180	470
GECO-PRAKLA Predictions	20	82	< 1 km

The sound along the upslope path (sound traveling into shallower water) undergoes less attenuation with distance than does sound along the downslope path (sound traveling into deeper water). This result follows from the fact that the received levels at the 500 m station on the upslope path (Fig. 6B) were about the same as the received levels at distance 300 m on the downslope path (Fig. 6A) while the levels at 70-90 m on both legs were about the same.

The GECO-PRAKLA predicted distances were less than those indicated by the measurements. Their predictions were based on the measurements of a much larger array, both in terms of number of guns (18 vs. 8), total airgun volume (3959 vs. 760 in^3) and in terms of geometrial extent. The VSP array airguns were confined to a space on the order of 2 m, while the large array was at least 10s of meters in extent (actual numbers were not presented). This large spacing reduces the coherence of the sounds from the individual airguns in the horizontal plane. Geometrically small arrays of tightly spaced airguns can provide surprisingly high sound levels in horizontal directions. If a receiver is at a point where the received pulses arrive at different times, their pressures will not add in phase. There are many more such points (large areas around the array) when the airguns are relatively far apart. Alternatively, if the airguns are close together, the individual pulses will add in phase almost everywhere, resulting in higher sound pressures.

TIME TO PREPARE A FIELD REPORT

The analysis and reporting of this VSP test data took more time than typically should be required for a planned field validation test. The analysis effort could have taken significantly less time if the times when the source array was operated at full strength had been communicated to the receiving boat. In an actual field validation project, all analysis software would be developed and tested before the field measurements. With all the field information in hand, the acoustic recordings could have been analyzed within a day without interruptions, two days at most. This report has taken two days to prepare, but if it were limited to the important results--validation of the predicted distances--the report could be prepared in a fraction of a day. In summary, it should be possible to analyze the recordings and prepare a brief field report in less than three days.

CONCLUSION

A better model is needed of lateral sound propagation from an array of airguns. The field measurements reported here indicated that the predicted distances from the airguns to the 190, 180 and 160 dB re 1 μPa sound pressure level contours were too low. This was probably the result of basing the predictions, in part, on the results of measurements on an airgun array with much greater distances between the airguns. The VSP array airguns were closely spaced and their pulses added coherently to form higher-pressure pulses at closer distances than would be expected from larger airgun array geometries.

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Richardson, W.J., C.R. Greene Jr., C.I. Malme, and D.H. Thomson. 1995. Marine mammals and noise. Academic Press, San Diego, CA. 576 p.

APPENDIX A: Three Measured Sound Velocity Profiles and Corresponding Sound Ray Paths for the Vicinity of Platform Harmony

This appendix presents the three measured sound velocity profiles and the corresponding sound ray paths for the Harmony vicinity during the sea tests on 17 March 1998. The measured profiles went to depth 150 m. Experience provided an assumed sound speed at greater depths to 400 m (the water depth at Harmony). The results are shown in Figure A-1 (for the profile taken at 1500 local time), Figure A-2 (for the profile taken at 1800), and Figure A-3 (for the profile taken at 2330 after the measurements were completed). These three profiles appear to be about the same, as do the corresponding sound ray paths.

The initial ray path began at horizontal angle 0°, and successive rays began at increasingly negative angles down to -20°. The sound ray paths show the impacts with the bottom but not the reflections, although some energy is reflected and returns to the surface to be reflected again. The horizontal ray, which travels farthest before impacting the bottom, is seen to impact at horizontal ranges of 3000 to 3700 m. Rays that impact at steeper angles can be absorbed, while rays with shallow grazing angles can be highly reflected. "Can be" is because the actual case depends on the bottom materials and their geoacoustic properties.

Given the geometry of the ray paths, it is likely that beyond the immediate vicinity (say >1 km) of the airguns, the received sound levels at shallow depths (say <50 m) will be considerably reduced compared to homogeneous free-field spherical spreading ($-20\cdot\log(R)$) losses. In fact, the loss rates over distances from 70 to 500 m calculated for the downslope and upslope legs are $-59.6\cdot\log(R)$ and $-48.2\cdot\log(R)$, respectively (see RESULTS, above).

