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STAFF RECOMMENDATION

ON CONSISTENCY DETERMINATION

Consistency Determination No.	**CD-32-99**
Staff:	MPD-SF
File Date:	4/13/1999
45th Day:	5/27/1999
60th Day:	6/11/1999
Commission Meeting:	5/11/1999

FEDERAL AGENCY: **U.S. Geological Survey (USGS)**

PROJECT LOCATION: Southern California offshore waters, nearshore areas to 20 mi. offshore, Point Dume (L.A. County) to U.S. Mexican Border (Exhibit 1)

PROJECT DESCRIPTION: Seismic survey to map earthquake faults and other subsea stratigraphic information

SUBSTANTIVE FILE DOCUMENTS: See page 19.

EXECUTIVE SUMMARY

The USGS has submitted a consistency determination for a seismic survey in southern California offshore waters to collect high-resolution seismic reflection data to investigate: (1) landslide and earthquake hazards in the nearshore region from Los

Angeles to San Diego; and (2) saltwater intrusion into freshwater aquifers that provide water supply for the Los Angeles-San Pedro area. The survey would take two weeks to complete and is scheduled for June/July 1999.

Seismic surveys involve loud seismic pulses which can disturb marine resources, and the noise and equipment can interfere with commercial fishing operations. USGS would use a small airgun (40 cu. inches), and the maximum sound level would be 220 decibels (dB), water reference standard[1] (at 1 meter). Most oil exploration seismic surveys use significantly larger and a greater number of airguns, and thus are considerably louder (230-259 dB, with each 10 dB representing an order of magnitude louder, and with typical airgun sizes (volumes) on the order of thousands of cu. inches, compared to USGS' 40 cu. inch airgun). In addition, USGS' survey would not contain the long tow lines that can disrupt fishing gear. Nevertheless USGS' survey is sufficiently loud to raise concerns over effects on marine mammals and trigger the need for monitoring and avoidance measures.

In its consistency determination and its application to the National Marine Fisheries Service (NMFS) for a marine mammal harassment permit, USGS has committed to monitoring marine mammals in the survey vicinity and avoiding subjecting marine mammals to sound levels above 180 dB. This commitment is consistent with the recommendations of an intergovernmental review effort called "HESS" (High Energy Seismic Survey), with which the Commission is involved. USGS expects the sound to attenuate to 180 dB within 40 meters (m) of the source (Exhibit 2). For pinnipeds and odontocetes (toothed whales), USGS has committed to observing a safety zone of 50 m, and for mysticetes (baleen whales) a zone of 100 m will be observed. USGS has established its ability to monitor and avoid adverse effects during past surveys on the west coast of the U.S. (including California).

Given the small size of the USGS airgun, along with USGS' proven ability to monitor and protect marine mammals, with the monitoring and avoidance commitments the project is consistent with the marine resource, environmentally sensitive habitat, commercial and recreational fishing and diving policies (Sections 30230, 30240, 30234, 30234.5, 30213 and 30220) of the Coastal Act.

STAFF SUMMARY AND RECOMMENDATION

I. Project Description. USGS proposes a seismic survey in southern California offshore waters in order to: (1) evaluate seismic hazards from active nearshore faults adjacent to densely populated urban areas; and (2) provide stratigraphic control for aquifer models in the Los Angeles Basin necessary for the study and management of saltwater intrusion. The surveys are part of a multiyear effort (e.g., an earlier phase of the

[1] All decibel references in this report will be based on the water standard (re: 1 micropascal (μPa))

study was conducted in southern California last year) and are being conducted in cooperation with local city and county groundwater management agencies.

Project Location and Dates

The area proposed for study is located within the marine environment of southern California, between Point Dume and the U.S.-Mexican border, extending from nearshore to a maximum of 20 miles offshore (Exhibit 1). The project is currently scheduled to be conducted for two weeks, starting no earlier than June 10 , 1999. Vessel scheduling may require that the survey period be extended partially or entirely into July, but completion will be no later than July 20, 1999.

Purpose and Need

The USGS plans to collect high-resolution seismic data using small acoustic sources, including electromechanical transducers and airguns. USGS seeks to improve its understanding of how earthquake deformation is distributed offshore, as well as to identify the sources and pathways of seawater that intrudes into freshwater aquifers below San Pedro. USGS is working with the Los Angeles County Department of Public Works and the Southern California Water Replenishment District to develop a ground-water simulation model to predict fluid flow below San Pedro and nearby parts of the Los Angeles Basin. USGS states:

> *Eventually this model will be helpful in managing water resources. The accuracy of the present model is compromised by a paucity of information about aquifer geometry and about other geologic factors in the offshore area that might affect fluid flow within the coastal zone. Data we collect will be used to improve 3- dimensional, fluid-flow models to aid management of water resources.*

Project Details

According to USGS, seismic-reflection profiling is a remote-sensing technique that uses sound waves to image the strata beneath the seafloor. Seismic profiling techniques span a spectrum of frequencies between 10 Hertz (Hz) and 8 kHz. In general, higher frequencies result in better resolution, but poorer penetration within the seafloor. The instruments the USGS is proposing to use in this survey are commonly referred to as "high-resolution," meaning that they are intended to image seafloor strata in the upper 1000 meters (m) of the seafloor, at a resolution of 1 m or better. Table 1 (below) summarizes the acoustic characteristics of the systems to be used. These sources are towed from a survey vessel traveling at a speed of approximately 4 knots, and will be operated continuously for the

duration of the survey, approximately 12 days (288 hours). During that time, the survey vessel will collect data along a series of sub-parallel lines, roughly perpendicular to the coastline, from north to south.

Table 1
Acoustic Source Characteristics

System	Small airgun	Huntec (boomer)
Power	35 cu. in. @ 3000 psi; 2.0 bar-m Pk-Pk 220 dB	217 dB
Frequency range	20-500 Hz	0.5 to 8 kHz
Repetition rate	8 to 12 sec	0.75 to 1.25 sec
Towing depth	1 to 2 meters	10-100 meters
Pulse duration	2 msec typical	0.34 msec typical

Note: power dB units referenced to 1 micropascal @ 1 meter

II. Background/History of Commission Review of Seismic Surveys. In the 1980s hundreds of oil company seismic surveys were conducted in California offshore waters pursuant to joint permits issued by the Minerals Management Service (MMS) and the State Lands Commission. The Commission staff received notices of the surveys but did not choose to independently regulate the activities. The major issues the Commission staff was aware of at that time were: (1) potential impacts to commercial fishing equipment from the long tow lines used by the oil companies; (2) biological effects such as effects on fish development (e.g., eggs and larvae development); and (3) disruption of fishing activities (e.g., fish dispersal) caused by the loud noises. Part of the reason the Commission was willing to decline to assert jurisdiction at that time was the existence and success of the joint oil and fisheries liaison office in the Santa Barbara Channel, which mediated potential disputes between fishermen and oil companies.

In once instance in 1988 the Commission attempted to assert jurisdiction over an Exxon seismic survey in northern California waters which conflicted with peak salmon fishing season; however after Exxon met with fishing groups and agreed to modify its activity to

avoid the peak fishing season, the Commission rescinded its request to review the "unlisted permit" activity.[2]

In 1994 the Commission staff issued a "no coastal development permit" needed to the Thums Long Beach Company for a seismic survey in State waters just offshore of Long Beach. Marine mammal and fisheries avoidance measures were incorporated into this survey and the survey was of short duration. USGS describes that survey as follows:

> *THUMS, 1995: In January, 1995, the THUMS Long Beach Company conducted a 3-D seismic survey in the Long Beach Harbor and vicinity with a large airgun array. (A 12-gun, 1,500 cu.in. array was proposed in the environmental analysis. The Report of Biological Observation Program did not include reference to the actual array used.) The environmental analysis (Chambers Group, 1994) concluded that the project was "unlikely to have significant effects on fish or invertebrate populations in the in the harbor area", and that "long term effects on fish populations would be unlikely". The subsequent report (Chambers Group, 1995) reported no adverse effects to marine life.*

In 1995 the Commission staff agreed with a "No Effects" determination by Exxon for a seismic survey at the Santa Ynez unit in federal waters offshore of Santa Barbara County. The Commission agreed not to require a consistency certification in part due to Exxon's incorporation of marine mammal protection measures, including visual, aerial and acoustic monitoring, acoustic model verification, marine mammal preclusion/avoidance areas, and other measures being required under the National Marine Fisheries Service (NMFS) marine mammal harassment permit.

III. <u>USGS History of Seismic Survey Activity</u>. In the 1991 USGS submitted a consistency determination for a seismic survey in the San Francisco Bay Region (CD-47-91), in which the Commission concurred on August 13, 1991. The Commission found that the activity would: (1) avoid important fishing grounds; (2) only be conducted for one or two days within areas of Coastal Commission jurisdiction (as opposed to within San Francisco Bay, which comes under the purview of the San Francisco Bay Conservation and Development Commission (BCDC)); and (3) be consistent with the marine resources policies of the Coastal Act. USGS describes that survey as follows:

> *BASIX, 1991: In 1991, the USGS and other cooperating groups used a large airgun array (10 guns, 5828 cu.in.) in a study of the Bay area fault systems from the continental margin to well inland on the Sacramento River. During that experiment, the USGS contracted Brezina and Associates as biological consultants to investigate the area in which the*

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[2] Pursuant to 15 CFR Part 930, Section 930.54, Unlisted federal license and permit activities.

> *airgun profiling had been conducted during the previous night (operation hours were between 6:00 pm and 6:00 am) and inspect the waters for signs of impact to fish and other marine life. The report provided by Brezina & Associates concluded that the airgun operation was not responsible for the death of any of the fish carcasses observed. Moreover, they noted that the airgun profiling did not appear to alter the feeding behavior of sea lions, seals, or pelicans, all of which were observed feeding in parts of the study area.*

USGS has performed two subsequent surveys in Pacific Ocean waters, both in 1998, in Puget Sound and in southern California. For the Puget Sound survey, USGS states:

> *SHIPS, 1998: In March, 1998, the USGS and cooperators conducted a large airgun survey in Puget Sound using a 16-gun, 5,300 cu.in. array (Fisher and others, 1999). The operation was monitored extensively, both with on-board observers and by small boat. No adverse effects to marine life or the environment were reported.*

The Commission staff was not aware of USGS' 1998 southern California survey, and it was not reviewed by the Commission. That survey took place in December 1998 and included marine mammal protection measures and extensive monitoring, the results of which are attached as Exhibit 5.

IV. HESS. "HESS" stands for High Energy Seismic Survey and is an intergovernmental review effort convened by the Minerals Management Service to attempt to fashion a coordinated regulatory approach and consensus decisionmaking for high energy seismic activities. The most recent HESS report defines high energy seismic activities 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.*

This HESS team report, recently issued and dated February 19, 1999, contains operational guidelines concerning review procedures and recommended mitigation/avoidance/monitoring measures for agencies to consider in analyzing high energy seismic surveys. The key elements of the HESS recommendations are attached as Exhibit 6. USGS does not believe its proposed survey fits within the above definition of surveys utilized by the HESS, stating:

*It is the opinion of the USGS that since the proposed survey is specifically a "*shallow hazards survey*", and is not in any way intended or expected to be used for "*mineral resources exploration and/or development*", it is therefore excluded from the HESS guidelines. Nonetheless, the mitigation measures proposed in the IHA application ...[and contained in Exhibit 3] for this survey are entirely consistent with the HESS Team recommendations regarding sound pressure levels, safety zones, and shipboard monitoring.*

V. Federal Agency's Consistency Determination. The USGS has determined the project consistent to the maximum extent practicable with the California Coastal Management Program.

VI. Staff Recommendation:

The staff recommends that the Commission adopt the following motion:

MOTION. I move that the Commission **concur** with the USGS' consistency determination.

The staff recommends a **YES** vote on this motion. A majority vote in the affirmative will result in adoption of the following resolution:

Concurrence

The Commission hereby **concurs** with the consistency determination made by the USGS for the proposed project, finding that the project is consistent to the maximum extent practicable with the California Coastal Management Program.

VII. Findings and Declarations:

The Commission finds and declares as follows:

A. Marine Resources/Environmentally Sensitive Habitat.

1. Coastal Act Policies. Section 30230 of the Coastal Act provides:

Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

Section 30240 provides:

(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.

