

To: cr_board_clerk Clerk Recorder/ClerkRec/COSLO@Wings,
Cc: Kristi Gutierrez/Admin/COSLO@Wings,
Bcc:
Subject: Fw: Seismic Study evidence for the record
From: Dan Buckshi/Admin/COSLO - Monday 10/22/2012 05:12 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:11 PM -----

From: "Dr. C. Hite" <aaaptly@gmail.com>
To: dbuckshi@co.slo.ca.us
Date: 10/17/2012 04:48 PM
Subject: Seismic Study evidence for the record

Mr. Buckshi;

For the record:

Conscientious objections to further seismic study on the Central Coast

----- Forwarded message -----

From: **Dr. C. Hite** <aaaptly@gmail.com>
Date: Mon, Oct 15, 2012 at 8:44 PM
Subject: Conscientious objections to further seismic study on the Central Coast
To: jpatterson@co.slo.ca.us

**San Luis Obispo County Board of
Supervisors, Chair
James Patterson**

**RE: 15 Arguments against further seismic
testing on the Central Coast of California**

By Dr. C. Hite, Los Osos, California

Item # 22 Meeting Date: 10/30/2012
Presented by: Dr. C. Hite
Received prior to meeting and posted to web
on: October 23, 2012

World Community Workshop

(Arguments highlighted in yellow)

- 1) There have been NO scientific studies on the adverse affects on wildlife from the 2011 Seismic testing throughout Los Osos and the County of San Luis Obispo, California.**
- 2) There has been no scientific release of data from this 2011 seismic ground testing.**
- 3) It would be prudent for PG&E to compile the data from the ground seismic testing first to see if shoreline, estuary and offshore seismic study is necessarily.**
- 4) PG&E should be required to release the scientific information on the low energy seismic research off portions of the California Central Coast before proceeding with the controversial high decibel seismic study.**

<http://www.pge.com/myhome/edusafety/systemworks/dcpp/newsmedia/seismic/index.shtml>

Seismic Studies Update

During the week of August 20, 2012, PG&E will resume low-energy seismic research work off portions of California's Central Coast.

PG&E began the first phase of this low-energy offshore study in 2010, and completed the second portion in 2011. The third phase will study areas near San Luis Bay, Estero Bay and Point Sal.

All operations will be performed during daylight hours and processes and procedures have been implemented to monitor and protect marine mammals while the study is underway.

Mariner and commercial boat traffic are encouraged to remain at least a mile away from the vessel while it operates in the area to avoid entanglement with research equipment. Daily updates on the location of the vessel can be found at www.marinetraffic.com using the search word "Pacific Star."

#

5) Further seismic study should NOT be allowed to proceed without guidelines. NOAA has yet to develop marine mammal acoustic guidelines.

<http://www.nmfs.noaa.gov/>

Ocean Acoustics

More on Acoustics

- [Guidelines](#)
- [Shipping Noise](#)
- [Sonar](#)
- [Behavioral Response Studies/ Controlled Exposure Experiments](#)

Humpback whales
(*Megaptera novaeangliae*)

Photo: R. Wicklund, NOAA

The NOAA Fisheries Acoustics Program is investigating all aspects of marine animal **acoustic communication, hearing**, and the **effects of sound** on behavior and hearing in **protected marine species**. Specifically, the program is:

- Developing acoustic exposure policy for NOAA
 - Developing [marine mammal acoustic guidelines](#)
 - Providing technical analysis for NOAA [Incidental Take Authorizations](#) and [Biological Opinions](#) involving human sound sources based on the best available marine mammal acoustic science
- Supporting research in a variety of areas to address critical data needed to improve and expand these criteria (working directly with [NOAA Fisheries Office of Science and Technology](#))
 - Leading efforts to develop a [global passive acoustic noise-monitoring network \[pdf\]](#) in key marine environments around the world

More Information

- [Cetacean and Sound Mapping Working Groups](#)
- [Federal Task Force on Anthropogenic Sound \(JSOST 2009\) \[pdf\]](#)
- [Shipping Noise](#)
- [Sonar](#)
- [Behavioral Response Studies/Controlled Exposure Experiments](#)
- NOAA Fisheries
 - [Alaska Fisheries Science Center](#)
 - [Northeast Fisheries Science Center](#)
 - [Northwest Fisheries Science Center](#)
 - [Pacific Islands Fisheries Science Center](#)
 - [Southeast Fisheries Science Center](#)
 - [Southwest Fisheries Science Center](#)
- [NOAA VENTS Program](#)
- [Stellwagen Bank National Marine Sanctuary](#)
- [Learn more about sound](#)

Updated: October 11, 2012

#

6. San Luis Obispo County has NO marine mammal stranding network to report to.

Southwest Region Marine Mammal Stranding Network

California

- NMFS Southwest Regional Office
Long Beach, CA
562-980-3230
- NMFS Southwest Fisheries Science Center
La Jolla, CA
858-546-7162
Dead Cetaceans and Pinnipeds; Sea Turtles
- California Academy of Sciences
Department of Ornithology and Mammalogy
San Francisco, CA
415-379-5381
Dead Cetaceans and Pinnipeds; Sea Turtles
- California Wildlife Center
Malibu, CA
310-458-9453 or 818-222-2658
Live Cetaceans and Pinnipeds; Sea Turtles
- Channel Islands Marine & Wildlife Institute
Goleta, CA
805-567-1505
Live Cetaceans and Pinnipeds; Sea Turtles
- Humboldt State University - Vertebrate Museum
Arcata, CA
707-826-4872
Dead Cetaceans; Sea Turtles
- Long Marine Lab, University of California
Santa Cruz, CA
831-212-1272
Live Cetaceans
Dead Cetaceans and Pinnipeds; Sea Turtles
- Los Angeles County Museum of Natural History
Los Angeles, CA
323-585-5105
Dead Cetaceans; Sea Turtles
- Marine Animal Rescue
El Segundo, CA

800-39-WHALE

Live Cetaceans and Pinnipeds; Sea Turtles

- Marine Mammal Care Center at Fort MacArthur
San Pedro, CA
310-548-5677
Live Cetaceans and Pinnipeds; Sea Turtles
- Moss Landing Marine Laboratories
Moss Landing, CA
831-771-4422
Dead Cetaceans and Pinnipeds; Sea Turtles
- Northcoast Marine Mammal Center
Crescent City, CA
707-465-6265
Live Cetaceans and Pinnipeds; Sea Turtles
- Pacific Marine Mammal Center
Laguna Beach, CA
949-494-3050
Live Cetaceans and Pinnipeds; Sea Turtles
- Santa Barbara Marine Mammal Center
Santa Barbara, CA
805-687-3255
Live Cetaceans and Pinnipeds; Sea Turtles
- Santa Barbara Museum of Natural History
Vertebrate Laboratory
Santa Barbara, CA
805-682-4711 x156
Dead Cetaceans; Sea Turtles
- SeaWorld
San Diego, CA 92109
800-541-7325
Live Cetaceans and Pinnipeds; Sea Turtles
- The Marine Mammal Center
Sausalito, CA
415-289-7350
Live Cetaceans and Pinnipeds; Sea Turtles

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7) The nitrogen hot fertilizer of organic flotsam from the seismic study "take" will clog the cooling water intake of Diablo Canyon Nuclear Power Plant, making it unreliable.

<http://www.pgecurrents.com/2012/04/27/san-luis-obispo-county-diablo-canyon-powers-down-after-sea-salp-migration/>

Posted on April 27, 2012

San Luis Obispo County: Diablo Canyon Powers Down after Sea Salp Migration

Diablo Canyon Power Plant
in San Luis Obispo County

AVILA BEACH – PG&E has powered down Unit 2 at its Diablo Canyon Power Plant after a migration of small jellyfish-like creatures known as sea salps.

As reported by the *San Luis Obispo Tribune*, southerly winds began blowing the salps into the plant's cooling water intake cove on Tuesday. Plant operators noticed differences in water pressure at the intake structure, which meant the salps were beginning to clog the rolling screens in front of the intake.

After initially reducing power in Unit 2 to 15 percent, the problem with the animals first got better and then got worse. So, on Wednesday, the decision was made to fully power down the plant.

"I've been very pleased with how staff has reacted to this by putting safety first," Ed Halpin, PG&E's chief nuclear officer, told the newspaper.

Small jellyfish-like
creatures called sea salps
are in the water near
Diablo Canyon.

Millions if not billions of sea salps, a one- to three-inch long transparent barrel-shaped animal that looks and feels much like a jellyfish, came ashore in the area with onshore currents. These creatures feed on plankton, and multiply rapidly.

The plant will return to full power as soon as it is safe to do so, and conditions warrant, Halpin said.

John Lindsey, a PG&E spokesman and meteorologist based in San Luis Obispo, said Friday that the winds have now changed direction in the area, and the salps should begin heading out to sea.

The Diablo Canyon intake provides seawater for cooling. It is 240-feet long, 100-feet wide and 18-feet high. It extends down 32 feet below sea level. The intake structure is backfilled by rock on three sides, and has water on the fourth (western) side.

The intake relies on four, 13,000-horsepower electric motors to pump 1.7 million gallons per minute or up to 2.5 billion gallons per day. In other words, the circulating water system provides the heat sink required for removal of waste heat in the power plant's thermal cycle. The circulating water system is designed to provide cooling water necessary to condense the steam entering the main condenser.

A curtain wall at the front of the intake structure limits the amount of floating debris entering the intake structure. Bar racks near the front of the intake structure intercept large submerged debris. Traveling screens intercept all material larger than the screen mesh opening, which measure 3/8ths of an inch.

The intake also houses the Auxiliary Salt Water (ASW) pumps. The ocean water supply to the ASW system provides the cooling and heat absorption capability required to remove waste heat under normal and emergency conditions.

The two units of Diablo Canyon produce approximately 2,300 net megawatts of greenhouse-gas-free electricity, about 10 percent of all electricity generated in California. That's enough to meet the needs of over three million homes in central and northern California. Unit 1 at the nuclear power plant was shut down for refueling starting on April 23.

#

8) PG&E will be acting against it's own stated commitment to the "environment" for the purpose of extending the license of the Diablo Canyon Nuclear Power Plant.

<https://mail.google.com/mail/?shva=1#drafts/13a65f7cf279a230>

PG&E's Environmental Commitment

At PG&E, we are committed to being an environmental leader and demonstrating this through our actions. We pledge to think creatively, work cooperatively and be results-oriented in our environmental stewardship efforts.

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9) PG&E Diablo Canyon Nuclear Power Plant is aged, scheduled for decommission and is unreliable

http://www.pge.com/myhome/edusafety/systemworks/dcpp/newsmedia/pressrelease/archive/unit_2_at_pges_diablo_canyon_power_plant_safely_shut_down_following_electrical_disturbance.shtml

Unit 2 at PG&E'S Diablo Canyon Power Plant Safely Shut Down Following Electrical Disturbance

October 11, 2012

AVILA BEACH, Calif. – Unit 2 at Pacific Gas and Electric Company's (PG&E) Diablo Canyon Power Plant safely shut down as designed at 12:08 p.m. today after an electrical disturbance occurred in equipment that moves power to the state's electric grid. Unit 1 continues to safely generate power.

Plant operators responded to the shutdown according to procedures and are working to determine the cause of the incident. The unit remains in a safe condition and will be restored to service after the cause is fully understood and the equipment is fully tested.

PG&E has informed the U.S. Nuclear Regulatory Commission and appropriate local and state officials.

Pacific Gas and Electric Company, a subsidiary of PG&E Corporation (NYSE:PCG), is one of the largest combined natural gas and electric utilities in the United States. Based in San Francisco, with 20,000 employees, the company delivers some of the nation's cleanest energy to 15 million people in Northern and Central California. For more information, visit <http://www.pge.com/about/newsroom/> and www.pgecurrents.com.

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<http://marinelife.about.com/od/conservation/a/sonarCA.htm>

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10) The Central Coast rate payers had NO vote on paying for the seismic study and have NO vote to shut the plant down as did the Sacramento rate payers.

The History of Rancho Seco

1966-1969

SMUD purchases 2,100 acres in southeast Sacramento County for a nuclear power plant. Construction begins on the cooling towers.

1971

- SMUD raises rates...even though Rancho Seco hasn't produced a single kilowatt-hour of electricity.
- The day Rancho Seco is dedicated there is a forced shutdown of the reactor (unknown to those attending the dedication ceremony)... a portent of things to come. [10/19/74]
- The turbine breaks down. The plant is shut down for 13 of the first 18 months of operation.

1976

- Loose parts are found in Rancho Seco's generator. SMUD says the find "will not cause any additional lost time." The plant is down for six months. [4/9/76, SB]

1978

- Rancho Seco shuts down four times. Problems are due to a dangerously fast cooldown.

1979

- Radioactive iodine is found in milk from cows grazing near Rancho Seco. [Quarterly Radiation Report on Rancho Seco]

1980

- Rancho Seco shuts down six times. Problems occurred with pipe supports, reactor coolant leaks, malfunctions, turbine bearings and feedwater flow. [9/26/83, SU]
- SMUD is fined \$25,000 by the NRC for violating federal safety standards.

1981

- A state report on emergency planning estimates that a serious nuclear accident at Rancho Seco could result in as many as 76,000 deaths and 110,000 injuries. [11/2/80, SB]
- Rancho Seco shuts down 12 times. Problems are due to steam generator tube leaks, feedwater, reactor coolant pump and turbine vibrations. [9/26/83, SU]

1982

- Rancho Seco shuts down 11 times, due to problems with the turbine, steam leaks, oil pressure and reactor trips. [9/26/83, SU]
- SMUD is fined \$120,000 for violating federal safety regulations.
- The steam generator leaks again...more radioactive steam escapes. Another shut-down.

1983

- Rancho Seco shuts down five times, due to maintenance, re-fueling, modifications, oil

pressure in turbine generator, heat imbalance in reactor and leak in steam generator tube. [9/26/83, SU]

- The steam generator tubes leak again and more radioactive steam escapes into the atmosphere. The plant is shut down again.
- SMUD faces a lack of skilled workers for Rancho Seco. [3/6/83, SB]

1984

- Rancho Seco is on the NRC's list of the ten worst nuclear plants in the U.S. in overall assessment of management performance. [3/28/89, Public Citizens Mishaps Report, NRC]
- More than two billion gallons of water containing radiation levels above federal guidelines have been dumped from Rancho Seco into a creek that feeds the Cosumnes and Mokelumne Rivers, SMUD officials confirmed. [4/14/84, SB]
- Two workers are killed by high-pressure steam bursting from a boiler at Rancho Seco.
- An explosion and fire shut down Rancho Seco for 38 days.

1985

- SMUD raises rates twice...by nearly 30 percent. SMUD has the first budget deficit in its history. From January 1, 1985 to March 31, 1988, Rancho Seco operates only three months (out of three and one-quarter years).
- On December 26, Rancho Seco suffers the third-fastest shut-down in U.S. reactor history when a control circuit malfunctions. The sudden temperature change could have cracked the reactor vessel and led to a meltdown.
- SMUD customers are now paying 40 percent more than a year ago. Rancho Seco work is \$27 million over budget and another rate increase is being considered.

1986

- Sacramentans for SAFE Energy (SAFE) calls for the SMUD board of directors to commission an independent, comprehensive study of the safety and economic risks associated with Rancho Seco as well as a comparison of alternative means of meeting our energy needs.
- Rancho Seco assistant manager for nuclear operations Dan Whitney said plant managers sometimes deliberately withheld information about system shortcomings when questioned by the NRC. [5/22/86, SB]
- SMUD admits that Rancho Seco was "mismanaged, mismaintained and misoperated" its entire lifetime. [5/20/86, SB]
- Two Rancho Seco workers are fired for drug abuse. They claim there is drug abuse throughout the plant.

1987

- Two water leaks lead to the release of approximately 10,000 gallons of radioactive water, some of it flowing into the nearby creek, outside of the plant's boundaries...[3/28/89, Public Citation of Mishaps, NRC]
- In 1987, SMUD pays more than \$350,000 in cash bonuses to fill positions at Rancho Seco. [7/10/88, SB]
- "Rates have increased 84 percent since March 1985, leading to ratepayer dismay and a situation in which half of SMUD households pay more than if served by surrounding

Pacific Gas and Electric Company. " [10/23/87, SB]

- Chief of nuclear operations, John Ward, is fired despite reputation as a fixer of hopeless cases. "It was like being in charge of the Keystone Kops," says Ward. [9/23/86]

1988

- "Closing Rancho Seco is the option for the future of SMUD that makes the most sense." [3/2/88, Sacramento Bee Editorial Staff]
- "The never-ending series of mishaps are beginning to look like a very high-budget Marx Brothers film, with Harpo in charge of warning the city should there be an emergency." [2/19/88, TV 40 Editorial Comment]
- A SMUD-commissioned, \$824,000 QUEST study team recommends closure of Rancho Seco, saying that unstable operation of Rancho Seco could bankrupt SMUD.
- Rancho Seco operates at less than 37%--even less than its lifetime capacity average of 39%. Rates have increased almost 92% since March 1985 due to Rancho Seco problems. [INPO]
- The October 1988 SMUD bond prospectus states, "The District has concluded that terminating Rancho Seco in June 1989 would not have a materially adverse impact on the District's operations through December, 1999." [SMUD]
- Measure B (to close Rancho Seco) loses on the June ballot by the narrowest of margins--only two votes per precinct. Measure C (to give Rancho Seco a trial run) barely passes.
- Rancho Seco supporters promise stability and low electric rates for SMUD. However, immediately following the June 1988 election, SMUD General Manager Richard Byrne is fired, Rancho Seco chief of nuclear operations resigns and SMUD discloses the need for additional rate increases. Two SMUD chiefs get \$520,000 in severance pay and bonuses.
- Former SMUD general manager Richard Byrne said he was "stifled, pressured and threatened by pro-Rancho Seco board members who wanted to keep potentially damaging information from reaching the public before the June 7, 1988 election. [6/18/88, SB]
- SMUD gives out \$248,500 in bonuses to middle- and upper-level employees in May for "extraordinary service." About 80 percent (\$197,000 was awarded to Rancho Seco managers and the balance to employees at SMUD headquarters. [9/1/88,SB]
- SMUD secretly paid out more than 970,000 in cash and benefits to eight managers who were forced to leave the utility during the past two years. [11/17/88, SB]
- Operating Rancho Seco in 1988 cost nearly twice the amount it would have cost SMUD to have purchased the same amount of electricity from other utilities. [12/26/88, SU]
- December 12--Operators try to restart Rancho Seco with malfunctioning valves. They rig the system in a manner for which there are no written procedures. One of two steam generators runs dry. NRC officials say operators took the plant through "uncharted waters" and showed poor judgment in handling the restart.

1989

- On January 31 Rancho Seco shuts down. Two days later, radioactive gas is released into the environment. The plant is down for 45 days. Bill Chapin, Rancho Seco plant mechanical maintenance supervisor and co-chairman of the Rancho Seco Political Action Committee says, "I think there's no doubt, the Ranch cannot have another breakdown between now and June, politically speaking." A day after his quote, Rancho Seco goes

- down yet another time. [3/28/89, SB]
- SMUD and PG&E contract ensures cheap, reliable power for Sacramento through 1999. [2/27/89, SU]
- The nuclear industry's own Institute of Nuclear Power Operations prepares a report on the recent shutdowns at Rancho Seco, saying that Rancho Seco's prior operating history as well as recent shutdowns "cause us to have a renewed concern over the quality of Rancho Seco operations." [INPO]
- SMUD pays \$1,230 for one Rancho Seco employee's clothing as part of the "distinctive attire" program. Jackets, pants, shirts and ties have already cost \$72,000; laundry bills, \$2,500 a month--all ultimately paid by the ratepayers.
- The plant comes to an abrupt halt (is scrambled) on the 10th anniversary of the Three Mile Island meltdown. High-level radioactive gasses are vented to the atmosphere. On April 8 the reactor is started, even though the cause of the March 28 accident has not been found and malfunctioning equipment (from the March 15 accident) has not been repaired. [3/29/89, SB, SU]
- June 6th, 1989 Sacramento Citizens go to the polls and vote to permanently close Rancho Seco.

Sources: SB: Sacramento Bee, SU Sacramento Union xxx The above was a poster created for Measure K on June 6, 1989

#

11) Continued seismic study is specific to "ensuring that Diablo Canyon continues" by not just extending the life span but providing an "after life" to Diablo Canyon Nuclear Power Plant

<http://www.pge.com/myhome/edusafety/systemworks/dcpp/newsmedia/seismic/index.shtml>

Seismic Information

Seismic Safety

PG&E remains focused on ensuring that Diablo Canyon continues, and improves upon, its strong record of safe operations. This includes making the facility resilient to natural hazards, including earthquakes and tsunamis.

PG&E is the only utility in the country that employs a seismic department staffed with experts. The scientific staff continually studies earthquake faults in the region of the power plant and global seismic events as part of the plant's comprehensive safety program.

In November 2008, the U.S. Geological Survey (USGS), working in partnership with PG&E's geosciences department, discovered a new shoreline fault zone, and PG&E evaluated whether that new feature presented a safety risk to the plant. PG&E submitted its evaluation to the

Nuclear Regulatory Commission (NRC) under the commitment of its current operating licenses. PG&E's evaluation confirmed the plant has adequate safety margin to withstand maximum ground motions postulated to occur from faults in the region, including the shoreline fault.

Advanced Seismic Research

PG&E is currently conducting advanced seismic studies that will provide a more accurate and detailed picture of the region's complex geology. The research, called for by the state, will help further define the amount of ground motions that seismic faults in the region are capable of producing.

PG&E has made steady progress toward completing the studies since the research began in 2010. The on-shore work is nearly complete, the majority of the low-energy off-shore studies are finished, and the California Coastal Commission has approved PG&E's request to install ocean-bottom seismometers to detect seismic activity.

The company plans to undertake the final, off-shore high-energy study as soon as it obtains all necessary permits from various regulatory agencies, including the State Lands Commission, California Coastal Commission and County of San Luis Obispo. To address public concern regarding the seismicity of the area surrounding Diablo Canyon, PG&E has worked to expedite the permitting process so it can begin this study as soon as possible. PG&E is committed to conducting this work safely and in a manner with the least impact to the community and the environment.

Once the research is complete, PG&E will use the data to support its ongoing work to continually assess and validate the seismic design of the plant. PG&E will also share information collected with local public and government agencies so they can incorporate it into emergency preparedness plans and ensure the safety of critical infrastructure. The data will also be used to support federal requirements for new seismic risk evaluations following the Fukushima Daiichi power plant tragedy in Japan.

Seismic Studies Update

During the week of August 20, 2012, PG&E will resume low-energy seismic research work off portions of California's Central Coast.

PG&E began the first phase of this low-energy offshore study in 2010, and completed the second portion in 2011. The third phase will study areas near San Luis Bay, Estero Bay and Point Sal.

All operations will be performed during daylight hours and processes and procedures have been implemented to monitor and protect marine mammals while the study is underway.

Mariner and commercial boat traffic are encouraged to remain at least a mile away from the

vessel while it operates in the area to avoid entanglement with research equipment. Daily updates on the location of the vessel can be found at www.marinetraffic.com using the search word "Pacific Star."

Seismic Information

- [August 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 83 KB)
- [July 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 83 KB)
- [June 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 83 KB)
- [May 9, 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 83 KB)
- [May 8, 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 83 KB)
- [April 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 83 KB)
- [March 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 81 KB)
- [February 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 83 KB)
- [January 2012 Status Report to ASLB on Seismic Studies](#) (PDF, 82 KB)
- [December 2011 Status Report to ASLB on Seismic Studies](#) (PDF, 81 KB)
- [November 2011 Status Report to ASLB on Seismic Studies](#) (PDF, 83 KB)
- [October 2011 Status Report to ASLB on Seismic Studies](#) (PDF, 92 KB)
- [September 2011 Status Report to ASLB on Seismic Studies](#) (PDF, 91 KB)
- [August 2011 Status Report to ASLB on Seismic Studies](#) (PDF, 91 KB)
- [July 2011 Status Report to ASLB on Seismic Studies](#) (PDF, 98 KB)
- [PG&E High Energy 3-D Seismic Scoping Presentation Before the State Lands Commission](#)
- [California Coastal Commission's Report on DCPD Safety From Tsunamis and Earthquakes](#) (PDF, 661 KB)
- [NRC releases post-Fukushima 90 day report](#) (PDF, 899 KB)

Seismic Survey Topics

[NRC Related Correspondence](#)

[Ocean Bottom Seismometer Study](#)

[2D/3D Low Energy Marine Studies](#)

[3D High Energy Marine Studies](#)

[Fishing Reading Room](#)

Diablo Canyon Newsroom

- [Unit 2 at PG&E'S Diablo Canyon Power Plant Safely Shut Down Following Electrical Disturbance](#)
- [PG&E to Submit Modified Seismic Study Proposal to California Coastal Commission](#)
- [PG&E Names New Diablo Canyon Site Vice President](#)
- [PG&E Supports Cal Poly Athletics with \\$20,000 Donation](#)
- [View all News Releases](#)

Articles and Perspectives About Diablo Canyon

[San Luis Obispo County: PG&E Taking Extensive Measures to Protect Marine Life in Seismic Testing](#)

[Trails Near Diablo Canyon Plant Offer Stunning Views of Coastal Scenery](#)

[San Luis Obispo County: State Lands Commission Approves Seismic Testing](#)

[San Luis Obispo County: Delano Students Get an Insider's View of Diablo Canyon Power Plant](#)

[San Luis Obispo County: Diablo Canyon Powers Down after Sea Salp Migration](#)

[View all articles](#)

#

12) We have NO comparisons to see if similar testing by oil companies have used this "similar testing" *safely* because not all have taken the same "multi-tiered monitoring program" approach.

<http://www.pgecurrents.com/2012/09/07/san-luis-obispo-county-pge-taking-extensive-measures-to-protect-marine-life-in-seismic-testing/>

With PG&E seeking approvals to conduct the final high-energy study, concerns have been raised about the affect the survey's high-decibel sounds will have on marine life. PG&E is mindful of these concerns, Strickland said, and is making every effort to mitigate potential impacts.

Other companies – including those in the oil industry — have used similar testing safely, he said. However, he said not all have taken the same “multi-tiered monitoring program” approach that PG&E has planned to protect marine life.

#

13) There is insufficient scientific data to determine if the "ramping up" of sound to full power will drive marine mammals into the many coves off the Central Coast and aground.

<http://www.pgecurrents.com/2012/09/07/san-luis-obispo-county-pge-taking-extensive-measures-to-protect-marine-life-in-seismic-testing/>

We are going above and beyond what other companies have implemented to date,” he said.

PG&E continues to take many steps to ensure and improve the safety of its Diablo Canyon Power Plant.

For example, before a survey track begins, a single air gun will sound at a low-level to warn marine life before ramping up to full power. The air gun sound will be managed or reduced based on the proximity of marine mammals to the survey boat. During the survey, a 180-decibel exclusion zone, and an even larger 160-decibel safety zone, will be established around the boat for the protection of marine mammals. The zones were established with help from the National Marine Fisheries Services.

#

14) PG&E expects that there will be marine mammal stranding.

Draft Stranding Response, Diablo Canyon, California (PDF Attached)

#

15) Diablo Canyon Nuclear Power Plant is NOT required to protect the "Nation."

<https://isearch.avg.com/search?cid={F6FBD5A1-DBED-4A16-AAEC-6CE53E47EE33}&mid=c0caaf6c40b547d6aa7141b2e00444d5-9e62f5f3df670fd2b1ece863d50da82cbe1f4817&ds=AVG&lang=en&v=10.2.0.3&pr=pr&d=2011-09-29%2011:12:48&sap=dsp&q=beached+mammals+from+seismic+testing>

U.S. Navy Allowed to Use Sonar That May Harm Whales

Supreme Court Rules in Favor of U.S. Navy

By [Jennifer Kennedy](#), About.com Guide

See More About:

- [whales](#)
- [cetaceans](#)
- [conservation](#)
- [sonar](#)

Updated January 16, 2009

In a case of national security once again trumping the environment, the U.S. Supreme Court ruled on November 12, 2008 that the U.S. Navy could continue using high-powered sonar as part of its training exercises, possibly at the expense of whales and other marine mammals. This decision was made in a case of the Natural Resources Defense Council (NRDC) versus the Navy regarding the Navy's use of sonar in training exercises in southern California. The sonar is used to detect enemy ships, and the Navy argued that the sonar is needed to effectively train and protect the nation.

The decision overturns one made earlier in the year by a federal judge in Los Angeles that was upheld by a U.S. Court of Appeals in San Francisco that required the Navy to suspend the use of sonar if it detected a marine mammal within 2,200 yards, and when sea conditions allowed the sonar to travel farther than usual.

#



pge2012_diablocanyon_stranding_response_draft.pdf

DRAFT Stranding Response Plan

Diablo Canyon, CA

November 1, 2012 through December 31, 2012.

PURPOSE

The purpose of this plan is 1) to ensure efficient responses to and investigation of live and dead stranded marine mammals in the Diablo Canyon area during the seismic survey work to be conducted by Pacific Gas & Electric (PG&E), as authorized under the Marine Mammal Protection Act (MMPA) and Endangered Species Act, and 2) to describe the adaptive management triggers resulting from detection of stranded marine mammals that would require a suspension of seismic airgun activities (additional adaptive management triggers resulting from other monitoring are discussed in other parts of the authorization). Specifically, the plan provides for rapid response to live stranded marine mammals and the timely recovery, necropsy, and examination of dead stranded marine mammals, resulting in appropriate information for the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), the California Department of Fish and Game (CDFG), and other agencies to assess the impacts of the seismic survey work.

BACKGROUND

Strandings

Marine mammal strandings, as defined by the MMPA, have occurred throughout recorded history, although U.S. stranding programs have only been keeping consistent records for (in some cases) the last three decades or (more commonly) the last decade. Strandings may result from many different causes, including infectious agents, biotoxins (usually associated with Harmful Algal Blooms), shark bites, starvation, fishery interactions, ship strikes, unusual oceanographic or weather events, sound exposures, or combinations of these stressors sustained concurrently or in series. In many cases, and for a number of reasons, the cause of a live stranding or death cannot be determined.