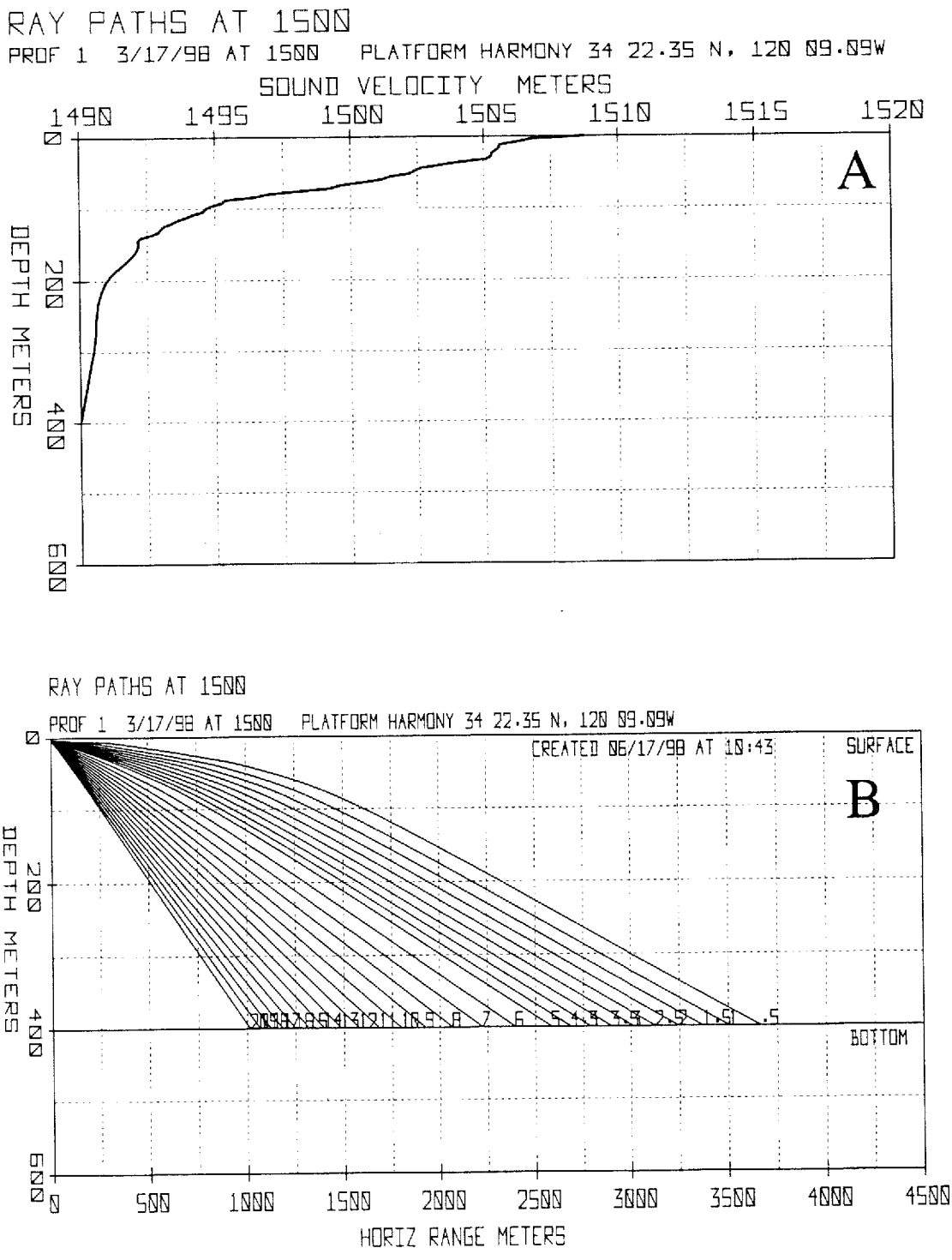

FIGURE A-1. Sound velocity profile (**A**) and sound ray paths (**B**) taken at 1500 on 17 March.