(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.

2. Marine Species. The Southern California Bight supports a diverse assemblage of 29 species of cetaceans (whales, dolphins and porpoises) and 6 species of pinnipeds (seals and sea lions). The species of marine mammals that are likely to be present in the seismic research area include the bottlenose dolphin (Tursiops truncatus), common dolphin (Delphinus delphis), killer whale (Orcinus orca), Pacific white-sided dolphin (Lagenorhynchus obliquidens), northern right whale dolphin (Lissodelphis borealis), Risso's dolphin (Grampus griseus), pilot whale (Globicephala macrorhynchus), Dall's porpoise (Phocoenoides dalli), sperm whale, humpback whale (Megaptera novaengliae), gray whale (Eschrichtius robustus), blue whale (Balaenoptera musculus), minke whale (Balaenoptera acutorostrata), fin whale (Balaenoptera physalus), harbor seal (Phoca vitulina), elephant seal (Mirounga angustirostris), northern sea lion (Eumetopias jubatus), and California sea lion (Zalophus californianus), northern fur seal (Callorhinus ursinus) and sea otter (Enhydra lutris) (NMFS, Fed. Reg., 3/5/99).

3. Issues. Marine mammals rely on sound for communication, orientation, and detection of predators and prey. In recent years the Commission's and the public's awareness of the effects of underwater noise, particularly low frequency noise, has increased significantly. In reviewing the Scripps' ATOC[3] and the Navy's LFA[4] research efforts, the Commission noted: (1) the growing evidence that anthropogenic sounds can disturb marine mammals (Richardson et al. 1995); (2) that observed mammal responses to such sounds include silencing, disruption of activity and movement away from the source; and (3) that low frequency sound carries so well underwater that animals "... have been shown to be affected many tens of kilometers away from a loud acoustic source."

Seismic surveys can be extremely loud; Richardson et al. (1995) notes that "Peak levels of sound pulses from airgun arrays are much higher than the continuous sound levels

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[3] Scripps Institution of Oceanography, Acoustic Thermometry of Ocean Climate (ATOC) Project and Marine Mammal Research Program (MMRP), CC-110-94/CDP 3-95-40.

4 Consistency Determinations No. CD-95-97 and CD-153-97 (Navy, Low-Frequency Active (LFA) Sonar, Phases I and II).

from any ship or industrial noise." At the same time it must be noted that USGS will use a small airgun, which is several orders of magnitude quieter than a typical or large airgun array commonly used for oil exploration. The maximum noise attributed to an oil exploration array is 259 dB; the USGS array would have a maximum source level of 220 dB. Nevertheless, as noted in the HESS guidelines mentioned above (and attached as Exhibit 6], any *received* level above 180 dB may raise cause for concern and warrant the need for monitoring and avoidance measures. In addition, the fact that the proposed survey is partly located within the coastal zone, combined with the fact that it triggers the need for National Marine Fisheries Service (NMFS) "take" permit under the Marine Mammal Protection Act (MMPA),[5] mean that the survey would clearly affect the coastal zone and needs to be carefully reviewed by the Commission for marine resource impacts.

4. Project Impacts. NMFS' Federal Register Notice announcing its receipt of USGS' application (Exhibit 3) contains a detailed description of the project, its potential impacts, including NMFS' preliminary conclusions concerning the level of harassment that could be induced by the survey, and appropriate marine mammal monitoring and protection measures being included in the survey. Relevant excerpts from the NMFS' Federal Register notice include the following discussion of the project's effects on marine mammals:

> *Potential Effects of Seismic Surveys on Marine Mammals*
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> *Any sound that is detectable is (at least in theory) capable of eliciting a disturbance reaction by a marine mammal or of masking a signal of comparable frequency. An incidental harassment take is presumed to occur when marine mammals in the vicinity of the seismic source (or vessel) react to the generated sounds or to visual cues.*
>
> *Seismic pulses are known to cause some species of whales, including gray whales, to behaviorally respond within a distance of several kilometers (Richardson et al., 1995). Although some limited masking of low-frequency sounds is a possibility for those species of whales using low frequencies for communication, the intermittent nature of seismic source pulses will limit the extent of masking. Bowhead whales, for example, are known to continue calling in the presence of seismic survey sounds, and their calls can be heard between seismic pulses (Richardson et al., 1986).*

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[5] For purposes of NMFS review under The Marine Mammal Protection Act of 1973 (MMPA) and, for endangered marine mammals, the Endangered Species Act (ESA) of 1973, and their respective amendments, which prohibit taking (including harassment, harm, and mortality), unless under permit or authorization or exempted from the provisions of these Acts.

When the received levels of noise exceed some behavioral reaction threshold, cetaceans will show disturbance reactions. The levels, frequencies, and types of noise that will elicit a response vary between and within species, individuals, locations and seasons.

Hearing damage is not expected to occur during the project. While it is not known whether a marine mammal very close to the airgun would be at risk of permanent hearing impairment, temporary threshold shift is a theoretical possibility for animals very close to the airgun. However, planned monitoring and mitigation measures (described later in this document) are designed to detect marine mammals occurring near the seismic source(s) and to avoid, to the greatest extent practicable, exposing them to sound pulses that have any possibility of causing hearing damage.

NMFS notes that while loud continuous sounds can damage the hearing of marine mammals, and that the adverse effects of sound on mammals have been documented for exposure times that last for tens of seconds or minutes, effects have not been documented for the brief pulses from the type of equipment proposed by USGS. NMFS considers that the maximum sound pressure levels (SPLs, or received levels) to which marine mammals can be exposed from impulse sounds are 180 dB for mysticetes and sperm whales, and 190 dB for odontocetes and pinnipeds. Exhibit 2 shows the sound decay/dispersion rates (based on the 25LogR decay rate considered reliable by USGS - the exhibit also shows a 20 log R decay rate for comparison purposes). Based on this rate, USGS estimates that a received level of 190 dB is attained about 16 m (52.5 ft) away from the airgun, and a received level of 180 dB is attained at about 40 m (131 ft) away. However, for precautionary reasons during field operations, USGS has committed to maintaining a safe distance for odontocetes and pinnipeds of 50 m (164 ft), and for mysticetes, 100 m (328 ft).

5. Estimated "Take". USGS also provided an estimate of the number of potential harassments of marine mammals, stating:

Based on estimated marine mammal populations within the survey area and on the number of individuals that were observed during the 1998 survey, the USGS estimates that up to 5 killer whales, 10 minke whales, 10 sea otters, 50 northern sea lions, 100 northern fur seals, 100 northern elephant seals, 100 Dall's porpoise, 100 Risso's dolphins, 100 northern right-whale dolphins, 100 Pacific white-sided dolphins, 100 bottlenosed dolphins, 200 California sea lions, 200 Pacific harbor seals, and 6,000 common dolphins may be harassed incidental to the USGS survey. No marine mammals will be seriously injured or killed as a result of the survey.

6. Monitoring Efforts. USGS' monitoring and mitigation approach are described more fully in NMFS Federal Register Notice announcing its receipt of a Request for an Incidental Harassment Authorization (Exhibit 3). Briefly, the measures that will be taken to mitigate possible effects on marine mammals include:

1. Professional mammal observers to be on watch at all times, with authority to order the shutdown of the acoustic sources if mammals are observed with safety zones.

2. For pinnipeds and odontocetes (toothed cetaceans), a safety zone of 50 m. to be observed.

3. For mysticetes (baleen whales), a safety zone of 100 m. to be observed.

USGS notes that during its previous 1998 survey in Southern California with the same acoustic equipment planned for the proposed 1999 survey, these same mitigation procedures were observed. According to USGS, the monitoring of that survey (by the Cascadia Research Collective - Exhibit 5) indicated no adverse environmental impact.

USGS describes the monitoring for the proposed 1999 survey as follows:

> *Monitoring and Reporting*
>
> *Monitoring marine mammals while the airguns are active will be conducted 24 hours each day. Two trained marine mammal observers will be aboard the seismic vessel to mitigate the potential environmental impact from airgun use and to gather data on the species, number, and reaction of marine mammals to the airgun. Each observer will work 6 hours during daylight and 6 hours at night. During daylight, observers will use 7x50 binoculars with internal compasses and reticules to record the horizontal and vertical angle to sighted mammals. Night-time operations will be conducted with a commercial hand-held light magnification scope. Monitoring data to be recorded during airgun operations include the observer on duty, weather conditions (such as Beaufort sea state, wind speed, cloud cover, swell height, precipitation, and visibility). For each mammal sighting, the observer will record the time, bearing and reticule readings, species, group size, and the animal's surface behavior and orientation. Observers will instruct geologists to shut off the airgun array whenever a marine mammal enters its respective safety zone.*

7. Alternatives. Considering alternatives, USGS states:

To abandon this study altogether is a poor option. In the introductory section of this application, the USGS described the societal relevance of this project and the benefits to scientists in understanding the regional earthquake hazard and to city planners in establishing building codes. Another facet of this study is understanding coastal aquifers and knowing how to stem the intrusion of salt water into them. If the project were canceled, such information would be unavailable.

The source strength might be reduced to limit the environmental impact. However, the proposed airgun size is already small, and the problem with this option is that the USGS cannot significantly reduce the source strength without jeopardizing the success of this survey. This judgment is based on USGS decades-long experience with seismic-reflection surveys, but especially on the 1998 survey that was conducted in the same general area as outlined here. If the USGS were to reduce the airgun size and then fail to obtain the required information, another survey would need to be conducted, and this would double the potential impact on marine mammals.

This project could be carried out at some other time of year, and the USGS is open to suggestions. In this pursuit, the USGS talked with biologists to find out the best time for the project to be conducted. The USGS wants to avoid the gray whale migrations and the mid-summer arrival of other mysticete species because, while these other species remain mostly in the area of the Channel Islands, some individuals venture closer to the mainland. An important point is that biologists can best prevent harm to mammals when daylight is long, that is, near the solstice.

8. NMFS Preliminary Analysis. NMFS' preliminary conclusions contained in its Federal Register Notice state:

NMFS has preliminarily determined that the short-term impact of conducting marine seismic-reflection data in offshore southern California will result, at worst, in a temporary modification in behavior by certain species of pinnipeds and cetaceans. While behavioral modifications may be made by certain species of marine mammals to avoid the resultant noise from the seismic airgun, this behavioral change is expected to have a negligible impact on the animals.

In addition, no take by injury and/or death is anticipated, and takes will be at the lowest level practicable due to the incorporation of the mitigation measures previously mentioned. No known rookeries, mating grounds, areas of concentrated feeding, or other areas of special significance for marine mammals occur within or near the planned area of operations during the season of operations.

...[P]provided [that] the above-mentioned mitigation, monitoring, and reporting requirements are incorporated[,].... NMFS has preliminarily determined that the proposed activities would result in the harassment of only small numbers of each of several species of marine mammals and will have no more than a negligible impact on these marine mammal stocks.

9. USGS Response to Questions. The Commission staff requested that USGS to respond to several questions, primarily concerning operating during low visibility conditions, the dispersion/decay model assumptions, project timing, and monitoring from past USGS surveys. USGS responded to these questions in its consistency determination; this response is attached as Exhibit 4. Concerning low visibility period monitoring and operating procedures, USGS states:

We propose to rely on visual monitoring. As we mentioned in our IHA request to NMFS, this survey will be the third one the USGS has conducted under the guidance and authority of marine-mammal biologists. We have gained considerable experience in operating an airgun in ways that do not harm the environment.

At night biologists will use light-amplification scopes, and the low power of the airgun is important in this regard because the mitigation zones will be close to the ship. We asked John Calambokidis for his opinion regarding mitigation at night: "Night observations of marine mammals are able to detect only animals in the immediate vicinity, say within 20-30m, of the ship. Even with the use of night vision equipment, sighting rates of marine mammals are dramatically reduced at night. Night observations are primarily valuable in detecting bow-riding dolphins or marine mammals in the immediate vicinity of the ship and air guns. During last year's airgun survey off southern California, the airguns were shut off at night as a result of sightings of marine mammals near the ship, indicating these observations were somewhat effective."