There is considerable scientific uncertainty about the behavioral and physiological responses of marine mammals when exposed to unusual stimuli, including airguns. One of the potential responses is a stranding event. Cetacean strandings have been associated with mid-frequency active sonar and underwater detonations; the potential for cetacean strandings to occur during seismic testing activities exists and must therefore be assessed. The responses of other marine mammals to seismic survey airguns are largely unknown. The plan outlined below describes the active monitoring and responses to marine mammal strandings that will be undertaken in the near shore area of the Diablo Canyon seismic survey study area. The goal of the plan is to ensure a rapid response to strandings, to provide information that will be used to assess potential impacts of the seismic survey activity on marine mammals, including whether adaptive management triggers have been reached, and to contribute scientific data that will improve our understanding of why marine mammal strandings occur.

This stranding response plan and adaptive management triggers contained within are part of the required mitigation and monitoring for the seismic study being conducted by PG&E around the Diablo Canyon Power Plant (DCPP), Avila Beach, CA. This plan is specifically intended to outline the requirements of the authorizations

issued by NMFS and USFWS in the event that marine mammal strandings are detected within the seismic study zone during or following the seismic testing. NMFS and USFWS will consider all plausible causes within the course of a stranding investigation, and the development of this plan in no way presumes that any strandings are related to, or caused by, the seismic testing conducted by PG&E, unless and until a determination is made following a Stage 2 investigation as outlined in this plan.

Stranding Network

Pinnipeds and Cetaceans

Response to stranded pinnipeds and cetaceans in California is conducted by members of the California Marine Mammal Stranding Network. There are two stranding network response groups authorized by NMFS for this geographic area. For live animals (primarily pinnipeds, but live cetacean triage and stabilization), the authorized response group is The Marine Mammal Center (TMMC), which has its main campus in the Marin Headlands north of San Francisco, but which maintains a satellite facility in Morro Bay (TMMC-SLO), approximately 45 minutes north of Avila Beach. Rehabilitation of live cetaceans would occur in Santa Cruz, San Diego, or Sausalito (typically a single cetacean each; multiple pinnipeds would be rehabilitated in Sausalito).

The authorized response group for dead cetacean response is the Santa Barbara Museum of Natural History (SBMNH), located in Santa Barbara, which is approximately 2 hours south of Avila Beach. Both groups operate primarily with volunteers with only a few (or 1) paid staff member, and typically handle minimal case loads during this time of year (see Appendix 1 for historical stranding information). Neither organization is well equipped for a drastic increase in the number of stranded animals, particularly with the distances involved to respond to each stranded animal. In addition neither organization has an active beach or near shore surveillance programs. No organization is responsible for assessment of dead pinnipeds, and most of the dead stranded pinnipeds are not examined.

These network participants also work collaboratively with other agencies throughout the region; for example, CDFG personnel in the Morro Bay have historically assisted with pinniped and cetacean strandings, and may be able to provide boat and/or vehicle access to difficult to reach locations during this timeframe.

Sea Otters

The CDFG and the U. S. Geological Survey (USGS) have intensively monitored and studied southern sea otter strandings along the Central California coast for over 40 years. An attempt is made by these groups to verify, examine, and/or collect every stranded sea otter. Under the existing program, dead stranded sea otters are either field necropsied by an experienced CDFG or USGS biologist or collected and examined by a veterinary pathologist at the CDFG Marine Wildlife Veterinary Care and Research Center (MWVCRC) in Santa Cruz. Live stranded sea otters (in the PG&E project area) are collected by the CDFG and/or TMMC and are transferred to the Monterey Bay Aquarium's Sea Otter Research and Conservation (MBA) program for evaluation, care and possible rehabilitation.

MARINE MAMMAL STRANDING RESPONSE AUGMENTATION

Personnel Requirements

To augment local response capabilities, a 2-person trained team (rotating through for two week periods) will be staged on the coast in the geographic area of the proposed seismic survey area. They will rapidly respond to reports of stranded animals and arrange further treatment/assessment/sampling. These teams would receive any reports of strandings (floaters, nearshore or on beach) from the aerial survey teams, the public (via established stranding network hotlines; Appendix 2), or other sources. Notification of strandings would be given following the Communication Plan (Appendix 3). This team will also perform active surveillance, driving or walking stretches of local beach looking for stranded animals on a periodic basis. A minimum of two people at any one time are needed for safety.

Active Surveillance

An active surveillance plan will be implemented to maximize the activities of this two person team. Coordination is planned with the existing stranding network responders (TMMC-SLO and SBMNH) and the Moss Landing Marine Laboratories BeachCOMBERs program, which has volunteers that survey index beaches in the Morro Bay area, as well as with local land management authorities (e.g., State Parks – Environmental Scientists and Rangers) and any aerial survey teams. In addition, up to four sea otter tracking staff working on the USGS-led sea otter monitoring program will be spending considerable time on the coast in the study area and can report any marine mammal strandings.

A seismic study zone is defined as the geographic area from Point Piedras Blancas, San Luis Obispo Co, to Point Arguello, Santa Barbara Co. This area is broader than merely inshore of the seismic survey, as impacted animals may potentially move out of that area and strand to the north or south. This zone may be redefined during the project (expanded or shifted) based upon observations from aerial surveys or animal movement/distribution data. Within the seismic study zone, surveys will be prioritized in areas with higher deposition rates of animals (based upon historic data). These areas include:

- Point Piedras Blancas
- San Simeon
- Cayucos Beach
- Morro Bay area – Morro Rock and Morro Strand
- Montana de Oro State Park
- Avila State Beach
- Pismo State Beach
- Oceano Dunes State Vehicular Recreation Area
- Guadalupe Dunes
- Point Sal State Beach
- Vandenberg Air Force Base – Sherman Creek, San Antonio Creek, Surf Beach, Purisima Point

A comprehensive survey will be undertaken in the 10 days immediately preceding the start of the seismic activities to document and mark all pinniped and cetacean carcasses present on the beach, so that if they are reported again it will be known that they stranded prior to the start of the survey (all sea otter carcasses will be removed or buried, per current sea otter stranding protocols). Potential marking methods include addition of ropes or twine, paint or dye, removal of particular parts, or some other method to be determined; carcasses may also be removed or buried whenever feasible. During the project, the choice of which beach(es) to survey

on a given day will be determined by the 2-person team, and subject to factors such as weather conditions, but the goal will be to cover all of these beaches in a 7-day period (if no stranding response is needed). A survey will consist of walking or slowly driving the beach from one end to the other. Any observed marine mammal strandings will be examined to determine if they were previously detected or if they are new; if new strandings, they would be reported according to the communication protocol (Appendix 3) and an investigation would be started.

The active surveillance and readiness component will also persist past the end of the seismic work to account for animals that may have been impacted at the end of the seismic activities but do not strand until days later. At a minimum, this will be one week after the end of the seismic work. Following this week, the 2-person team will be demobilized and the active surveillance work will be concluded, but the local stranding network responders will continue to respond to all reports of stranded animals, and may complete a detailed investigation.

RESPONSE ACTIONS – PINNIPEDS AND CETACEANS

1. **Initial stranding response** – The 2-person team, acting in coordination with the local stranding network responders, will respond to reports of stranded pinnipeds or cetaceans within the seismic study zone when feasible. All marine mammals that are responded to will receive examination appropriate to the condition code of the animal and the feasibility of the logistics.
 - a. **Dead animals** - Once observed, a dead animal will be recovered (including towed or picked up if observed floating) if feasible. Following recovery, the animal will be removed from the beach for necropsy, or a beach necropsy performed if carcass retrieval is not possible (depending on carcass decomposition and logistics/weather/safety conditions). If possible, necropsies will be done in a laboratory setting following diagnostic imaging (for fresh animals). At the necropsy, samples will be taken and may be shipped to appropriate laboratories for diagnosis.
 - b. **Live animals** - Live animals will be evaluated and determined whether they are rehabilitation candidates, should be released from the scene, or euthanized. Cetaceans will receive auditory evoked potential (AEP) examination(s) when appropriate to determine the hearing capabilities of each animal at stranding or at release according to permit requirements and with approval of the veterinarian. Rehabilitation candidates will require transport to the appropriate rehabilitation facility.
 - c. **Mass strandings or other elevated stranding rates** – If a mass stranding occurs, or if stranding rates are very elevated, additional personnel from other stranding network organizations may be brought in for response or animals transported to more distant necropsy or rehabilitation facilities. Significant additional resources must be made available for both live and dead mass stranding response. Costs would be very high if there is a mass stranding event. Depending on the number of animals that strand and on the veterinary assessment for each, animals may be returned to the water and released, taken to a rehabilitation center, or they may be euthanized or die on the beach or during transport. All dead animals would require a necropsy.
 - d. **Phase 1 investigation** – The Phase 1 investigation refers to the initial investigation on a stranded animal (both alive and dead). The specific assessment performed will depend upon the species, condition code, and logistics, but generally includes the following:

- i. General description of the stranding event (numbers, location, environmental parameters, behavioral assessment of live animals)
 - ii. Live animals – physical examination, morphometrics, photographs, blood work, diagnostics such as AEP or ultrasound
 - iii. Dead animals – external examination, morphometrics, photographs, diagnostic imaging including CT/MRI scans as appropriate and feasible, gross necropsy with internal examination, descriptions, photographs and sample collection
 - iv. Preliminary analysis of information collected during Phase 1
- e. **Phase 2 investigation** – The Phase 2 investigation is a more comprehensive investigation into a stranded animal for purposes of documentation of lesions, determining the cause of stranding or determining the cause of death. Again, the specific assessment will depend upon many factors, and will be informed by the findings obtained during the Phase 1 investigation, but may include:
- i. Further analyses and review of information obtained in Phase 1 (potentially including formation of an expert panel)
 - ii. Histopathology, including special stains where needed
 - iii. Ancillary diagnostics (e.g., PCR for infectious agents, air bubble sampling when emboli were discovered, domoic acid levels)
 - iv. Additional diagnostic imaging as needed
 - v. Histology of ears, where indicated

2. **Adaptive management** - Adaptive management triggers resulting from stranding investigations have been identified. If these triggers are met, suspension of seismic airgun activities will occur. Following suspension of activities, NMFS and our stranding network partners will further evaluate the available information, including new information collected while activities are suspended, and coordinate with PG&E to determine if and how seismic operations may continue. The triggers that have been identified are as follows:

- a. A mass stranding (2 or more animals that simultaneously strand, other than cow-calf pairs) or atypical nearshore milling (aka "near mass stranding") of any cetacean species. At a minimum, the shutdown would continue until the disposition of the animals was complete - this could involve herding offshore, refloating/transporting/herding, transport to rehabilitation, euthanasia, or any combination of the above. Shutdown procedures will remain in effect until NMFS determines that, and advises PG&E that, all live animals have left the geographic area (either of their own volition or following herding).
- b. If 2 cetaceans within one day, 3 or more cetaceans within a week, or 5 or more pinnipeds within a week are newly detected stranded (sick, injured, in need of medical attention, or dead) on the beach or floating incapacitated or dead within the impact zone during the seismic testing period, the following would occur:
 - i. For live stranded animals, the stranding team would attempt to capture the animal and perform a Phase 1 examination (detailed above), including auditory evoked potential (AEP) testing of all odontocetes, and any clinical tests deemed necessary by the attending veterinarian. If the animal(s) are determined to be candidates for immediate release (either from the original stranding location or following transport to a new location), shutdown may be needed until the release is complete. If the animal is determined to be a candidate for rehabilitation and the initial examination is

inconclusive regarding a reason for stranding, Phase 2 investigations (see description above) will be conducted.

- ii. For all dead stranded animals, the stranding team would attempt to recover the carcass(es) and perform a detailed necropsy with diagnostic imaging scans to rule out obvious causes of death (e.g. a Phase 1 investigation, described above), as appropriate given the decomposition state of the animal and other logistical constraints (size, weight, location, etc.). Then, if Phase 1 tests are inconclusive and the animal(s) is (are) in good body condition, Phase 2 investigations will be conducted.
 - iii. In either case, if Phase 2 investigations are warranted for enough animals to meet the initial numerical criteria, seismic testing will be suspended.
- c. Strandings of single marine mammals with signs of acoustic trauma or barotrauma without another etiology would require a suspension.
 - d. A shipstrike of a marine mammal by any of the vessels involved in the seismic testing (including observation vessels) would require a suspension.

- 3. **Final report** - At the end of the survey period, sample and data analyses will be completed and a report will be generated by the SWFSC, SERO, TMMC and SBNHM personnel.

RESPONSE ACTIONS – SEA OTTERS

- 1. **Initial stranding response** – Using the existing network of collaborators, CDFG, USGS, and TMMC will coordinate an efficient, timely response to all reported sea otters strandings.
 - a. **Dead animals** – During the project operation and extending seven days after, all dead stranded sea otters between Point Piedras Blancas (San Luis Obispo County) and Point Arguello (Santa Barbara County) will be collected and transported to the MWVCRC for necropsy. Fresh dead and any tagged (i.e., study animal) dead sea otter will be transported via FedEx overnight shipping or scheduled TMMC transport to the MWVCRC, to ideally arrive within 24 hours of recovery. These fresh and/or tagged cases will receive a detailed necropsy by a veterinary pathologist to determine the cause of death. All non-tagged moderately to severely decomposed sea otters recovered within the study area will be collected, frozen and transported to the MWVCRC for future necropsy. At the necropsy, samples will be taken and may be shipped to appropriate laboratories for diagnosis.
 - b. **Live animals** - Following established protocols, all live stranded sea otters will be collected after consultation with CDFG and/or MBA. TMMC has the trained personnel and equipment to provide timely response and transportation. Once a live sea otter is recovered, MBA will direct the treatment for each case. In general, all live sea otters will be transported to MBA as soon as possible.
 - c. **Phase 1 investigation** – The Phase 1 investigation refers to the initial investigation on a stranded animal (both alive and dead). The specific assessment generally includes the following:
 - i. General description of the stranding event (numbers, location, environmental parameters, behavioral assessment of live animals)

- ii. Live animals – physical examination, morphometrics, photographs, blood work, and appropriate diagnostics.
 - iii. Dead animals – external examination, morphometrics, photographs, gross necropsy with internal examination, descriptions, photographs and sample collection.
 - iv. Assessment of stranding numbers and locations in comparison to historic stranding data for sea otters (corrected for increased search effort) to determine if stranding is unusual.
 - v. Preliminary analysis of information collected during Phase 1
- d. **Phase 2 investigation** – The Phase 2 investigation is a more comprehensive investigation into a stranded animal for purposes of determining the cause of stranding or determining the cause of death. If the Phase 1 investigation identifies a clear cause of death that is not associated with the project, Phase 2 investigation may not be required. The specific Phase 2 assessment will depend upon many factors, and will be informed by the findings obtained during the Phase 1 investigation, but may include:
- i. Further analyses and review of information obtained in Phase 1 (potentially including formation of an expert panel)
 - ii. Diagnostic imaging including CT/MRI scans as appropriate
 - iii. Histopathology, including special stains where needed
 - iv. Ancillary diagnostics (e.g., PCR for infectious agents, air bubble sampling when emboli were discovered, domoic acid levels)
 - v. Additional diagnostic imaging as needed
 - vi. Histology of ears, where indicated
2. **Adaptive management** – For sea otters, permitting documents from the USFWS and CDFG call for suspension of activities only in the case of acute mortality found to be associated with the project. There are no interim adaptive management triggers for harassment of sea otters; the USGS sea otter monitoring program may detect potential effects of the project on otters, but sub-lethal effects are not likely to be evident prior to post-project data analysis. If these acute mortality triggers are met, suspension of seismic airgun activities will occur. Following suspension of activities, USFWS and partner agencies will further evaluate the available information, including new information collected while activities are suspended, and coordinate with PG&E to determine if and how seismic operations may continue. The triggers that have been identified are as follows:
- a. Stranding of a single dead sea otter with signs of acoustic trauma or barotrauma without another etiology (based on Phase 2 investigation above) would require a suspension.
 - b. A lethal shipstrike of a sea otter by any of the vessels involved in the seismic testing (including observation vessels) would require a suspension.
3. **Final report** - At the end of the survey period, sample and data analyses will be completed and a sea otter stranding report will be generated by the CDFG and USGS personnel.

APPENDIX 1

Historical stranding information from the California Marine Mammal Stranding Network and USGS (for sea otters) from the Monterey/San Luis Obispo County line to Point Conception, 1988-2010.

	Species	Total Strandings (1988-2010)			Average Strandings		
		Nov	Dec	Jan	Nov	Dec	Jan
CETACEANS							
	Common Dolphin*	2	2		0.09	0.09	
	Gray Whale	3	0		0.14	0	
	Minke Whale	1	0		0.05	0	
	Northern Right Whale Dolphin	0	1		0	0.05	
	Pacific White-Sided Dolphin	1	0		0.05	0	
	Pygmy Sperm Whale	0	1		0	0.05	
PINNIPED							
	California sea lion	100	86		4.5	3.9	
	Harbor seal	2	1		0.09	0.05	
	Northern elephant seal	9	13		0.41	0.59	
	Northern fur seal	24	3		1.1	0.14	
	Unidentified pinniped	5	5		0.23	0.23	
MUSTELID							
	Southern Sea Otter	108	89	80	4.7	3.9	3.5

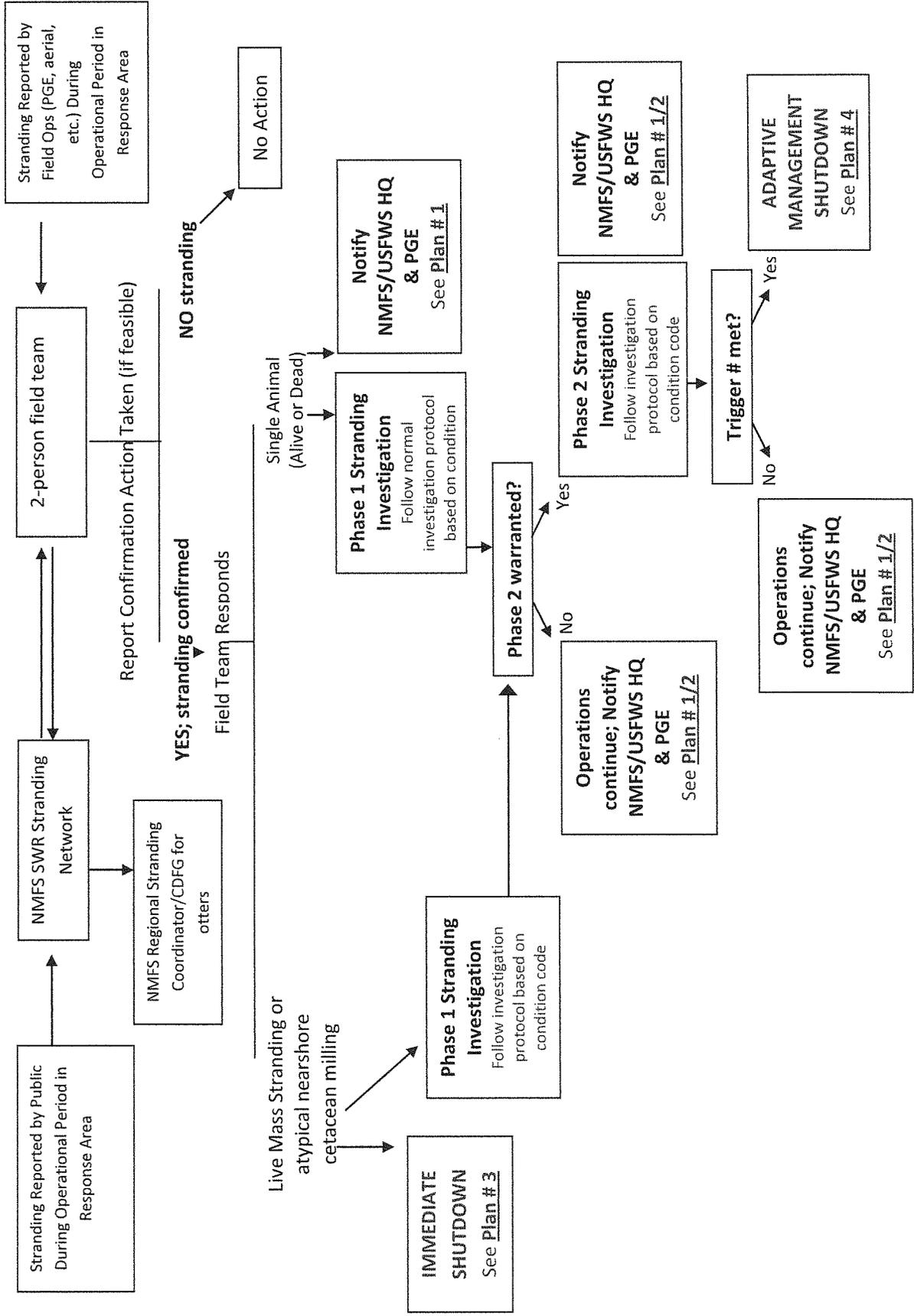
*includes long-beaked, short-beaked, and unidentified common dolphin

APPENDIX 2

Marine mammal stranding response reporting phone numbers.

Field Team:	TBD
Live Marine Mammals (TMMC):	805-771-8300
Dead Pinnipeds or Cetaceans (SBMNH):	805-682-4711 ext. 156
Dead Sea Otters (CDFG):	805-772-1135 (office); 831-212-7090 (mobile)

APPENDIX 3: STRANDING RESPONSE ADAPTIVE MANAGEMENT DURING DCPP SEISMIC WORK DECISION TREE



Fw: From MoCo Board of Supervisors

Dan Buckshi to: cr_board_clerk Clerk Recorder
Cc: Kristi Gutierrez

10/22/2012 05:15 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:14 PM -----

From: "Julie Tacker" <julietacker@charter.net>
To: <dbuckshi@co.slo.ca.us>
Date: 10/18/2012 01:20 PM
Subject: FW: From MoCo Board of Supervisors

Please share the attached with the Board and include it in your staff report for the 30th.
Thanks,



Julie 101212 - CCC LTR re PGE Seismic Study.pdf

Item # 22 Meeting Date: 10/30/2012

Presented by: Julie Tacker

Received prior to meeting and posted to web
on: October 23, 2012

MONTEREY COUNTY



BOARD OF SUPERVISORS

FERNANDO ARMENTA, *Vice Chair, District 1*

LOUIS R. CALCAGNO, *District 2*

SIMÓN SALINAS, *District 3*

JANE PARKER, *District 4*

DAVE POTTER, *Chair, District 5*

October 12, 2012

Mary Shallenberger
Chair, California Coastal Commission
North Central Coast District Office
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

**SUBJECT: PG&E Offshore High-Energy Seismic Study
(November 2012 - Coastal Committee Meeting Agenda Item)**

Dear Chair Shallenberger:

On behalf of the Monterey County Board of Supervisors, I am writing to express our concerns regarding the Pacific Gas & Electric (PG&E) proposal for offshore high-energy seismic study near the Diablo Canyon Power Plant.

While we are concerned with the seismic safety of the region surrounding PG&E's Diablo Canyon Nuclear facility, those concerns must be balanced with the disturbance of marine mammals and fish in the environmentally sensitive survey areas.

PG&E plans to use the research vessel *Langseth* to tow an array of air guns through the waters that include two state marine protected areas which is adjacent to the Monterey Bay National Marine Sanctuary, the largest national marine sanctuary and one of the largest marine protected areas in the United States. The air guns emit loud sounds into the ocean that penetrate Earth's crust resulting in three-dimensional images of the earthquake faults near Diablo Canyon which are intended to give seismologists a better picture of the seismic danger facing the nuclear power plant. However, dozens of endangered species use these waters and the loud sounds emitted by the air guns could injure marine wildlife or drive it away from the area (McCauley, R.D. et al 2000).

One of the main concerns is that the high-energy sound blasts could disturb and/or damage animal life, particularly cetaceans such as whales, porpoises and dolphins, all of which use the area off of the Central Coast as a migratory route to and from their annual feeding and birthing areas. Marine mammals such as whales, porpoises and dolphins use sonar and hearing to navigate and communicate, such seismic testing could damage their sensitive systems leading them off-route and possibly missing critical milestones along their routes putting them at risk to be in the wrong areas at the wrong time of the year.

We request that PG&E seek alternatives to the manner in which it researches potential seismic safety concerns so that to the maximum degree practical these efforts protect and respect the marine protected areas and Monterey Bay National Marine Sanctuary, thereby preserving the environment and economic viability of our pristine coastal areas while simultaneously safeguarding the public.

Sincerely,



Dave Potter, Chair
Monterey County Board of Supervisors

cc: Congressman Sam Farr
Senator Dianne Feinstein
Senator Barbara Boxer
Governor Gerald Brown
Assembly Member Luis Alejo
Assembly Member Bill Monning
Senator Anthony Cannella
Senator Sam Blakeslee
John Laird – Secretary, California Resources Agency
Monterey County Board of Supervisors
Lew C. Bauman – CAO, Monterey County
Charles J. McKee – County Counsel, Monterey County
Benny Young – Director, Resources Management Agency, Monterey County
Nicholas E. Chiulos – Director, Intergovernmental & Legislative Affairs, Monterey County
Clerk of the Board, Monterey County
John E. Arriaga – JEA & Associates
Brent R. Heberlee – Nossaman LLP

To: cr_board_clerk Clerk Recorder/ClerkRec/COSLO@Wings,
Cc: Kristi Gutierrez/Admin/COSLO@Wings,
Bcc:
Subject: Fw: PGE HESS comments
From: Dan Buckshi/Admin/COSLO - Monday 10/22/2012 05:16 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:16 PM -----

From: hunter kilpatrick <morrobayhunter@yahoo.com>
To: "dbuckshi@co.slo.ca.us" <dbuckshi@co.slo.ca.us>
Cc: "fmecham@co.slo.ca.us" <fmecham@co.slo.ca.us>, "bgibson@co.slo.ca.us" <bgibson@co.slo.ca.us>, "ahill@co.slo.ca.us" <ahill@co.slo.ca.us>, "pteixeira@co.slo.ca.us" <pteixeira@co.slo.ca.us>, "jpatterson@co.slo.ca.us" <jpatterson@co.slo.ca.us>
Date: 10/18/2012 09:48 PM
Subject: PGE HESS comments

I am respectively submitting the attached comments on the proposed PGE HESS for consideration in the October 30th Board of Supervisors meeting. I request that the SLO Board of Supervisors respect the comments of their constituents and submit a letter to the California Coastal Commission supporting the denial of the permit. Please join our neighbors in Monterey County and the residents of Morro Bay and make the public statement that this test as designed must not be permitted and that PGE must reapply once further baseline information is available and currently acquired data and past data is thoroughly reviewed and analyzed as per AB 1632 and the CEC analysis report.

Hunter Kilpatrick
Central Coast Director
California Gray Whale Coalition

(805) 772-7501



Submission to SLO BOS.pdf

Item # 22 Meeting Date: 10/30/2012

Presented by: Hunter Kilpatrick

Received prior to meeting and posted to web
on: October 23, 2012



CALIFORNIA GRAY WHALE COALITION

PROTECTING THE MOST ANCIENT BALEEN WHALE ALIVE TODAY

P. O. Box 50939 Palo Alto, CA 94303 Ph: 650 322 4729

Email: info@californiagraywhalecoalition.org • www.californiagraywhalecoalition.org

18/10/2012

Dear Supervisor:

I respectfully am requesting the San Luis Obispo County Board of Supervisors to withdraw their conditional support of the proposed HESS project application and to issue a statement against project for the following reasons:

- The IHA is incomplete
 - California Gray whales will be migrating
 - Ignored in the take estimates and assumed to not be in the area and not endangered
 - 191 counted last year in December – documented ACS census (see attached)
 - Western Gray Whales
 - Highly endangered population with approx. 110 individuals left on the planet
 - 14 known to be migrating using the eastern migration route to lagoons in Mexico last year (greater than 10% of existing stock)
 - Documented photographic ID (see attached)
 - Migrating Northern Elephant Seals
 - Majority of population will be migrating through these waters in late November through mid-December to rookeries on the channel Islands
 - Pregnant females and bulls
 - Diversion of migration will cause births at sea and loss of newborns
 - Will force individuals into deeper waters lacking coastal protection from predators and be forced away from food sources
 - Stress and avoidance of sound will cause haul out on unsafe locations
 - IHA assumes the Sea Otters will leave the area for safety
 - Mothers with newborn pups will not be able to feed or flee
 - Starvation and disease will created great distress, harm and loss
 - California Sea Lions and Harbor Seals will be chased out of the water for at least 2 weeks
 - Causing malnutrition and illnesses
 - Invertebrates and Rock Fish can't just leave

- Only fish that might be able to get out of the way are non-resident pelagic's
- IHA is assuming only "harassment Level B take"
 - Relocation, hauling out, forced into predatory water, disorientation, disruption or breeding and normal behavior will cause stress, malnutrition, injury, harm and mortality
 - **Clearly Level A Take** not Level B minor harassment
 - Application is for wrong "Take"
 - Clear violation of MMPA
- Mitigation plan is ineffective
 - Weekly aerial surveys over small area and on board observers will not see anything until it is already in harms way, already harmed or injured, and only properly could be spotted during daylight hours
 - Marine mammals migrating often cover great distance under the surface and will not be spotted
 - Diversion of normal migration routes will cause predation and harm
 - Sea Otter mitigation will only show damage done not prevent harm and take
- Sound will travel hundreds of miles and still be 120db as far away as 58.95 miles according to PGE report
 - Not taking in to count reflection of sea mount and through thermal inclines
- Scope of project has changed drastically since original application and new application reflecting the current project must be submitted
- EIR that was certified by California State Lands Commission is flawed, inaccurate and incomplete for same reasons and must be decertified and therefore not assumed to be valid by NMFS
- New project does not include the area of most concern
 - Shoreline and San Luis fault zones
 - Future projects must not be taken in to consideration as this IHA will expire and must be reapplied for at a future time
- Existing data and newly acquired data has yet to be thoroughly reviewed and analyzed as per AB1632 and the SEC analysis of AB1632
 - Current low energy 3d survey has just been completed and PGE has commented to California Fish and Game will take at least one year to analyze
 - This data may produce the needed answers and therefore make the proposed project redundant and unnecessary
- The current project has changed significantly from the original and must be reapplied for
 - The greater good and concern for public safety will not be met with the reduced plan
 - The potential for biological and ecosystem damage is greater than the minimum if any gain that will result in this greatly reduced project

The proposed HESS is a flawed plan with incomplete application data and may prove to be unnecessary after recently acquired data and existing data are properly reviewed and analyzed as per AB1632 and CEC analysis. The Take permit is inaccurate and the wrong permit is applied for. For these reasons, the take and potential harm, injury and mortality of marine mammals may prove to be unnecessary and therefore avoidable and any permitting at this time will be in direct violation of the MMPA. Highly endangered species and many other species will be put at harm and at risk for Level A take.