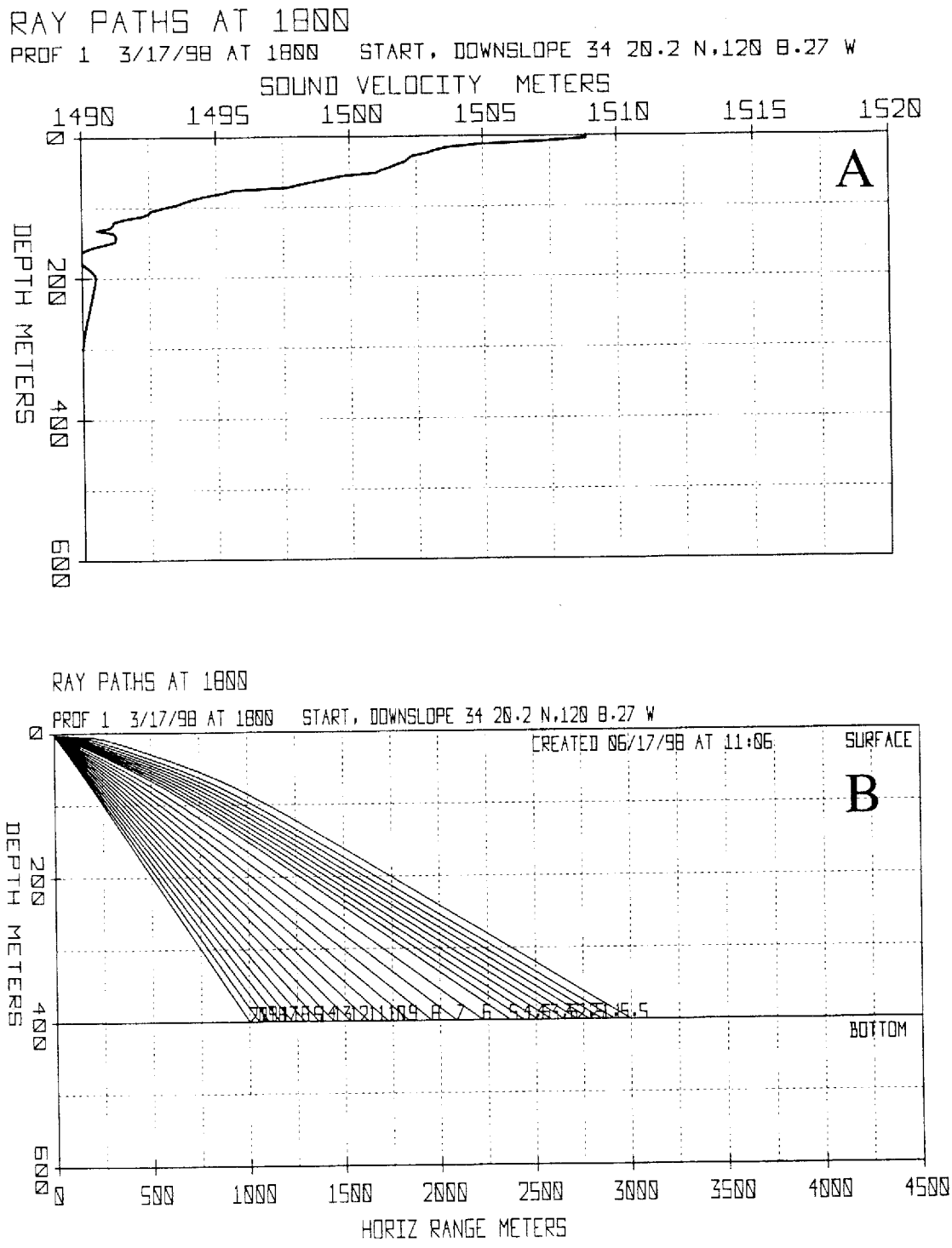

FIGURE A-2. Sound velocity profile (**A**) and sound ray paths (**B**) taken at 1800 on 17 March.