We believe there are cogent arguments in favor of continuous airgun operation. If we turn the airgun on and off repeatedly because of dark, fog or high sea state, then whenever the airgun is off, marine mammals would move back into the survey area and could be unintentionally harassed each time we resume operations. In contrast, continuous use of the airgun reveals our location and direction of travel to mammals so they can avoid the survey ship.

During the SHIPS survey in Puget Sound, mammals observed from the ship were moving away from the active airguns, so given the choice, marine mammals apparently will stay away. Off Southern California the airguns will be fired every 12 s, and during this interval the ship will have moved 25 m, so the ship will not approach mammals unannounced.

If airgun use is restricted to periods of good visibility our operations would be greatly prolonged, thereby increasing the possibility that some mammals would be unintentionally harassed. This survey will require only two weeks to complete, and it will be spread out geographically from Los Angeles south to San Diego, so no one area will be greatly impacted by our activities.

As a final point in favor of continuous operations, the USGS has a fixed budget for this cruise, and the contract for the ship has a set period of performance. The USGS, therefore, cannot conduct this survey as if it had an indefinite time span.

In our view, the best course is to complete the experiment as expeditiously as possible.

Considering the appropriate decay/dispersion model, USGS believes there is ample evidence to support its assumption of a "25 log R" model, noting:

...[T]he USGS used a 25log(R) decay in sound pressure level (SPL) because acoustic modeling and measurements in the field show that sound decays quickly in water that overlies a sloping seabottom. In a medium with no acoustic interfaces, sound spreads spherically and SPL reduces at 20log(R). A sloping bottom, however, causes sound to exit the water layer and beam into the underlying sediment, enhancing the transmission loss toward a beach (e.g. Jensen and Tindle, 1987; Deane and Buckingham, 1993; Glegg, et al., 1993; Richardson et al., 1994; Jensen, et al., 1994). In fact, a zone of high transmission loss, an "acoustic shadow zone," lies just offshore from a beach. This argues against the common misunderstanding that underwater sound intensifies up-slope toward a beach.

> *The enhanced transmission loss, relative to 20log(R), that occurs over a sloping bottom has been verified by field measurements from scattered locations [see Exhibit 4]*
>
> ...
>
> *Hence on the basis of abundant, numerical acoustic modeling and some field measurements we believe that 25log(R) is a conservative estimate of sound transmission loss for airgun sounds over a sloping seabottom, like that offshore from Southern California. In particular sound that propagates into shallow water near and within the 3-mile limit should decay sharply toward shore.*

Finally, in responding to the Commission staff USGS also provided copies of its monitoring reports from its previous two surveys in Puget Sound and southern California, the latter of which is attached as Exhibit 5.

10. Commission Conclusion: Marine Resources. As noted in its review of Navy LFA and Scripps ATOC acoustic research activities, the Commission remains concerned over the lack of reliable information regarding the effects of underwater sounds on the marine environment. Through its involvement in the "HESS" effort, the Commission is working with government agencies and seismic survey operators to attempt to determine appropriate minimization and mitigation measures that should be used in conjunction with seismic surveys. Much of the focus of those efforts has been towards achieving noise model verification, defining marine mammal protection areas (which vary depending on the sound levels), and necessary monitoring and documentation. For example, the HESS guidelines recommend 180 dB as the threshold for impact that should be avoided if at all possible and "is recommended as the safety zone distance to be used for all seismic surveys within the southern California study area." USGS' survey would be consistent with this guideline.

Another issue of concern in the formulation of those guidelines was operating during nighttime and other reduced visibility conditions (such as fog). The HESS team struggled with the tradeoffs inherent in prohibiting operations during these conditions, and recommended as follows:

> *... operations at night involve a trade-off regarding the ability to visually detect animals in the study area and the advantages of continuous operation. ... 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.*

> *When operating under conditions of reduced visibility due to adverse weather conditions, operations may continue unless, in the judgment 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.*

USGS questions whether the HESS guidelines were intended to apply to its survey but nevertheless maintains that, with the monitoring and avoidance commitments, its activities would be "consistent with the HESS Team recommendations regarding sound pressure levels, safety zones, and shipboard monitoring." Concerning nighttime operation, USGS states:

> *The Need for 24-hour Seismic Operations*
>
> *Operating less than 24 hours each day incurs substantially increased cost for the leased ship, which the USGS cannot afford. The ship schedule provides a narrow time window for this project; other experiments are already scheduled to precede and follow this one. Thus, the USGS is not able arbitrarily to extend the survey time to include large delays for dark or poor visibility. Reasons for around-the-clock operation that benefit the environment are (1) when the airgun ceases to operate, marine mammals might move back into the survey area and incur an increased potential for harm when operations resume and (2) daylight-only operations prolong activities in a given area, thus increasing the likelihood that marine mammals will be harassed. The 1999 survey will require only 2 weeks, and it will be spread out geographically from Los Angeles to San Diego, so no single area will see long-term activity. In the view of the USGS, the best course is to complete the experiment as expeditiously as possible. For these reasons, the USGS requests that the IHA allow 24-hour operations.*

In conclusion, the Commission notes that: (1) USGS would use a small airgun, which would emit a maximum sound level of 220 dB (most oil exploration seismic surveys are several orders of magnitude louder, 230-259 dB, with typical airgun sizes (volumes) on the order of thousands of cu. inches, compared to USGS' 40 cu. inch airgun); (2) USGS has committed to monitoring marine mammal and avoiding subjecting marine mammals to above 180 dB; (3) USGS has established a successful ability to monitor and avoid adverse effects during past surveys in the Pacific Ocean; (4) the need for flexibility

during low visibility conditions discussed above (and in the HESS guidelines) does not warrant a prohibition on operating during such conditions in this case; and (5) USGS is also avoiding operating during the gray whale migration period. Considering all these factors, the Commission concludes that, with the monitoring and mitigation commitments incorporated by USGS, the proposed surveys would not cause significant adverse reactions or physiological effects on marine resources, and, therefore, that the project is consistent with the marine resource and environmentally sensitive habitat policies (Sections 30230 and 30240) of the Coastal Act.

B. Commercial and Recreational Fishing. Section 30230 of the Coastal Act, quoted on page 7 above, provides for the protection of economically (as well as biologically) significant marine species. Section 30234 provides that: "Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded." Section 30234.5 provides that: "The economic, commercial, and recreational importance of fishing activities shall be recognized and protected."

USGS states:

> *Fish and fisheries*
>
> *Extensive research has been conducted into the effects of airguns, especially large airgun arrays used for petroleum exploration and development, on fish and fisheries. These "high energy seismic survey" arrays are significantly more powerful than the acoustic sources to be used in the proposed survey.*
>
> *While the potential effect on marine life, particularly in the zone proximal to the seismic source (within 3 meters), cannot be conclusively precluded, the potential impact even very near the proposed sources is deemed to be small. Studies conducted on fish (adult and eggs) and crustacean larvae consistently report either no effect from airgun sources or statistically insignificant effects even at distances as small as 2 m from an airgun. Recent summaries of the biological and environmental effect of airguns include Marsh (1993) and Chambers Group (1994).*
>
> *There is no evidence of injury or mortality occurring under field conditions. Several recent environmental assessments and monitoring programs associated with large airgun surveys (summarized below) have reported no adverse environmental effects of airgun surveys.*

Fishing and Recreation

Concerns for equipment safety and data quality dictate standard survey practice that avoids fishing and recreational vessels to the greatest extent possible. The impacts on either commercial or recreational fishing are considered very low. The survey objectives include collecting data as close to the beach as possible, but similarly, vessel and equipment safety and data quality preclude operations in water depths less than 25 meters or within 1 km of the shore. Harbor fisheries such as bait fish, lobster and crab will be unaffected.

One of the concerns the Commission has historically had with oil exploration seismic surveys, aside from noise issues, has been the milti-mile tow lines attaching the survey ships to the airgun arrays, which can disrupt fishing gear. The proposed USGS's survey, with its single airgun and short tow line does not raise this concern, and, as noted in the previous section of this report, the survey would be significantly less noisy than a typical oil exploration seismic survey. These facts, along with the nature of USGS' survey, which is to continue transiting along a long stretch of coastline over a relatively short period of time, lead to the conclusion that the project will minimize adverse effects on commercial and recreational fishing in the area. The Commission therefore finds that the project is consistent with Sections 30230, 30234 and 30234.5 of the Coastal Act.

C. Public Access and Recreation. Sections 30210-30212 of the Coastal Act provide for the maximization of public access and recreational opportunities. Section 30213 provides that "Lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided." Section 30220 provides that: "Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses."

In reviewing past Navy acoustic test impacts on diving activities, the Navy has committed to avoiding active acoustic operations within 0.5 miles of diving activities. In reviewing LFA Phase I research (CD-95-97), the Commission concluded that Navy avoidance of exposing divers to sounds exceeding 130 dB would be adequate, based in part on advice and research from the Navy's Bureau of Medicine and Surgery. USGS will avoid most diving activities with the above-stated commitment to not operate in water depths less than 25 meters or within 1 km of the shore. USGS has also committed to providing Coast Guard Notice to Mariners, to alert any known diving associations in the survey vicinity, and avoid operating within 500 meters of any dive boat encountered on the survey. The Commission agrees that, with these commitments, the proposed survey will minimize adverse effects on recreational boating and diving in the project vicinity, and that the project is consistent with Sections 30210-30212, 30213 and 30220 of the Coastal Act.

VIII. Substantive File Documents:

1. Low-frequency Sound and Marine Mammals: Current Knowledge and Research Needs, Committee on Low-frequency Sound and Marine Mammals, Ocean Studies Board, Commission on Geosciences, Environment, and Resources, National Research Council, March 21, 1994.

2. Richardson, W. J., C. R. Greene, et al. (1995). Marine Mammals and Noise. New York, Academic Press.

3. Request by the U.S. Geological Survey for an Incidental Harassment Authorization Under the Marine Mammal Protection Act, to Use a Small Airgun Near Marine Mammals in the Southern California Bight, submitted February 10, 1999.

4. National Marine Fisheries Service, Federal Register Notice of March 5, 1999: Small Takes of Marine Mammals Incidental to Specified Activities; Seismic Hazards Investigation in Southern California; Notice of receipt of application and proposed authorization for a small take exemption; request for comments.

5. Consistency Determinations No. CD-95-97 and CD-153-97 (Navy, Low-Frequency Active (LFA) Sonar, Phases I and II).

6. Draft Environmental Assessment for Low-Frequency Sound Scientific Research Program in the Southern California Bight, September/October 1997, National Marine Fisheries Service, June 1997.

7. Consistency Certification CC-110-94/Coastal Development Permit Application 3-95-40, Scripps Institution of Oceanography, Acoustic Thermometry of Ocean Climate (ATOC) Project and Marine Mammal Research Program (MMRP).

8. Malme CI, PR Miles, CW Clark, P Tyack and JE Bird (1984), Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 migration. Bolt Beranek and Newman Report No. 5586 submitted to Minerals Management Service, U. S. Dept. of the Interior.

9. Malme CI, PR Miles, CW Clark, P Tyack and JE Bird (1983), Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Bolt Beranek and Newman Report No. 5366 submitted to Minerals Management Service, U. S. Dept. of the Interior.

10. Quick Look – Playback of low frequency sound to gray whales migrating past the central California coast – January, 1998, Peter Tyack, Christopher Clark, 23 June 1998.

11. Summary Record and Report SACLANTCEN Bioacoustics Panel, NATO (A. D'Amico, Editor), El Spezia, Italy, 15-17 June 1998.

12. Consistency Determination No. CD-109-98, Advanced Deployable System (ADS) acoustic undersea surveillance system tests.

13. High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California, the High Energy Seismic Survey Team, for the California State Lands Commission and the U.S. Minerals Management Service Pacific OCS Region, September 1996 – February 1999.