The risk to an entire ecosystem is too great and the potential for a greater gain is too little to permit at this time.

Please urge PGE to complete the studies currently in progress before progressing to such a potentially damaging and destructive method of gaining what could be redundant, incomplete and unnecessary data.

I would be happy to meet with any supervisors to clarify or provide further information.

Sincerely,

Hunter Kilpatrick
Hunter Kilpatrick
Central Coast Director
California Gray Whale Coalition
805-772-7501
morrobayhunter@yahoo.com

Fw: Surfrider Foundation information for Supervisor's information packet, Oct 30th meeting

Dan Buckshi to: cr_board_clerk Clerk Recorder

10/22/2012 05:19 PM

Cc: Kristi Gutierrez

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:19 PM -----

From: Brad Snook <snookbw@yahoo.com>
To: dbuckshi@co.slo.ca.us
Cc: Stefanie Sekich <ssekich@surfrider.org>, jennifer jozwiak <girlonabike@hotmail.com>, jennifer jozwiak <girlonabike@hotmail.com>, Carol Georgi <cdgeorgi@hotmail.com>, Melissa Latimer <melissa.latimer@merial.com>, chair@surfrider.org, Bruce Gibson <bgibson@co.slo.ca.us>
Date: 10/19/2012 09:14 AM
Subject: Surfrider Foundation information for Supervisor's information packet, Oct 30th meeting

Please include attached materials for consideration of County Board of Supervisors in their October 30th meeting.

Thank you!

Brad Snook
Chair, Surfrider SLO



Recreational impacts DCPD factsheet.pdf

Item # 22 Meeting Date: 10/30/2012

Presented by: Brad Snook

Received prior to meeting and posted to web on: October 23, 2012

Recreational Impacts from PG&E's Seismic Testing

Seismic testing has the potential to adversely impact recreational ocean users, including fishers, divers, swimmers and surfers during active testing, which will take place for 42 consecutive days. PG&E's Environmental Impact Report (EIR) clearly states seismic testing can impact humans:

"The proposed offshore activities *would* expose persons present in the water to harmful noise levels..."

"Studies have shown that high levels of underwater noise can cause dizziness, hearing damage, or other sensitive organ damage to divers and *swimmers*, as well as indirect injury due to startle responses"

"Noise levels in excess of 154 dB re 1 μ Pa could be considered potentially harmful to recreational divers *and swimmers* in the Project area".¹

A study conducted by U.S. Navy concluded that 145 dB is a safe level for humans, stating:

"In June 1999 NSMRL set interim guidance for the operation of low frequency underwater sound sources in the presence of recreational divers at 145 dB... Based on this guidance, the operation of the SURTASS LFA sonar will be restricted in the vicinity of known recreational and commercial diving so that **sound levels will not exceed 145 dB**".²

There is a clear case for serious concern. The Central Coast area between Cayucos and Oceano is very popular for ocean recreation (diving, swimming, fishing, surfing, etc.).

It is equally concerning that PG&E has presented contradictory information about allowed recreational uses and potential impacts to ocean users. Moreover, the FEIR lacks pertinent information about impacts to ocean users. That information was only ascertained after Coastal Commission Staff requested PG&E to provide supplemental materials.

PG&E's Inconsistency

PG&E's inconsistency about recreational uses/impacts was revealed when the Surfrider Foundation submitted a comment letter on the DEIR stating that PG&E overlooked the safety of swimmers and surfers. In Volume I of the FEIR, PG&E responded directly to Surfrider's concerns, with the below statement:

"In response to this and other related comments...MM LU-1 has been revised to include noticing beaches and local dive shops ***regarding offshore areas closed to diving, surfing, and swimming.***"³

Based on this statement, it seems clear that diving, surfing, and swimming will not be allowed within Project zone. However, in the FEIR, PG&E only addresses the prohibition of diving and is *clearly disregarding the safety of other ocean users.*

Another example of inconsistent information is that PG & E failed to include data and

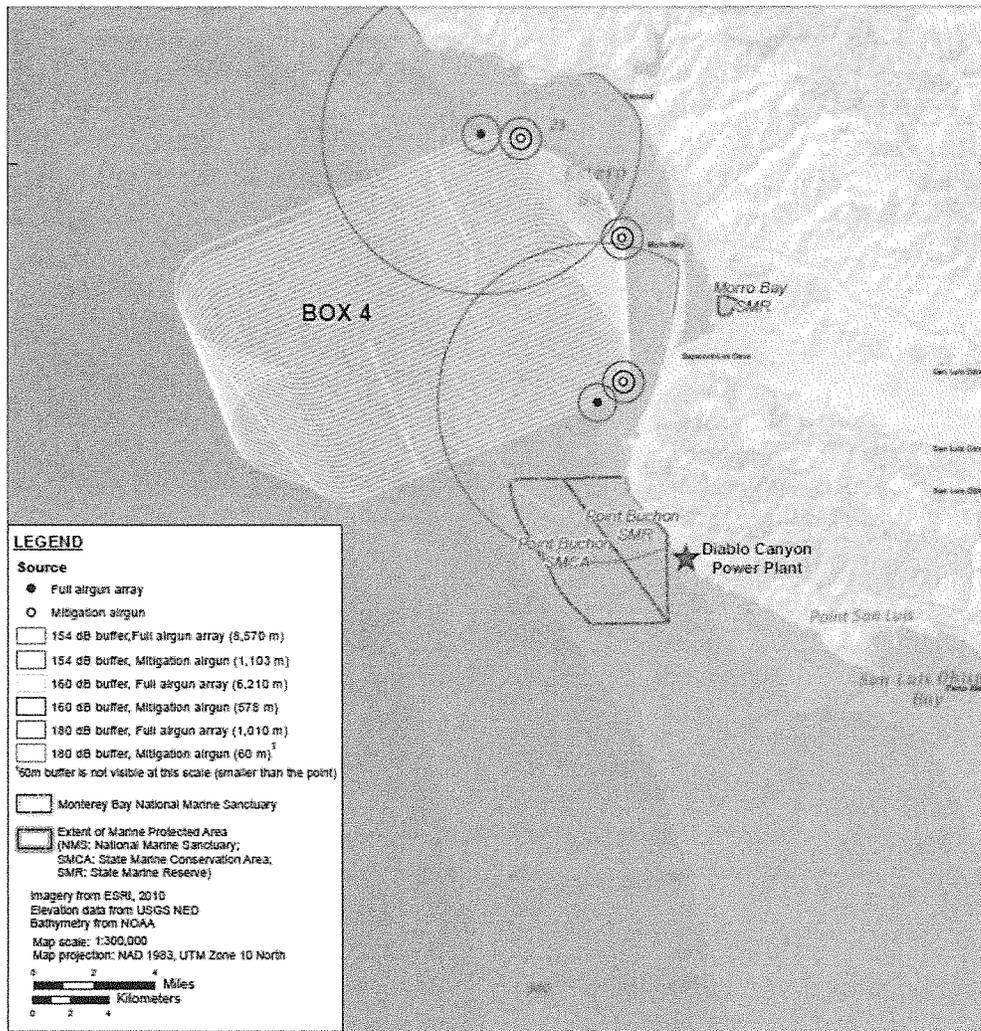
¹ http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/PDF/FEIR_4.11_NOISE.pdf

² <http://www.surtass-lfa-eis.com/DiverStudies/index.htm>

³ [http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/FEIR_Comments/FEIR_RTCs_NGOs_\(13of14\)_Surfrider.pdf](http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/FEIR_Comments/FEIR_RTCs_NGOs_(13of14)_Surfrider.pdf)

maps regarding impacts to ocean users in the FEIR. The Surfrider Foundation had questions about how close will the vessel/air guns would be to shore; and also questioned what the instantaneous decibel (dB) exposure levels would be to nearshore environments. Since the information was not apparent in the EIR, Surfrider contacted Coastal Commission Staff asking for clarification.

In order to answer the questions, Coastal Commission Staff had to request additional information from PG&E. Coastal Commission Staff then provided Surfrider with maps that illustrated **dB levels could reach 160 dB at some beaches (yellow circles), which exceeds the human safety threshold of 145-155 dB.** As mentioned above, the Navy uses 145 dB as a threshold and PG&E uses 155dB as the threshold in their EIR.



A final example of PG&E not providing adequate information is reflected by the fact that Volume I of the EIR lacks an updated Expanded Project Description. The Expanded Project Description contains information about how dB levels travel to nearshore environments. Once again, this information was obtained only after Surfrider had questions and Coastal Commission Staff provided the new document. The document contains important information and calculations on sound propagation models. When analyzing the upslope sound propagation, it's clear that dangerous dB levels could come close to nearshore environments. For example, the below chart illustrates that dB levels could reach 190 at 0.13 nautical miles (which is equivalent to 789 ft offshore.)

Sound Pressure Level (SPL) (dB re 1 uPa)	Upslope Distance (In Shore)			Downslope Distance (Offshore)			Alongshore Distance		
	M ¹	SM ²	NM ³	M ¹	SM ²	NM ³	M ¹	SM ²	NM ³
190	250	0.16	0.13	280	0.17	0.15	320	0.20	0.17
187	390	0.24	0.21	370	0.23	0.20	410	0.25	0.22
180	1,010	0.63	0.55	700	0.43	0.38	750	0.47	0.40
170	2,990	1.86	1.61	1,760	1.09	0.95	1,760	1.09	0.95
160	6,210	3.86	3.35	4,450	2.77	2.40	4,100	2.55	2.21
154	8,570	5.33	4.63	7,820	4.86	4.22	6,780	4.21	3.66
120	24,650	15.32	13.31	251,320	156.16	135.70	94,870	58.95	51.23

M¹ = Meters; SM² = Statute miles; NM³ = Nautical Miles

4

It is extremely important to stress that PG&E is not providing critical information in the FEIR that is required to understand dangerous noise impacts to ocean users. Given the lack of data, PG&E should be applying the precautionary principle when analyzing potential for dangerous impacts to ocean users from seismic testing.

Other Recreational Impacts:

Recreational fishing and boating will be prohibited during testing. This is a clear violation of the following sections of the Coastal Act.

- **Section 30220—Protection of certain water-oriented activities--** Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.
- **Section 30224—Recreational boating use; encouragement; and facilities.** Increased recreational boating use of coastal waters shall be encouraged...
- **Section 30234.5—Economic and Recreational Importance of Fishing.** The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.
- **Section 30210 Access; recreational opportunities; posting** In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.

PG&E's FEIR also mentions impacts to onshore recreation:

"Recreationists hike along trails that overlap with or cross the Accelerated Weight Drop (AWD) and Vibroseis seismic transects, (e.g., the Point Buchon trail, which goes to Point Buchon along the coast, just south of Montaña de Oro State Park; and the Pecho Coast Trail, which follows the coastline beginning at the Port San Luis Harbor, and heads past the Point San Luis lighthouse)".

"The onshore seismic surveys would use and cross over sections of hiking trails... if hikers were to encounter the seismic equipment they would be able to hike around the equipment."

While onshore recreation will not come to a complete stand still, these recreational impacts conflict with the following section of the Coastal Act:

⁴ Central Coastal California Seismic Imaging Project 1.0 Expanded Project Description Revision No. 8 8-30-2012

- **Section 30223—Upland Areas.** Upland areas necessary to support coastal recreational uses shall be reserved for such uses, where feasible.

In conclusion, the proposed seismic testing will impact recreational users (both onshore and offshore). PG&E has provided inconsistent information about allowed recreational uses and is culpable of potentially exposing recreationalists to harmful dB levels in nearshore waters (especially to swimmers and surfers). PG&E has not provided adequate (or updated) information in their FEIR, and others have had to go to great lengths to ascertain potential impacts to ocean users.

Fw: Letter to SLO County Board of Supes on PGE Seismic Testing

Dan Buckshi to: cr_board_clerk Clerk Recorder
Cc: Kristi Gutierrez

10/22/2012 05:20 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:20 PM -----

From: "Mary E. Webb" <maryewebb@charter.net>
To: <dbuckshi@co.slo.ca.us>
Date: 10/19/2012 09:14 AM
Subject: FW: Letter to SLO County Board of Supes on PGE Seismic Testing

Please let me know that you have received this electronic mail. Thanks!

From: Mary E. Webb [mailto:maryewebb@charter.net]
Sent: Friday, October 19, 2012 9:14 AM
To: boardofsups@co.slo.ca.us
Cc: 'Jerry Gruber'; 'Board'; 'georgem@moonstonehotels.com'; 'bhensley@thetribunenews.com'; 'skniffen1@charter.net'; 'clbartist@gmail.com'; 'sansimeonlodge@earthlink.net'; 'lputnam@hearstcastletheater.com'; 'info@cambriachamber.org'; 'mmccolloch@yahoo.com'; 'Marjorie Ott'
Subject: Letter to SLO County Board of Supes on PGE Seismic Testing

Good morning,

We understand the SLO County Board of Supervisors will make recommendations to the CA Coastal Commission regarding this Seismic Testing project at their Oct. 30 meeting. Greenspace - the Cambria Land Trust, in unity with Commercial and Recreational Fisherman, NRDC, the Ocean Conservancy, Greenpeace, Save the Whales, the Morro Bay Harbor, the Sierra Club and many other organizations, agencies and nonprofits in SLO County oppose this project.

Over 80,000 people have signed 3 or more circulating petitions opposing Seismic Testing on the Central Coast of California. We urge the Board of Supervisors and your organizations to protect the outstanding resources the Central Coast has to offer, which attract visitors from all over the world.

Thank you for your consideration,
Mary Webb, on behalf of the Board of Directors of

Greenspace -the Cambria Land Trust

Greenspace Seismic Testing SLOCounty.pdf

101212 - CCC LTR re PGE Seismic Study.pdf

PGE Box 2.pdf

PGE box 4.pdf

PGE Map.pdf

Item # 22 Meeting Date: 10/30/2012

Presented by: Mary Webb

Received prior to meeting and posted to web
on: October 23, 2012



October 19, 2012

SLO County Board of Supervisors
boardofsups@co.slo.ca.us
dbuckshi@co.slo.ca.us

By Electronic Mail

**RE: Marine Geophysical Survey off the Central Coast of California,
November to December, 2012**

Greenspace Mission: The North Coast area of San Luis Obispo County is a national treasure. Greenspace will protect and enhance its ecological systems, cultural resources and marine habitats through land acquisition and management, public education and advocacy.

Thank you for considering this critical project that will negatively impact local coastal resources, businesses, tourism, commercial and recreational fishing, and enjoyment of the waters along our coast. Greenspace was an active advocate for the establishment of Marine Protected Areas for the Central Coast. Pt. Piedras Blancas State Marine Reserve, the Cambria State Marine Park, White Rock (Cambria) State Marine Conservation Area, Pt. Buchon State Marine Reserve and Pt. Buchon State Marine Conservation Area were created under the MLPA as areas for habitat protection and ecosystem based management of species. This project affects these Marine Protected Areas.

Thanks to a decision by CA State Lands Commission and increasing citizen awareness and opposition this project has been significantly reduced in size and scope. Northern Zone Box 3 (Cambria State Marine Park and White Rock State Marine Conservation Area) was eliminated, the time frame was reduced to Nov. 1 thru Dec. 31, 2012, and the project will be phased over several years. Boxes 1 and 2 have been deferred and will be scheduled for the 2013-2014 work window (if approved by the CA Coastal Commission Nov. 14, 2012). Refinement of the Box 1 and 2 survey components will be completed following the 2012 survey and will be subject to a supplemental review process. (see attached map)

The most recent report now describes the proposed 3D seismic survey race track to be completed during the 2012 survey period will be Box 4 which is located within Estero Bay. However, the CA Coastal Commission will not be making a decision on this project until November 14, 2012. Therefore, this year's project activities (if approved) are being squeezed into a very short timeframe of November 19 –December 31, 2012.

Central Coastal California Seismic Imaging Project 1.0 Expanded Project Description Revision No. 9 9-28-2012.

This project is constantly changing and has been significantly reduced in size and scope at every level of agency permitting due to new findings of negative impacts to marine life, ecosystems and people. At the same time, agencies created to protect marine life are scrambling to try to perform baseline studies that should have been completed before low intensity surveys were conducted last year. These baseline studies that are designed to protect marine life should not be rushed in order to meet a deadline that has now been shown to be false. (PGE Safety Committee statement 10/10/12). The results of low intensity surveys have not been analyzed and made public.

New information includes:

- Senate Bill AB 1632 does not mandate that Seismic Tests be conducted in order to relicense Diablo Nuclear plant.
- Supervisor Bruce Gibson opposes this project as designed (10/17/12 NCAC).
- North Coast Advisory Council unanimously opposes this project as designed 10/17/12.
- Less intensive alternatives exist to High Energy Seismic surveys but have not been analyzed. Greenspace comments to NOAA October 15, 2012 have not received response.
- Inconsistencies exist between the State EIR and Federal EIS especially in regard to “Level A take” versus “Level B harassment” of Marine Mammals.
- San Simeon Community Services District opposes Seismic Testing (SS CSD 10/10/12)
- Monterey City Council opposes Seismic Testing (letter attached)
- Morro Bay City Council opposes Seismic Testing (9/11/12)

Greenspace respectfully requests that this project be denied as designed, and that more analysis and effort be directed toward alternatives that exist to High Energy Seismic Surveys.

Sincerely,

Mary Webb VP
Greenspace – the Cambria Land Trust

Richard Hawley, Exec. Director
Greenspace-the Cambria Land Trust

cc: Board Cambria Community Services District board@cambriaacd.org
General Mgr. Jerry Gruber jgruber@cambriaacd.org
Cambria Chamber of Commerce
North Coast Advisory Council

MONTEREY COUNTY



BOARD OF SUPERVISORS

FERNANDO ARMENTA, *Vice Chair, District 1*

LOUIS R. CALCAGNO, *District 2*

SIMÓN SALINAS, *District 3*

JANE PARKER, *District 4*

DAVE POTTER, *Chair, District 5*

October 12, 2012

Mary Shallenberger
Chair, California Coastal Commission
North Central Coast District Office
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

**SUBJECT: PG&E Offshore High-Energy Seismic Study
(November 2012 - Coastal Committee Meeting Agenda Item)**

Dear Chair Shallenberger:

On behalf of the Monterey County Board of Supervisors, I am writing to express our concerns regarding the Pacific Gas & Electric (PG&E) proposal for offshore high-energy seismic study near the Diablo Canyon Power Plant.

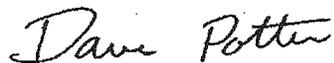
While we are concerned with the seismic safety of the region surrounding PG&E's Diablo Canyon Nuclear facility, those concerns must be balanced with the disturbance of marine mammals and fish in the environmentally sensitive survey areas.

PG&E plans to use the research vessel *Langseth* to tow an array of air guns through the waters that include two state marine protected areas which is adjacent to the Monterey Bay National Marine Sanctuary, the largest national marine sanctuary and one of the largest marine protected areas in the United States. The air guns emit loud sounds into the ocean that penetrate Earth's crust resulting in three-dimensional images of the earthquake faults near Diablo Canyon which are intended to give seismologists a better picture of the seismic danger facing the nuclear power plant. However, dozens of endangered species use these waters and the loud sounds emitted by the air guns could injure marine wildlife or drive it away from the area (McCauley, R.D. et al 2000).

One of the main concerns is that the high-energy sound blasts could disturb and/or damage animal life, particularly cetaceans such as whales, porpoises and dolphins, all of which use the area off of the Central Coast as a migratory route to and from their annual feeding and birthing areas. Marine mammals such as whales, porpoises and dolphins use sonar and hearing to navigate and communicate, such seismic testing could damage their sensitive systems leading them off-route and possibly missing critical milestones along their routes putting them at risk to be in the wrong areas at the wrong time of the year.

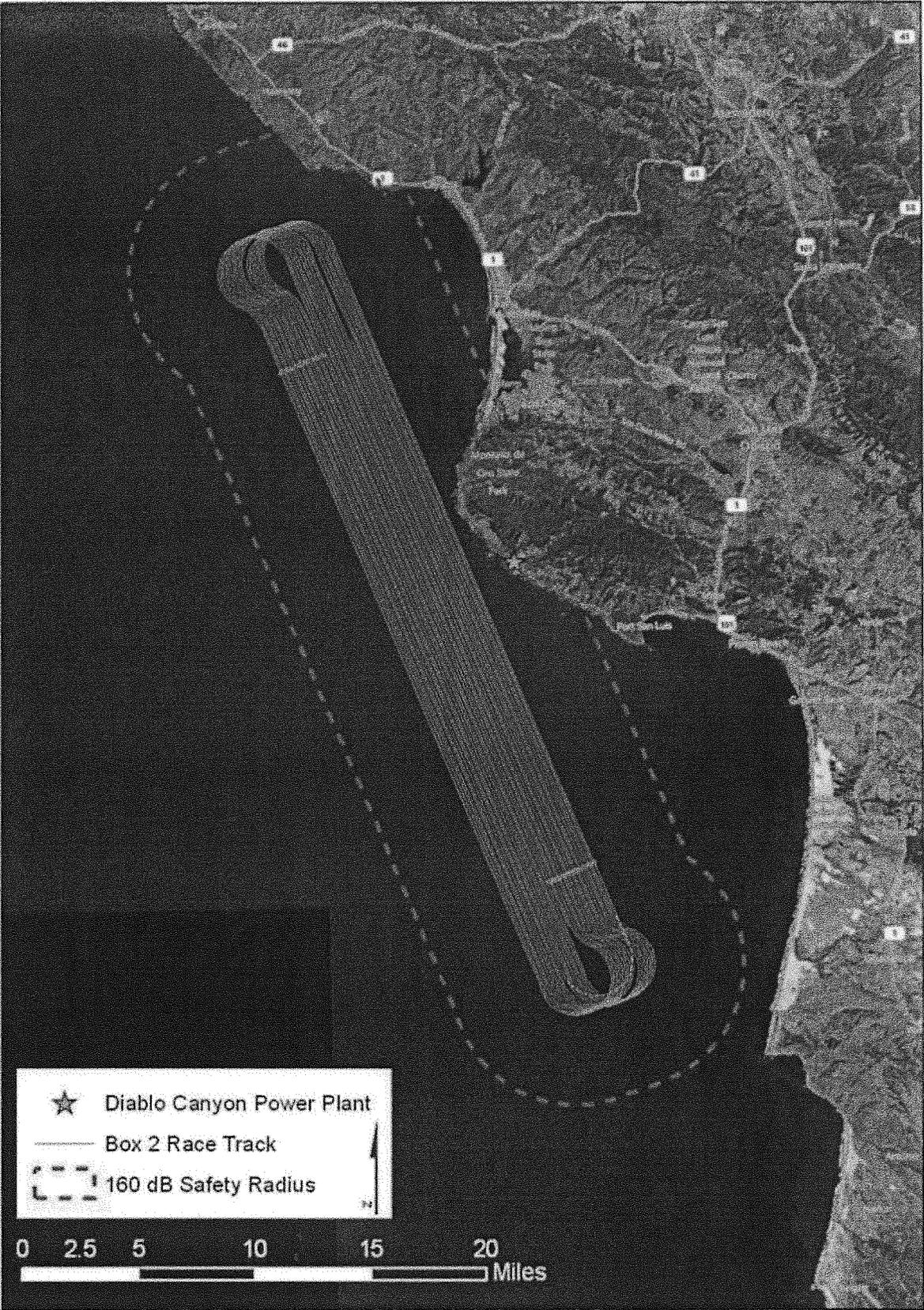
We request that PG&E seek alternatives to the manner in which it researches potential seismic safety concerns so that to the maximum degree practical these efforts protect and respect the marine protected areas and Monterey Bay National Marine Sanctuary, thereby preserving the environment and economic viability of our pristine coastal areas while simultaneously safeguarding the public.

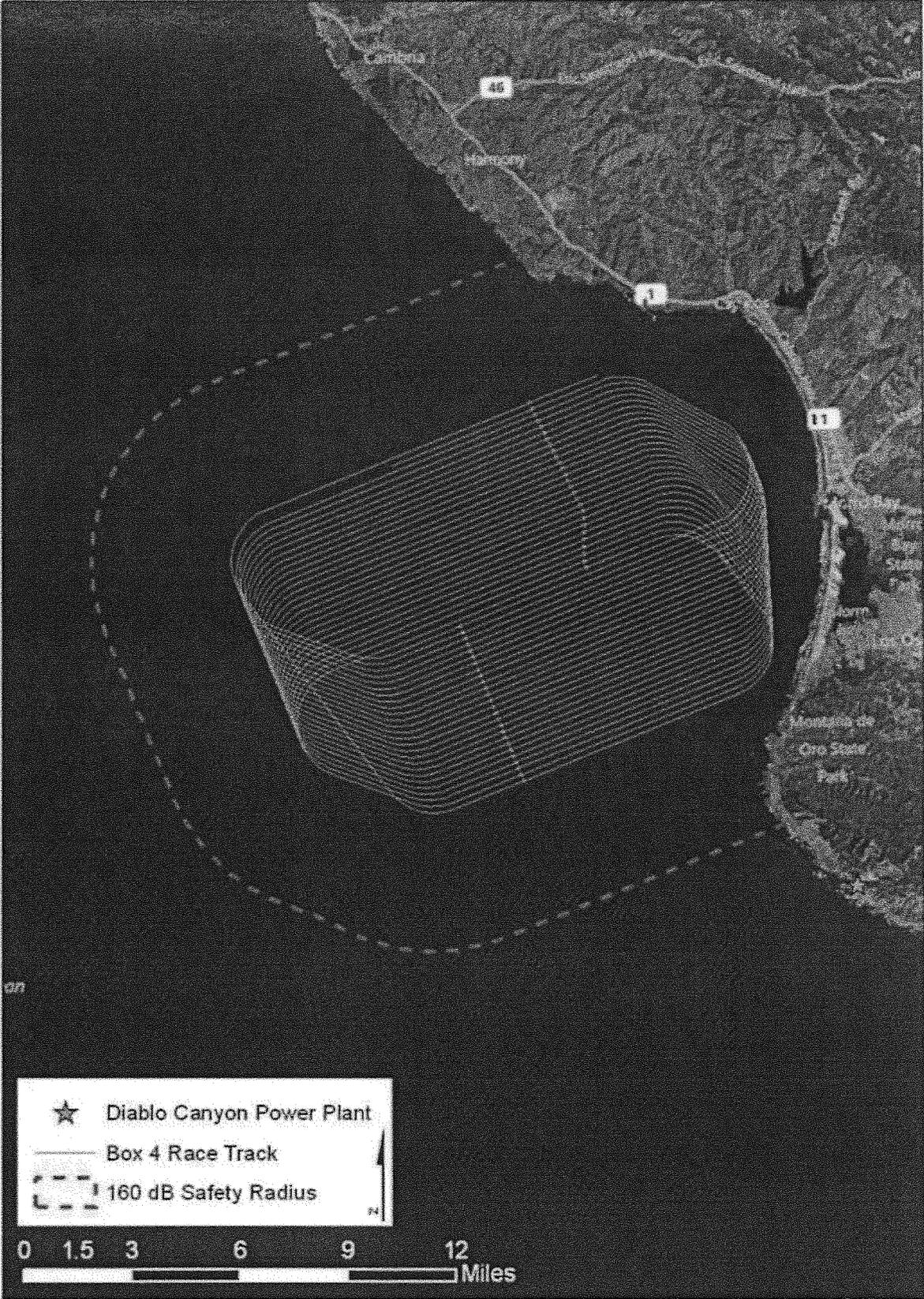
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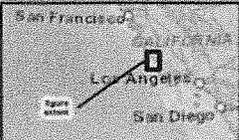
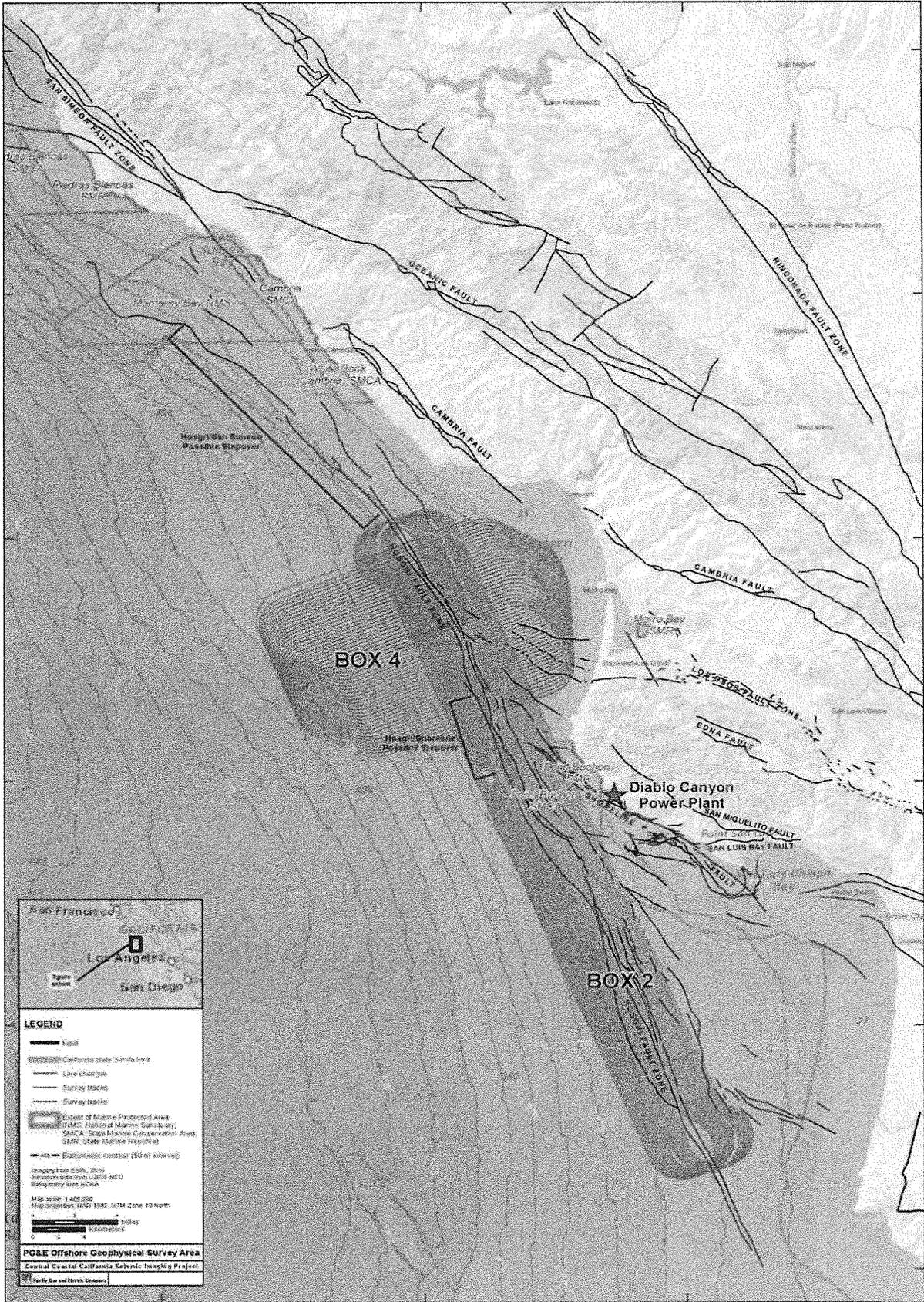