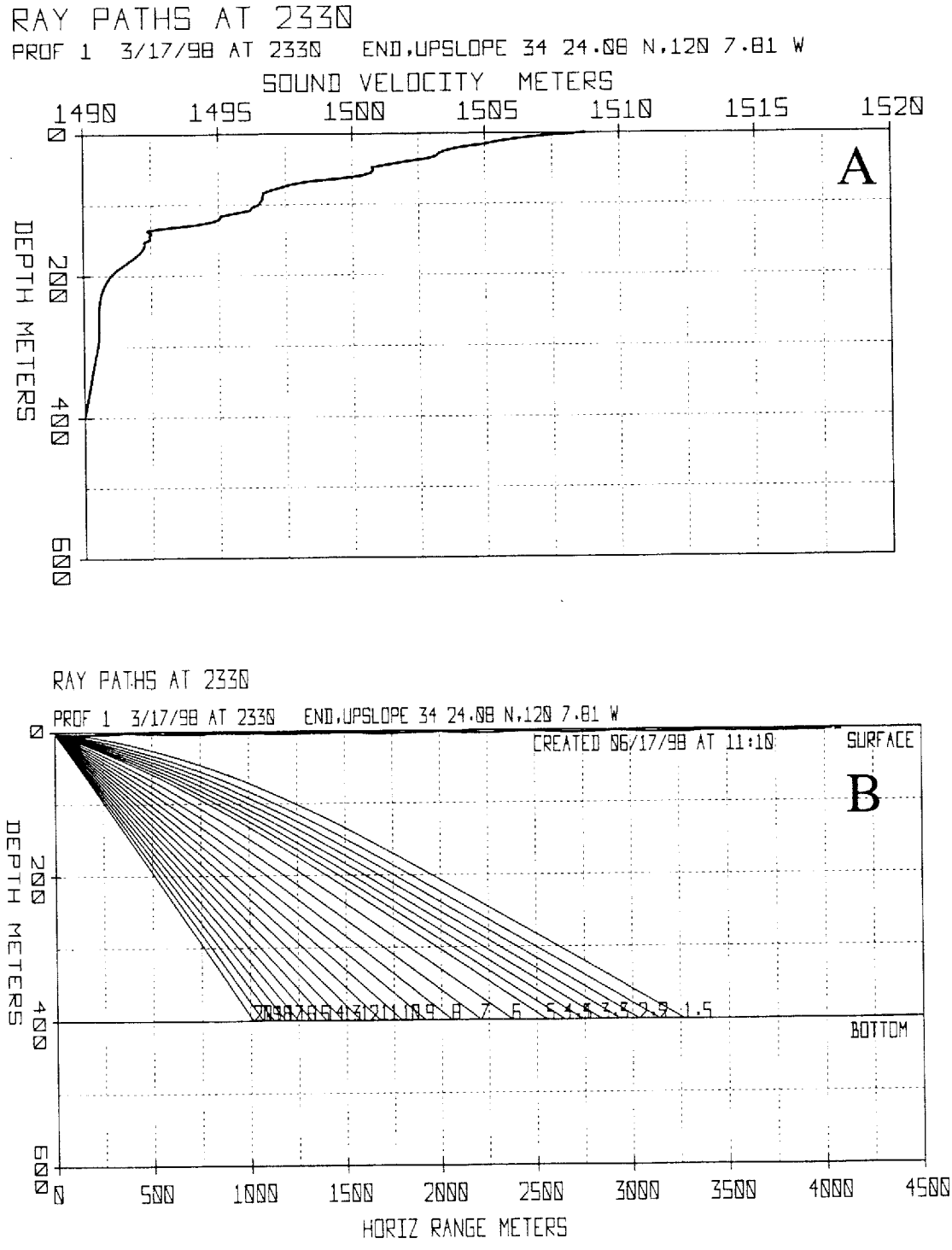

FIGURE A-3. Sound velocity profile (**A**) and sound ray paths (**B**) taken at 2330 on 17 March.

