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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 standard¹ (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 groundwater 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. USGS History of Seismic Survey Activity. 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

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' ATOC³ and the Navy's LFA⁴ 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

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

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).

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]rovided [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 $25\log(R)$ 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 $20\log(R)$. 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 $20\log(R)$, 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 $25\log(R)$ is a conservative estimate of sound transmission loss for airgun sounds over a sloping seafloor, 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 multi-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.