Dave Potter, Chair
Monterey County Board of Supervisors

cc: Congressman Sam Farr
Senator Dianne Feinstein
Senator Barbara Boxer
Governor Gerald Brown
Assembly Member Luis Alejo
Assembly Member Bill Monning
Senator Anthony Cannella
Senator Sam Blakeslee
John Laird – Secretary, California Resources Agency
Monterey County Board of Supervisors
Lew C. Bauman – CAO, Monterey County
Charles J. McKee – County Counsel, Monterey County
Benny Young – Director, Resources Management Agency, Monterey County
Nicholas E. Chiulos – Director, Intergovernmental & Legislative Affairs, Monterey County
Clerk of the Board, Monterey County
John E. Arriaga – JEA & Associates
Brent R. Heberlee – Nossaman LLP







LEGEND

- Fault
- California state boundary
- Live changes
- Survey tracks
- Survey tracks
- Coast of Marine Protected Area (FMS, National Marine Sanctuary, SMCA, State Marine Conservation Area, SMR, State Marine Reserve)
- Bathymetric contour (100 m interval)

Imagery from 2016, 2018
 Contour: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000
 Bathymetry from NOAA

Map scale: 1:400,000
 Map projection: NAD 1983, UTM Zone 10 North

0 1 2 3 4
 Miles
 0 1 2 3 4
 Kilometers

PG&E Offshore Geophysical Survey Area
 Central Coastal California Seismic Imaging Project

PG&E Energy Services

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To: <boardofsups@co.slo.ca.us>, <dbuckshi@co.slo.ca.us>, "Cherie Aispuro" <caispuro@co.slo.ca.us>
Cc: "Jerry Gruber" <JGruber@cambriacsd.org>, "Board" <board@cambriacsd.org>, <georgem@moonstonehotels.com>, <bhensley@thetribunenews.com>, <skniffen1@charter.net>, <clbartist@gmail.com>, <sansimeonlodge@earthlink.net>, <lputnam@hearstcastletheater.com>, <info@cambriachamber.org>, <mmccoloch@yahoo.com>, "Marjorie Ott" <info@olalieberry.com>
Date: 10/19/2012 10:02 AM
Subject: RE: Letter to SLO County Board of Supes on PGE Seismic Testing

Attached is a revision to Greenspace letter – it was the Monterey County Board of Supervisors (letter was incorrect) who wrote a letter opposing.
Thanks and please let me know you received this.
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Greenspace –the Cambria Land Trust rev. Greenspace Seismic Testing SLOCounty.pdf

Item # 22 Meeting Date: 10/30/2012
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101212 - CCC LTR re PGE Seismic Study.pdf



October 19, 2012

SLO County Board of Supervisors
boardofsups@co.slo.ca.us
dbuckshi@co.slo.ca.us

By Electronic Mail

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cc: Board Cambria Community Services District board@cambriacsd.org
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Cambria Chamber of Commerce
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MONTEREY COUNTY



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October 12, 2012

Mary Shallenberger
Chair, California Coastal Commission
North Central Coast District Office
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

**SUBJECT: PG&E Offshore High-Energy Seismic Study
(November 2012 - Coastal Committee Meeting Agenda Item)**

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Nicholas E. Chiulos – Director, Intergovernmental & Legislative Affairs, Monterey County
Clerk of the Board, Monterey County
John E. Arriaga – JEA & Associates
Brent R. Heberlee – Nossaman LLP

Fw: seismic resolution's

Dan Buckshi to: cr_board_clerk Clerk Recorder
Cc: Kristi Gutierrez

10/22/2012 05:24 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:24 PM -----

From: "Julie Tacker" <julietacker@charter.net>
To: <dbuckshi@co.slo.ca.us>
Date: 10/19/2012 12:33 PM
Subject: seismic resolution's

Mr. Buckshi,

Here are two community's positions against seismic testing. Please include them in the staff report for the 30th.

Thanks,

Julie



reso.sesmic.121013.pdf



Seismic Reso_City of Morro Bay.pdf

Item # 22 Meeting Date: 10/30/2012

Presented by: Julie Tacker

Received prior to meeting and posted to web
on: October 23, 2012

RESOLUTION NO.12-354

RESOLUTION OF THE BOARD OF DIRECTORS
OF THE SAN SIMEON COMMUNITY SERVICES DISTRICT
OPPOSING THE CENTRAL COASTAL CALIFORNIA
SEISMIC IMAGING PROJECT

WHEREAS, the Central Coastal California Seismic Imaging Project proposes to perform seismic testing in and around the waters of Central Coast; and,

WHEREAS, the San Simeon Community Services District is concerned with the impacts from the seismic testing; and,

WHEREAS, those concerns included the short-term, long-term and permanent effects on fish, fishing, and fish stocks; the short-term, long-term and permanent effects on marine mammals; a portion of the seismic project boundary being located within a highly rich Marine Protected Area; and, the inability for vessels to leave and enter the Morro Bay Harbor; and,

WHEREAS, the project has not taken into consideration the land side impacts related to fishing that include, but are not limited to, reduced fish landing and processing activity, fuel docks, fish availability for restaurants, tourism and other environmental issues; and,

WHEREAS, the project has not identified an adequate mitigation and claims process for those affected; and,

WHEREAS, the project does not include an adequate monitoring plan for assessing fish stock recovery in either the short or long term periods.

NOW, THEREFORE, BE IT RESOLVED, that the San Simeon Community Services District opposes the Central Coastal California Seismic Imaging Project being proposed by Pacific Gas and Electric.

PASSED AND ADOPTED by the BOARD OF DIRECTORS of the San Simeon Community Services District at a regular meeting thereof held on the 10th of October 2012, by the following vote:

Upon motion of Chairperson Ricci, seconded by Vice-Chair McAdams, and on the following roll call vote to wit:

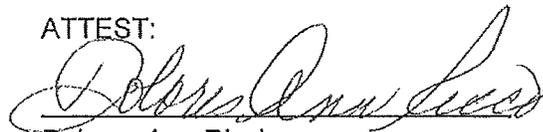
AYES: 3

NOES: 2

ABSTAIN:

ABSENT:

ATTEST:



Dolores Ann Ricci

Chairperson of the Board of Directors

ATTEST:



Charles Grace

General Manager/Secretary SSCSD

AGENDA NO: A-7
MEETING DATE: 9/11/12

RESOLUTION NO. 49-12

**RESOLUTION OF THE CITY COUNCIL
OF THE CITY OF MORRO BAY, CALIFORNIA
OPPOSING THE CENTRAL COASTAL CALIFORNIA
SEISMIC IMAGING PROJECT**

**THE CITY COUNCIL
City of Morro Bay, California**

WHEREAS, the Central Coastal California Seismic Imaging Project proposes to perform seismic testing from November 1, 2012 through December 31, 2012 in and around the waters of Morro Bay; and,

WHEREAS, the City of Morro Bay sent a letter to the California State Lands Commission regarding the Draft Environmental Impact Report outlining numerous concerns; and,

WHEREAS, those concerns included the extension of recreational rockfish season to December 31st; the short-term, long-term and permanent effects on fish, fishing, and fish stocks; the short-term, long-term and permanent effects on marine mammals; a portion of the seismic project boundary being located within a highly rich Marine Protected Area; and, the inability for vessels to leave and enter the Morro Bay Harbor; and,

WHEREAS, the project has not taken into consideration the land side impacts related to fishing that include, but are not limited to, reduced fish landing and processing activity, fuel docks, fish availability for restaurants, tourism and other environmental issues; and,

WHEREAS, the project has not identified an adequate mitigation and claims process for those affected; and,

WHEREAS, the project does not include an adequate monitoring plan for assessing fish stock recovery in either the short or long term periods.

NOW, THEREFORE, BE IT RESOLVED, that the City of Morro Bay opposes the Central Coastal California Seismic Imaging Project being proposed by Pacific Gas and Electric.

PASSED AND ADOPTED by the City Council of the City of Morro Bay at a regular meeting thereof held on the 11th of September 2012, by the following vote:

AYES:

NOES:

ABSENT:

WILLIAM YATES, Mayor

ATTEST:

JAMIE BOUCHER, City Clerk

Fw: Alternatives to high intensity acoustic seismic testing

Dan Buckshi to: cr_board_clerk Clerk Recorder

Cc: Kristi Gutierrez

10/22/2012 05:25 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:25 PM -----

From: Carol Georgi <cdgeorgi@hotmail.com>
To: "dbuckshi@co.slo.ca.us" <dbuckshi@co.slo.ca.us>
Cc: "fmecham@co.slo.ca.us" <fmecham@co.slo.ca.us>, "bgibson@co.slo.ca.us" <bgibson@co.slo.ca.us>, adam hill <ahill@co.slo.ca.us>, "pteixeira@co.slo.ca.us" <pteixeira@co.slo.ca.us>, "jpatterson@co.slo.ca.us" <jpatterson@co.slo.ca.us>
Date: 10/19/2012 02:56 PM
Subject: Alternatives to high intensity acoustic seismic testing

Please include the attached documents in the folder for the Oct. 30th meeting on PG&E's proposed seismic testing project.

Alternatives to high intensity acoustic seismic testing

- 1)The seismic pdf is an important 4-page document prepared by the Natural Resources Defense Council.
- 2)The Monterey Airgun Alt. Tech. Workshop is a 35 page document prepared by Okeanos and held in Monterey, CA 2009.

Thank you,



Carol Georgi seismic.pdf

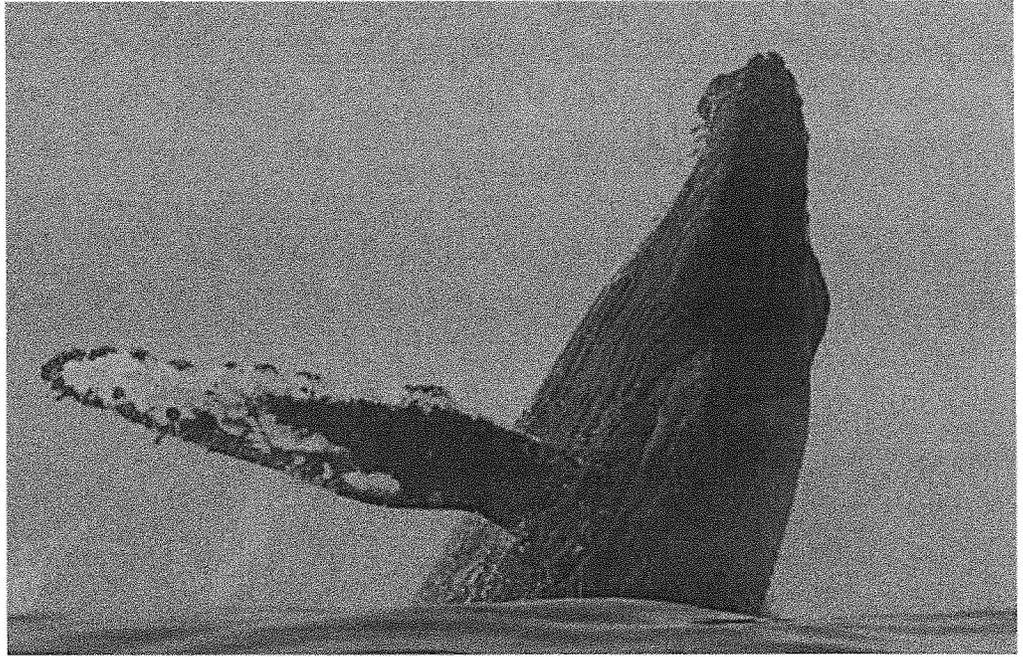


Monterey Airgun Alt. Tech. Workshop Report.pdf

Item # 22 Meeting Date: 10/30/2012

Presented by: Carol Georgi

Received prior to meeting and posted to web on: October 23, 2012



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Boom, Baby, Boom: The Environmental Impacts of Seismic Surveys

For offshore exploration, the oil and gas industry typically relies on arrays of airguns, which are towed behind ships and release intense impulses of compressed air into the water about once every 10 to 12 seconds. Although most of the energy from these acoustic “shots” is intended to search downward for evidence of oil and gas deep beneath the seafloor, a significant amount of the energy travels outwards and can be heard throughout vast areas of the ocean. The environmental problems created by these noise invasions are not fully understood, but we do know that these intense sounds threaten the habitats of endangered whales and commercial fisheries, and cannot remotely be confined to the waters off individual states that approve offshore production. Seismic surveys have been shown to disrupt essential behavior in endangered whales and cause catch rates of some commercial fish to plummet—in some cases over enormous areas of ocean. To mitigate these impacts, NRDC recommends that airguns be kept out of sensitive areas and that greener alternatives be promoted, some of which are already well into development and could be made commercially available within a few years.

For more information,
please contact
Michael Jasny
(604) 736-9386



www.nrdc.org/policy

Airguns and Ocean Life

The ocean is an acoustic world. Unlike light, sound travels extremely efficiently in seawater, and marine mammals and many fish depend on sound for finding mates, foraging, avoiding predators, navigating, and communicating—in short, for virtually every vital life function. When we introduce loud sounds into the ocean, we degrade this essential part of the environment. Some biologists have likened the increasing levels of noise from human activities to a rising tide of “smog” that has urbanized and in some

areas industrialized major portions of the marine environment off our coasts. This “acoustic smog” is shrinking the sensory range of marine animals.¹ A substantial and growing body of research now indicates that ocean noise pollution negatively affects at least 55 marine species, including several endangered species of whales and 20 commercially valuable species of fish.^{2,3}

Seismic surveys have a staggering environmental footprint. A large seismic array can produce peak pressures of sound higher than those of virtually any other man-made source

Boom, Baby, Boom: The Environmental Impacts of Seismic Surveys

save explosives;⁴ and though its airguns are pointed downwards towards the sea floor, their sound travels outward so widely as to significantly raise noise levels literally thousands of miles away.⁵ The director of Cornell's Bioacoustics Research Program once described these surveys as possibly "**the most severe acoustic insult to the marine environment.**" Unfortunately for the whales, airgun surveys last anywhere from weeks to many months and, in many coastal areas that represent vital feeding and breeding grounds, cause animals harm by depriving them access to their normal acoustic habitats.

Impacts on a Population Scale

The impacts of seismic surveys are felt on an extraordinarily wide geographic scale. For example, a single seismic survey can cause endangered fin and humpback whales to stop vocalizing—a behavior essential to breeding and foraging—over an area *at least* 100,000 *square nautical miles in size.*^{6,7} The few animals that persist in calling seem to abandon the entire area, which is larger than the state of New Mexico. Seismic surveys can also drown out mating and other calls of endangered whales over enormous distances. Beyond several miles, the periodic blasts of airguns can sound virtually continuous, making it impossible for species that use low-frequency sound—like the endangered great whales—to communicate, feed, and find mates.^{8,9}

Alarming, one of the species most vulnerable to these impacts, according to the latest research from NOAA and Cornell, is the critically endangered North Atlantic right whale, whose only known calving grounds occur off Florida and Georgia.^{10,11}

Given the scales involved, surveys taking place off the coast of Virginia could well affect endangered species off southern New England, and right whales could be disrupted throughout their east-coast migratory range.

Airguns have also been shown to affect a broad range of other marine mammal species beyond the endangered great whales. For example, sperm whale foraging appears to decline significantly on exposure to even moderate levels of airgun noise,¹² and harbor porpoises have been seen to engage in strong avoidance responses fifty miles from an array.¹³ Seismic surveys have been implicated in the long-term loss of marine mammal biodiversity off the coast of Brazil.¹⁴

Impacts on Fish and Fisheries

Airgun surveys also have serious consequences for the health of fisheries. For example, airguns have been shown to dramatically depress catch rates of various commercial species (by 40 to 80 percent) over thousands of square kilometers around a single array,^{15,16} leading fishermen in some parts of the world to seek industry compensation for their losses. These compensations are already occurring

The Seismic Footprint

Noise from a single seismic survey, operating in the direction of the upper right corner, saturates an area in the North Atlantic larger than the state of West Virginia (10,000 square nautical miles), masking low frequencies used by endangered baleen whales. Red signifies noise several orders of magnitude higher than the prevailing background noise in the region. In fact, biologists have found that airguns cause endangered fin and humpback whales to go silent over an area at least 10 times larger than this.



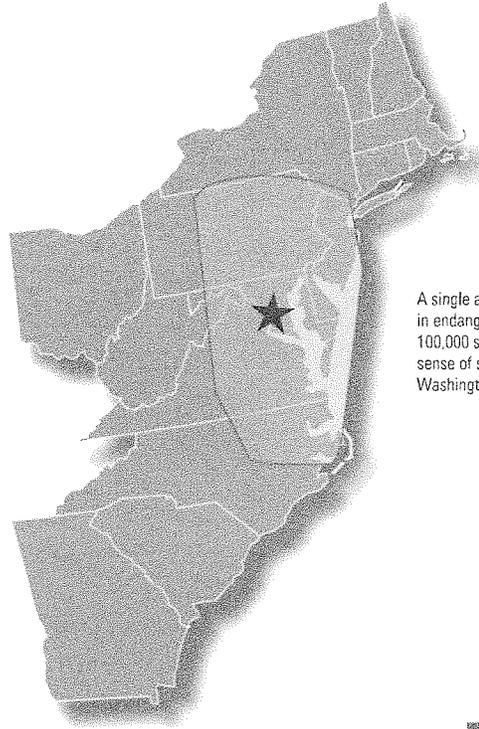
in Norway. Other impacts on commercially harvested fish include habitat abandonment—one possible explanation for the fallen catch rates—reduced reproductive performance, and hearing loss;¹⁷⁻¹⁹ and recent data suggest that loud, low-frequency sound also disrupts chorusing in black drum fish, a behavior essential to breeding in this commercial species.²⁰

What's in Store for the Atlantic

How much seismic surveying are we likely to see in the former moratorium areas? Within months after the Minerals Management Service (MMS) issued its scoping notice for the Atlantic region, Spectrum Geo proposed shooting 112,500 line miles of surveys from Massachusetts down to Florida, Western Geco another 54,900 miles between New Jersey and Georgia, and CGG Veritas more than 42,000 miles running southwards from Maine. In all, more than 285,000 line miles were proposed in the initial flurry of applications.²¹ Industry will conduct more surveys as areas are opened for leasing, and will send ships back time and again to certain areas of interest to see how geologic features there change over time. On top of this, some companies are making more and more use of “wide azimuth” surveys, in which up to four airgun arrays run side-by-side and fire in tandem.

The Way Forward

The mitigation measures typically prescribed by MMS require little more than visual monitoring for marine mammals within a small “safety zone” immediately around the seismic vessel. But that approach is completely inadequate to redress the large-scale environmental harm that science has identified.²² The only effective ways to mitigate these serious longer-range impacts are to keep airguns out of sensitive environmental areas (and the areas nearby), to cap the number of activities allowed each year by region, to bar redundant surveys, and to promote the use of greener alternatives—some of which are already well into development and could be made commercially available within a few years.



A single airgun array can disrupt vital behavior in endangered whales over an area at least 100,000 square nautical miles in size. For a sense of scale, here is that area centered over Washington, D.C.

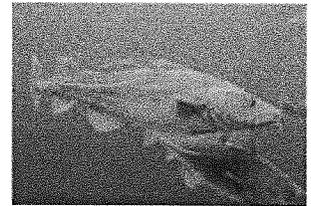
NRDC makes the following recommendations:

- **Congress should not introduce new “seismic inventory” language into the pending climate and energy bills.**

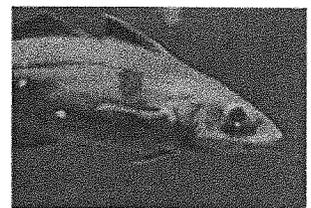
A provision in the Senate’s energy bill would mandate that MMS conduct a seismic inventory of the OCS and authorize more than \$750 million for the purpose. In addition to unnecessarily subsidizing the industry, such a provision would result in significant environmental harm to marine mammal and fish habitat in regions, like the northeast and west coasts, that strongly oppose OCS development on environmental grounds and will certainly not figure in any government lease plan for at least 7 years.

- **Congress should strengthen environmental review of seismic surveys on the Outer Continental Shelf.**

Allowing airgun surveys to proceed across ocean regions without even considering their harmful impacts, and how to mitigate them, is simply irresponsible and could result in needless harm to commercial fisheries and endangered species on a wide scale. Yet in some regions, like the Gulf of Mexico, neither MMS nor industry have obtained legally required permits under the Marine Mammal Protection Act or satisfied environmental review requirements of other laws. As one important step, Congress



Atlantic cod



Haddock

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Boom, Baby, Boom: The Environmental Impacts of Seismic Surveys

should amend the Outer Continental Shelf Lands Act to let the public seek judicial redress against companies that violate the Marine Mammal Protection Act.

- **Congress should authorize research and development funding for lower-impact exploration technologies and require MMS, in consultation with NOAA, to set 5- and 10-year benchmarks for their development and use.**

According to industry experts, airguns produce a great deal of “waste” sound and generate peak levels (which are thought to be one of the dangerous characteristics of airgun noise) substantially higher than those actually needed for exploration. Lower-impact technologies that would substantially shrink the environmental footprint of airguns in many areas could be available for commercial use within 3 to 5 years. Marine vibrators, for

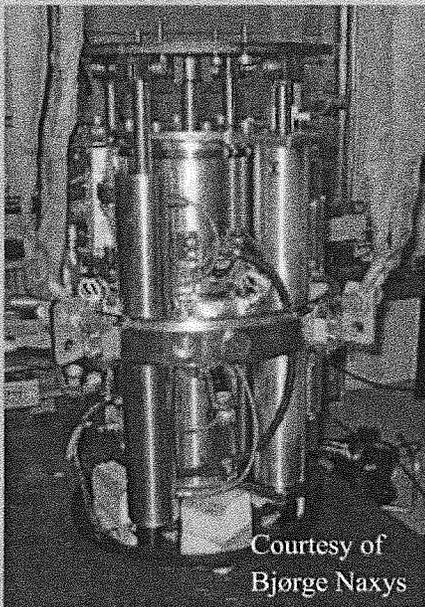


North Atlantic right whale

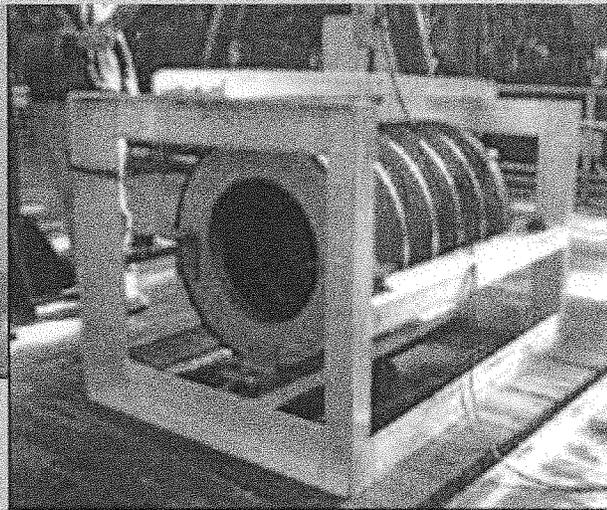
© NOAA

example, have the potential to reduce peak sound levels by 30 to 50 decibels, at least in shallow water, turning an extraordinarily powerful airgun array into the equivalent of a very large ship.²³ But increased funding and regulatory involvement are essential to realizing these lower-impact alternatives.²⁴

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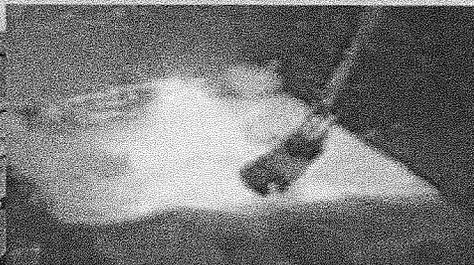
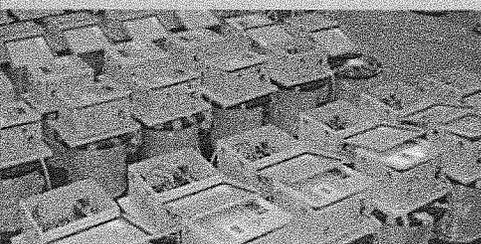
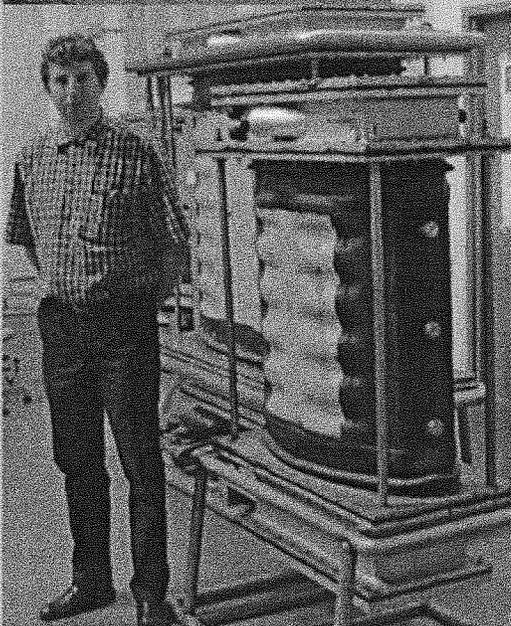
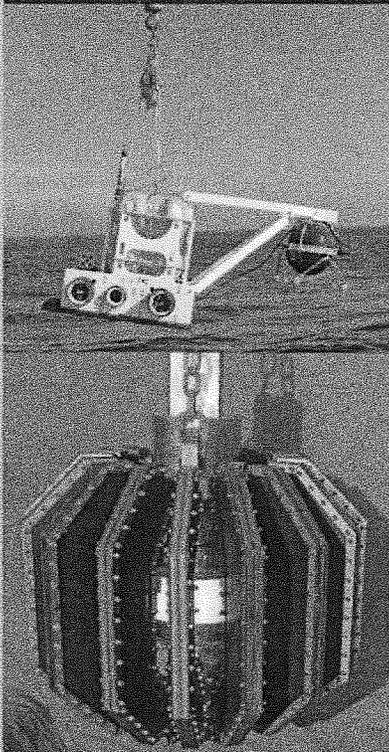
REPORT OF THE WORKSHOP ON
**ALTERNATIVE TECHNOLOGIES TO
SEISMIC AIRGUN SURVEYS FOR
OIL AND GAS EXPLORATION
AND THEIR
POTENTIAL FOR REDUCING
IMPACTS ON MARINE MAMMALS**

Held by Okeanos - Foundation for the Sea
Monterey, California, USA

31st August – 1st September, 2009

Edited by

Lindy Weilgart, Ph.D.



March, 2010



okeanos - Stiftung für das Meer

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Weilgart, L.S. (ed) 2010. Report of the Workshop on Alternative Technologies to Seismic Airgun Surveys for Oil and Gas Exploration and their Potential for Reducing Impacts on Marine Mammals. Monterey, California, USA, 31st August – 1st September, 2009. Okeanos - Foundation for the Sea, Auf der Marienhöhe 15, D-64297 Darmstadt. 29+iii pp. Available from http://www.sound-in-the-sea.org/download/AirgunAlt2010_en.pdf

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Prologue

By Dieter Paulmann

As part of our continuing efforts to preserve the oceans and their inhabitants, we, Okeanos – Stiftung für das Meer (Foundation for the Sea), have focused on the issue of anthropogenic (human-made) underwater noise and its impact on marine mammals. Okeanos has held a number of international, multi-disciplinary workshops on various novel aspects of this issue, ranging from noise-induced stress effects, and noise management through spatial planning, to ship-quieting technologies, and techniques for assessing the cumulative impacts of underwater noise together with other anthropogenic stressors facing marine mammals. Fruitful, productive discussions and collaborations, especially between experts from diverse fields that don't commonly interact, have resulted from these workshops. Scientists from a diversity of disciplines and specialties (ranging from biologists to engineers) and policy makers, working together, have managed to merge their expertise to develop new ideas, techniques, and mechanisms for making progress on the science and management of ocean noise.