APPENDIX B: Acoustic Concepts and Terminology

The following material was adapted from a report to BP Exploration (Alaska), Inc. (Greene et al. 1998). It attempts to explain the concepts and terms used in this report.

Acoustic concepts and terminology are generally confusing to non-acousticians, and often to acousticians as well. An attempt to summarize the concepts and terms relevant to assessing noise effects on marine mammals was given in Chapter 2 (and the associated Glossary) of Richardson et al. (1995). A few terms used in this report are discussed here.

Four measures of pulse sound levels were computed for each pulse thought to be from the full array: energy, instantaneous peak pressure, duration, and the root-mean-square pressure. All of these measures are appropriate for the broadband pressure vs. time signature of pulses.

The energy is the integral of the pressure squared over time; the units are (micropascal)^{2}seconds. For pulses whose pressures are large compared to the background sound, the duration of the integration is not too important because the integral essentially stops growing after the pulse ends. It is sufficient to start the integral before the pulse begins and end it after the pulse has ended. If the background noise is significant, then it is important to estimate the contribution of the noise and subtract it from the integral. This noise subtraction has been done in the analysis reported in this report.

The pulse duration is the time between 5% and 95% of the total energy. That is, as the energy accumulates during the pulse, the pulse is said to start after 5% of the total energy has accumulated and to end when 95% of the energy has accumulated. In this way, the pulse elongation from low-level reverberation is eliminated, and the principal part of the pulse is used. This is important because the duration is the time over which the square pressure is averaged to determine the sound pressure of the pulse. Neglecting 10% of the pulse energy results in less than an 0.5 dB change in the pulse energy level.

The word "level" is used to denote a sound measurement in decibels. A one decibel (dB) change in sound level is considered to be the smallest change in sound level perceptible to a human listener. A change of +10 dB or -10 dB is perceived by a human listener to be, respectively, about a doubling or a halving of the sound level. However, in physical units, a 10 dB change in sound pressure level corresponds to a three-fold change in the rms sound pressure (commonly measured in micropascals). A doubling of the rms sound pressure corresponds to a 6 dB increase in sound pressure level.

Unrelated sound sources add incoherently, meaning that the sound waveforms are not correlated; the sum of the mean square pressures gives the mean square pressure of the waveform sum. (A waveform, in the context used here, refers to the relationship between sound pressure and time.) In contrast, similar sound sources operating synchronously produce identical waveforms that are in-phase with one another. These add coherently, meaning that their combined sound pressure is the sum of their individual sound pressures. Two coherent sources produce twice the sound pressure of either source operating alone (a 6-dB higher sound level). Closely-spaced airguns firing at the same time have related waveforms that add coherently.

In calculating average sound levels over specified lengths of time, the common practice is to square the pressures and average them, obtaining a mean square pressure, and then compute 10·log (mean square) to obtain the sound pressure level (SPL). An alternative procedure is to compute the square root of the mean square to obtain the "root-mean-square" or rms sound pressure, and then compute 20·log(rms) to obtain the sound pressure level. The results are the same, and it is convenient to refer to the value derived by either procedure as an rms pressure level. This rms pressure level is commonly called the "sound pressure level", or SPL, by acousticians. Readers must keep in mind that in this report the term "sound pressure level" means the rms pressure level calculated over the pulse duration.

"Peak" and "rms" pulse levels are often presented for the received airgun signals. The peak level is the instantaneous maximum or minimum amplitude seen while the rms level is an average over the pulse duration. Another term used to emphasize this distinction is the "crest factor" of a waveform, which is the ratio of the peak level to the rms level. The crest factor of a sinusoidal waveform is 1.4, or 3 dB.