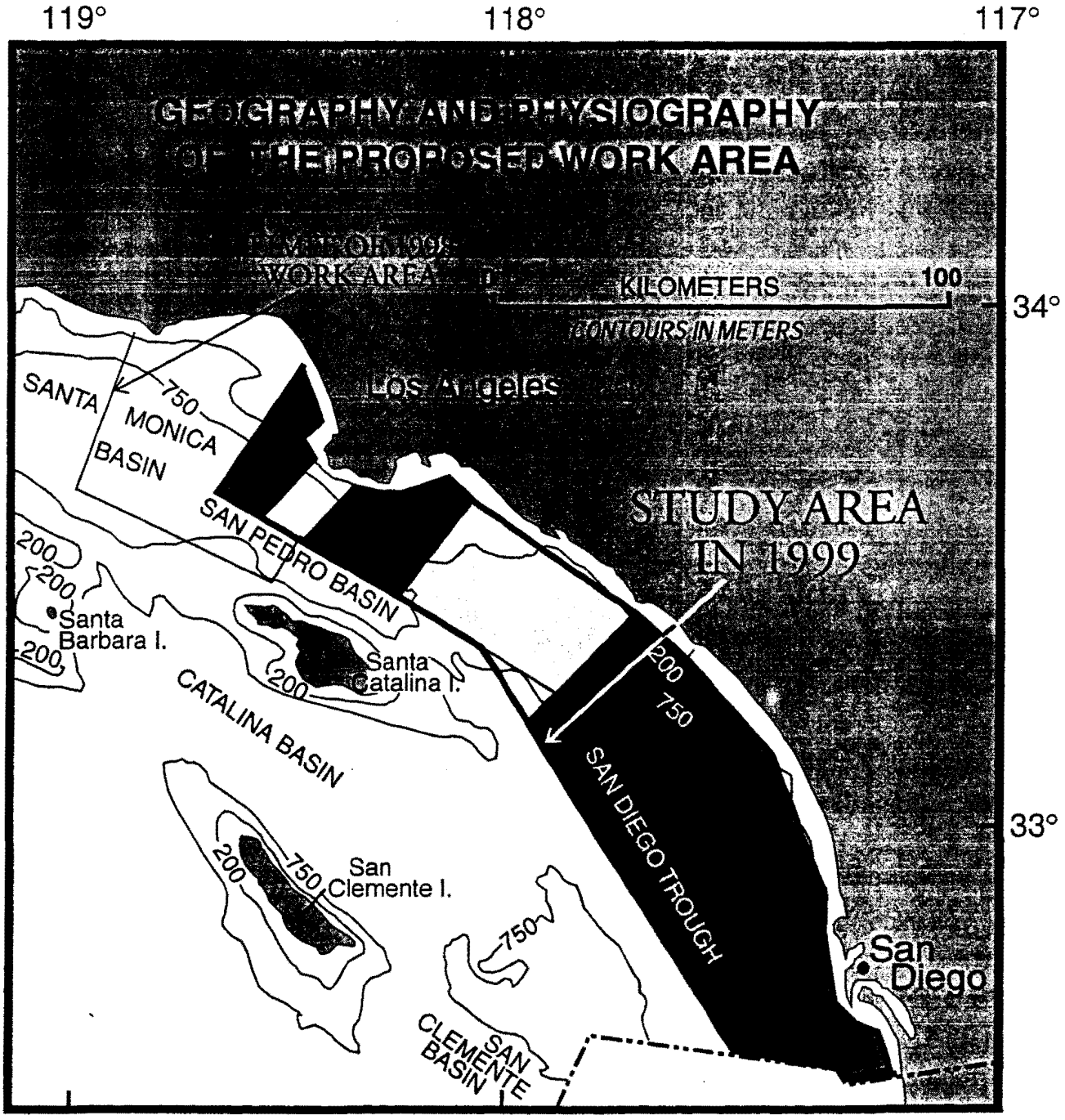

Figure 2. Area of the proposed airgun survey to study offshore earthquake and landslide hazards as well as aquifer quality near Los Angeles. Seismic refection data will be collected along a 2-km by 2-km grid in the offshore areas that are shaded with dark gray. The grid size will be 4 km by 4 km in the light-gray shaded area.

EXHIBIT NO. 1
APPLICATION NO.
CD-32-99

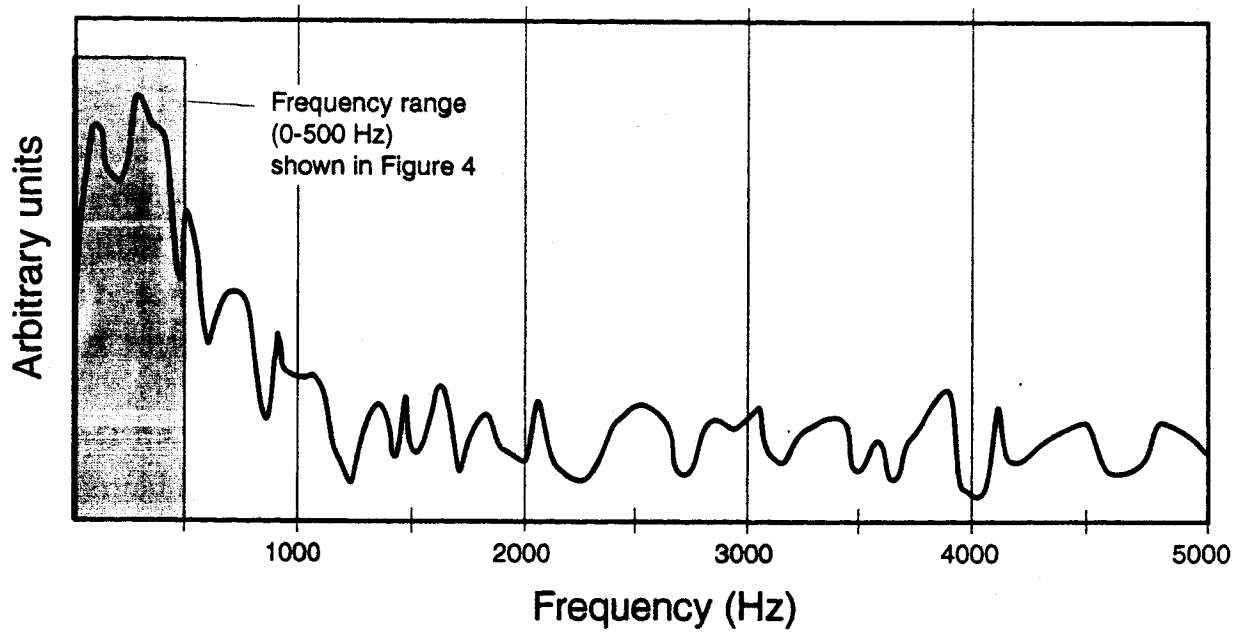

Figure 5. Frequency spectrum of the GI gun, measured by USGS scientists, shows that amplitudes are low at frequenies above 500 Hz. Measurement was made with an uncalibrated hydrophone, which is why amplitude is shown in arbitrary units. This information indicates that the main sound energy is outside the sensitive hearing band of odontocetes and pinnipeds.

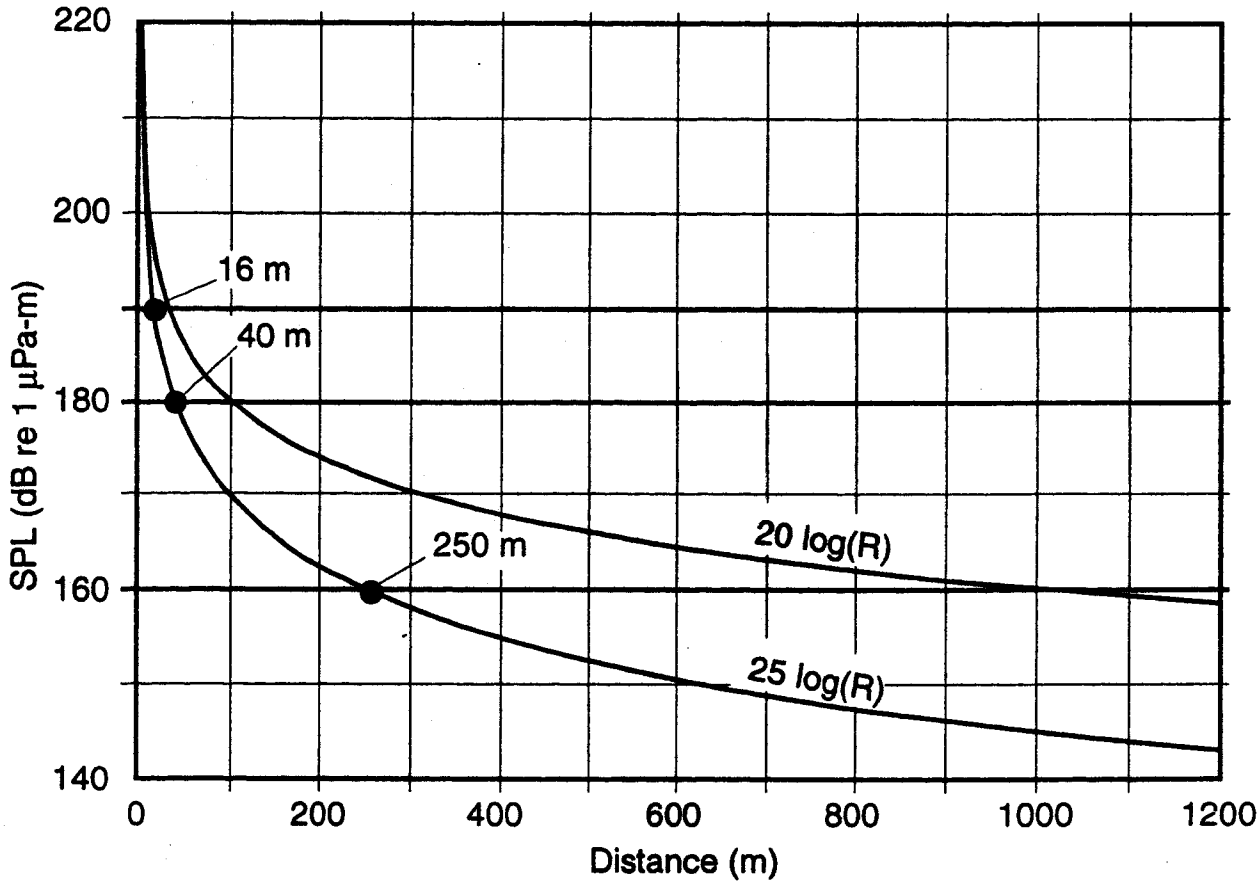

Figure 6. Safe distances for the main types of marine mammals from the GI-gun, which has an SPL of 220 dB re 1 µPa-m. The procedure used to calculate safe distance is described

EXHIBIT NO. 2
APPLICATION NO. CD-32-99

[Federal Register: March 5, 1999 (Volume 64, Number 43)]
[Notices]
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From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr05mr99-38]

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
[I.D. 021699A]

Small Takes of Marine Mammals Incidental to Specified Activities; Seismic Hazards Investigation in Southern California

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of receipt of application and proposed authorization for a small take exemption; request for comments.

SUMMARY: NMFS has received a request from the U.S. Geological Survey (USGS) for an authorization to take small numbers of marine mammals by harassment incidental to collecting marine seismic-reflection data offshore from southern California. Under the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to authorize the USGS to incidentally take, by harassment, small numbers of marine mammals in the afore mentioned area for a 2-week period between May and July 1999.

DATES: Comments and information must be received no later than April 5, 1999.

ADDRESSES: Comments on the application should be addressed to Donna Wieting, Acting Chief, Marine Mammal Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Silver Spring, MD 20910-3225. A copy of the application may be obtained by writing to this address or by telephoning one of the contacts listed here.

FOR FURTHER INFORMATION CONTACT: Kenneth R. Hollingshead, NMFS, (301) 713-2055, or Christina Fahy, NMFS, 562-960-4017.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 et seq.) directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Permission may be granted if NMFS finds that the taking will have a

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negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses and that the permissible methods of

taking and requirements pertaining to the monitoring and reporting of such takings are set forth. NMFS has defined ``negligible impact'' in 50 CFR 216.103 as `` ...an impact resulting from the specified 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.''

Subsection 101(a)(5)(D) of the MMPA established 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 now 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.

Subsection 101(a)(5)(D) establishes a 45-day time limit for NMFS review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of small numbers of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny issuance of the authorization.