One such management mechanism to reduce ocean noise is source-based mitigation, i.e. making sound sources more benign to marine mammals. Seismic airgun surveys, including those used in the exploration of oil and gas deposits underneath the ocean floor, produce loud, sharp impulses that can raise noise levels substantially over large areas. These surveys can last for months and the noise they produce is virtually ubiquitous in the world's oceans. Though noise impacts on marine life (fish and even invertebrates, along with marine mammals) from seismic surveys are well documented, the biological relevance of these impacts on wild populations remains controversial among the various stakeholders. Rather than address the controversy or evaluate the evidence for or against impact, our purpose in this workshop was to examine quieter, potentially less harmful technologies that might be able to, at least partially, replace airguns. While airguns are excellent tools to image formations, structures, and deposits deep in the ocean substrate, they also have drawbacks from an engineering/industry point of view. They produce more noise than is needed for hydrocarbon exploration, the signal is not very repeatable or controllable, and the frequencies produced are not as low as are sometimes necessary for good penetration of the substrate. In the same way that, historically, airguns replaced explosives for oil and gas exploration because airguns were safer for humans, it is perhaps now time for airguns themselves to evolve into technologies that are more environmentally sensitive and perhaps even more effective in finding oil and gas deposits.

To this end, and supported by the Okeanos Foundation, an international, multi-disciplinary group of geophysical scientists, seismologists, biologists, and regulators met in Monterey, California, 31 August-1 September, 2009, to seek alternatives and/or modifications to airguns and airgun array configurations in order to minimize their potential impacts. Participants were asked to evaluate the strengths and limitations of various alternative/supplementary technologies, consider the conditions under which each could be applied, and discuss aspects such as the timeframes over which they would be commercially available, if not in use presently. Only participants with expertise in a particular alternative technology or airgun array configuration were invited, along with marine mammal biologists. The goal was to preferentially eliminate the use of sound for hydrocarbon exploration, or to reduce the amount or type of potentially harmful acoustic energy introduced, or the total area ensonified.

On the first day, each participant gave a presentation, generally about the technology in which they specialize. These technologies were then discussed on the second day, and a consensus summary statement was formulated by the group. This report consists of that summary statement, along with some supplementary notes by various participants, and three tables on seismic survey characteristics, applications for airgun alternatives, and characteristics of airgun alternatives, respectively.

Discussions were extremely collegial, and there was little disagreement on the main points, namely that:

- airguns produce “waste sound” that is not used by the industry, yet has the potential to impact marine life;
- that this sound (mainly high frequencies and lateral propagation) could be eliminated without sacrificing any data quality for the hydrocarbon industry;
- that reducing peak sound levels is a worthwhile goal even at the expense of requiring a slightly longer signal;
- that technologies are available or emerging that do not introduce any anthropogenic sound, or introduce substantially less sound, into the environment;
- that less sound may be required to gather the same quality of data due to more sensitive receivers;
- and, finally, that regulatory pressure/incentives and more funding to develop these technologies will expedite their availability and broaden their applications.

As the ever-expanding search for petroleum deposits moves towards deeper water (possibly requiring a louder signal) and more sensitive habitats, such as the Arctic, the need for more benign alternatives to airguns will escalate. Nevertheless, in some particularly vulnerable, critical, and productive habitats, any addition of noise may be too much. Moreover, alternatives that are assumed to be more environmentally benign than airguns, may in fact not be. Quieter is almost always better, but all alternatives should be assessed for their environmental impact before being put to wide use. This report is not meant to advocate any alternatives without such essential prior testing.

Some of the information contained within this report is somewhat preliminary in nature. There is still much research and development that needs to be done on some alternatives to seismic airguns. However, this report should dispel any doubts that substantial improvements can be made, even in the near future. What is mainly lacking is regulatory pressure as well as funding. This report seeks to stimulate debate and interest from companies, which in some cases are already developing alternatives to airguns, and policymakers.

This report also includes lists of participants and their presentations, the latter with abstracts.



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Consensus Summary
of the
Workshop on Alternative Technologies to Seismic Airgun Surveys
for Oil and Gas Exploration and
their Potential for Reducing Impacts on Marine Mammals

Lindy Weilgart (ed. and co-organizer of the workshop), Andrew Wright (co-organizer of the workshop), Leila Hatch (chair)

Participants (alphabetically): Ron Brinkman, MMS; Chris Clark, Cornell University; John Diebold, LDEO; Peter Duncan, Microseismic Inc.; Rob Habiger, Spectraseis AG; Leila Hatch, NOAA; John Hildebrand, Scripps Institution of Oceanography; Phil Nash, Stingray Geophysical Ltd.; Jeremy Nedwell, Subacoustech; Dave Ridyard, EMGS; Rune Tenngamn, PGS; Peter van der Sman, Shell; Lindy Weilgart, Dalhousie University; Warren Wood, NRL; John Young, ExxonMobil

Abstract

Past experience shows us that a fraction of the airgun sound that has potential to impact marine mammals (either physically or behaviorally) comes from "waste sound" that is either too high frequency and filtered out before recording or propagates laterally away from receivers and is also never recorded. The Okeanos Seismic Airgun Alternatives workshop panelists identified several ways in which unwanted sound or noise from seismic airguns might be reduced with little or no effect on the quality of data acquired. In addition to eliminating this noise or unused signal, peak sound levels required for exploration might also be reduced by spreading the source energy out over time, and/or moving sources and receivers closer to the seafloor. Panelists also discussed promising new imaging technologies that are either completely silent (e.g. controlled source electromagnetics) or that can lessen the amount of seismic sound required to gather seismic data (e.g. increasing the density of more sensitive receivers, such as fiber optics or through the use of passive seismic technology) thereby still allowing for a reduction of the economic risk of hydrocarbon recovery. Workshop panelists acknowledged that these technologies are purpose driven and do not work in all circumstances. Many of these technologies may be either available now or in the next 1-5 years, depending on funding and technology advancements.

Introduction

Supported by Okeanos, a multi-disciplinary group of geophysical scientists, seismologists, biologists, and regulators met to seek ways to reduce noise from seismic airgun surveys, specifically the large airgun arrays used for oil and gas operations in the ocean. We, the participants of this unique gathering, agree that marine life would benefit from a quieter ocean. With the introduction of new technologies and techniques, turning the tide on rising levels of noise in the oceans now seems feasible. The following findings and recommendations represent the key results of our discussions at the workshop.

Findings and Recommendations

The most effective acoustic mitigation remains not exposing marine life (i.e., through avoidance) to additional anthropogenic noise.

- Government agencies responsible for regulating offshore seismic data acquisition activities (hereafter: 'Regulators') should collect or fund collection of baseline data on the distribution of marine mammals in space and time in areas where seismic data acquisition is being planned. These data should be collected as far in advance of the seismic data acquisition as is practicable (especially where species distribution is poorly understood or in areas where seismic data acquisition is new).
- In areas where seismic data acquisition will take place and is likely to expose marine animals to noise, efforts should be made by regulators in conjunction with the operator of the seismic data acquisition activity to reduce sound levels to the lowest practicable and/or integrate the use of alternative technologies into planned activities to reduce noise exposure.
- Impulsive sources like airguns have the potential to physically impact marine life because of the sharp rise times and high peak pressures of airguns. Behavioural effects are also possible due to exposure to sound at distances away from the airguns.
- A multi-dimensional metric or scoring system to quantify the impacts of airguns or alternatives on various marine animals would be very helpful, though difficult.

Airguns

- Airgun design can be optimized to reduce unwanted energy.
 - Imaging deep geological targets requires an acoustic source outputting relatively low frequency content (<200Hz). The lower frequencies provide the deep energy penetration into the earth. Currently seismic airguns produce broad-band acoustic energy (>200Hz) and in directions (both inline and horizontal to the plane of interest) that are not of use. During collection of seismic data for deep imaging purposes one should strive to reduce unnecessary acoustic energy (noise) through array, source, and receiver design optimization. A more general statement can be made that regardless of the imaging target, anyone collecting seismic data should strive to reduce unwanted energy or noise. It should be noted that even if unwanted frequencies (> 200 Hz) are removed, there will still be frequency overlap with several marine animals (including most baleen whales) that can and should be minimized.
- Lower source levels could be achieved through better system optimization, i.e. a better pairing of source and receiver characteristics, and better system gain(s). For example, new receiver technologies, such as fibre optic receivers, may allow the use of lower amplitude sources through a higher receiver density and/or a lower system noise floor.
- Some evidence exists which indicates that re-engineered air guns with "mufflers" can be used to attenuate unwanted high frequency energy without affecting frequencies of interest.
- Bubble curtains may be used to optimize the directivity of the source, but they can be difficult to use, produce some noise themselves, and cannot fully eliminate horizontal propagation.

Use of alternative technologies with airguns and/or instead of airguns

Controlled sources generally put the same level of geophysically useable energy into the water as impulsive sources like airguns, but over a longer period of time, and a resulting lower peak sound level, i.e. they are quieter. For example, for a rough calculation in the near-field, a one-second oscillatory/vibrator/projector pulse puts the same level of geophysically useful energy into the water as an airgun's ten millisecond pulse, but is one-hundred times quieter, resulting in a ten-thousand fold reduction in the area of ensonification. These sources include technologies such as the electro-mechanical modern marine vibrator, low frequency acoustic projector (driving cylinder, e.g. LISA, a low frequency electromagnetic transducer system), the solid state piezo-ceramic Helmholtz resonator (e.g. The Naval Research Laboratory's DTAGS), and other non-impulsive, oscillating sound sources. Furthermore, controlled sources can produce sound over the frequency range desired, generating signals that can be specifically designed to minimize the impact on marine mammals and maximize geological interpretability (e.g. pseudo-random sequences).

It has been suggested that masking, or the obscuring of signals important to marine life, may worsen over this smaller ensonified area, because of the more continuous nature of the vibratory source. However, airguns at distance, especially in a reverberant environment, permanently raise the noise floor, as the previous pulse does not decay fully to background noise levels before the next shot is fired. Thus, airgun shots do not represent truly intermittent signals, with gaps of silence between shots. To better understand the environmental advantages or disadvantages of the use of controlled acoustic sources will require further research.

Controlled sources, such as marine vibrators (e.g., hydraulic, electric, etc.), offer the opportunity to reduce the peak amplitudes introduced into the water column and to tune the frequencies transmitted to exactly the band-width required for operations. By using a sweep instead of an impulse source, one can reduce the amplitude (peak levels) by 30 dB. This is done by spreading out the energy over time. A sweep that is 10 s has the same amplitude after correlation that a short 40 ms pulse generated by the airgun has. The use of pseudo noise (PN) sequences could reduce the acoustic footprint further (perhaps by an additional 20 dB/Hz by spreading out frequencies over time), but more research is needed to fully understand how to implement these sequences in an effective and optimized way.

- There is some evidence that a swept signal with lower peak amplitude would have less impact on marine animals than a higher peak impulsive signal. It is possible that pseudonoise sequences would reduce impacts further than normal up or down sweeps as they would sound broadly similar to natural background noise--noise to which such animals would presumably be adapted. More research is needed to assess this.
- In certain situations and with certain non-airgun source types, placing the sources and/or receivers near or on to the sea floor can reduce the required source level, as well as the amount of sound that needs to travel through the water column. For example, marine vibrators can operate close to the sea-bed and accomplish increased penetration relative to shallow towing.
- A controlled source offers improved receiver optimization possibilities compared to airguns. For instance, a combination of fiber optic sensors with a reduced bandwidth seismic source, such as a marine vibrator, may make the most optimal use of these technologies.
- Marine vibrators also have the advantage of being more vertically directional in deeper water.
- Front-loading the exploration workflow with the use of silent technologies (e.g., CSEM / 3D EM, gravity, gravity gradiometry, etc.) has potential to optimize the exploration process and require

less sound to be injected into the environment. For instance, if 2D airgun surveys followed by quieter technologies (e.g. 3D CSEM) do not show promising targets, proceeding with 3D seismic surveys may not be worthwhile. Conversely, one may optimize 3D seismic activities based on the results from 2D seismic and 3D CSEM.

- Technologies such as marine vibrators, microseismic monitoring (passive seismic), and fiber optics have potential to reduce the need for 4D airgun surveys, used to monitor the movement of oil or gas in an exploited reservoir over time.
- Regulators and/or the geological and geophysical industry (including oil and gas exploration and production companies) should fund or undertake research into impacts on marine animals of alternative technologies such as marine vibrators and CSEM / 3D EM surveys. Companies developing these technologies need to work together with marine biologists to better understand, design, and carry out research needs in this area.
- While some airgun alternative technologies are available now or in the next 1-5 years (see Table 1), an increase in R&D funding for alternative exploration technologies (e.g., CSEM / 3D EM, marine vibrators, passive seismic, fibre optics receivers, etc.) will accelerate development and expand the application window. Governments should encourage the development and use of alternative technologies in an environmentally sensitive manner through both regulatory changes as well as additional funding to regulatory bodies, scientists, and engineers.

Coordination / Incentives

- Regulators should fund or undertake efforts to produce higher quality, accessible, and well-managed databases for marine animal distribution in space and time, which are needed to inform environmental impact assessments. Note: The Minerals Management Service (MMS) is data basing all current marine mammal observer sighting records and, although presently not a requirement, is encouraging the use of Passive Acoustic Monitoring (PAM) for future surveys.
- Efforts should be made to characterize the current (snap-shot in time) spatial distribution and other characteristics of noise exposure from airgun use in worldwide waters (centralize data on incidence of different uses and locations/regional use). Good measurements of the frequency content of seismic airgun pulses at various depths and ranges should be made.
- Holders of geological and geophysical data should mine their data to more fully characterize what is known about where airguns were used, what their output characteristics were, and any related propagation information that is available. Additionally, marine mammal observer databases, along with passive acoustic monitoring data, should be maintained for information on the distribution and behavior of marine mammals. Radiated acoustic energy from airguns should be related to marine mammal observer reports and other marine mammal data.
- Oil and gas industry associations could play a role in facilitating the collaboration between oil and gas operators, contractors, regulators, and scientists so that all parties can jointly exploit currently missed opportunities to share and/or obtain useful, multi-disciplinary information about the potential impacts of the various exploration methods and make the results available.
- Some countries have inherent incentives for airgun surveys within their work programs and in doing so, have implied disincentives for alternative technologies. Governments should discontinue programs that discourage the utilization of non-airgun technologies. Governments should develop incentives for any alternative technologies that are found to have clear environmental benefits over current airgun technology.

- The academic geophysical community should also be encouraged to research quieter alternatives to airguns, with the aid of government and/or industry funding.
- Regulators should encourage and help fund research and development of quieter, alternative sources and their impact assessments.
- Governments and regulators should produce, domestically and internationally, clear, consistent environmental compliance laws, regulations, and standards, as well as apply them in a similarly consistent manner across different geographical areas. This would facilitate the development of more environmentally benign technologies.

Additional Notes/Information

While proponents of LACS and gravity gradiometry, two technologies we mention in our tables, were unable to attend our workshop, we nevertheless supply information about these technologies in the interest of being more complete.

From:

http://www.bjorge.no/modules/module_123/proxy.asp?D=2&C=233&I=1691&mid=-1&sid=-1&pid=766

LACS (patented) Low-frequency Acoustic Source

LACS can be used for seismic acquisition. It is a digital source, is small in size, and does not need high pressure air to operate. It can control the spectral contents of single pulses, is repeatable with precise timing, and has a high pulse rate yet no interaction between pulses. In contrast, the interaction between airgun pulses which are close together in time (gas bubbles) is less predictable and weakens the pulses. Several LACS units may operate together to provide an increased pulse pressure. The system also allows accurate simulation of shipping noise, since it is similar both in the time and frequency domain, without a sweeping fingerprint.

Bjørn Askeland, a developer of LACS, adds: "...The important issue now is to get an overview of the potential of time-coded sequences for marine seismics. LACS is a digital high fire rate marine source. In telecommunications signals used to be analog, but now most of them are digital."

"... new sources [could] replace airguns for borehole seismic applications within 5 years if research money is made available and access to offshore wells is regulated. Taxation of borehole airgun surveys may be a way of speeding up the technological development and also for providing the necessary research money..."

Gravity Gradiometry

The following is supplied by Duncan Bate, ARKeX Inc.:

Unlike air guns, both gravity and gradiometry are passive; no energy is put into the earth or water. Variations in the naturally occurring gravity field are measured. Both technologies are fairly well developed and have been used by both mining and oil and gas industries for decades.

The major difference between gravity and gravity gradiometry is the way the field is measured. To measure the gradient of the field, a much more complex piece of equipment is needed, which is newer and more expensive than traditional gravity meters. The benefit of gravity gradiometry is the increase in resolution. The resolution is now more on the same scale as seismic data. Also, there has been a big step forward in the processing and interpretation of gravity gradient data. Gravity and gravity gradiometry are not applicable in all geological settings, and seismic data will always be preferred. However, in the correct setting, working with an integrated data set of seismic and gravity gradiometry, a better picture of the subsurface can be delivered which may also reduce the amount of seismic needed.

Additional Notes/Information from Participants:

Christopher Clark:

Past research has shown that bowhead and gray whales respond to seismic airgun arrays by moving away from and avoiding the area of the seismic survey (*Malme, C.I., Miles, P.R., Clark, C.W., Tyack, P., and Bird, J.E. 1984. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 migration. Report of Bolt Beranek & Newman, Inc., Cambridge, MA, to U.S. Minerals Management Service, Anchorage, AK. NTIS PB86-218377.; Richardson, W.J., Greene, C.R., Jr., Malme, C.I., and Thomson, D.H. 1995. Marine mammals and noise. Academic Press, New York, 576 pp.*). There is also evidence that baleen whales change their vocal behavior in response to seismic exploration sounds. For example, blue whales summering in the Gulf of St. Lawrence increased the rates at which they produced mid-frequency (30-90Hz), social calls when a seismic sparker was operating (*Di Iorio, L., and Clark, C.W. 2009. doi: Exposure to seismic survey alters blue whale acoustic communication. Biol. Lett., doi: 10.1098/rsbl.2009.0651, 4 pp.*), while fin whales wintering in the area to the west of the British Isles stop singing in the presence of seismic airgun surveys (*Gagnon and Clark, unpublished data*). Di Iorio and Clark (2009) suggested that the blue whales increased their call rates as a way of compensating for the increased amount of background noise from the sparker. The fin whale response of song cessation is similar to that of humpback whale singers when disturbed by loud sounds or noises. In sum, none of the observed responses by large whales to geophysical exploration sounds is surprising, and we should expect continuing evidence to accumulate demonstrating that these low-frequency specialists respond to seismic impulses and seismic surveys in ways that are biologically sensible.

John Diebold:

A larger number of smaller airguns can be more effective when it comes to focusing the energy downwards, especially at higher frequencies. In theory, increasing receiver density can have a similar effect, and the proprietary "Q" streamers do this in the along-track direction. But with the current approach of individual streamers, it's dangerous to increase the across-track density very much.

With Wide Azimuth acquisition, there are more sources (typically 3 or 4) but the total number of shots is about the same, although they are more greatly distributed in space. If the number of receivers was doubled, the same result could (in principle) be achieved with half the shots. This certainly is what happens with multi-streamer vs. single-streamer 3D acquisition.

There are a couple of things going on simultaneously with tow depth of the array. Deeper towing enhances low frequencies in all directions, but it also limits the useful upper frequency boundary, and thus the resolution in travel time. A secondary effect is that shallow towing decreases the horizontal sound propagation, due to the Lloyd's mirror cancellation effects.

John Young:

Typical offshore 2D seismic surveys can cost in the millions to tens of millions of dollars, 3D seismic can cost in the tens to hundreds of millions, and deep water wells would also be in the tens to hundreds of millions. Field production facilities can be in the hundreds of millions to billions of dollars.

To image the geological target requires a certain degree of signal to noise ratio. This can be obtained by either reducing the noise or increasing the signal or a bit of both. For example, additional receivers can provide both additional signal and/or reduced noise through beam steering. Furthermore, finer receiver spatial sampling allows one to sample the noise better which, in turn, allows it to be removed more easily and optimally when the data are processed.

As an example (not an endorsement), WesternGeco's Q streamer acquisition technology has three distinct components. 1) It has finer receiver sampling in the inline direction or along a given seismic cable; 2) It has the ability to measure each source signature and then extrapolate to a far-field signature; 3) It has both lateral and vertical cable position control. Improvements to the data come from additional inline receiver sampling which allows one to sample the noise for better noise removal and/or sum adjacent receiver channels for increased signal. By measuring each source for each shot of the airgun, one can use individual signatures to deconvolve the data (in other words, remove the source signature on a shot-by-shot basis leaving only a spike for each acoustical interface). This in effect improves the signal-to-noise ratio (S/N). By controlling the positions of receivers more precisely one can minimize smear (most data processing algorithms like straight cables) which again is a form of increased S/N.

Another example (again, not an endorsement) so called across-track or cross-line density has increased to the point that the PGS Ramform Sovereign (2008) provides 22 streamer capability. PGS has since gone a step further with the development of "GeoStreamer" technology which allows streamers to be equipped with both a pressure and velocity phone. The dual sensor capability allows suppression of the surface ghost. Suppression of the surface ghost provides improved data quality via broad bandwidth/higher resolution and lower noise from being able to tow the streamers deeper. The deeper tow also allows one to work in higher sea states which provides greater operating efficiencies i.e., less time footprint in a given geographic area. On the other hand, operating in higher sea states means mitigation through visual detections of marine mammals in the safety zone is less effective.

Peter van der Sman:

Improvements in reducing high frequency noise could be made in airguns by altering the port/throat design. Some work has been done in the past to illustrate this. While the ideas are published, the results are not available in the open literature. However, a patent has been filed on this concept in 2005 proposing such changes and suggesting an attendant reduction in high frequency noise.

Noise can be added in or convoluted with the actual data at all stages of the exploration process, and the actual design and implementation of this whole chain of events (design, acquisition, processing, interpretation, etc.) will decide if the final objective can be met. For instance, self-noise from the streamer can be an important consideration. Increasing the output power at the source may not help, and indeed even hinder, the signal to noise ratio, if the source power is not the weakest link. "Shot-generated noise," for instance, is source energy that cannot be interpreted. If the sound decay of the previous shot has not yet reached ambient levels, increasing the source power may in fact raise the noise level for the subsequent shot. Though difficult, ideally, all components in the exploration process must be matched and designed to work optimally together. The source level should be lowered to the point just before it becomes the weakest link.

Warren Wood:

Deep Towed Acoustic Geophysical Systems (DTAGS) can detect areas missed by surface-towed airguns, but there is less penetration than from surface-towed airguns. This is mostly due to frequency content. DTAGS operates at higher frequencies (220-850 Hz) thus providing greater resolution at a cost of reduced penetration (100-200m in sand, 1000 m in soft mud). The vertical resolution is better because of the higher frequency content, and the horizontal resolution is better because of the proximity to the target (i.e. deep).

Any deep-towed instrument, of which DTAGS is one, limits the speed of the towing vessel. DTAGS is towed at 2.0 to 2.5 knots, whereas a surface towed seismic system may be towed up to 3 times faster, thus covering a greater number of kilometers per day of ship time. For surface or deep-tow, traversing from site to site requires pulling in all the gear and traveling at full speed (15-20 knots) to the next site and re-deploying the source and receivers. Deployment and recovery of DTAGS requires 2-3 hours. This is perhaps slightly more than required for a small surface seismic system, but much less than for a large 3-D system.

With the DTAGS system in its present form, there is also an issue of navigating the source and receivers. Right now, the system is simply towed, with knowledge of its location but without having complete control over where it goes (on the sub-wavelength scale). However, technology exists to solve this problem, so this could be accomplished with adequate funding.

Dave Ridyard:

The EM source is towed deep, 10-50 m above the seabed. As the depth of investigation of the EM method increases in the future, the power of the technology to de-risk further exploration efforts will increase accordingly.

Rune Tenghamn:

The latest version of PGS's Electrical Marine Vibrator will probably have an efficiency which is 4-6 times higher than for an airgun, though this needs to be tested before it can be confirmed. The Marine Vibrator is as reliable as an airgun.

Vibrators could have multi-azimuth applications. With coded output, several vibrators can be used at the same time with a different azimuth.

Vibrators have been used at a water depth of 100 m, but from an operational perspective, it is difficult to operate them at great depth (>1,000 m). They are pressure compensated and can therefore be used at different depths. The limitation is the length of the umbilical (electrical losses) and the change of air density. At some depth, the air will become a liquid or have such a high density that the performance will be affected.

To have mainly vertical propagation, the vibrator has to be at the right depth. For 20 Hz, the source would have to be at 18.75 m (a quarter of a wavelength). This is not possible if one is operating in shallower water. Seafloor reflections will spread the energy more in shallow water.

In shallow water operations with 6-10 sources, one has the option to not only send out a signal once at each location, but to "stack" several signal sweeps or sequences, i.e. repeat the signal generation at the same source location until an adequate signal to noise ratio is achieved. By doing this, one can improve the signal to noise ratio even if the source itself is rather weak. The reason one can "stack" the signal with a marine vibrator (a controlled source) is that the signature of the signal can be made identical each time. For an airgun, the signature will change from shot to shot, which will make this process less effective.

Even if many vibrator sources are needed for deep-water operations, the peak signals will be much quieter than for an airgun array. This is due to three factors: 1) the energy is more spread out in time; 2) the frequency is more spread out in time; 3) only the energy in the seismic band of interest is sent out.

Rob Habiger:

Low Frequency (~1-10 Hz) measurements of the earth's passive seismic wave field are being studied by multiple academic and industry groups as a new technology for identifying and delineating hydrocarbon reservoirs. This technology has been predominately applied on land where acquisition instrumentation, survey design, and processing workflows/software are evolving fairly rapidly among a limited technical community. The technology is much less mature for marine applications, with

only one offshore survey acquired to date. Additional experiments are required to fully test it offshore and advance its application to oil and gas exploration.

Peter Duncan:

Passive seismic (using earthquakes or interferometry) for structural imaging is a lot less costly than the acquisition of conventional seismic on land. However, it may not be in the marine environment (compared to streamer acquisition) as it requires the deployment of ocean bottom receivers, either cables or autonomous nodes.

Passive imaging techniques today offer a lower resolution imaging suitable for frontier exploration and to rank order a list of exploration opportunities to determine which are the most likely to be successful, and therefore pursued, but they are not sufficient for field development.

The frequency limit of 20 Hz achievable with interferometry means that the resolution is low. Conventional streamer data has signal content up to 60 Hz and sometimes higher, thus achieving higher resolution. Over the next years (perhaps 5), passive techniques might be able to achieve higher frequencies, hence higher resolution.

Note: The following tables contain values that are highly variable, e.g. from survey to survey, etc. We have attempted to give our best guess in the interest of giving the reader “ballpark” values only. Many thanks to Ron Brinkman, John Diebold, John Hildebrand, and Warren Wood, for filling in values for airguns and other acoustic sources used in seismic surveys.

Table 1. Characteristics of various technologies used to image the ocean substrate for petroleum deposits.

	Pings /Survey	J /Ping	Duty Cycle	Peak Frq	Frq Range	Watts	Peak Pres re 1 μ Pa	Pulse Duration	Directionality sr/4pi	Source Depth	Tow Rate
Added noise:											
Airgun Array & Silenced Airguns	100,000	2.5×10^5	20 s	50 Hz	5-200 Hz@	8.3×10^6	256 dB	.03 s	0.25	3-12 m	4 kts
Marine Vibrators	Similar to airguns			10 Hz	6-100 Hz#	?	20-50 dB below airguns	6-10 s	omni	0-1000 m	0-4 kts
DTAGS	c20k		30s	650 Hz	220-850Hz			250ms	omni	0-6 km	2kts
Para-metrics	?	?	?	?	?	?	?	?	10 deg.	0-6 km	?
LISA			100%	10	5-500	20-200K	210@1m	continuous	variable	0-100m	0-4kts
Sparkers + Boomers	c20k	300	1 s	500 Hz	480-520 Hz	1.5×10^5	233 dB	2 ms	omni	0-6 m	4 kts
LACS**	c20k	280		600Hz	0.1-15 kHz			2-3 ms	omni	0-6 m	4 kts
No added noise:											
Gravity*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gravity Gradiometry*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Passive Seismics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Near seabed	1.5 kts
Micro-seismics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Receivers:											
Fibre Optics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Added by Duncan Bate, ARKeX Inc., a supplier of gravity gradiometry

**Added by Bjorn Askeland, a developer of LACS

***LACS increases its signal energy by transmitting many pulses at a rapid rate.

Any harmonic attenuated, practically no energy above 100Hz

@ - Frequencies extend to at least 10,000 Hz, but typically, the industry will record at 2 ms intervals, which means that no frequencies > 250 Hz are recorded, regardless of what & - Turner et al. 2006. Preliminary acoustic level measurements of airgun sources from ConocoPhillips' 2006 seismic survey in Alaskan Chukchi Sea. JASCO Research Ltd. Report, July 27, 2006.

+ - Cannelli, G.B. and D'Ottavi, E. 1994. Optimization of marine sparker source efficiency by electroacoustic method. IEEE J-750-755.

Table 1 (cont'd.).

	Days /Survey Area	Water Depth	Burial Depth	Vert. Resol.	Horiz. Res.	Deployment	Receiver Density	Signal Process. Maturity	Est. Time to Commer. Avail.	EIA Maturity	Max. fire rate
Added noise:											
Airgun Array & Silenced Airguns	30	all		30 m	20-200	surface tow	variable	mature	available	medium	10 s
Marine Vibrators		all		30 m	20-200	surface tow	variable	mature	1 yr	medium	10 s
		all		3 m	20-200	8 - 15m	variable	medium	3-5 yrs	young	continuous
DTAGS		all	1km	1.5	20m	Deep tow (full ocean)	variable	medium	1 yr	young	30 s
Para-metries	?	all	?	?	?		variable	young	5-10 yrs	infant	10 pings/s
LISA		all		30 m	30m	surface tow	variable	young	5-10 yrs	young	
Sparkers + Boomers		<1000		1 m	20-200	surface tow	variable	mature	available	young	5 s?
LACS**		<1000		1.5 m	20-200	surface tow	variable	mature	available	young	5 s?
No added noise:								medium	2 yrs.	available	15 shots/s***
Gravity*	~200 sq mi/mo.	all	all	depth dep.	2000m	boat/air/water bottom	N/A	mature	available		
Gravity Gradiometry*	~200 sq mi/mo.	all	all	depth dep.	200m	boat/air	N/A	medium	available		
Passive Seismics	365	all	water bottom	300m	150m	water bottom	4/sq mi	mature	5 yrs	young	N/A
EM	5-100	>20 m	<6 km	1-200 m	1-200 m	seabed	500-5,000m	medium	available	emerging	
Micro-seismics	life of field	all	water bottom	100m	50m	water bottom	4/sq mi	medium	2 yrs	young	
Receivers											
Fibre Optics	life of field	all	water bottom	100 m	50 m	seabed	150/sq m	mature	available	emerging	

*Added by Duncan Bate, ARKeX Inc., a supplier of gravity gradiometry

**Added by Bjørn Askeland, a developer of LACS

***LACS increases its signal energy by transmitting many pulses at a rapid rate.

Any harmonic attenuated, practically no energy above 100Hz

@ - Frequencies extend to at least 10,000 Hz, but typically, the industry will record at 2 ms intervals, which means that no frequencies > 250 Hz are recorded, & - Turner et al. 2006. Preliminary acoustic level measurements of airgun sources from ConocoPhillips' 2006 seismic survey in Alaskan Chukchi Sea. JASCO Research Ltd. Report, July 27, 2006.