Measured sound levels depend on the frequency range (bandwidth) under consideration. Levels are often presented for bands 1 Hz in width; such levels are called spectrum levels or spectral density levels. In this report, we often describe sound levels in various one-third octave bands. These are frequency bands whose upper limit in hertz is $2^{1/3}$ (1.26) times the lower limit. Their bandwidth is proportional to center frequency, and in fact is 23% of the center frequency. For example, the one-third octave band centered at 100 Hz extends from 89 to 112 Hz, whereas that centered at 1000 Hz extends from about 890 to 1120 Hz. Sound levels are often presented for one-third octave bands because the effective filter bandwidth of mammalian hearing systems is roughly proportional to frequency and often about one-third octave. For frequencies above 5 Hz, the one-third octave band level of any broadband sound exceeds the spectrum level because the one-third octave bandwidth exceeds 1 Hz. Likewise, the overall level (considering all frequencies) of a broadband sound generally exceeds the level in any single one-third octave band.

Regarding distance measures other than the MKS standard kilometer, the usual practice is to use statute miles (st.mi.) on land and nautical miles (n.mi.) at sea. One nautical mile is equal to 1.15 st.mi. and to 1.852 km.

Appendix 8
FINAL APPROACH FOR HANDLING NEW INFORMATION POST HESS TEAM PROCESS

Outlined below is the process proposed by the Hess Team regarding an approach for integrating new information (research, monitoring, verification) into the MMS review process for seismic surveys after the formal HESS Team process concludes. This is not a substitute for other legal requirements regarding agency consideration of new significant information.

ANNUAL MEETING OF THE HESS TEAM

Annually, for at least five years after the conclusion of the formal HESS Team process, MMS will reconvene a meeting of the Team to provide continued oversight, advice and continuity as the permitting process is implemented. Representation on the Team will be similar to that of the current Hess Team. Meetings will be held in October of each year, with the first meeting scheduled for October, 1999. MMS will serve as an ongoing clearinghouse of information between annual meetings.

MMS will compile a brief report describing: 1) Any studies or materials relating to seismic/marine mammal effects or other critical marine resources considered in environmental documents that have become available during the prior calendar year; 2) High energy seismic survey activities during the prior year, including information received as part of applications and monitoring data; 3) Any changes to the review process protocols that are approved by the Pacific OCS Regional Director, 4.) Knowledge of upcoming high energy seismic survey activities.

An Executive Committee of the Team will meet in advance of the annual meeting to plan the agenda. This will include: 1.) Identifying key issues to be addressed, 2.) Selecting and preparing background materials including the studies report that is necessary to guide Team deliberations, 3.) Determining the need for speakers to provide technical updates to the Team as appropriate, 4.) Determining the need for an expert workshop.

Membership of the Executive Committee will include (see next page for Executive Committee roster):

1 MMS representative
1 federal resource agency representative
1 State government representative
1 industry representative
1 local government representative
1 environmental group representative

At the annual meeting, the Team will: 1) Review any new information that might have become available regarding seismic operations/marine mammals effects, 2) Reexamine the effectiveness of the high energy seismic survey review process as applicable, 3) Make recommendations to the Pacific OCS Regional Director of MMS on any changes to the process that would be appropriate. The Team will attempt to reach a consensus on any recommended changes, and 4) Recommend additional studies necessary to better understand the potential impacts of high energy seismic surveys on the marine environment.

Expert workshops to provide guidance to the Team regarding the effectiveness of mitigation and monitoring activities or the implications of new information available on seismic effects to marine resources will be conducted on an as needed basis. The Executive Committee shall consider the need for a formal workshop as its agenda planning session as an option for examining new information.

HESS Team members will be notified in writing if the Pacific Regional Director decides not to follow the consensus recommendations of the Team developed at the annual meeting and will be provided with the reasons for selecting an alternative course of action. If the reasons provided by the Pacific Regional Director do not sufficiently address the concerns of members, then an individual member will officially notify the Pacific Regional Director that there no longer is a consensus on the policy utilized by the Region and support for the policy from members can no longer be assumed in any subsequent permit review process.