Summary of Request

On January 15, 1999, NMFS received a request from the USGS for authorization to take small numbers of several species of marine mammals by harassment incidental to collecting marine seismic-reflection data offshore from southern California. Seismic data will be collected during a 2-week period between May and July 1999, to support studies of the regional landslide and earthquake hazards and to understand how saltwater invades

coastal aquifers. A revised request was received on February 11, 1999.

Background

The USGS proposes to conduct a high-resolution seismic survey offshore from Southern California, for a 2-week period between May and July 1999. The USGS would like to collect seismic-reflection data to investigate: (1) the hazards posed by landslides and potential earthquake faults in the nearshore region from Santa Barbara to San Diego and (2) the invasion of seawater into freshwater aquifers that are critical to the water supply for people within the Los Angeles-San Pedro area. Both of these tasks are multi-year efforts that require using a small airgun.

Coastal Southern California is the most highly populated urban area along the U.S. Pacific coast. The primary objective of the USGS research is to provide information to help mitigate the earthquake threat to this area. The USGS emphasizes that the goal is not earthquake prediction but rather an assistance in determining what steps might be taken to minimize the devastation should a large quake occur. The regional earthquake threat is known to be high, and a major earthquake could adversely affect the well being of a large number of people.

Important geologic information that the USGS will derive from this project's seismic-reflection data concerns how earthquake deformation is distributed offshore, that is, where the active faults are and what the history of movement along them has been. This should improve understanding of the shifting pattern of deformation that occurred over both the long term (approximately the last 100,000 years) and short term (the last few thousand years). The USGS seeks to identify actively deforming structures that may constitute significant earthquake

threats. The USGS also proposes to locate offshore landslides that might affect coastal areas. Not only major subsea landslides might affect the footings of coastal buildings, but also very large slides can generate local tsunamis. These large sea waves can be generated by seafloor movement that is produced either by landslides or by earthquakes. Knowing where large slides have occurred offshore will help locate areas susceptible to wave inundation.

Some faults that have produced earthquakes lie entirely offshore or extend into offshore areas where they can be studied using high-resolution seismic-reflection techniques. An example is the Rose Canyon fault, which extends through the San Diego area, and is considered to be the primary earthquake threat. This fault extends northward from La Jolla, beneath the inner continental shelf, and appears again onshore in the Los Angeles area. This fault and others like it near shore could generate moderate (M5-6) to large (M6-7) earthquakes.

Knowing the location and geometry of fault systems is critical to estimating the location and severity of ground shaking. Therefore the results of this project will contribute to decisions involving land use, hazard zonation, insurance premiums, and building codes.

The proposed work is in collaboration with scientists at the Southern California Earthquake Center, which analyzes faults and earthquakes in onshore regions, and with scientists at the Scripps Institute of Oceanography, who measure strain (incremental movement) on offshore faults.

The USGS also wants to collect high-resolution seismic- reflection data to locate the sources and pathways of seawater that intrudes into freshwater aquifers below San Pedro. Ground water usage in the Los Angeles basin began in the mid-1800s. Today, more than 44,000 acre-feet of freshwater each year are extracted from the aquifers that underlie just the city of San Pedro. Extracting freshwater from coastal aquifers causes offshore salt water to flow toward areas of active pumping. To limit this salt-water intrusion, the Water Replenishment District and water purveyors in San Pedro are investing $2.7 million per year to inject freshwater underground to establish a zone of high water pressure in the aquifer. The resulting zone of high pressure will form a barrier between the invasive saltwater and the productive coastal aquifers.

USGS scientists in San Diego are working with the Los Angeles County Department of Public Works and the Water Replenishment District to develop a ground-water simulation model to predict fluid flow below San Pedro and nearby parts of the Los Angeles Basin. This model will eventually be used in managing water resources. The accuracy of the present model, however, is compromised by a paucity of information about aquifer geometry and about other geologic factors that might affect fluid flow. Data the USGS collects will be used to improve three-dimensional, fluid-flow models to aid management of water resources.

Fieldwork described here will be the third airgun survey that the USGS has conducted under close supervision by marine-mammal biologists. In March 1998, the USGS used a large (6500 in³; 106 liters) airgun array in and around Puget Sound to study the regional earthquake hazard. The USGS employed 12 biologists, who worked on two ships continuously to oversee airgun operations. On several occasions the USGS shut off the airguns when marine mammals entered safety zones that had been stipulated by NMFS under an Incidental Harassment Authorization (IHA), and, when mammals left these zones, the USGS gradually ramped up the array as required to avoid harming

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wildlife. Marine-mammal biologists reported that, during the survey, no overt distress was evident among the dense marine mammal populations, and, afterward, no unexplained marine mammal strandings occurred.

In August 1998, the USGS surveyed offshore from Southern California, using a small airgun (40 in³; 655

cm³). Two marine mammal biologists oversaw this activity, and the survey the USGS proposes will be conducted with similar oversight.

Experimental Design

Marine studies conducted by the USGS focus on areas where natural hazards have their greatest potential impact on society. In Southern California, USGS studies will concern four areas. The first area in priority is the coastal zone and continental shelf between Los Angeles and San Diego, where much of the hazard appears to be associated with strike-slip faults, such as the Newport-Inglewood and Palos Verdes faults. The second study area lies offshore, in the Santa Monica, San Pedro, and San Diego Trough deeps, where rapid sedimentation has left a more complete record, relative to shallow-water areas, that the USGS can use to decipher earthquake history. The third area is the extension into the Santa Barbara Channel of major elements of onshore geology, including some large faults. The fourth area is the geologic boundary, marked generally by the Channel Islands, between the inner California Borderland (dominated by strike-slip faults) and the Santa Barbara Channel (dominated by compressional faults). The study proposed here focuses on the highest priority area, which lie near shore between Los Angeles and San Diego.

The seismic-reflection survey will last 14 days. From its experience collecting seismic-reflection data in this general area during 1998, the USGS has decided to conduct the 1999 survey sometime within the May through July window. The basis for this decision is its desire to avoid the gray whale migrations and the peak arrival of other mysticete whales during late summer.

The USGS has not yet determined the exact tracklines for the survey, but the USGS does know the areas where airgun use will be concentrated. Two of these areas are southwest and southeast of Los Angeles, and the third and largest one is west and northwest of San Diego. In these areas seismic-reflection data will be collected along a grid of lines that are about 2 km (1.2 mi) apart.

The USGS proposes to use a small airgun and 200-m (656-ft) long streamer to collect seismic-reflection data. The potential effect on marine mammals is from the airgun; mammals cannot become entangled in the streamer. The USGS will also use a low-powered, high-resolution seismic system to obtain detailed information about the very shallow geology. The seismic- reflection system will be aboard a vessel owned by a private contractor. Ocean-bottom seismometers will be deployed to measure the velocity of sound in shallow rocks to help unravel the recent history of fault motion. These seismometers are passive recorders and pose no threat to the environment.

Ship navigation will be accomplished using satellites of the Global Positioning System. The survey ship will be able to report accurate positions, which is important to mitigating the airgun's effect on marine mammals and to analyzing what impact, if any, airgun operations had on the environment.

The Seismic Sound Sources

During this survey the USGS will operate two sound sources--an airgun and a high-resolution Huntec^(TM) system. The main sound source will be a single small airgun of special type called a generator-injector, or GI-gun (trademark of Seismic Systems, Inc., Houston, TX). This type of airgun consists of two small airguns within a single steel body. The two small airguns are fired sequentially, with the precise timing required to stifle the bubble oscillations that typify sound pulses from a single airgun of common type. These oscillations impede detailed analysis of fault and aquifer structure. For arrays consisting of many airguns, bubble oscillations are cancelled by careful selection of airgun sizes. The GI-gun is a mini-array that is carefully adjusted to achieve the desired bubble

cancellation. Airguns and GI-guns with similar chamber sizes have similar peak output pressures.

The GI-gun for this survey has two equal-sized chambers of 35 in³ (57 mm³), and the gun will be fired every 12 seconds. Compressed air delivered to the GI-gun will have a pressure of about 3000 psi. The gun will be towed 12 meters (39.4 ft) behind the vessel and suspended from a float to maintain a depth of about 1 m (3.3 ft).

The manufacturer's literature indicates that a GI-gun of the size the USGS will use has a sound-pressure level (SPL) of about 220 dB re 1 <greek-m>Pa-m. In comparison, a 40-in³ (65 mm³) airgun has an SPL of 216 dB re 1 <greek-m>Pa-m (Richardson et al., 1995). The GI-gun's output sound pulse has a duration of about 10 ms. The amplitude spectrum of this pulse, as shown by the manufacturer's data, indicates that most of the sound energy is at frequencies below 500 Hz. Field measurements by USGS personnel indicate that the GI-gun's output is low amplitudes at frequencies above 500 Hz. Thus high-amplitude sound from this source is at frequencies that are outside the main hearing band of odontocetes and pinnipeds (Richardson et al., 1995).

The high-resolution Huntec^(TM) system uses an electrically powered sound source. In operation, the sound producing and recording hardware are towed behind the ship near the seabottom. The unit emits sound about every 0.5 sec. This system provides highly detailed information about stratified sediment, so that dates obtained from fossils in sediment samples can be correlated with episodes of fault offset. The SPL for this unit is 210 dB re 1 <greek-m>Pa-m. The output-sound bandwidth is 0.5 kHz to 8 kHz, with the main peak at 4.5 kHz.

The Need for 24-hour Seismic Operations

Operating less than 24 hours each day incurs substantially increased cost for the leased ship, which the USGS cannot afford. The ship schedule provides a narrow time window for this project; other experiments are already scheduled to precede and follow this one. Thus, the USGS is not able arbitrarily to extend the survey time to include large delays for dark or poor visibility. Reasons for around-the-clock operation that benefit the environment are (1) when the airgun ceases to operate, marine mammals might move back into the survey area and incur an increased potential for harm when operations resume and (2) daylight-only operations prolong activities in a given area, thus increasing the likelihood that marine mammals will be harassed. The 1999 survey will require only 2 weeks, and it will be spread out geographically from Los Angeles to San Diego, so no single area will see long-term activity. In the view of the USGS, the best course is to complete the experiment as expeditiously as possible. For these reasons, the USGS requests that the IHA allow 24-hour operations.

Description of Habitat and Marine Mammals Affected by the Activity

The Southern California Bight supports a diverse assemblage of 29 species of cetaceans (whales, dolphins and porpoises) and 6 species of pinnipeds (seals and sea lions). The species of marine mammals that are likely to be present in the seismic research area include the bottlenose dolphin (Tursiops truncatus), common dolphin (Delphinus delphis), killer

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whale (Orcinus orca), Pacific white-sided dolphin (Lagenorhynchus obliquidens), northern right whale dolphin (Lissodelphis borealis), Risso's dolphin (Grampus griseus), pilot whales (Globicephala macrorhynchus), Dall's porpoise (Phocoenoides dalli), sperm whale, humpback whale (Megaptera novaengliae), gray whale (Eschrichtius

robustus), blue whale, minke whale (Balaenoptera acutorostrata), fin whales (Balaenoptera physalus), harbor seal (Phoca vitulina), elephant seal (Mirounga angustirostris), northern sea lion (Eumetopias jubatus), and California sea lion (Zalophus californianus), northern fur seal (Callorhinus ursinus) and sea otters (Enhydra lutris). General information on these latter species can be found in the USGS application and in Barlow et al. (1997). Please refer to those documents for information on the biology, distribution, and abundance of these species.

Potential Effects of Seismic Surveys on Marine Mammals

Discussion

Seismic surveys are used to obtain data about rock formations up to several thousands of feet deep. These surveys are accomplished by transmitting sound waves into the earth, which are reflected off subsurface formations and recorded with detectors in the water column. A typical marine seismic source is an airgun array, which releases compressed air into the water creating an acoustical energy pulse that is directed downward toward the seabed. Hydrophones spaced along a streamer cable just below the surface of the water receive the reflected energy from the subsurface formations and transmit data to the seismic vessel. Onboard the vessel, the signals are amplified, digitized, and recorded on magnetic tape.

Disturbance by seismic noise is the principal means of taking by this activity. Vessel noise may provide a secondary source. Also, the physical presence of vessel(s) could also lead to some non-acoustic effects involving visual or other cues.