+ - Cannelli, G.B. and D'Ottavi, E. 1994. Optimization of marine sparker source efficiency by electroacoustic method. IEEE I-750-755.

Table 2. Applications of various technologies used to image the ocean substrate for petroleum deposits.

Added noise:	Applications								Penetration	
	Site Survey	2D	3D	4D	Refraction	High Res	WAZ	Other	Shallow	Deep
Airguns	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Silenced Airguns	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Marine Vibrators	P	P	P	P	P	Y	P	P	Y	Y
DTAGS	Y	P	P	P	P	Y	P	P	Y	N
Para-metrics	N	N	N	N	N	P	N	N	P	N
LISA	P	P	P	P	P	Y	P	P	Y	Y
Sparkers	Y	N	N	N	N	Y	N	N	Y	N
Boomers	Y	N	N	N	N	Y	N	N	Y	N
LACS	P	P	P	P	P	P	P	P	P	P
LACS**	Y	Y	Y	Y	P	P	P	P	Y	P
No added noise:										
Gravity	-	+	+	+	+	-	+		-	+
Gravity*	-	++	++	-	N/A	-	N/A		+	++
Gravity Gradiometry*	+	++	++	+	N/A	+	N/A		++	++
LF Passive Seismics	-	+	+	+	+	-	+		+	+
CSEM / 3D EM	+	++	++	++	+	+	+		++	+
Magneto	-	+	+	+	+	-	+		-	+
Heatflow	-	+	+	+	+	?	-		-	+
Micro-seismics	-	+	+	++	-	-	+		-	+
PSTT	-	+	+	+	+	-	+		-	+
Daylight Seismic	-	+	+	+	-	-	+		-	+
Receivers:										
Fibre Optics	+	+	+	++	+	+	+		+	+

"P" = possibly

*Added by Duncan Bate, ARKeX Inc., a supplier of gravity gradiometry

**Added by Bjørn Askeland, a developer of LACS

Table 3. Characteristics of various types of seismic surveys and imaging technologies.

Uses	Area Covered (typically)	Survey Time	Sound Intensity (dB re 1 μ Pa)**	Power (Watts)*	Incidence (Shots / Day)	Peak Pressure (PSI)	Frequencies (Hz)
Shallow							
2D	100-5,000 miles	28 days-6 mos.	215-230 dB	150 - 270 KW	4,320 - 8,640	2,000	10-10,000 #
3D	9-1,000 sq. miles	2 mos.-1 year	240-255 dB	150 KW	4,320 - 8,640	2,000	10-10,000 #
4D	9 sq. miles	2 weeks-1 mo.	240-255 dB	150 KW	4,320 - 8,640	2,000	10-10,000 #
Deep							
Site Spec. Survey	60-600 miles	5 days-2 mos.	200-230 dB	1,500	17,280	2,000	10-10,000 #
2D	100-10,000 miles	28 days-1 year	215-230 dB	150-270 KW	4,320 - 8,640	2,000	10-10,000 #
3D (including WAZ)	9-25,000 sq. miles	2 mos.-3 years	240-255 dB	150 KW	4,320 - 8,640	2,000	10-10,000 #
4D	9-27 sq. miles	2 weeks-1 mo.	240-255 dB	150 KW	4,320 - 8,640	2,000	10-10,000 #
Shallow and Deep							
Refraction	Linear	1 day		270 KW	1,440	2,000	6 - 60
Bathymetry (@)	60-120 miles	varies	210 dB	100 - 2,000 KW	8,640 - 86,400	N/A	3,500 - 12,000
High Res		varies		500 KW	17,280	2,000	30 - 300
Sidescan Sonar	9-90 sq. miles	5 days- 2 weeks			1,440 - 7,200	N/A	50-600 kHz
Site Spec. Survey	60-120 miles	5 days- 2 weeks	200-230 dB	1,500 KW	17,280	2,000	10-10,000 #
Sub-Bottom Profile	60-120 miles	5 days- 2 weeks	200-230 dB		1,440 - 7,200	N/A	10-10,000 #
VSP	near well	1-2 days	200-230 dB		4,320 - 8,640	2,000	10-10,000 #

Note: several instruments are often used concurrently, such as bathymetry and high res for site surveys

* - note: actual units are total energy, Joule/square meter-Hz; one Joule = one Watt-second

** - note: an airgun signal is an energy signal (not power), therefore intensity @ 1 μ Pa makes more sense

- typically, the industry will record at 2 ms intervals, which means that no frequencies > 250 Hz are recorded, regardless of what is generated.

@ - time, area, and power values vary a lot for swath bathymetry surveys.

In deep water, power is high, pings are further spaced apart, swaths are wide, so more area is covered in a given time.

In shallow water, power is low, pings are frequent, swaths are narrow.

Participants

1. Participants (Chair, then in alphabetical order) and their specialty

Chair: Leila Hatch, Ph.D., NOAA, Scituate, Mass., USA; marine mammals, marine ecologist

Ronald Brinkman, Senior Staff Geophysicist, Minerals Management Service, New Orleans, LA, USA; regulations and R&D

Christopher W. Clark, Ph.D., Director Bioacoustics Research Program, Cornell Laboratory of Ornithology, Ithaca, NY, USA; marine mammals, bioacoustics

John Diebold, Ph.D., Chief Scientist for Marine Operations, Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY, USA; seismic surveys for science

Peter Duncan, Ph.D., President, Microseismic, Inc., Houston, TX, USA; passive seismic tomography

Rob Habiger, Ph.D., CTO, Spectraseis AG, Zürich, Switzerland; passive seismic

John Hildebrand, Ph.D., Professor of Oceanography, Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA, USA; marine mammals, bioacoustics, seismic surveys for science

Phil Nash, CTO, Stingray Geophysical Limited, Guildford, UK; fiber optic sensors

Jeremy Nedwell, Ph.D., Founder, Subacoustech Ltd., Southampton, UK; low frequency projector arrays and airgun "silencers"

Dave Ridyard, President, EMGS, Houston, TX, USA; electromagnetic survey techniques

Rune TENGHAMN, Vice President, Innovation and Business Development, PGS Data Processing and Technology, Houston, TX, USA; marine vibrator technology

Peter van der Sman, Shell, Amsterdam, Netherlands; airguns

Lindy Weilgart, Ph.D., Department of Biology, Dalhousie University, Halifax, NS, Canada; marine mammals, bioacoustics

Warren Wood, Ph.D., Naval Research Laboratory, Stennis Space Center, MS, USA; deep water seismic source

John Young, Marine Sound Issue, Mgmt. Team Coordinator, ExxonMobil Exploration Co., Houston, TX, USA; petroleum industry use of seismic data

Presentation Abstracts

An Overview of the Uses of Sound by Marine Mammals and the Impacts from Anthropogenic Underwater Noise Sources

Lindy Weilgart, Dalhousie University

Marine mammals, particularly cetaceans (dolphins, porpoises, and whales), use sound for all aspects of their life, including reproduction, feeding, communication, navigation, hazard avoidance, and otherwise sensing their environment. Hearing is their primary sense, as sound travels very efficiently underwater (hundreds of kilometers), whereas vision is limited to only tens of meters. Some cetacean species are primarily solitary and widely scattered, so that sound could be particularly important in uniting them. In blue and fin whales, for instance, females probably must rely on finding mates by the loud, low frequency sounds males make. Such calls can theoretically travel almost across ocean basins, at least in the absence of appreciable human-made noise. Cetacean vocalizations are thought to be used for purposes such as to coordinate movements and maintain contact between group members, to repel mating competitors and attract mates, to identify group membership, etc. Mating songs probably also allow females to assess the quality of potential mates. Echoes from the ice may help whales found in polar waters navigate through open leads safely (Ellison et al. 1987). Similarly, whales likely use acoustic cues, such as echoes from ocean bottom features or surf noise, to find their way during long migrations.

Some of the observed effects of anthropogenic underwater noise on marine mammals include: changes in vocalizations (increases in call duration, falling silent, etc.), displacement or avoidance, changes in diving or feeding behavior, changes in swim speed or breathing rate, shifts in migration path, stress, hearing damage (from captive animal studies), and strandings and deaths at sea. Specifically, some of the more concerning impacts from noise are: noise causing hemorrhaging and death in beaked whales (Jepson et al. 2003, Fernández et al. 2005), the displacement of gray whales from their breeding lagoons for about 10 yrs. (Bryant et al. 1984), the avoidance of noise by killer whales for 6 yrs. (Morton and Symonds 2002), belugas fleeing from noise at distances of 35-50 km and staying away for 1-2 days (Finley et al. 1990, Cosens and Dueck 1993), increased stress hormones in a captive beluga whale with exposure to noise (Romano et al. 2004), indications of a reduction in feeding in sperm whales (Miller et al. 2009), and a greater fatal entanglement rate in fishing gear by humpbacks exposed to noise (Todd et al. 1996). Given that we know cetaceans use sound for so many life functions, the consequences of noise might be to decrease their feeding efficiency, place higher energetic demands on them, interfere with their group cohesion and social behavior, cause mother-calf separations, increase predation pressure, produce more navigational errors (e.g. strandings, entanglements in fishing gear, etc.), and lower calving rates. Thus, the welfare of cetacean populations could be impacted. Indeed, noise is thought to contribute to some species' population declines or their lack of recovery (e.g. killer whales, western gray whales; NMFS 2002, IWC 2007).

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Biological Implications of Chronic Exposure from over Large Spatial Scales: Seismic Surveys

Christopher W. Clark, Cornell University

There is little to no precedent as to the scientific processes for quantifying and evaluating the potential impacts of chronic exposure from anthropogenic sources of sound on marine animals. This statement certainly applies to the situation when a seismic airgun array is the sound source, and to a lesser extent when another mechanism is the source of the intense, impulsive survey signal (e.g., sparkers). Although shipping noise is undoubtedly the largest contributor to chronic ocean noise on an ocean basin scale, noise from a seismic airgun array survey can change the acoustic environment on a seasonal timescale and for a region much larger than the region within which the survey is conducted. It is noteworthy that a seismic survey generates sound intentionally, while a ship produces noise as a bi-product of its propulsion system. Thus, although one could say that the seismic sound is a signal and the ship sound is noise, from the perspective of a marine mammal both activities introduce sounds that have the potential to interfere with and mask bioacoustically important activities (e.g., communication, finding food, navigating, detecting predators). Under sound propagation conditions which promote frequency and time dispersion, a seismic signal can be transformed from an impulsive, reasonably broadband sound into a much longer sound with biologically salient features. Under such circumstances the original, *ca.* 100ms seismic signal can last for many seconds and/or have distinctive frequency-modulation characteristics such that the original seismic sound is no longer impulsive and simply noise, but acquires structure and becomes bioacoustical clutter. Present regulations do not yet

recognize this acoustic phenomenon as representing a shift from the impulsive into the non-impulsive behavioural response regulatory paradigm. Overall, these seismic survey situations can result in complex acoustic scenes that infuse large ocean areas with varied mixtures of impulsive noise and frequency-modulated sounds, often convolved with high levels of reverberation. As a result, for situations in which multiple seismic sources are operating concurrently in the same region, the active bioacoustic space for a given species can be dominated by seismic sounds for periods of many months.

Impacts of Airguns on Marine Animals: Thresholds for Injury and Behavioral Alterations

John Hildebrand, Scripps Institution of Oceanography

The sound pressure fields created by airguns have been shown to create both injuries and behavioral disturbances to marine animals such as cetaceans and fish. This presentation provides background information on relevant acoustic metrics, and examples of injuries and behavioral disturbances following exposure to operating airguns.

Decibel sound pressure level (dB re: μPa RMS) is the standard metric for describing an acoustic field, but may not be the best criterion for judging the impact of sound exposure. Acoustic peak pressure (dB re: μPa peak) and sound exposure level (dB re: $\mu\text{Pa} - \text{s}$) are alternate metrics with appeal for impulsive sources such as airguns. Using acoustic peak pressure accounts for the potential for sound impact, independent of duration. Alternately, sound exposure level is a metric that takes into account the signal duration by integration of the sound pressure level over the duration of the signal, a proxy for acoustic energy. A dual exposure criteria for tissue injury and behavioral disturbance from noise exposure has been proposed, based on these two metrics.

Studies with captive beluga whales and bottlenose dolphins have demonstrated that following exposure to sounds of sufficient intensity, these animals exhibit an increased hearing threshold, described as a temporary threshold shift (TTS). The trade-off between sound intensity and duration that produces TTS, follows roughly an equal-energy curve; long duration signals produced TTS at lower signal intensities than short duration signals.

Field studies have demonstrated behavioral disturbance of cetaceans following exposure to airguns. Migrating gray whales deviate from their swim tracks to reduce received sound pressure levels from exposure to airguns. Likewise, observations during seismic surveys demonstrate that small odontocetes show large lateral spatial avoidance, while mysticetes and killer whales show localized spatial avoidance.

Studies with caged fish suggest that the ears of fish exposed to airguns sustain severe damage to their sensory cells, with no evidence of repair or replacement of damaged cells after exposure. Likewise, acoustic mapping and fishing trawls before, during, and after airgun usage suggest severely affected fish distribution, local abundance, and catch rates.

Marine seismic surveys for science: Purpose, operation and product

John Diebold, Lamont-Doherty Earth Observatory

Marine seismology using controlled sources began in the 1930's, producing fundamental new understanding of the extension of continental structures along continental shelves, and also that the deep ocean is floored by an entirely different kind of crust. By necessity, the sources used were explosives, sometimes in great quantity (many hundreds of pounds.)

The introduction of the airgun as a marine seismic source during the early 1960's represented a great increase in safety and resolution, though it took several decades of additional development to achieve the kinds of airgun arrays that are in use today. These arrays typically use a dozen or more small airguns, firing simultaneously, but spread out in space so as to deliver a short and repeatable pulse of acoustic energy in a generally downward direction.

Current developments in active-source marine seismology are increasing the resolution with which acoustic images can be made, and increasing the depths that can be imaged. Typically the latter effort requires longer arrays of passive receivers, though signal strength is a concern as well. Increased resolution typically requires smaller, specially designed sources and increased number and wider aerial disposition of receivers.

The resulting images and structural details are a critical data type, providing fundamental improvements in humankind's understanding of earth processes. This understanding in turn allows important progress to be made in a wide range of topics from the locations and mechanics of earthquakes to the history of climate change.

Airguns, explosives, and a number of other marine seismic sources depend upon the same basic principle – a bubble of gas, which, due to its internal pressure, expands. In the case of airguns, the pressure within the initial bubble is well constrained, and is far less than that produced by the rapid combustion of explosive solids. As a result the expansion of the air bubble is much slower, and comparatively few high frequencies are produced.

On board US academic research vessels environmental impact is reduced in a number of ways. Minimum source level is used in the first place, and timing of each survey is planned to avoid times of known seasonal breeding, feeding and migration for key marine mammal species. Track lines are often adjusted for local areas of sensitivity and principal investigators are encouraged to favor deeper water options whenever possible. A comprehensive program of visual observation is always carried out, most often supplemented with passive acoustic monitoring. Typically five experts, independent of other operations, are devoted to these tasks. A complete report of sighting and behavioral descriptions is filed with NMFS for every survey and these data are available for inclusion in larger database efforts.

How Seismic Data Is Used By the Petroleum Industry

John Young, ExxonMobil

By 2030, it is widely estimated that global energy demand will increase approximately 30% from today's level. In order to address this need for energy, the petroleum industry explores for

hydrocarbon deposits beneath the earth's surface including under oceans. Seismic surveys are the most accurate and efficient method currently available for hydrocarbon exploration.

Today, the most common marine seismic operations include acoustic sources and receiver streamers, towed behind a vessel. The sources are activated, releasing sound energy directed downward through the water column and into the earth. As a result of differences in acoustic impedance between geologic strata, seismic energy is reflected back to the streamers. The reflected energy is digitally recorded and processed to obtain a detailed image of the subsurface.

Sophisticated subsurface imaging, facilitated by increased computing power, allows for the identification of previously unknown hydrocarbon deposits and reduces the risks associated with drilling in water depths of up to two miles. Increased drilling success rates equate to increased hydrocarbon reserves for the world's energy needs.

The potential for reducing unnecessary horizontal and high frequency components of sound produced by airguns

Peter van der Sman, Shell

Since the early sixties, the seismic industry started to move away from using dynamite as seismic energy source. The main reason for this move was safety, yet in the years to follow also the environmental impact started being used as a motivation. Being used to deal with impulsive sources, the first alternative the industry came up with was impulsive in nature; the airgun. Yet, it was soon followed with marine vibroseis in the mid sixties. Since then, a host of different sources have been proposed and used. Currently though, over 95 percent of the seismic operations is conducted using airguns. So what are the underlying reasons for the airgun to 'survive' in a Darwinian like sense?

As with any new technology, it takes time to develop it in all relevant aspects needed to realize the desired objectives. A typical timeframe in this sense is often in the range of 10 to 25 years. On the other side, one needs to realize that development is costly and that over the duration of such a development the industry tends to alternate several times through periods of prosperity where new technologies are nurtured and others where technologies are shelved or worse.

In the case of the airgun for instance, it took about 10 years before arrays of airguns emerged, tuning a range of volumes to collectively emit a signal suitable for seismic prospecting. Yet it took another 10 to 15 years or so to develop them into the high-fidelity source systems the industry needs. Marine vibroseis though did not do as well. In contrast to their onshore cousins, the marine version never really got off the ground. The fundamental reason for this may be the geophysical requirement to generate sufficient low-frequency energy (say 5 to 10 Hz) at typical surveying speeds. To do so, units become large and heavy which also prevents the use of fair sized arrays to circumvent this. Then again, the vibroseis technology offers a huge potential in that it can shape both the emitted signal and its frequency spectrum and this is exactly where the technology is believed to have merits in an environmental sense. So is marine vibroseis the way to go or can we still work the airgun system to accommodate both geophysical and environmental constraints.

In my presentation I will present a few concepts and ideas on airguns, aiming to complement the contributions by the other speakers such that we collectively present the whole spectrum and merits of all the technologies at our disposal in the context of the workshop.

A Deep Water Resonator Seismic Source

Warren T. Wood, U.S. Naval Research Laboratory

The Naval Research Laboratory's deep-towed acoustics/geophysics system (DTAGS), originally designed to characterize abyssal plain sediments, is an example of a seismic source technology capable of generating 220 Hz – 1 kHz swept frequency sound waves at levels up to 200 dB (re 1 μ Pa @ 1 m), and at full ocean depths. The source is composed of a series of five concentric rings each composed of pie-shaped piezo-ceramic material. The natural resonance of the ceramic transducers provides the high frequencies and the size and shape of the barrel-shaped resonator cavity boosts the low frequencies. This combination yields a broadband (over two octaves) signal with a relatively flat spectrum. The solid-state nature of the construction ensures not only that the source is extremely repeatable, but also that it is insensitive to changes in depth; yielding nearly identical signals from the sea surface to full ocean depth (6000 m). The source can be energized with almost any kind of waveform, and at almost any sound level below 200 dB, allowing significant flexibility to tune the source amplitude, frequency, and waveform for specific needs.

Although the resonator source operates in all water depths, it is most useful where other sources fail. As hydrocarbon exploration moves into deeper waters, the signal loss from surface towed sources becomes excessive. In 2000 m (6562 ft) of water signal loss from spherical spreading results in sound levels at the seafloor only 0.05 percent as strong as at the sea surface, (a 66 dB loss in amplitude). For example: a 180 dB source at the surface fades to 114 dB at the seafloor.

DTAGS is currently configured as a towed multi-channel system, capable of recording 48 hydrophones (3 m spacing) for trace lengths of two seconds, at a two kHz sample rate, on a duty cycle of 30 seconds. The system is typically towed at 2 knots at an altitude of 100m above the seafloor. After some conventional, and some unique processing steps, the resulting seismic sections allow detection of both vertical and lateral changes in the sediment as small as 1-2 meters, and can fully resolve features at a scale of 5-10 meters.

To augment its use as a deep-towed multi-channel seismic system, efforts are currently underway to design and build a coupling system to enable the resonator source to be set directly on the seafloor. In this mode we anticipate not only increased excitation of P and S waves, but also increased signal to noise by repeated firings at the same location (similar to techniques used on land with swept frequency systems).

Deep water sources in general, and the DTAGS Helmholtz resonator specifically represent an attractive option for achieving commercially useful sound pressure equivalent levels in the earth, while minimizing the instantaneous sound levels in the ocean, particularly the shallow ocean where sound sensitive marine life is concentrated. These advantages are achieved mainly through proximity of the source to the target of interest, and time integration over a highly controlled and repeatable source waveform.

Potential application of 3D EM methods to reduce effects of seismic exploration on marine life

Dave Ridyard, EMGS Americas

Introduction

This paper addresses the question “Can 3D EM methods reduce the amount of seismic activity?”. It does not address the broader question “Is there any need to reduce the amount of seismic activity?”.

3D EM method summary

It has been known for over 80 years that hydrocarbon saturated rocks exhibit higher electrical resistance than brine saturated rocks. In recent years the 3D EM method (Controlled source electromagnetics) has emerged as a powerful exploration tool. A dipole electric source towed close to the seabed generates electric and magnetic fields which are perturbed by any subsurface resistive structures. These fields can be measured by sensors deployed on the seabed. The measurements can be processed to create a 3D image of the subsurface resistive structures. Where a resistor is observed co-located with a prospective hydrocarbon bearing structure, the risk of drilling a dry hole is significantly reduced.

It should be noted that a 3D EM image shows resistors ... not hydrocarbon reservoirs. There are many other resistors buried in the subsurface – salt, volcanic rocks, carbonates and methane hydrates all exhibit resistive properties. The deep penetration and high resolution of seismic data is invaluable in creating meaningful, detailed regional geologic models and identifying potential hydrocarbon traps. However, seismic data is clearly more reliable if it is used in conjunction with EM.

Environmental impact of EM

Receivers deployed on the seabed use biodegradable anchors and have negligible environmental impact. The source uses extremely low spatial and temporal frequencies – typically wavelengths of many kilometers and frequencies of 0.1 to 1 Hz. When these low frequencies are considered in combination with the exponential decay of energy caused by highly conductive seawater, the region of potential influence on marine life resulting from EM transmissions is tiny. Furthermore, since EM methods reduce the number of dry wells drilled, the method can be considered environmentally positive.

Potential reduction in seismic activity

In theory, broader application of EM methods could reduce “dry 3D seismic surveys” in the same way it currently reduce dry wells. However, the current impact of EM methods on seismic activity is negligible. There are 2 reasons for this.

1) Current EM methods have neither the resolution nor the penetration to replace seismic in a significant range of exploration and production applications.

2) Even where EM technology is effective, it is underutilized by many oil companies due to the wide spread lack of understanding and adoption of the technology.

Summary and Recommendations

EM offers some, limited potential to reduce the growth in seismic activity, but action is needed in 2 areas to enable this.

1) Further R&D investment is required to grow the application window for EM methods by increasing depth of penetration and resolution of the method.

2) Regulatory changes in leasing practices, taxation, accounting (reserves estimation etc.) can accelerate the adoption of EM methods.

Vibroseis Technology

Rune Tenngamn, PGS Data Processing and Technology

For several decades, airgun sources have dominated the marine seismic acquisition market. Surprisingly, few new source concepts have been presented to the industry during this period. During the eighties, however, developments related to marine vibrator sources took place. These sources were tested mainly for deep target marine seismic applications. These applications have since been limited, due to factors such as high cost, handling and operational difficulties, etc.

During the late nineties, PGS started the development of a completely new electro-mechanical marine vibroseis concept. The objective of the project was to develop a 100% repeatable low-cost vibrator source with an energy output in the frequency band of 6-100 Hz and with a size and weight easy to operate in the field. Target applications of the source are shallow water acquisition, seismic monitoring and environmentally sensitive areas.

A marine vibrator will provide several environmental advantages. Vibrator technology spreads the net source energy over a long period, reducing the acoustic power in comparison to impulsive sources. The peak power of a Marine Vibrator is about 30 dB lower in sweep mode than the corresponding peak power of an impulsive source. This is attractive for applications where high peak power may be problematic. There is no need for heavy equipment and hydraulic systems that can cause hydraulic oil spills. As the electrical vibrator requires only an electrical power supply it can be easily transported to different vessels and locations without any costly installations and potential environmental hazards.

Electrical marine vibrators also have several operational advantages. Due to the high efficiency of the sources, controllable and arbitrary signals can be generated in the frequency band of interest. This fact has been used to develop a control system that makes the acoustic sources repeatable over time. Having a feedback loop for control of the output means that not only can high repeatability be achieved, but the harmonics can also be attenuated. Any mechanical system will generate harmonics. Tests have shown some dramatic change in harmonics generated by a sweep. Some of the harmonics are attenuated by more than 30 dB.

The controllability of the source makes it possible to introduce Pseudo Noise sequences (PN). With the use of PN signals it will be possible to reduce the peak power even more. The PN sequences will not only spread the source energy over time, but will also spread the frequencies over time. This technology will further reduce the peak power for any frequency at any particular time by another 20 dB compared to a sweep.

In a future scenario, we could have an array of controllable marine vibrators with the energy concentrated in the vertical plane through beam steering of the acoustic output. The PN signals would “mimic” natural background noise. By having a continuous “noise” signal the active array would be difficult to distinguish from the natural background noise.

Low frequency passive seismic for oil and gas exploration and development: a new technology utilizing ambient seismic energy sources

Robert M. Habiger, Spectraseis

Introduction

A growing number of low frequency surveys at different oil and gas field locations throughout the world have indicated the possible relationship between certain microtremors and the presence of hydrocarbons. These narrow-band, low frequency (from ~1Hz to ~10Hz) micro-tremor signals offer new types of seismic attributes for the optimization of decisions for exploration and development phases of hydrocarbon exploitation.

Although the primary application of this technology to date has been on land, the potential exists for applying in a marine environment and a proof of concept survey was conducted in April, 2007 in the North Sea.

Data Acquisition

The low frequency data were acquired by using broadband seismometers located on the ocean bottom. The ocean bottom sensors (OBS) can be deployed in deep water and left to record data for days, weeks, or even months. No active sources, such as air guns, are needed in these measurements since only modifications to the earth’s natural background energy are monitored. The OBS units can be easily deployed and recovered using well known operating procedures.

Data Processing

The main challenges of moving this technology from land to marine applications are adequate coupling of the sensors to the ocean floor for short data acquisition durations and the large amounts of extraneous ambient noise in the oceans. The nature of the ocean noises and how it can interfere with the quality of measurements and analysis will be discussed along with suggestions for mitigation.

The workflow consists of removing unwanted noise, characterizing the measured signal according to time stability and frequency characteristics, and then calculating low frequency attributes related to hydrocarbon micro tremors.

Conclusions

Low Frequency passive seismic is a new technology that has been applied mostly in land surveys but warrants further investigation and development for application to a marine environment. An initial test has been completed in the North Sea for oil and gas applications and the information gained can be used for planning follow-on surveys to further advance this technology.

Passive Seismic Tomography: structural imaging using natural sources

Peter M. Duncan, MicroSeismic

Reflection seismology is a mainstay of the exploration for hydrocarbons, whether onshore or offshore. While the use of controlled sources (dynamite, airguns or vibrators) for such imaging is certainly the standard, it has been appreciated for many decades that one can also use the earth's natural seismic sources to illuminate the earth's structure. Much of our knowledge of the interior structure of the earth on a global scale has been derived from imaging involving the transmission and reflection of seismic waves whose source was an earthquake on the other side of the earth. Recent work using surface waves excited by the pounding of waves on the beach has begun to unravel the crustal structure of continents. In the last decade there has been work directed at using these same energy sources to create images useful for hydrocarbon exploration and production. These efforts are driven by both environmental concerns and by the expense of conventional seismic imaging. Collectively we refer to these imaging techniques using naturally occurring or ambient noise sources as passive seismic tomography.

The most straightforward application of this passive technology is commonly referred to as passive seismic transmission tomography (PSTT). PSTT creates 3-D images using the observed travel time of seismic signals originating from micro-earthquakes occurring below the target. A sparse array of independent seismometers is established above the target. The array usually consists of 20 to 100 stations each recording the output of a 3-component geophone. With the array in place, the survey proceeds by simply listening. Assuming an initial velocity model, the observed micro-earthquakes are located in time and space using long-standing location algorithms based upon picks of the p and s phase arrival times at each observation station. Once a number of events has been located one flips the process, assumes the origin time and hypocenters of the events are known, and uses some form of travel time inversion to estimate a new velocity model. As more events are added to the dataset, finer estimates of the velocity structure can be achieved. The process proceeds in this boot-strapping fashion until the desired resolution is reached.

If one cross correlates the time signal recorded by the stations of the array established for PSTT, it is often possible to identify 2 other types of seismic signal that are useful for imaging. The first is the surface waves that course back and forth along the earth's surface. The speed of travel of these waves is controlled by the velocity of the material that the wave "sees". Longer wavelengths penetrate more deeply into the earth and therefore sample the earth to a greater depth. This allows one to create a structural image from the rate that these surface waves traverse the array.