If new information is identified that would significantly affect the requirements enumerated in the Interim Operational Guidelines, then the MMS representative on the Executive Committee will convene the Committee by teleconference to confer regarding the need to propose changes to the Operational Guidelines prior to the Annual Meeting.

Each representative has the responsibility to communicate with the members of their organizations regarding information received as well as to obtain their input on planning for the annual meeting.

The Executive Committee shall be notified of proposed small projects such as a VSP.

1999 HESS EXECUTIVE COMMITTEE ROSTER

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Appendix 9:

High Energy Seismic Survey Team Membership
Note: All Persons Listed Are Full Team Members. Additional Subcommittee Membership(s) is in Parentheses

Jack Caldwell
GECO-PRAKLA Geophysical
IAGC Representative

LCDR Edward Cassano
Channel Islands National Marine Sanctuary

Alison Dettmer
California Coastal Commission
(Process)

Tina Fahy
National Marine Fisheries Service

Michael Fisher
U.S. Geological Survey

Nancy Francis
County of Ventura

Craig Fusaro
Joint Oil/Fisheries Liaison Office
(Mitigation, EIS/EIR, Workshop)

Michelle Gasparini
County of Santa Barbara
(EIS/EIR)

Roger Gentry
National Marine Fisheries Service
(Mitigation, Workshop)

Daniel Gorfain
California State Lands Commission
(Process, EIS/EIR, Workshop)

Bill Grady
Exxon Company, U.S.A.
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James Grant
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(Mitigation)

Gordon Greve
Orion Consultants - IAGC Representative
(Mitigation, Workshop)

Ron Heck
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Maurice Hill
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Frank Holmes
Western States Petroleum Association
(EIS/EIR)

Maher Ibrahim
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Vijaya Jammalamadaka
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Susan Jordan
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Alana Knaster
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Linda Krop
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Joel Reynolds
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Dale Schafer
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Lewis Schneider
Edison-Schwest, IAGC Representative

Robert Sollen
Sierra Club

Ron Tan
Santa Barbara County APCD
(EIS/EIR)

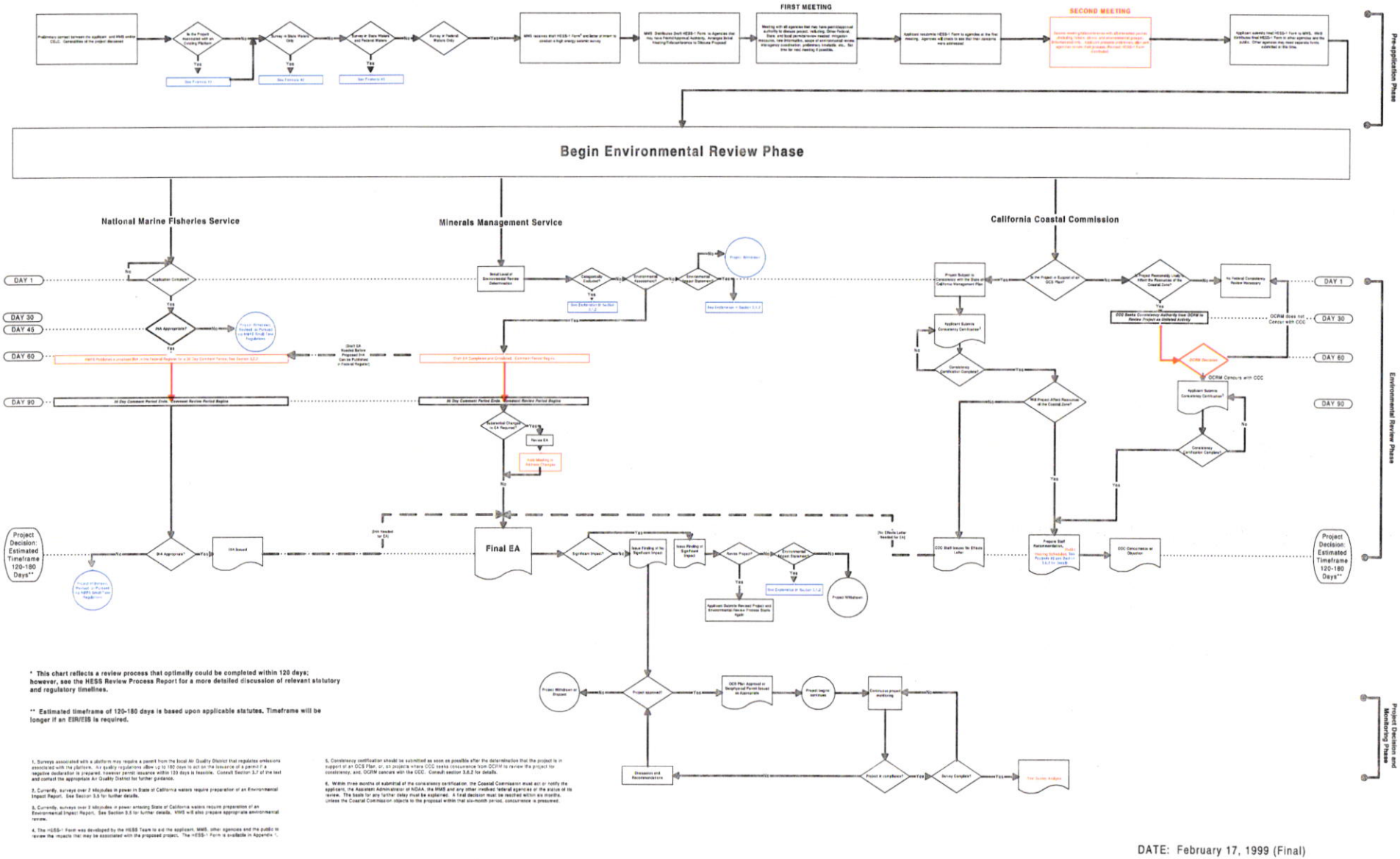
Sara Wan
California Coastal Commission
(Mitigation, Workshop)