Depending upon ambient conditions and the sensitivity of the receptor, underwater sounds produced by open-water seismic operations may be detectable some distance away from the activity. Any sound that is detectable is (at least in theory) capable of eliciting a disturbance reaction by a marine mammal or of masking a signal of comparable frequency. An incidental harassment take is presumed to occur when marine mammals in the vicinity of the seismic source (or vessel) react to the generated sounds or to visual cues.

Seismic pulses are known to cause some species of whales, including gray whales, to behaviorally respond within a distance of several kilometers (Richardson et al., 1995). Although some limited masking of low-frequency sounds is a possibility for those species of whales using low frequencies for communication, the intermittent nature of seismic source pulses will limit the extent of masking. Bowhead whales, for example, are known to continue calling in the presence of seismic survey sounds, and their calls can be heard between seismic pulses (Richardson et al., 1986).

When the received levels of noise exceed some behavioral reaction threshold, cetaceans will show disturbance reactions. The levels, frequencies, and types of noise that will elicit a response vary between and within species, individuals, locations and seasons. Behavioral changes may be subtle alterations in surface-dive-respiration cycles. More conspicuous responses include changes in activity or aerial displays, movement away from the sound source, or complete avoidance of the area. The reaction threshold and degree of response are related to the activity of the animal at the time of the disturbance. Whales engaged in active behaviors, such as feeding, socializing, or mating are less likely than resting animals to show overt behavioral reactions, unless the disturbance is directly threatening.

Hearing damage is not expected to occur during the project. While it is not known whether a marine mammal very close to the airgun would be at risk of permanent hearing impairment, temporary threshold shift is a theoretical possibility for animals very close to the airgun. However, planned monitoring and mitigation measures (described later in this document) are designed to detect marine mammals occurring near the

seismic source(s) and to avoid, to the greatest extent practicable, exposing them to sound pulses that have any possibility of causing hearing damage.

Maximum Sound-Exposure Levels for Marine Mammals

At this time, the USGS lacks detailed measurement of sound-transmission loss for the southern California offshore, so the USGS estimated how SPL varies with distance from the airgun by assuming that sound decays according to 25log(R). The coefficient 25 accounts approximately for the attenuation that is caused by the sound interacting with the seabottom. The USGS used this procedure to derive safety zone estimates based on the 220 dB SPL produced by the GI-gun, the larger of the two sound sources the USGS plans to use.

Loud continuous sounds can damage the hearing of marine mammals. However, the adverse effects of sound on mammals have been documented for exposure times that last for tens of seconds or minutes, but effects have not been documented for the brief pulses typical of the GI-gun (10 ms) and the Huntec^(TM) system (0.3 ms). NMFS considers that the maximum SPLs to which marine mammals can be exposed from impulse sounds are 180 dB re 1 <greek-m>Pa-m RMS for mysticetes and sperm whales, and 190 dB re 1 <greek-m>Pa-m RMS for odontocetes and pinnipeds.

Assuming that the 25LogR decay that the USGS used to estimate safe distances from the airgun is correct, this indicates that an SPL of 190 dB re 1 <greek-m>Pa-m is attained about 16 m (52.5 ft) away from the airgun, and an SPL of 180 dB re 1 <greek-m>Pa-m is attained at about 40 m (131 ft) away. However, for precautionary reasons during field operations, the USGS proposes that, at all times, the safe distance for odontocetes and pinnipeds be 50 m (164 ft) and for mysticetes, 100 m (328 ft).

Estimated Number of Potential Harassments of Marine Mammals

The zone of influence for the GI-gun is defined to be the circle whose radius is the distance from the gun where the SPL reduces to 160 dB re 1 <greek-m>Pa-m. For the assumed 25LogR, the zone of influence is a circle with a radius of 250 m (820 ft). Based on estimated marine mammal populations within the survey area and on the number of individuals that were observed during the 1998 survey, the USGS estimates that up to 5 killer whales, 10 minke whales, 10 sea otters, 50 northern sea lions, 100 northern fur seals, 100 northern elephant seals, 100 Dall's porpoise, 100 Risso's dolphins, 100 northern right-whale dolphins, 100 Pacific white-sided dolphins, 100 bottlenosed dolphins, 200 California sea lions, 200 Pacific harbor seals, and 6,000 common dolphins may be harassed incidental to the USGS survey. No marine mammals will be seriously injured or killed as a result of the survey.

Proposed Mitigation of Potential Environmental Impact

To avoid potential harassment of marine mammals, a safety zone will be established and monitored continuously by biologists, and the USGS will shut off the airguns whenever the ship and a marine mammal converge closer than

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the previously mentioned safety distance. For pinnipeds, if the seismic vessel approaches a pinniped, the 50 m (164 ft) safety radius will be maintained; however, if a pinniped approaches the towed airgun, NMFS proposes that it will not require the USGS to shutdown the airgun, but will require the USGS to monitor the interaction to ensure the animal does not show signs of distress. Experience indicates that pinnipeds will come from great distances to inspect seismic operations. Seals

have been observed swimming within airgun bubbles, 10 m (33 ft) away from active arrays, apparently unaffected. Although airgun oprations will be terminated if the pinnipeds show obvious distress, the USGS will conduct observations on effects the airguns may have on the animals.

The USGS plans to have marine biologists aboard the ship who will have the authority to stop airgun operations when a mammal enters the safety zone.

During seismic-reflection surveying, the ship's speed will only be 4 to 5 knots, so that when the airgun is being discharged, nearby marine mammals will have gradual warning of the vessel's approach and can move away. Finally, NMFS will coordinate with the local stranding network to determine whether strandings can be related to the seismic operation.

Monitoring and Reporting

Biologists who oversaw the previous USGS airgun surveys were affiliated with the Cascadia Research Collective in Olympia, Washington. Because of their experience with the operations, the USGS prefer to employ these scientists again, but this preference is subject to contracting arrangements.

Monitoring marine mammals while the airguns are active will be conducted 24 hours each day. Two trained marine mammal observers will be aboard the seismic vessel to mitigate the potential environmental impact from airgun use and to gather data on the species, number, and reaction of marine mammals to the airgun. Each observer will work 6 hours during daylight and 6 hours at night. During daylight, observers will use 7x50 binoculars with internal compasses and reticules to record the horizontal and vertical angle to sighted mammals. Night-time operations will be conducted with a commercial hand-held light magnification scope. Monitoring data to be recorded during airgun operations include the observer on duty, weather conditions (such as Beaufort sea state, wind speed, cloud cover, swell height, precipitation, and visibility). For each mammal sighting, the observer will record the time, bearing and reticule readings, species, group size, and the animal's surface behavior and orientation. Observers will instruct geologists to shut off the airgun array whenever a marine mammal enters its respective safety zone.

Possible Modifications or Alternatives to the Proposed Survey

The instructions for this permit request stipulate that the USGS consider alternatives to the proposed experiment. Options to change the activity are limited, but the USGS might conduct it in some other way, such as with a low-powered source or in a different season.

To abandon this study altogether is a poor option. In the introductory section of this application, the USGS described the societal relevance of this project and the benefits to scientists in understanding the regional earthquake hazard and to city planners in establishing building codes. Another facet of this study is understanding coastal aquifers and knowing how to stem the intrusion of salt water into them. If the project were canceled, such information would be unavailable.

The source strength might be reduced to limit the environmental impact. However, the proposed airgun size is already small, and the problem with this option is that the USGS cannot significantly reduce the source strength without jeopardizing the success of this survey. This judgment is based on USGS decades-long experience with seismic-reflection surveys, but especially on the 1998 survey that was conducted in the same general area as outlined here. If the USGS were to reduce the airgun size and then fail to obtain the required information, another survey would need to be conducted, and this would double the potential impact on marine mammals.

This project could be carried out at some other time of year, and

the USGS is open to suggestions. In this pursuit, the USGS talked with biologists to find out the best time for the project to be conducted. The USGS wants to avoid the gray whale migrations and the mid-summer arrival of other mysticete species because, while these other species remain mostly in the area of the Channel Islands, some individuals venture closer to the mainland. An important point is that biologists can best prevent harm to mammals when daylight is long, that is, near the solstice.

Consultation

Under section 7 of the Endangered Species Act, NMFS has begun consultation on the proposed issuance of an IHA. Consultation will be concluded upon completion of the comment period and consideration of those comments in the final determination on issuance of an authorization.

Conclusions

NMFS has preliminarily determined that the short-term impact of conducting marine seismic-reflection data in offshore southern California will result, at worst, in a temporary modification in behavior by certain species of pinnipeds and cetaceans. While behavioral modifications may be made by certain species of marine mammals to avoid the resultant noise from the seismic airgun, this behavioral change is expected to have a negligible impact on the animals.

In addition, no take by injury and/or death is anticipated, and takes will be at the lowest level practicable due to the incorporation of the mitigation measures previously mentioned. No known rookeries, mating grounds, areas of concentrated feeding, or other areas of special significance for marine mammals occur within or near the planned area of operations during the season of operations.

Proposed Authorization

NMFS proposes to issue an IHA to the USGS for the possible harassment of small numbers of several species of marine mammals incidental to collecting marine seismic-reflection data offshore from southern California, provided the above-mentioned mitigation, monitoring, and reporting requirements are incorporated. NMFS has preliminarily determined that the proposed activities would result in the harassment of only small numbers of each of several species of marine mammals and will have no more than a negligible impact on these marine mammal stocks.

Information Solicited

NMFS requests interested persons to submit comments, information, and suggestions concerning this request (see ADDRESSES).

Dated: March 1, 1999.
P. Michael Payne,
Acting Deputy Director, Office of Protected Resources, National Marine Fisheries Service.
[FR Doc. **99-5497 Filed** 3-4-**99**; 8:45 am]
BILLING CODE 3510-22-F

Below are answers to questions posed by the California Coastal Commission in a letter, dated 18 March 1999, to the National Marine Fisheries Service.

1) The operations will be both day and night (and presumably in various weather-conditions). How will marine mammals be observed and avoided during these low-visibility times? Will there only be visual monitoring or is acoustic monitoring included as well?

We propose to rely on visual monitoring. As we mentioned in our IHA request to NMFS, this survey will be the third one the USGS has conducted under the guidance and authority of marine-mammal biologists. We have gained considerable experience in operating an airgun in ways that do not harm the environment.

At night biologists will use light-amplification scopes, and the low power of the airgun is important in this regard because the mitigation zones will be close to the ship. We asked John Calambokidis for his opinion regarding mitigation at night: "Night observations of marine mammals are able to detect only animals in the immediate vicinity, say within 20-30m, of the ship. Even with the use of night vision equipment, sighting rates of marine mammals are dramatically reduced at night. Night observations are primarily valuable in detecting bow-riding dolphins or marine mammals in the immediate vicinity of the ship and air guns. During last year's airgun survey off southern California, the airguns were shut off at night as a result of sightings of marine mammals near the ship, indicating these observations were somewhat effective."

We believe there are cogent arguments in favor of continuous airgun operation. If we turn the airgun on and off repeatedly because of dark, fog or

high sea state, then whenever the airgun is off, marine mammals would move back into the survey area and could be unintentionally harassed each time we resume operations. In contrast, continuous use of the airgun reveals our location and direction of travel to mammals so they can avoid the survey ship.

During the SHIPS survey in Puget Sound, mammals observed from the ship were moving away from the active airguns, so given the choice, marine mammals apparently will stay away. Off Southern California the airguns will be fired every 12 s, and during this interval the ship will have moved 25 m, so the ship will not approach mammals unannounced.

If airgun use is restricted to periods of good visibility our operations would be greatly prolonged, thereby increasing the possibility that some mammals would be unintentionally harassed. This survey will require only two weeks to complete, and it will be spread out geographically from Los Angeles south to San Diego, so no one area will be greatly impacted by our activities.

As a final point in favor of continuous operations, the USGS has a fixed budget for this cruise, and the contract for the ship has a set period of performance. The USGS, therefore, cannot conduct this survey as if it had an indefinite time span.

In our view, the best course is to complete the experiment as expeditiously as possible.

2) If the operation includes shallow water, why is 25 log R an appropriate dispersion model? Also, one of the two sources, the "Huntec" system, emits sound at or near the seabottom – how will marine mammals be

observed area the bottom (if at all), and again, is the 25 log R the appropriate dispersion model for this source?