The second signal that may be extracted by the cross correlation process contains the multiple reflections of the ambient noise that have been bounced downward from the free surface of the earth and then reflected off velocity contrasts in the subsurface. This technique of recovering 3-D reflection image data from ambient noise signals was first postulated 40 years ago as “daylight seismic”. Recent experimental work has shown promise that such a technique may be able to deliver seismic images with a resolution sufficient to be useful in hydrocarbon exploration.

The dB_{ht} Method for Evaluating Impact, Airgun Silencers and LF Projector Arrays

J Nedwell, Subacoustech

Introduction

High levels of man-made noise may be created by oil and gas exploration, construction, blasting, and many other offshore activities. Death and injury are extreme effects of underwater sound, occurring mainly where explosives are used. These are relatively well understood and unlikely in a well-managed programme.

However, the more subtle behavioural effects of sound have been an increasing focus of concern internationally. It has been alleged that seismic exploration may have undesirable side-effects upon aquatic animals over ranges of kilometres, or even tens of kilometres.

This paper reports on tests of two possible methods of attenuating the effects of seismic surveying, such that its likely impact on marine mammals will be reduced but its effectiveness as a sound source for seismic surveys would be adequate.

Estimating effects

The ability to estimate effect is critical in rating or comparing technologies intended to reduce the effects of seismic surveying. A simple measurement of sound, such as its peak pressure, is inadequate to judge the likelihood of, for instance, a behavioural avoidance response. Marine species have a wide range of hearing ability, and the same underwater sound will affect each species in a different manner depending upon the its hearing sensitivity and frequency range. Consequently, many researchers are now advocating the use of audiogram-based weighting scales to determine the level of the sound in comparison with the auditory response of the aquatic or marine animal. Madsen *et al.* (2006), for example, recommend that “*as the impact of sounds impinging on the auditory system is frequency-dependent, noise levels should (as for humans) ideally be weighted with the frequency response of the auditory system of the animal in question*”.

The dB_{ht} metric developed by the author incorporates the concept of “loudness” for a species. It incorporates hearing ability by referencing the sound to the species’ hearing threshold, and hence evaluates the level of sound a species can perceive, rather than its absolute level. It is critically important to judge the effects of noise reduction of seismic sources in this way, because a modification that reduces the level of high-frequency noise, for instance, may well reduce its “loudness” for a high-frequency hearer such as many marine mammals. The peak level may, however, be unaffected, or even, as in the experiments reported here, increased.

Measurements were made at Vobster Inland Diving Quay, a water-filled former quarry near Mells in Somerset, of the pressure time history generated by an airgun with and without a compliant silencer. The silencer was intended to reduce the high-frequency components that marine mammals can hear, while leaving the low frequency components used for seismic exploration unchanged. It was found that the broadband (chiefly low frequency) output of the airgun was actually consistently higher, by about 3 dB on average, for the results with the silencer. However, there was an associated reduction in level of the airgun at low operating pressures in terms of its $\text{dB}_{\text{ht}}(\textit{phoca vitulina})$ value, and hence in its effects on a seal, of about 6 dB. At the higher discharge pressures the silencer material was thought to be collapsed by the airgun discharge, causing it to become relatively rigid, hence having less effect on the acoustics of the airgun. The silencer was thus beneficial for both seismic surveying and for the environment.

While the reduction achieved by the airgun silencer was modest, and, it is thought, well below that potentially achievable, a 6 dB reduction in dB_{ht} level represents a 4-fold reduction in the area of sea in which a seismic survey might have a given effect on a marine mammal, or 12-fold for an airgun array of constant Source Level if the increase in Source Level, and consequent reduction in the number or power of airguns required, is taken into account.

The concept of the low impact seismic array (LISA) was based on the use of inexpensive but powerful and rugged electromagnetic projectors to replace airgun arrays. The prospective benefit was that since the signal could be well controlled, both in frequency content and in the direction in which the sound propagated, the possibility existed of undertaking seismic surveys in environmentally sensitive areas with little or no collateral environmental impact.

The LISA project embodied the idea of using a large array of small but powerful electromagnetic projectors to replace airgun arrays. Initial measurements were made on a small ($n=4$) array of existing electromagnetic transducers designed by Subacoustech. It was found that a Source Level of about 142 dB re 1 μPa per volt @ 1 metre was achieved, at a peak frequency of 25 Hz. The operating frequency could be reduced to under 10 Hz with reasonable modifications, allowing use of an array for seismic exploration. The results indicate that it would be possible to achieve an array Source Level of about 223 dB re 1 μPa @ 1 metre, which is adequate for seismic surveying.

In summary, both of these technologies have significant prospective benefits in respect of reducing environmental effects during seismic surveying. In the case of the airgun silencer, the technology has additional benefits for seismic surveying, as it increases the level of the airgun while simultaneously reducing its environmental effect on marine mammals.

Fibre optic receivers and their effect on source requirements

P. Nash, A.V. Strudley, Stingray Geophysical

There is growing interest in the use of Seismic Permanent Reservoir Monitoring to maximise recovery and optimise production by time-lapse reservoir monitoring. In comparison to repeat towed streamer surveys, such systems offer greatly improved repeatability, better seismic signal/noise, and provide additional value from the direct recording of the full 4C vector wave-field. Seabed arrays based on

fully fibre optic sensing and telemetry are particularly attractive for this application because of their increased reliability and relative ease of deployment and operation compared to electrical systems.

The characteristics of fibre-optic seismic PRM systems result in different seismic source requirements compared to conventional systems as described below:

Reduced amplitude: Permanent seabed systems typically achieve better signal to noise ratio than towed streamer systems because the receivers are directly coupled into the seabed and hence are not subjected to towing or weather induced noise. Also, the signal is only subject to one-way transmission loss in the water column. Further fibre-optic sensors have high sensitivity which, together with the lower noise floor results in reduced requirements for high amplitude sources. For these reasons, seismic Permanent Reservoir Monitoring (Seismic PRM) has so far been conducted with relatively small seismic airgun sources –typically, a towed airgun array with around 70 bar-m p-p output (0-128Hz).

Reduced airgun volume: Typically, large volume airguns are used in the array for improved low frequency content. With fibre-optic seismic PRM the availability of pressure and acceleration measurements allows improvement in the low frequency performance by combination of the two wave-fields up to the limit imposed by the low frequency noise floor. The use of accelerometers rather than velocity sensors avoids a low frequency limitation in sensor bandwidth associated with sensor resonance (typically 10 -15Hz for a velocity sensor). Hence the requirement for large airgun volumes may be reduced, with beneficial effects across the whole source bandwidth.

Reduction in total survey duration: Because the receiver array is permanently deployed total survey time is reduced compared to towed streamer surveys because no infill is needed and weather downtime is minimised. In areas where Ocean Bottom Seismic is required (e.g. for 4C data), there is no requirement for repeated shots at the edges of the receiver spread unlike the case for retrievable systems. Hence, for the same shot coverage, the total number of shots is likely to be reduced.

Reduced high frequency bandwidth: Fibre-optic hydrophones and accelerometers are very broadband sensors with responses into the 10s of kHz range. Typical airgun sources have appreciable energy output at these frequencies and hence the receivers require a large top end system dynamic range (typically ~ 180dB) to avoid sensor saturation. Significant efficiencies in fibre-optic architectures, which would result in reduced receiver array cost, could be gained if this dynamic range requirement were reduced. Hence a seismic source array with reduced high frequency output is desirable.

In summary, Seismic PRM based on fibre-optic technology is likely to be of increasing importance in the near future for improved reserves recovery. Such systems offer a number of potential opportunities for optimisation of seismic survey source requirements and in particular would benefit from reduced high frequency airgun source output, such as a marine vibrator or other non-impulsive, oscillating sources.

Alternatives to Acoustic (Seismic) Geophysical Data Collection

Ron Brinkman, Minerals Management Service

Minerals Management Service (MMS) is a bureau of the Department of the Interior. Its mission is to manage the mineral resources of the Outer Continental Shelf in an environmentally sound and safe manner.

The collection of geophysical and geological data is critical for the MMS to fulfill its mission in helping meet our Nation's energy needs. However, the approval of seismic data collection activities must be considered in conjunction with concerns over the impact of these activities on the environment. These concerns are largely focused on sound introduced into the environment from seismic surveys and related activities (i.e., icebreaking, support vessel traffic, and aircraft over flights) and the effects of this sound on marine life and resources.

The issue of effects is further heightened by the lack of scientific certainty on the true impacts, the level of significance of these effects, and the ever increasing public scrutiny over these concerns. Despite these challenges, MMS is still charged with making decisions using the best available information. This leads to more conservative protective measures, additional mitigation and monitoring requirements, public criticism of environmental analyses and decision making, increased litigation, greater uncertainty on costs and risks for companies wanting to conduct seismic activities, impacts to access, and additional costs and delays in agency programs.

Ultimately, MMS must ensure that all seismic survey activities it regulates are in full compliance with all relevant environmental statutes and requirements. It is, therefore, imperative that MMS re-examine its processes for addressing seismic survey activities, both regionally and nationally, to identify where full environmental compliance is not yet reached and develop a plan forward to more effectively integrate seismic surveying and environmental compliance needs in light of these many challenges.

MMS is currently undertaking NEPA mandated geological and geophysical (G&G) Environmental Impact Studies (EIS) in all Regional Offices to determine compliance with call existing Laws. MMS is concurrently studying potential methods of noise reduction to existing seismic surveys. Samples of these studies include the following alternatives:

- ◇ Attenuate lateral noise with air bubble curtains, like has been shown in the literature, or with some special bubble curtain material, acting as a more solid (like a curtain) barrier;
- ◇ Make arrays more vertically directional, and thus narrow the cone of sound;
- ◇ Change the structure of the airguns to reduce high frequency sound (noise) while maintaining the strong source signal and low frequency source needed for exploration.

For more technical assessment and research studies see: <http://www.mms.gov/tarprojectcategories/>



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Fw: Response PG&E's Proposed Seismic Testing

Dan Buckshi to: cr_board_clerk Clerk Recorder
Cc: Kristi Gutierrez

10/22/2012 05:26 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:26 PM -----

From: James Patterson/BOS/COSLO
To: Dan Buckshi/Admin/COSLO@Wings
Date: 10/21/2012 06:23 PM
Subject: Fw: Response PG&E's Proposed Seismic Testing

Dan,
More materials on the off-shore seismic testing.
Jim

James Patterson
Supervisor, District Five
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San Luis Obispo, CA 93408
ph: 805 781.5450 fax: 805 781.1350

----- Forwarded by James Patterson/BOS/COSLO on 10/21/2012 06:21 PM -----

From: Ruth & Karl Kempton <nrview@thegrid.net>
To: jpatterson@co.slo.ca.us, fmecham@co.slo.ca.us, bgibson@co.slo.ca.us, pteixeira@co.slo.ca.us
Date: 10/19/2012 03:41 PM
Subject: Response PG&E's Proposed Seismic Testing

To:

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from

Item # 22 Meeting Date: 10/30/2012
Presented by: Karl Kempton
Received prior to meeting and posted to web
on: October 23, 2012

Karl Kempton
2740 Grell Lane
Oceano, Ca 93445
nrview@thegrid.net

October 19, 2012

□

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As an individual who earned a minor in mathematics with a statistical emphasis and as a former paid statistician, I would like to address perhaps the most glaring false assumption, in my opinion. This glaring false assumption is the use of various sonic research papers and conclusions based upon these studies to forecast the numbers of 'take' for various mentioned and unmentioned marine life species, especially mammals. The sited studies, statistically speaking, are not in the same 'statistical universe' as the proposed seismic imaging project. The proposed intensities and durations of the sonic waves exponentially far exceed any sited study or studies; the proposed intensities and durations of the sonic waves are unprecedented in scope compared to any referenced study. Thus, the predictive model is useless other than a significantly understated guess.

Moreover, the draft PG&E EIR and final PG&E EIR ignored in their approaches the conflict between the federal government's assumed lower standards or assumptions of sonic impacts to marine life, especially mammals and those of the California Coastal Commission that are significantly higher. The differences between these two standards are of statistical significance.

I and others have many concerns regarding understated and what we consider false assumptions in PG&E's Final Environmental Impact Report for the proposed Central Coast seismic imaging project that was certified by the California State Lands Commission on August 20, 2012. There are major concerns regarding the documents prepared by NSF and the EA prepared by Padre Associates, Inc.: both contradict the high levels of 'take' forecasted by both the DEIR and EIR of PG&E by stating that there will not be significant impact on the environment. Other understated or conflicting issues deal with human use of the ocean during testing periods, such as decibel levels impacting recreational ocean areas and lack of warning to overseeing agencies and cities.

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PG&E's Draft EIR Map shows their assumption/error that the Hosgri fault is 105 miles long, compared to USGS scenario of it being 250 miles long. These differences suggest PG&E may be underrepresenting the faults near DCNPP.

Local communities reflect on Fukushima when required to orchestrate an emergency evacuation plan during and after the worse case earthquake. We question why DCNPP and the onsite storage of nuclear waste have not been decommissioned and/or relocated.

Sincerely,

Karl Kempton



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bos letter.pdf



Slo Coast Journal - Marine Sanctuaries.pdf



Recreational impacts DCPP factsheet.pdf



CCC_CommentsSeismicSurveys.pdf



121018seismicsurveymemo.pdf

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District 5 James Patterson

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Local communities reflect on Fukushima when required to orchestrate an emergency evacuation plan during and after the worse case earthquake. We question why DCNPP and the onsite storage of nuclear waste have not been decommissioned and/or relocated.

Sincerely,

Karl Kempton

San Luis Obispo Country Board
of Supervisors
County Government Center
1055 Monterey Street
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fmecham@co.slo.ca.us

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District 5 James Patterson
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Karl Kempton
2740 Grell Lane
Oceano, Ca 93445
nrview@thegrid.net

October 19, 2012

Dear Board Members,

I am currently the lead researcher for the California Central Coast Marine Sanctuary Alliance. I was the lead ocean protection individual for the Environmental Center of San Luis Obispo from 1991 through 2005. As a former energy planner for the County of San Luis Obispo, I was hired to write the documentation for and promote the proposed Central Coast Marine Sanctuary as well as represent SLO County's interests against Offshore Oil extraction programs promoted by the Federal Minerals Management Service.

As an individual who earned a minor in mathematics with a statistical emphasis and as a former paid statistician, I would like to address perhaps the most glaring false assumption, in my opinion. This glaring false assumption is the use of various sonic research papers and conclusions based upon these studies to forecast the numbers of 'take' for various mentioned and unmentioned marine life species, especially mammals. The sited

studies, statistically speaking, are not in the same 'statistical universe' as the proposed seismic imaging project. The proposed intensities and durations of the sonic waves exponentially far exceed any sited study or studies; the proposed intensities and durations of the sonic waves are unprecedented in scope compared to any referenced study. Thus, the predictive model is useless other than a significantly understated guess.

Moreover, the draft PG&E EIR and final PG&E EIR ignored in their approaches the conflict between the federal government's assumed lower standards or assumptions of sonic impacts to marine life, especially mammals and those of the California Coastal Commission that are significantly higher. The differences between these two standards are of statistical significance.

I and others have many concerns regarding understated and what we consider false assumptions in PG&E's Final Environmental Impact Report for the proposed Central Coast seismic imaging project that was certified by the California State Lands Commission on August 20, 2012. There are major concerns regarding the documents prepared by NSF and the EA prepared by Padre Associates, Inc.: both contradict the high levels of 'take' forecasted by both the DEIR and EIR of PG&E by stating that there will not be significant impact on the environment. Other understated or conflicting issues deal with human use of the ocean during testing periods, such as decibel levels impacting recreational ocean areas and lack of warning to overseeing agencies and cities.

To address these and other issues, I attach four PDF documents:

- 1) SLO Coast Journal — Marine Sanctuaries PDF: this contains the October 2012 article co-authored by Carol Georgi and me focusing on several issues regarding intended and unintended consequences of the proposed seismic testing.
- 2) Recreational Impacts from PG&E's Seismic Testing PDF from the local Chapter of Surfrider

- 3) Coastal Commission Comments on the Effects of Anthropogenic Sound on Marine Mammals PDF
- 4) Proposed PG&E Seismic Survey Project PDF
(121018seismicsurveymemo)

While the neglected macro seismic issue is addressed in the SLO Coast Journal — Marine Sanctuaries PDF, I think and feel it is necessary to reiterate this issue:

The land mass west of the San Andreas Fault, north from Tomales Bay and south to the tip of Baja, is on a tectonic trajectory to form an archipelago off North America. Rifting is occurring up the Sea of Cortez into California pushing Baja westward. Baja's pressure causes the Western Transverse Block to our immediate south to rotate. The rotation to the current moment has been over 90 degrees since the process began. This rotation places pressure on our land mass, that in part causes of the uplift of the Irish Hills and the deformation of the seabed off our coast. The cracks in the seabed, the Hosgri, Santa Lucia and other faults, are a result of these and other tectonic forces which are tremendous in nature. Only recently has this macro picture begun to be understood. Cataclysmic ruptures are in our near and distant future.

The Diablo Canyon Nuclear Power Plant would not be permitted on its present site today. It may not have been permitted had PG&E not covered up and down played an earthquake fault upon which they built the power plant, i.e. within 500 feet and perhaps running under one of the nuclear reactor units.

Carl Neiburger reported the 14-year cover-up by PG&E in the SLO Tribune on November 5, 1981. "PG&E found evidence of an earthquake fault within 500 feet

of the Diablo Canyon Nuclear Power Plant in 1967, but chose not to pursue it to avoid 'additional speculation and possibly delay the project.'"

The "fault" referenced in the article is the fault Dr. Hamilton refers to today as the "Diablo Cove Fault." It had never been given a formal name until a couple of years ago when Dr. Hamilton submitted his first treatise (and draft) of his paper on this subject to the California Energy Commission.

We question that the Diablo Cove Fault is not included in the fault lines printed on the EIR map. This is the fault line that remains undiscussed. Does the fault extend under Unit One nuclear Reactor and out to sea connecting, perhaps, with the Shoreline fault discovered by the USGS in 2008?

We ask for land seismic surveys and low level ocean seismic surveys to be evaluated, and Dr. Hamilton's scope to be included before rushing to destroy the precious marine life within these waters and financially impacting coastal communities. (As printed in the September, 2012 Slo Coast Journal http://slocoastjournal.com/docs/archives/2012/sept/pages/marine_sanctuary.html.)

In their June 4, 2012 letter (printed at end of letter), The Alliance for Nuclear Responsibility (A4NR) asked the CA State Lands Commission to require PG&E to specifically delineate the changes in its offshore and onshore study plans necessary to gather data to fully assess the "missed fault" recommendations of Dr. Douglas Hamilton, as graphically mapped in the DEIR comment submitted by geologist Erik Layman. (Central Coastal California Seismic Imaging Project) Dr. Hamilton

was part of PG&E's Diablo geosciences team from 1971 to 1988.

Rochelle Becker, Executive Director of A4NR states that the CA Public Utilities Commission (CPUC) Judge proposed decision in the Diablo seismic funding case stated that they expect PG&E to include Dr. Hamilton's scope and that is what ratepayers expect for their multimillion dollar expenditure. Dr. Douglas Hamilton's point in his testimony before the CPUC, February 10, 2012: ". . . nothing in the planned additional surveys, both onshore and offshore, offers any prospect for any result beyond marginal improvement to what is already known."

Andrew Christie, Director of the Santa Lucia Sierra Club states: "PG&E says they will incorporate the additional onshore areas he pointed out they had ignored in their initial survey design; they have not said they are deleting offshore areas he pointed out as already sufficiently studied, or sought his input on which areas those are, beyond the now-deleted Cambria Steptoe."

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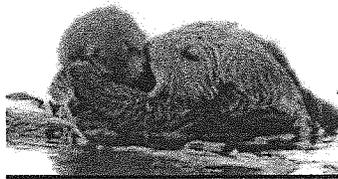
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Sincerely,

Karl Kempton



The Slo Coast Journal

California Sea Otter
(*Enhydra lutris*)

Marine Sanctuaries

SloCoastJournal.com

October 2012

Issue 40

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PG&E's Proposed Acoustic Seismic Testing Off the California's Central Coast Should Be Denied

by Carol Georgi and Karl Kempton

(Former Energy Planner for San Luis Obispo County and
Lead Author of "[Proposed Central Coast National Marine Sanctuary, 1990](#)")



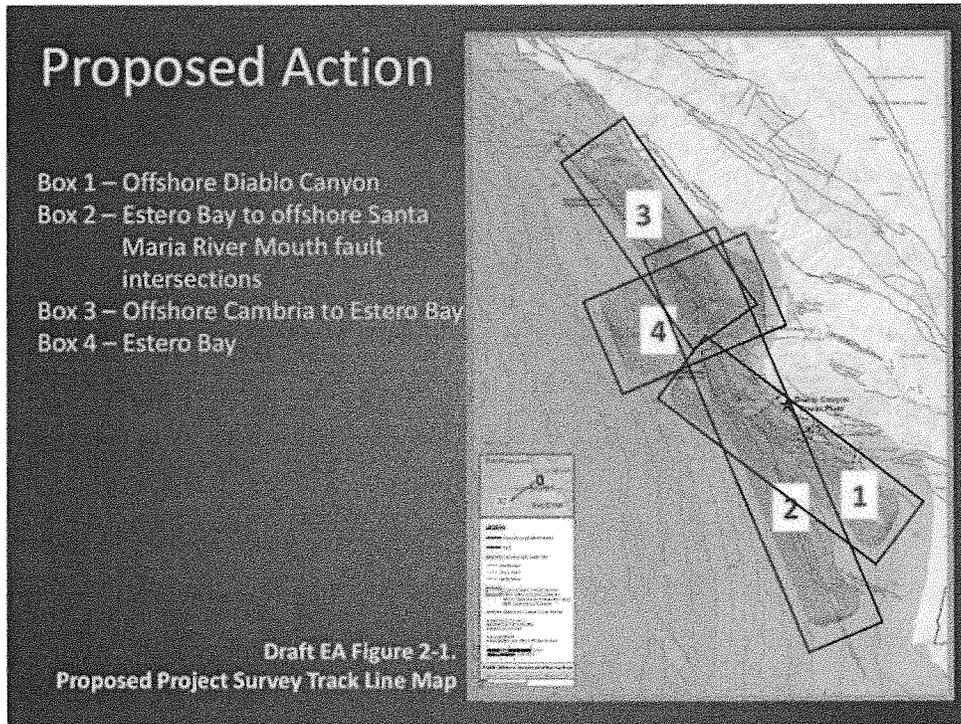
Location of Proposed Seismic Testing

PG&E's proposed acoustic seismic survey is planned to occur in 540 square miles of the ocean area between the Channel Islands National Marine Sanctuary and the Monterey Bay National Marine Sanctuary. Our June 2012 Marine Sanctuary Article detailed information on the "[Concerns and Risks of PG&E's Proposed Central Coastal California Seismic Imaging Project](#)".

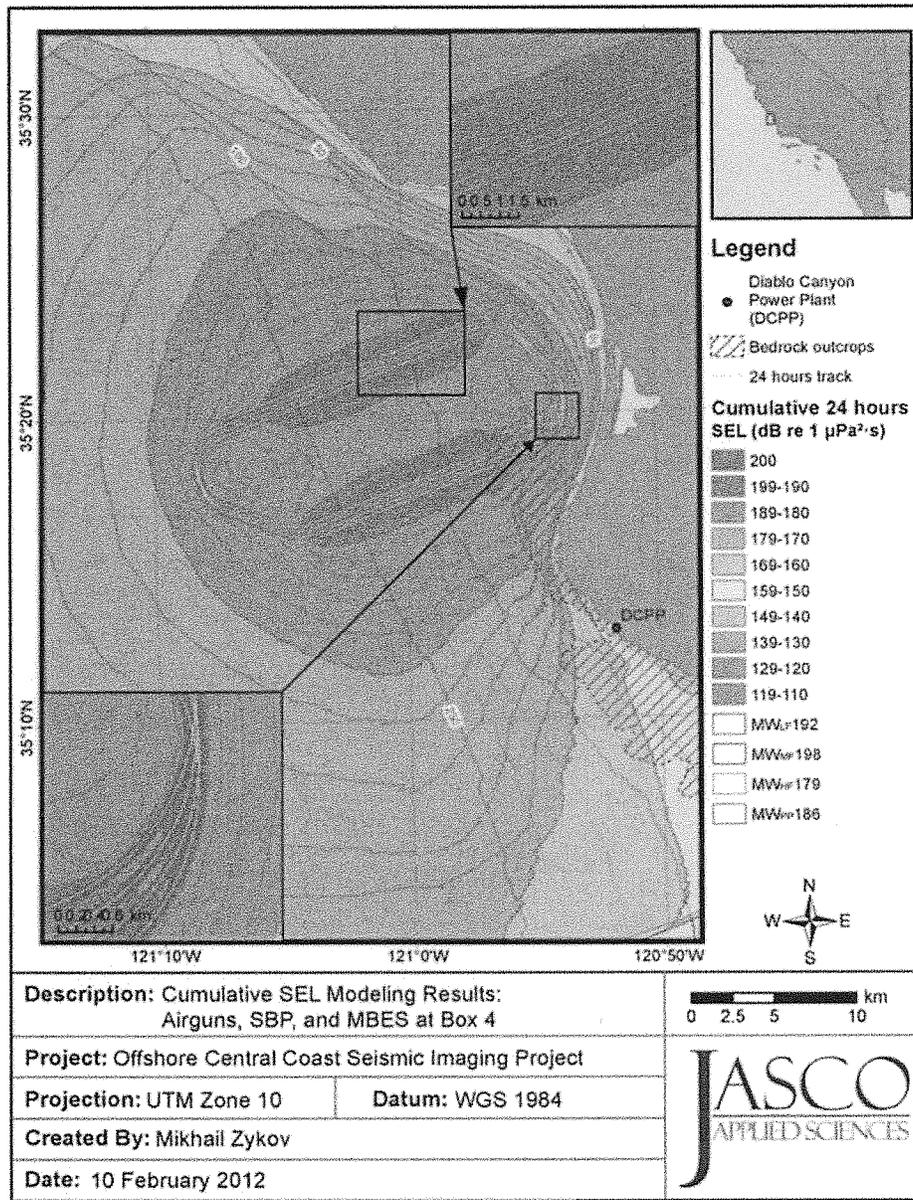
These two protected sanctuaries and the ocean area between them share many marine species that swim into the seismic testing ocean area to feed. Marine mammals especially feed from the year-round persistent upwelling between Point Conception and Point Sal. This upwelling flows through the submerged five-fingered Arguello Canyon. (See: [SLO Coast Journal, June 2011](#))

A large portion of this seismic testing ocean area, including the Santa Lucia Bank, was nominated twice through Congressional legislation for National Marine Sanctuary designation in the early 1990's. (See: [May 2011 SLO Coast Journal](#))

PG&E's Proposed Seismic Zones of 4 Boxes with Boat's Grid Patterns of entire two-year survey.



Testing Zone Box 4 with the Boat's Grid Pattern is Planned to begin November 19, 2012



Impacts to Marine Web-of-Life and Coastal Economies

PG&E's proposed seismic testing would be catastrophic to local marine life, especially marine mammals, which rely on their sensitive auditory capabilities for communication and navigation. The takings permit for the project – the estimated amount of wildlife that could be killed (Page 4.4-79 of the EIR) includes "One minke whale, two sperm whales, five dwarf sperm whales, 13 humpback whales, 15 blue whales, 25 fin whales, 97 California gray whales, one short-finned pilot whale, three Baird's beaks, seven orcas, eight striped dolphins, eight small beaked whales, 81 Dall's porpoise, 82 long beaked white-sided dolphins, 1,652 bottlenose dolphins,

and 1834 short-beaked dolphins, 76 harbor seal, 1,062 California sea lions, 1,485 southern sea otters, untold sea turtles, numerous fish and bird species and larva." (See: [SLC CA](#))

The Morro Bay and San Luis Harbor fishermen have worked for decades to create sustainable locally "branded" fishing. They now stand to lose their livelihoods. The [EIR](#) states that fishing will end for an unknown length of time. Loss of fish stocks and the marine web-of life is especially significant for the Marine Protected Areas within the seismic testing zone.

Receiving acoustic blasts at 250 decibels every 15 seconds around the clock for weeks will destroy the marine web-of-life within the survey areas because the decibel level is too intense. The boat will follow a grid pattern within the survey area assuring a "Cleansing" result of all marine life, including marine mammals, crabs, abalone, fish, larvae, eggs, plankton, algae, kelp forests, etc, as we described in our [September 2012 SLO Coast Journal Article](#).

We urge all commissions and agencies to consider how much granting a permit would ask these coastal communities and marine web-of-life to sacrifice in exchange for a few more years of operating an old nuclear power plant located on and near faults.

We question that PG&E's Sonic Seismic Studies are Mandated by California State Laws.

The proposal to conduct high intensity acoustic sonic seismic studies of the ocean floor along the Central Coast is PG&E's response to recommendations made by the 2008 California Energy Commission Report, "[An assessment of California's Nuclear Power Plants: AB 1632 Committee Report](#)."

The California Energy Commission (CEC) was directed by AB 1632 "to assess the vulnerability of the state's operating nuclear power plants." The bill did not require the kind of seismic studies that PG&E is proposing. In 2009, the CEC and the California Public Utilities Commission directed PG&E to complete the three-dimensional geophysical studies recommended by the CEC.

The State Lands Commission (SLC), lead agency on the proposed project, certified the EIR for the project on Aug. 14 and on Aug. 20, 2012, the SLC adopted the [Mitigation Monitoring Program, Findings, and Statement of Overriding Considerations](#).

[National Resources Defense Council Calls for Stop to PG&E's Seismic Test, and Urges Coastal Commission to Deny Permit](#)

California Fish and Game Commission Meeting September 24, 2012

The CA Fish and Game Commission (CFG) met in Sacramento on September 24, 2012 to gather information and discuss the status of PG&E's proposed Central

Coast seismic imaging project, PG&E's application for a Scientific Collecting Permit.

The CFGC has regulatory authority to protect natural resources and oversee Marine Protected Areas, including those near Diablo Canyon. However, the Fish and Game Commission does not have authority to manage whales, dolphins or sea otters. Marine mammals are protected under federal authorities.