Julie Ward
County of Ventura

Plate 1

High Energy Seismic Survey Review Process For Surveys in Federal Waters Offshore Southern California
If an EIS is not Required*

Bold italics denote steps with statutory time constraints. Red text denotes opportunities for public comment. Blue text denotes a departure from the chart.



* This chart reflects a review process that optimally could be completed within 120 days; however, see the HESS Review Process Report for a more detailed discussion of relevant statutory and regulatory timelines.

** Estimated timeframe of 120-180 days is based upon applicable statutes. Timeframe will be longer if an EIR/EIS is required.

1. Surveys associated with a platform may require a permit from the local Air Quality District that regulates emissions associated with the platform. Air quality regulations allow up to 180 days to act on the issuance of a permit if a negative declaration is prepared; however permit issuance within 120 days is feasible. Consult Section 3.7 of the text and contact the appropriate Air Quality District for further guidance.

2. Currently, surveys over 2 kilojoules in power in State of California waters require preparation of an Environmental Impact Report. See Section 3.5 for further details.

3. Currently, surveys over 2 kilojoules in power entering State of California waters require preparation of an Environmental Impact Report. See Section 3.5 for further details. MMS will also prepare appropriate environmental review.

4. The HESS-1 Form was developed by the HESS Team to aid the applicant, MMS, other agencies and the public to review the impacts that may be associated with the proposed project. The HESS-1 Form is available in Appendix I.

5. Consistency certification should be submitted as soon as possible after the determination that the project is in support of an OCS Plan, or, on projects where CCC seeks concurrence from OCRM to review the project for consistency, and, OCRM concurs with the CCC. Consult section 3.6.2 for details.

6. Within three months of submittal of the consistency certification, the Coastal Commission must act or notify the applicant, the Assistant Administrator of NOAA, the MMS and any other involved federal agencies of the status of its review. The basis for any further delay must be explained. A final decision must be reached within six months. Unless the Coastal Commission objects to the proposal within that six-month period, concurrence is presumed.

DATE: February 17, 1999 (Final)