In the permit request to NMFS, the USGS used a 25log(R) decay in sound pressure level (SPL) because acoustic modeling and measurements in the field show that sound decays quickly in water that overlies a sloping seabottom. In a medium with no acoustic interfaces, sound spreads spherically and SPL reduces at 20log(R). A sloping bottom, however, causes sound to exit the water layer and beam into the underlying sediment, enhancing the transmission loss toward a beach (e.g. Jensen and Tindle, 1987; Deane and Buckingham, 1993; Glegg, et al., 1993; Richardson et al., 1994; Jensen, et al., 1994). In fact, a zone of high transmission loss, an "acoustic shadow zone," lies just offshore from a beach. This argues against the common misunderstanding that underwater sound intensifies up-slope toward a beach.

The enhanced transmission loss, relative to 20log(R), that occurs over a sloping bottom has been verified by field measurements from scattered locations. The U.S. Geological Survey, in conjunction with the SHIPS seismic survey in Puget Sound (Fisher et al., 1999), measured sound decay with distance from a 108 L airgun array (Bain, 1999; a copy of this draft report has been sent to the CCC). A least-squares, straight line fit to data from ranges less than 10 km indicates that airgun sound decays at 29log(R).

Off the Big Sur coast of central California, the SPL of a single, 1.6 L airgun decreased at 25log(R) (Malme et al., 1986).

Airgun SPL measured off northern Germany, where the water is shallow (2-10 m; J. Nedwell, Subacoustech, Ltd., written commun., 1999), indicates a sharp, 33log(R) decay toward the beach.

Greeneridge Sciences, Inc. measured the transmission loss of airgun sound at Platform Harmony in the Santa Barbara Channel (Greeneridge Sciences, Inc., 1998). Estimated loss in this report is high, the coefficient of the logarithm is 48 to 60; however we propose a least-squares, straight line fit to all data, which yields a transmission loss of 27log(R).

Measurements of ATOC sounds versus distance, in nearshore water that is 10 m to 80 m deep, indicate a high transmission loss of about 43log(R) (http://atoc.ucsd.edu/HIquicklookrpt.html).

Hence on the basis of abundant, numerical acoustic modeling and some field measurements we believe that 25log(R) is a conservative estimate of sound transmission loss for airgun sounds over a sloping seabottom, like that offshore from Southern California. In particular sound that propagates into shallow water near and within the 3-mile limit should decay sharply toward shore.

The Huntec instrument is deployed at varying depths beneath the sea surface to avoid noise from large ships and ocean waves, but no attempt is made to maintain this instrument at a close distance to the sea floor. For safety reasons, the Huntec vehicle remains at least 50 m above the seafloor, except in water that is shallower than 100 m, where the Huntec will be at about a 10-m depth. The maximum deployment depth is 150 m. The maximum SPL of the Huntec is about 1/4 of the G-I gun's maximum SPL, and mitigation zones were calculated to account for the G-I gun. These zones, therefore, are even more conservative for Huntec.

3) Just out of curiosity, why is a 35 cu. In. air gun louder than a 40 cu. in. air gun—is that because it contains 2 chambers?

The 3000-psi air pressure used with the generator-injector gun, instead of the 2000-psi pressure used with most airguns, likely accounts for the greater source strength of the G-I gun.

4) At what point will we know who will be doing the actual monitoring?

Employees of John Calambokidis at Cascadia Research in Olympia, WA, will most likely oversee the mitigation.

5) When does NMFS expect to complete its review of USGS' application?

NMFS expects to complete the review in early to middle May (Ken Hollingshead, oral commun.; April 8, 1999)

6) What is the currently-anticipated commencement date for the survey?

We plan to conduct the seismic-reflection survey for two weeks starting no earlier that June 10, 1999, with completion no later than July 20, 1999. We are endeavoring to commence the survey as early as possible, but final dates will not be determined until contract negotiations for the research boat are completed.

7) Concerning night-time visual monitoring, what is the illumination distance for the handheld commercial light magnification scope – is it enough to cover the marine mammal avoidance area?

The proposed night-vision equipment will not have the capability to illuminate the ocean with infra-red radiation but instead will amplify available light.

8) The federal register notice notes that marine mammal monitoring occurred during past USGS surveys of March 1998 in Puget Sound and August 1998 in southern California. We would appreciate being provided a copy containing or summarizing the results of such monitoring., including but not limited to marine mammals observed, marine mammal reactions, and avoidance actions taken.

Copies of two reports about the SHIPS survey have been included in a package sent to California Coastal Commission.

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FINAL REPORT

MARINE MAMMAL OBSERVATIONS AND MITIGATION ASSOCIATED WITH USGS SEISMIC SURVEYS IN THE SOUTHERN CALIFORNIA BIGHT IN 1998

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INTRODUCTION

From 9 to 22 August 1998, the U.S. Geological Survey conducted seismic surveys in the Pacific Ocean just off Los Angeles to investigate earthquake hazards. Details on the purposes and specifications of the equipment used are described below. As a part of this project, Cascadia Research was contracted by the USGS to monitor marine mammals from the survey platform and provide mitigation on impacts on marine mammals by requesting shutdown of the sound sources when marine mammals were close to the operations. We report here the results of this marine mammal mitigation and monitoring program conducted in conjunction with the USGS Los Angeles surveys.

BACKGROUND ON OVERALL PROJECT AND SOUND SOURCE DESCRIPTION

The following background on the overall project and sound source description was provided by USSGS:

The focus of the Southern California Earthquake Hazards project is to identify the landslide and earthquake hazards and related ground-deformation processes that have the potential to impact the social and economic well-being of the inhabitants of the Southern California coastal region. The primary objective is to help mitigate the earthquake hazards for the Southern California region by improving our understanding of how deformation is distributed (spatially and temporally) in the offshore with respect to the onshore region.

The active field program for the project focuses on those areas with the greatest impact potential on the Southern California populace:

1) The coastal strip (coastal zone and continental shelf) between Los Angeles and San Diego, where much of the hazard appears to be associated with strike-slip or oblique-slip faults;
2) Active faults within the Santa Monica, San Pedro, and San Diego Trough basins, where more extensive sedimentation has left a greater stratigraphic record;
3) The offshore extension into the Santa Barbara Channel of the fold and thrust belt;
4) The boundary (Channel Islands region) between the inner California Borderland (strike-slip dominated deformation) and the Santa Barbara Channel (thrust and fold deformation).

Tracklines were planned at a 2 km spacing aligned perpendicular to the shelf break and basin slope and on an "orthogonal" set aligned to intercept major structural features that are oblique to the trend of the basin slope and shelf edge.

The FY 1998 field program was conducted using a leased vessel, the 156-ft-long M/V AURIGA, owned and operated by F/V North Wind, Inc. Two sound transmissions were used:

Huntec: A high-resolution Huntec DTS boomer system, towed between 6 m and 160 m below the sea surface (depending upon the water depth), was used to image the upper few tens of milliseconds of strata with a resolution of better than 0.5 ms (0.4 m). Power output was 350 Joules (540) with a firing rate that was also dependent on water depth, ranging in 0.25 sec intervals from 0.75 sec over the shelf and upper basin slopes to 1.25 sec over the deeper parts of the basins. Returning signals were received with a 5-m-long Benthos 10-element hydrophone

array. Signals were filtered at 800-6000 Hz and recorded at a 0.25 sec sweep. The data were recorded both on paper using an EPC recorder and on magneto-optical disc. The average survey speed of about 3.8 kt (7 km/hr) resulted in a shot spacing between 1.5 and 2.5 m for the deep-tow boomer profiles.

Multichannel seismic-reflection system (MCS): As a result of equipment problems, the multichannel seismic-reflection (MCS) profiling activity during the cruise used two different sound sources and two different streamers to receive the signals. The primary sound source was a 35/35 in^3 double-chamber GI gun firing every 12 seconds at a pressure of about 3000 psi. A Sureshot system was used to fire the gun in "harmonic mode" wherein the second chamber is delayed relative to the initial trigger pulse in order to achieve the cleanest signal by minimizing the bubble pulse. The most efficient settings for the Sureshot control are given in (Table 3). The GI gun was towed 12 meters behind the vessel and suspended from a float to maintain a depth of about 1 meter. Catastrophic failure of the gun resulted in changing to the backup sound source, a 40 in^3 Bolt airgun, which was deployed for the last 48 hours of data collection. This airgun, which had a wave-shape kit to reduce the effect of the bubble pulse, was towed at a depth of about 4 meters using 2000 psi air pressure and fired at a six-second shot rate.

The primary streamer for the mcs operation was a 24-channel ITI streamer with 10-m-long groups and 3 phones per group. This streamer was unusable for the first part of the survey because of extensive corrosion of the wiring in the termination box of the deck cable. The backup receiving system, a 24-channel ITI streamer with 6.25 m groups and 1 phone per group was used initially until repairs could be effected on the primary streamer. Failure of the GI gun late in the survey as noted above meant that three combinations of sound source and streamers were used during the operation: primary sound source with backup streamer, primary sound source and streamer, and backup sound source with primary receiver.

Data was collected using a STRATAVIEW digital recording system and a Geometrics marine controller. Shots were triggered by the YoNav system. Data was recorded in SEGD format on 2-gbyte DAT tapes using a 1 msec sample rate and a three second record length. A 60-Hz notch filter was used, otherwise all frequency bands were passed. A total of approximately 250 hours (20 gigabytes) of data were collected.

OBJECTIVES

The objectives of the marine mammal study were as follows:

1. Mitigate impacts on marine mammals by monitoring the presence of these species from the survey ship and requesting shut-down of the airgun array when marine mammals were seen within specified safety zones representing distances close enough to potentially cause physically injury.

2. Mitigate impacts by identifying potentially sensitive areas to marine mammals that should be avoided or surveyed only during daylight hours.

3. Document the number of animals of each species present in the vicinity of sound transmissions.

4. Evaluate the reactions of marine mammals to the sound transmissions at different distances from the air gun array.

METHODS

General Approach

The research effort consisted of observations made directly from the seismic vessel (*Auriga*) to provide mitigation, document marine mammals exposed to the air guns, and monitor reactions of marine mammals close to the seismic survey vessel. Observations were conducted from a platform in front of the bridge that put the observers eye level at 7.6 m above the water. This external platform provided excellent visibility to the front and sides and only slightly obscured visibility to the rear. The platform was near the front of the vessel 6.4 m behind the bow and 47 m from the stern of the vessel.

Observations were conducted from the seismic vessel (*Auriga*) 24 hours a day when seismic operations were underway. Two observers were placed about the seismic vessel to provide the mitigation described above and gather data on the species, number, and reaction o marine mammals to the seismic vessel. Each observer worked during six hours of daylight and six hours of darkness. During daylight observations, observers used *Tasco 7x50* binoculars with internal compasses and reticles to record the horizontal and vertical angle to sightings. Night-time operations were conducted with a commercial hand-held light magnification scope. Observers would search the area close forward and to either side of the ship for marine mammals.

Data on survey effort and sightings were recorded on a datasheet recording information to track survey effort which includes observer on duty and weather conditions (Beaufort sea state, wind speed, cloud cover, swell height, precipitation, visibility, etc.). For each sighting the time, bearing and reticle reading to sighting, species, group size, surface behavior and orientation were recorded.

Distances to sightings were calculated using the vertical angle to the animal (based on either the reticle reading through the binoculars or a hand help clinometer for close sightings) and the known elevation above the water. This was then used to evaluate whether a sighting was within the mitigation safety zones.

Mitigation safety zones

Two safety zones were used for this project. These were:

1. For pinnipeds and Odontocetes (toothed cetaceans) seismic operations would be shut down when an animal was seen close to a distance of 100 m or less.

2. For mysticetes (baleen whales), the safety zone was 200 m.

To allow a quick determination of status, safety zones were calculated in three arcs around the ship and the safety distance was applied using the closest part of the ship or array. Three different cut-off distances (based on distance and angle from the observers) were

calculated for off the bow (60 degrees to either side of the bow), to either side of the vessel (from 60 to 120 degrees off the bow and off the stern (120 to 180 degrees off the bow).

Observers were instructed to call for a shut-down when a marine mammal was seen inside the safety zone or close enough to the safety zone that given measurement-error, it could be within the safety zone. Shut-down was also considered when animals were ahead of the vessel path outside the safety zone, but it appeared likely that the direction of travel of the vessel would result in the marine mammal being within the safety zone shortly.

For effective mitigation, the observers needed to know very quickly whether a sighting was within the safety zone. We used a polaris (angle board) for the observers to estimate the angle to the sighting. The cut-off vertical angle, which represented each of the safety zones, was also written on the polaris, allowing quick determination of the proximity of a sighting to the safety zone.

RESULTS AND DISCUSSION

Shut-downs for marine mammal mitigation

Seismic operations were requested to be shut down on eleven occasions related to the presence of marine mammals (Table 1). All requested shutdowns were because animals were in close proximity to the seismic vessel. Eight of the shut-downs were for common dolphins (five of them approaching to bow-ride) and three were for California sea lions.

Only 3 of the 11 shut-downs were requested at night. This likely reflected the poorer sighting conditions at night that made it hard to spot marine mammals even within the safety zones. Two of these three shut-downs were due the presence of dolphins riding the bow wave of the vessel.

Sightings made by vessel

There were 133 sightings of 6,313 marine mammals not including the 98 re-sightings made from the *Auriga* during the surveys (Table 2). These represented at least eight species of marine mammals. Common dolphins and California sea lions were most frequently sighted. Other large whale species included humpback and minke whales and several sightings of blue and possibly fin whales made at long distances from the vessel. Other smaller cetaceans besides common dolphins included Cuvier's beaked whale, Risso's dolphin, and either a Dall's or harbor porpoise. The only other pinniped seen beside California sea lions was northern fur seals.

Sightings at night were far less common with only the three sightings close to the boat that resulted in shut-downs. These involved common dolphins bowriding that could be heard and a California sea lion.

Orientation and behavior of marine mammals

A disproportionate number of marine mammals were headed away from the vessel as opposed to toward the vessel or perpendicular to the direction to the vessel (Table 4). For both sightings and resightings animals were headed away about twice as often as any of the other three direction quadrants. Most of the survey effort was conducted with either the Huntec operating or both the Huntec and airgun operating. This makes it hard to evaluate whether animals were reacting to the vessel or one or both of the sounds generated.

Marine mammals were sighted engaged in a variety of behaviors (Table 5). The majority of sightings and resightings were of animals judged to be either fast or slow traveling. The next most common behavior was hauled (many of the California sea lions). Animals were also seen milling, surfacing in the same area, and likely indicating feeding. Common dolphins were seen bowriding on six occasions. A number of less common behaviors were seen including a minke whale lunge feeding and a humpback that was seen breaching on five occasions. It was not possible to judge if any of these behaviors could have been related to survey activities.

DISCUSSION

The species encountered during the surveys is consistent with what would be expected in the region. Both common dolphins and California sea lions are considered the most common marine mammals in nearshore waters of Southern California. Sightings of unidentified dolphins were also likely common dolphins seen at distances that did not allow species identification. Both Risso's dolphins and Cuvier's beaked whales, seen a few times in the study, are more typical of deeper waters off the continental shelf edge. The sighting of a potential harbor porpoise was surprising and was scored as a possible Dall's porpoise primarily because harbor porpoise are generally considered to not occur south of Point Conception.

The sightings of several large balaenopterid whales are of interest and indicate these species were present in the study area despite the proximity of the surveys to shore. Humpback, blue, and fin whales are the most common large baleen whales that feed off California. Recent photographic identification research conducted by Cascadia has indicated a population of about 800 humpback whales feeding off California each summer (Calambokidis et al. 1996, 1997). Most of these are generally concentrated from the Santa Barbara Channel north during the summer. About 2,000 blue whale are estimated to feed off California, one of the areas of highest blue whale density anywhere in the world (Calambokidis and Steiger 1995, 1997).

CONCLUSSIONS AND RECOMMENDATIONS

Overall, the surveys provided valuable information on the species of marine mammals present in the survey area. They also provided some protection from potential impacts through shut-downs when marine mammals were observed close to the survey vessel. Although sample size was small these surveys yielded data on the reactions of several species to a survey vessel. Night-time operations were of limited value in sighting marine mammals or making observations of reactions of marine mammals. The few sightings made at night resulted in three shut-downs, which provided some mitigation of impacts. The low number of sightings and shut-downs at night, however, indicated these observations were of only limited effectiveness. In the future it would be more effective to better staff daylight shifts and not risk compromising these observations for the limited effectiveness of night observations.

Table 1. Cases where air gun/Huntec shut-downs were requested due to marine mammal occurrence.

Date	Time	Resume firing	Firing	Reason for request	Comments
08/11/98	9:31:00	9:36:00	Huntec	Proximity of California sea lion	
08/12/98	3:16:00		Huntec	Bowriding dolphins	Auth. shut-down personnel not in lab
08/12/98	18:50:00	18:59:00	Huntec	Bowriding common dolpins	
08/15/98	2:06:00	2:09:00	Huntec	Proximity (<100m) of California sea lion	
08/15/98	21:55:00	21:57:00	Huntec/Airgu	Bowriding dolphins	
08/16/98	9:32:00	9:35:00	Huntec/Airgu	Proximity of California sea lions	
08/17/98	11:34:00	11:40:00	Huntec/Airgu	Proximity of common dolphins	
08/17/98	11:59:00	12:07:00	Huntec/Airgu	Proximity of common dolphins	
08/21/98	9:18:00	9:26:00	Huntec	Proximity of common dolphins	
08/21/98	17:58:00	18:04:00	Huntec/Airgu	Bowriding common dolpins	
08/22/98	12:12:00	12:16:00	Huntec/Airgu	Bowriding common dolpins	

Table 2. Summary of sightings and resightings of difference species during daylight and night observations.

	Daylight observations				Night obs.		Total day and night	
	Sighting		Resighting		Sightings		Sightings	
Species	Sight.	Anim.	Sight.	Anim.	Sight.	Anim.	Sight.	Anim.
Humpback whale	1	1	6	6			1	1
Minke whale	4	4	2	2			4	4
Large Balaenopterid (blue or fi	3	3	4	4			3	3
Cuvier's beaked whale	1	1					1	1
Unidentified whale	1	1					1	1
Common dolphin	32	3,981	48	6,555			32	3,981
Risso's dolphins	1	8	1	8			1	8
Unidentified porpoise	1	5	1	5			1	5
Unidentified dolphin	22	2,155	18	1,746	2	4	24	2,159
California sea lion	61	144	18	43	1	2	62	146
Northern fur seal	2	2					2	2
Unidentified pinniped	1	2					1	2
Grand Total	130	6,307	98	8,369	3	6	133	6,313

Table 4. Headings of marine mammals sighted from survey vessel in relation to sighting type and firing status.

	Heading relative to direction to boat				
Firing status	**away**	**left**	**right**	**toward**	**Total**
	Sightings				
None				1	1
Airgun only				2	2
Huntec only	11	4	6	7	28
Huntec & airgu	16	10	9	7	42
Total for sighti	27	14	15	17	73
	Resightings				
None	2				2
Airgun only					0
Huntec only	6	1	4	2	13
Huntec & airgu	22	8	5	9	44
Total for resigh	30	9	9	11	59
Grand total	57	23	24	28	132

Table 3. Daytime sightings (not including resightings) by operational status of airgun and Huntec.

	None firing		Huntec only		Airgun only		Huntec & airgun		Total	
Species	**Sight.**	**Anim.**	**Sight.**	**Anim.**	**Sight.**	**Anim.**	**Sight.**	**Anim.**	**Sight.**	**Anim.**
Humpback whale							1	1	1	1
Minke whale			1	1			3	3	4	4
Large Balaenopterid (blue or fin)			2	2			1	1	3	3
Cuvier's beaked whale							1	1	1	1
Unidentified whale							1	1	1	1
Common dolphin	3	498	11	1620	2	95	16	1768	32	3981
Risso's dolphins							1	8	1	8
Unidentified porpoise							1	5	1	5
Unidentified dolphin	1	40	9	652			12	1463	22	2155
California sea lion	28	101	16	21	1	2	16	20	61	144
Northern fur seal							2	2	2	2
Unidentified pinniped							1	2	1	2
Grand Total	32	639	39	2296	3	97	56	3275	130	6307
Hours of daylight operation		19.8		61.4		0.6		101.4		183.2

Table 4. Headings of marine mammals sighted from survey vessel in relation to sighting type and firing status.

	Heading relative to direction to boat				
Firing status	**away**	**left**	**right**	**toward**	**Total**
	Sightings				
None				1	1
Airgun only				2	2
Huntec only	11	4	6	7	28
Huntec & airgu	16	10	9	7	42
Total for sighti	27	14	15	17	73
	Resightings				
None	2				2
Airgun only					0
Huntec only	6	1	4	2	13
Huntec & airgu	22	8	5	9	44
Total for resigh	30	9	9	11	59
Grand total	57	23	24	28	132

Table 5. Behavior of marine mammals sighted or resighted during daylight hours during surveys. Behaviors were clasified based on primary behavior seen during observation.

Behavior	Sightings					Resightings					Both Total
	Firing status					Firing status					
	Airgun	Huntec	A&H	None	Total	Airgun	Huntec	A&H	None	Total	
Fast travel		13	16	1	30		11	23	1	35	65
Slow travel	1	14	19	1	35		3	11		14	49
Hauled		3	1	25	29				8	8	37
Milling		5	8	1	14		2	13		15	29
Stationary		2	3		5			2		2	7
Bow riding	2			2	4		1		1	2	6
Breaching			1		1			4		4	5
Pec slaping					0			2		2	2
Surface lunge-feed			1		1					0	1
Feeding				1	1					0	1
Total	3	37	49	31	120	0	17	55	10	82	202

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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

EXHIBIT NO. 6
APPLICATION NO.
CD-32-99

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 methods 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 surveys. 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).

STATE OF CALIFORNIA GRAY DAVIS, *Governor*

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PAUL D. THAYER, *Executive Officer*
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Tu 6d

April 15, 1999

File Ref: W24712

Mr. William R. Normark
U.S. Geological Survey
Coastal and Marine Geology Team, MS 999
345 Middlefield Road
Menlo Park, CA 94025

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 2
To Mark DeLaplaine	From Dan Gorfain
Co. CCC	Co.
Dept.	Phone # (916) 574-1889
Fax # 415/904-5400	Fax #

Re: Seismic Reflection Survey

Dear Mr. Normark:

The Staff of the State Lands Commission has reviewed the U.S. Geological Survey's request for an incidental Harassment Authorization from the National Marine Fisheries Service, dated February 10, 1999, and has found that the project, as shown thereon, involves State sovereign lands for which no lease or permit has been issued.

You must therefore secure a geophysical permit from the California State Lands Commission for the use of those State-owned lands over which your project will extend.

In addition, your proposed project is subject to environmental review by the Commission's staff. Standards for this review are set forth in the California Environmental Quality Act (CEQA), the State CEQA Guidelines, and the Public Resources Code. It should be noted that the Commission in 1987 determined that, before it could consider the use of high acoustical energy geophysical survey equipment in State waters, an environmental impact report was required.

It is the Commission's position that, because the State of California owns the property in question and requires an application for a permit from all others who carry out geophysical surveys on State lands, the U.S. Geological Survey must also obtain a permit just as it would from any other land owner upon whose land it conducts a survey. There is no issue of preemption, since the authority of the State in this case is as landowner, rather than as regulator. I would also like to refer you to the High Energy Seismic Survey Review Process and Interim Operational Guideline for Marine Surveys Offshore Southern California prepared by the High Energy Seismic Survey Team for the California State Lands Commission and the U.S. Minerals Management Service. September 1996 through February 1999. These guidelines provide directions for all

offshore high-energy surveys off California, and they include a clear requirement for close and early consultation with the State.

I have enclosed information relative to the Commission's application requirements. If you need more information or any assistance in preparing the application, please call Art Nitsche at (562) 590-5270.

Your cooperation and early response will be appreciated.

Sincerely,

Paul D. Thayer

PAUL D. THAYER
Executive Officer

Cc: Michael A. Fisher
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