Internationally and locally, the public is concerned about PG&E's proposed seismic testing. The Commission received over 50 letters and faxes and 44,000 emails before they had to shut down the email account.

Many citizens representing 10,000 residents of Morro Bay and nearby coastal communities in San Luis Obispo County, CA drove six hours to Sacramento to speak three minutes each to the CFGC.

Fred Collins, Tribal Administrator of the Northern Chumash Tribal Council, stated the Chumash Nation has lived in the San Luis Obispo coastal areas for 18,000 years, and they do not give a permit to extract cultural resources important to their nation. He emphasized destruction of submerged Chumash Sacred Sites and Chumash Cultural Resources would violate sections of the [United Nations Declaration of the Rights of Indigenous Peoples](#). (See: [The Northern Chumash Tribal Council \(NCTC\)](#))

During public comment, representatives from Stop Diablo Canyon Seismic Testing, COAST, National Resources Defense Council, Sierra Club, Ocean Conservancy, Greenpeace, Surfrider Foundation, Sea Shepard, and many others asked the CFGC to deny giving PG&E a permit that would decimate the fishing stocks and marine web-of-life. Some stated PG&E's proposal for the acoustic seismic survey is not mandated.

No decision was made, and CFGC directed its staff to attend the Oct. 10-11 meeting of the CA Coastal Commission to gain further information before considering granting a permit to PG&E.

CFGC President Jim Kellogg of Discovery Bay stated, "It's a Marine Life Protection Area, not a Marine Life Killing Area, and as long as I'm here we're not gonna recommend to the Department (Fish and Game) anything that's kill'n anything that we're trying to protect."

Watch the [California Fish and Game Commission September 24, 2012 meeting online](#) to hear the full story.

We are concerned about the damage this seismic testing proposal would have locally and internationally, and we are working with others to prevent unnecessary damage to the marine web-of-life and the local economies.

Local Activist Groups Formed to Stop the Seismic Testing

Two local grass-root groups of concerned citizens have been organized and are actively speaking, writing letters, posting information, planning events, and receiving international attention and support. The local [San Luis Obispo Chapter of Surfrider Foundation](#) is working with both groups. SLO Surfrider's presents their 10th annual Cayucos Freefall Art & Music Festival October 20th at the pier. Cayucos in on Estero Bay and Surfrider Freefall will include information tables on seismic testing.

1) [Stop the Diablo Canyon Seismic Testing Facebook Family](#)

Founded by Joey Racano of Los Osos on July 13, 2012 with the focus on Saving the Whales from harm caused by sonic blasting. The group has inspired a community to learn about the seismic tests and write letters to stop this harmful testing with high intensity sonic blasts.

*Facebook page is enjoyed by many as it is updated daily with whale inspired poetry and art.

*Several people post important information about whales and seismic testing with sonic blasts.

* Organized the successful letter/email and speaking campaign to the CFGC and to the CCC

2) [C.O.A.S.T: Citizens Opposed to Acoustic Seismic Testing](#)

Founded by Mandy Davis and Mark Tognazinni of Morro Bay on September 14, 2012 with the focus on helping the commercial fishermen. Most of the group is from Morro Bay and they are working to stop the seismic tests so the fishermen do not lose their fish stocks.

*Posts information and action items.

*Communicated with the CFGC and organizing for more active participation.

Announcement of October Events in Morro Bay and Cayucos ([Estero Bay](#))

October 6th & 7th –10am-6pm - [Morro Bay Harvest Festival](#)

COAST event: Land and Sea rally in Morro Bay during the Harbor Festival

See [COAST facebook](#) for details.

October 8 - Calling of the Whales – See the [Event Calendar on Facebook](#)

Starting at 3:00pm in the Avila Parking lot: Come meet Mz Blue, the 90' Great Blue Whale provided by Gershon Cohen, from the Great Whale Conservancy, and a Gray Whale dirigible, provided by Farmer's Kites of Morro Bay. Visit the nearby Avila Beach Sea Life Center, and visit our booths!

**Then at 6:30pm on Port San Luis Beach, join us in the 1st ever
Calling of the Whales!**

At sundown, we will gather around a roaring fire on Port San Luis Beach, where a member of the Chumash Tribe will blow the sacred Conch Shell and Call to the Whales of Avila. Greenpeace will unfurl their famous banner and then we will begin the light festival, using flashlights to create a human-powered pinwheel! [Facebook Page](#)

Deny Permit for Seismic Blasting or Restore Ecosystem

We ask the commissions to deny or postpone issuing a geophysical survey permit to PG&E for high intensity seismic testing in San Luis Obispo County. Further, we state that if the permit is allowed, then the only acceptable mitigating condition is the restoration of the marine ecosystem damage.

We suggest the mitigating condition of \$2.5 million per year for 20 years to provide funds for a basic marine sanctuary for the restoration of sustainable fishing and ecosystem health. For example, Rockfish need to be about 20 years old to reproduce.

This mitigating condition would save the City of Morro Bay and other coastal communities, as well as give back to the ocean. This mitigation is in addition to the settlement PG&E is offering the fishermen for lost catches due to seismic testing. The [EIR](#) states that commercial fishing will end for an unknown length of time.

Additional Permits PG&E Needs to Acquire

The agencies besides the Lands Commission are the California State Parks, California Department of Fish and Game, Central Coast Regional Water Quality Control Board, National Science Foundation, National Marine Fisheries Service, United States Fish and Wildlife Service, United States Army Corps of Engineers, United States Coast Guard, and San Luis Obispo Air Pollution Control District.

Please see Jack McCurdy's article, "[Seismic Studies Likely To Be Delayed](#)," SLO Coast Journal, September 2012 for the complete list of needed permits.

The California Coastal Commission - The [California Coastal Commission](#) (CCC) will consider PG&E's application for a coastal development permit at their November 14-16, 2012 in Santa Monica, California. The CCC has posted the background materials to [PG&E's Offshore Seismic Survey](#). Meeting Location: Santa Monica Civic Auditorium – East Wing, 1855 Main Street, Santa Monica, CA 90401

PG&E revised its project to only include the survey of "Box 4" in Estero Bay. A detailed description of this new proposal is on the CCC website as a link from their agenda: [Coastal California / Seismic Survey](#) .

a. Application No. E-12-005 and CC-027-12 (Pacific Gas & Electric Co., San Luis Obispo Co.) Application of PG&E to conduct a high energy three-dimensional geophysical survey employing use of air guns, hydrophones, and seafloor geophones in state and federal waters offshore San Luis Obispo County. (CT-SF)

We encourage you to write letters and mail or FAX to the CCC stating your concerns.

**California Coastal Commission
Central Coast District Office
Dan Carl, Deputy Director
725 Front Street, Suite 300
Santa Cruz, CA 95060-4508
FAX (831) 427-4877**

The National Marine Fisheries Service (NMSF) and the National Oceanic and Atmospheric Administration (NOAA), Department of Commerce

Federal Register / Takes of Marine Mammals Incidental to Specified Activities

Posted Notice of Action: Incidental Harassment Authorization; request for comments in the Federal Register, Vol. 77, No. 182.

Takes of Marine Mammals incidental to Specified Activities; Marine Geophysical survey of the Central Coast of CA, November to December, 2012.

Comments and information must be received no later than October 15, 2012.

Comments on the application should be addressed to:

P. Michael Payne, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910

Email comments including attachments must not exceed a 10-megabyte file size.

No announcement of a public meeting at this time.

DCNPP Seismic Issues – Overview by Karl Kempton

The land mass west of the San Andreas Fault, north from Tomales Bay and south to the tip of Baja, is on a tectonic trajectory to form an archipelago off North America. Rifting is occurring up the Sea of Cortez into California pushing Baja westward. Baja's pressure causes the Western Transverse Block to our immediate south to rotate. The rotation to the current moment has been over 90 degrees since the process began. This rotation places pressure on our land mass, that in part causes of the uplift of the Irish Hills and the deformation of the seabed off our coast. The cracks in the seabed, the Hosgri, Santa Lucia and other faults, are a result of these and other tectonic forces which are tremendous in nature. Only recently has this macro picture begun to be understood. Cataclysmic ruptures are

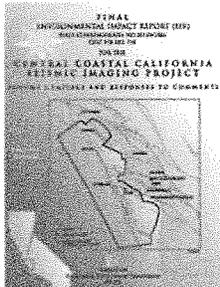
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We question that the Diablo Cove Fault is not included in the fault lines printed on the EIR map. This is the fault line that remains undiscussed. Does the fault extend under Unit One nuclear Reactor and out to sea connecting, perhaps, with the Shoreline fault discovered by the USGS in 2008?



Final Environmental Impact Report (EIR)

Include Dr. Hamilton's scope

We ask for land seismic surveys and low level ocean seismic surveys to be evaluated, and Dr. Hamilton's scope to be included before rushing to destroy the precious marine life within these waters and financially impacting coastal communities. (As printed in the [September, 2012 Slo Coast Journal](#).)

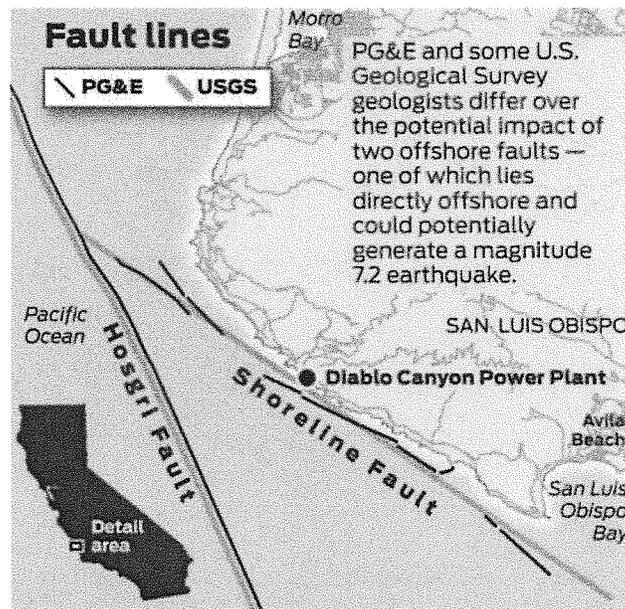
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Dr. Hamilton was part of PG&E's Diablo geosciences team from 1971 to 1988.

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according to Mr. Johnson, the more likely it could connect with other faults to the north of the plant to produce "close to an 8.0" earthquake. Diablo Canyon was constructed to withstand ground-shaking from a 7.5 earthquake on the Hosgri, three miles off shore. This scenario might elevate concerns." (See: [Rock of the Coast](#))

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Local communities reflect on Fukushima when required to orchestrate an emergency evacuation plan during and after the worse case earthquake. We question why DCNPP and the onsite storage of nuclear waste have not been decommissioned and/or relocated.

Concluding Background and Additional Information

Marine Life Issues

"Proposed Central Coast National Marine Sanctuary, 1990"

In the early 1990's, the nearshore and offshore waters from Point Sal to Mill Creek were nominated twice in Congressional bills for Marine Sanctuary status due to the international and national significance of bio diversity and density. This ocean area is where the high intensity seismic testing is proposed to occur. In the first decade of this century, The Channel Islands and Monterey Bay National Marines Sanctuaries studied the unprotected waters between Point Conception and Santa Rosa Creek. Both sanctuaries have published maps and plans as a result of those studies to expand to protect these waters.

See studies:

- 1) A Biogeographic Assessment of the Channel Islands National Marine Sanctuary, "A Review of Boundary Expansion Concepts for NOAA'S National Marine Sanctuary Program," November 2005
- 2) A Biogeographic Assessment off North/Central California: In Support of the National Marine Sanctuaries of Cordell Bank, Gulf of the Farallones and Monterey Bay, "Phase II Environmental Setting and Update to Marine Birds and Mammals," October 2007
West Coast Only Persistent Upwelling --

The oceanographic features of the Santa Lucia Bank, a cetaceous uplift block to within 400 meters of the surface north of Arguello Canyon, the five-fingered Arguello Canyon, running NE-SW to a depth of 3000 meters, the Channel Islands, the Southern California Bite, and a meeting place of various currents all

contribute to the only persistent upwelling along the west coast located between Points Conception and Sal.

The September 2010 article of the SLO Coast Journal "[Core Area One of the Proposed Marine Sanctuary Expansion - Santa Lucia Bank, Santa Lucia Escarpment, Arguello Canyon and the Persistent Upwelling between Point Conception and Point Sal](#)**"**

Because of the nutrient-richness of the upwelling waters the area contains a vast array of marine life: a benthic (deep water) community of world-wide significance, simultaneous gathering of 13 whale and porpoise species, and large numbers of birds and fish during the Autumn. The upwelling feeds the entire web of life along the eastern rim of the Pacific Basin including two National Marine Sanctuaries to its South (Channel Islands) and North (Monterey Bay).

The entrained nutrients of this upwelling are the foundational food for the phytoplankton that in turn forms the basis of the web of life for the area and two national marine sanctuaries to its north and south. The phytoplankton richness maintains the internationally and nationally significant bio density and diversity of an area that two marine sanctuaries have called for sanctuary designation through expansion in their research documents and proposals.

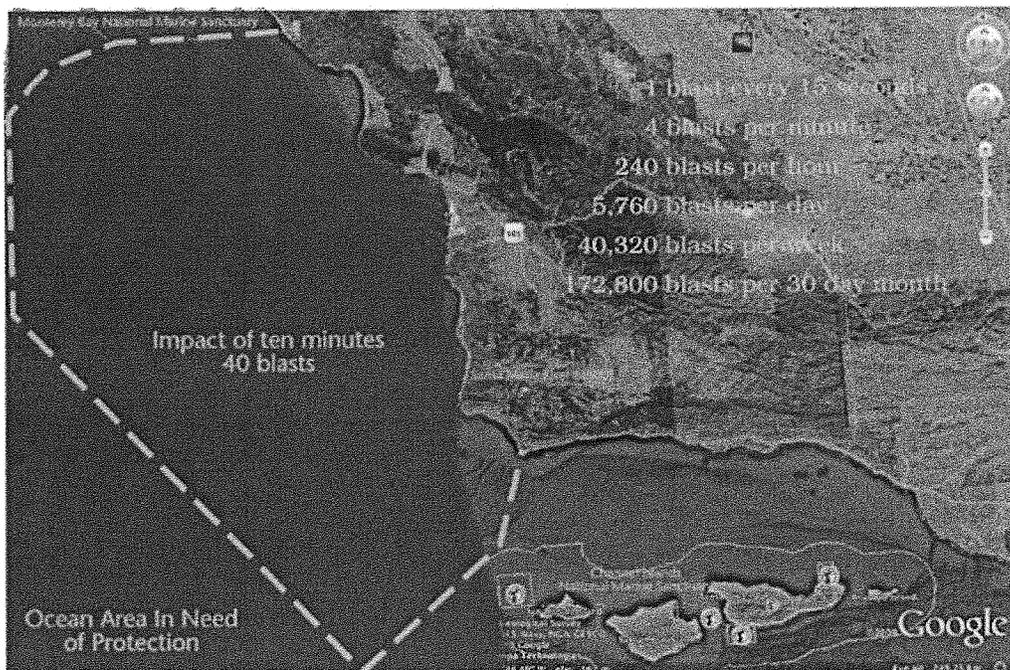
This area temporally hosts many seasonal migrating species including the endangered brown pelican and California Grey Whale. The former's pre-wintering rookery population is densest along the shoreline of San Luis Obispo County. Many brown pelicans are in this area in November. The latter population begins its southern bound migration from the Arctic in the late Autumn; its first migrants are known to appear in late October or early November.

Of special note: some commercial businesses use sound waves to kill algae in a cleaning process, and state: The complex pattern of ultrasonic vibrations through the water causes the algae vacuole cell wall to resonate and break, much like a glass breaking from a high pitched sound. The broken vacuole wall eliminates its ability to grow and reproduce. (See: [Spartan Water Treatment](#))

We question: what will constant bombardment to all forms of algae from single cell to complex kelp do to the food chain? What will it do to single cell plankton and animal life, all of which form the foundation for the area's and the national marine sanctuaries to the south and north?

We are concerned that the marine web-of-life is at risk of surviving. The high intensity seismic testing at 250 decibels is expected to "cleanse" the close-proximity project area of all life.

Death and harm from sound waves occur because sound is a pressure wave. This is why you can feel your body vibrate during loud, low sounds (such as those felt



5,760 blasts per day
40,320 blasts per week
172,800 blasts per 30-day month

PG&E's sonic seismic studies will violate many existing International, Federal, State, and Local Laws, as well as, Regulatory Requirements and Plans listed in the 4.0 Existing Environment and Environmental Impact Analysis of The Central Coastal California Seismic Imaging Project.

Table 4.0-1 Major International and Federal Laws, Regulatory Requirements, and Plans

Of the many, 30 are listed here:

Monterey Bay National Marine Sanctuary
CA Coastal Act
Coastal Zone Management Act
CA Fish and Game Code
CA Sea Otter Game Refuge
CA Marine Protected Areas
CA Coastal Monument
CA State Parks
Nipomo Dunes National Wildlife Refuge
Estuaries and Natural Preserves
The Endangered Species Act

- Marine Mammal Protection Act**
- Magnuson Stevens Fishery Conservation Management Act**
- Bald and Golden Eagle Protection Act**
- Migratory Bird Treaty Act**
- National Marine Sanctuary Act**
- Executive Order #13112 to prevent Invasive Species**
- Executive Order #13158 Marine Protected Areas**
- Rockfish Conservation Areas**
- Clean Water Act**
- California Ocean Plan**
- Clean Air Act**
- National Historic Preservation Act**
- Archaeological and Historic Preservation Act of 1974**
- Archaeological Resources Protection Act of 1979**
- Rivers and Harbors Act**
- Coastal Zone Management Act**
- California Species Preservation Act of 1970**
- California Endangered Species Act of 1984**
- California Marine Life Protection Act**

Banner Image of Otter & Pup by [Cleve Nash](#)

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Recreational Impacts from PG&E's Seismic Testing

Seismic testing has the potential to adversely impact recreational ocean users, including fishers, divers, swimmers and surfers during active testing, which will take place for 42 consecutive days. PG&E's Environmental Impact Report (EIR) clearly states seismic testing can impact humans:

"The proposed offshore activities *would* expose persons present in the water to harmful noise levels..."

"Studies have shown that high levels of underwater noise can cause dizziness, hearing damage, or other sensitive organ damage to divers and *swimmers*, as well as indirect injury due to startle responses"

"Noise levels in excess of 154 dB re 1 μ Pa could be considered potentially harmful to recreational divers *and swimmers* in the Project area".¹

A study conducted by U.S. Navy concluded that 145 dB is a safe level for humans, stating:

"In June 1999 NSMRL set interim guidance for the operation of low frequency underwater sound sources in the presence of recreational divers at 145 dB... Based on this guidance, the operation of the SURTASS LFA sonar will be restricted in the vicinity of known recreational and commercial diving so that **sound levels will not exceed 145 dB**".²

There is a clear case for serious concern. The Central Coast area between Cayucos and Oceano is very popular for ocean recreation (diving, swimming, fishing, surfing, etc.).

It is equally concerning that PG&E has presented contradictory information about allowed recreational uses and potential impacts to ocean users. Moreover, the FEIR lacks pertinent information about impacts to ocean users. That information was only ascertained after Coastal Commission Staff requested PG&E to provide supplemental materials.

PG&E's Inconsistency

PG&E's inconsistency about recreational uses/impacts was revealed when the Surfrider Foundation submitted a comment letter on the DEIR stating that PG&E overlooked the safety of swimmers and surfers. In Volume I of the FEIR, PG&E responded directly to Surfrider's concerns, with the below statement:

"In response to this and other related comments...MM LU-1 has been revised to include noticing beaches and local dive shops ***regarding offshore areas closed to diving, surfing, and swimming.***"³

Based on this statement, it seems clear that diving, surfing, and swimming will not be allowed within Project zone. However, in the FEIR, PG&E only addresses the prohibition of diving and is *clearly disregarding the safety of other ocean users.*

Another example of inconsistent information is that PG & E failed to include data and

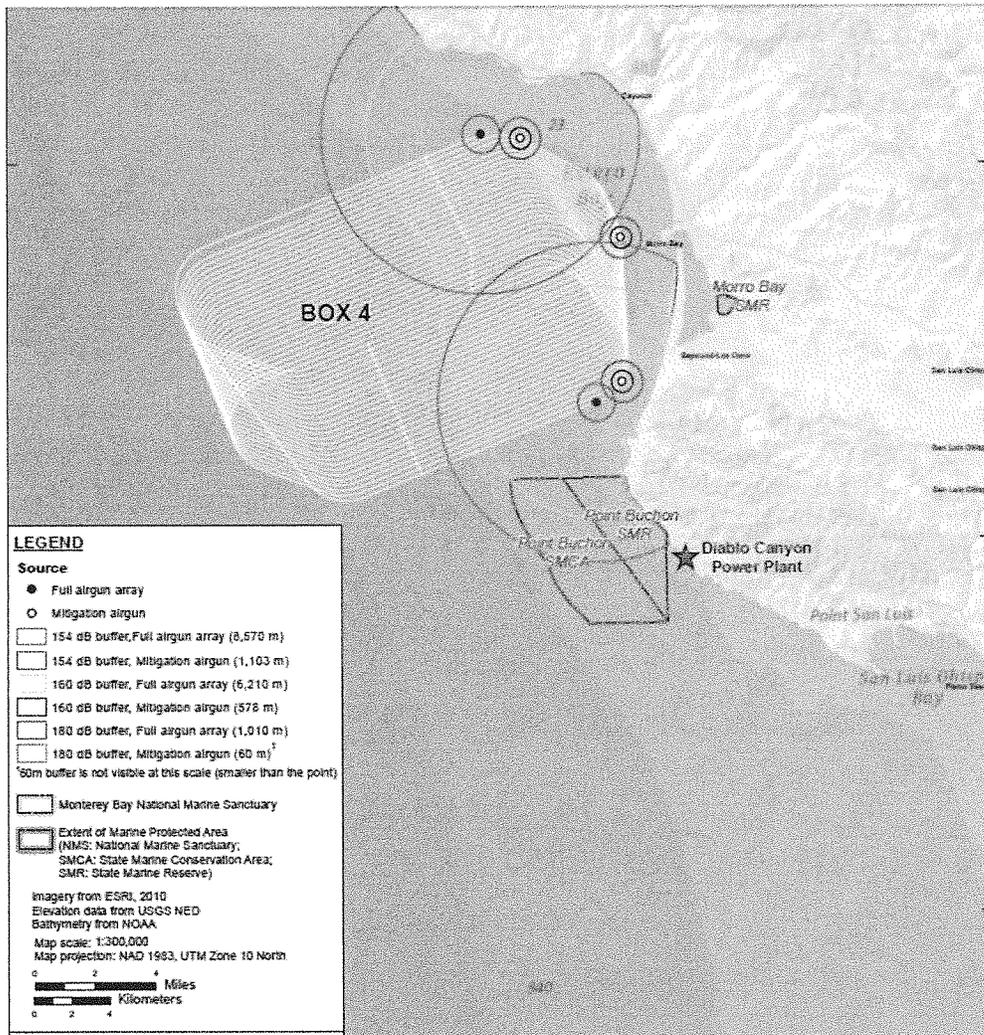
¹ http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/PDF/FEIR_4.11_NOISE.pdf

² <http://www.surtass-lfa-eis.com/DiverStudies/index.htm>

³ [http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/FEIR_Comments/FEIR_RTCs_NGOs_\(13of14\)_Surfrider.pdf](http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/FEIR_Comments/FEIR_RTCs_NGOs_(13of14)_Surfrider.pdf)

maps regarding impacts to ocean users in the FEIR. The Surfrider Foundation had questions about how close will the vessel/air guns would be to shore; and also questioned what the instantaneous decibel (dB) exposure levels would be to nearshore environments. Since the information was not apparent in the EIR, Surfrider contacted Coastal Commission Staff asking for clarification.

In order to answer the questions, Coastal Commission Staff had to request additional information from PG&E. Coastal Commission Staff then provided Surfrider with maps that illustrated **dB levels could reach 160 dB at some beaches (yellow circles), which exceeds the human safety threshold of 145-155 dB.** As mentioned above, the Navy uses 145 dB as a threshold and PG&E uses 155dB as the threshold in their EIR.



A final example of PG&E not providing adequate information is reflected by the fact that Volume I of the EIR lacks an updated Expanded Project Description. The Expanded Project Description contains information about how dB levels travel to nearshore environments. Once again, this information was obtained only after Surfrider had questions and Coastal Commission Staff provided the new document. The document contains important information and calculations on sound propagation models. When analyzing the upslope sound propagation, it's clear that dangerous dB levels could come close to nearshore environments. For example, the below chart illustrates that dB levels could reach 190 at 0.13 nautical miles (which is equivalent to 789 ft offshore.)

Sound Pressure Level (SPL) (dB re 1 uPa)	Upslope Distance (In Shore)			Downslope Distance (Offshore)			Alongshore Distance		
	M ¹	SM ²	NM ³	M ¹	SM ²	NM ³	M ¹	SM ²	NM ³
190	250	0.16	0.13	280	0.17	0.15	320	0.20	0.17
187	390	0.24	0.21	370	0.23	0.20	410	0.25	0.22
180	1,010	0.63	0.55	700	0.43	0.38	750	0.47	0.40
170	2,990	1.86	1.61	1,760	1.09	0.95	1,760	1.09	0.95
160	6,210	3.86	3.35	4,450	2.77	2.40	4,100	2.55	2.21
154	8,570	5.33	4.63	7,820	4.86	4.22	6,780	4.21	3.66
120	24,650	15.32	13.31	251,320	156.16	135.70	94,870	58.95	51.23

M¹ = Meters; SM² = Statute miles; NM³ = Nautical Miles

4

It is extremely important to stress that PG&E is not providing critical information in the FEIR that is required to understand dangerous noise impacts to ocean users. Given the lack of data, PG&E should be applying the precautionary principle when analyzing potential for dangerous impacts to ocean users from seismic testing.

Other Recreational Impacts:

Recreational fishing and boating will be prohibited during testing. This is a clear violation of the following sections of the Coastal Act.

- **Section 30220—Protection of certain water-oriented activities--** Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.
- **Section 30224—Recreational boating use; encouragement; and facilities.** Increased recreational boating use of coastal waters shall be encouraged...
- **Section 30234.5—Economic and Recreational Importance of Fishing.** The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.
- **Section 30210 Access; recreational opportunities; posting** In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.

PG&E's FEIR also mentions impacts to onshore recreation:

“Recreationists hike along trails that overlap with or cross the Accelerated Weight Drop (AWD) and Vibroseis seismic transects, (e.g., the Point Buchon trail, which goes to Point Buchon along the coast, just south of Montaña de Oro State Park; and the Pecho Coast Trail, which follows the coastline beginning at the Port San Luis Harbor, and heads past the Point San Luis lighthouse)”.

“The onshore seismic surveys would use and cross over sections of hiking trails... if hikers were to encounter the seismic equipment they would be able to hike around the equipment.”

While onshore recreation will not come to a complete stand still, these recreational impacts conflict with the following section of the Coastal Act:

⁴ Central Coastal California Seismic Imaging Project 1.0 Expanded Project Description Revision No. 8 8-30-2012

- **Section 30223—Upland Areas.** Upland areas necessary to support coastal recreational uses shall be reserved for such uses, where feasible.

In conclusion, the proposed seismic testing will impact recreational users (both onshore and offshore). PG&E has provided inconsistent information about allowed recreational uses and is culpable of potentially exposing recreationalists to harmful dB levels in nearshore waters (especially to swimmers and surfers). PG&E has not provided adequate (or updated) information in their FEIR, and others have had to go to great lengths to ascertain potential impacts to ocean users.

Statement [] submitted by Sara Wan, California Coastal Commission

Coastal Commission Comments
on the Effects of Anthropogenic Sound on Marine Mammals

Statement for

**The Report of the Advisory Committee on Acoustic Impacts on
Marine Mammals**

to the

Marine Mammal Commission

Submitted by:

Sara Wan, California Coastal Commission

on behalf of:

Meg Caldwell, Chair, California Coastal Commission

Submission Date: December 13, 2005

The following statement reflects only the views of the individuals and organizations listed as submitting authors. The inclusion of this statement does not indicate support or endorsement by other members of the Advisory Committee on Acoustic Impacts on Marine Mammals or by the Marine Mammal Commission.

Statement [] submitted by Sara Wan, California Coastal Commission

Alternative Committee Member, Mark Delaplaine, California Coastal Commission

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The California Coastal Commission appreciates the opportunity to have had a representative on the Federal Advisory Committee on Acoustic Impacts on Marine Mammals. The California Coastal Commission is charged with overseeing the coastal zone of the State of California and protecting its valuable coastal resources, including marine mammals. The coastal and marine ecosystems of this State represent both an important economic interest and a vital spiritual one. The coastal and marine ecosystems and marine life within this State's sovereign waters and beyond support important commercial activities, including fishing and tourism. California residents and tourists alike enjoy the benefits and solace that comes from being able to see and appreciate the beauty and wonder of nature. Marine mammals represent a critically important part of this and play a special role in our society and as such deserve our protection.

The California Coastal Commission's regulatory authority over state waters and beyond into federal waters comes through both the California Coastal Act and the federal Coastal Zone Management Act (CZMA). It is within the coastal waters of the states that U.S. strandings occur. It is thus critically important that the states have a say in what happens relative to this issue.

It is with that in mind that the California Coastal Commission is submitting this statement to the Marine Mammal Commission. It is unfortunate that consensus was not reached among the Advisory Committee members so that one comprehensive document could be submitted to Congress and we have not attempted to craft one. Instead we have commented only on those issues that were listed as disagreements at the final Plenary session.

Introduction

Anthropogenic noise is a recognized, but largely unregulated, form of ocean pollution that can deafen, disturb, injure, and kill marine life.¹ Many species of marine mammals are known to be highly sensitive to sound and rely upon sound to navigate, find food, locate mates, avoid predators, and communicate with one another. A combination of noise sources, including shipping, oil and gas exploration and production, dredging, construction, and military activities, has resulted in dramatic increases in noise levels throughout the oceans. Over the last ten years, a growing body of evidence has shown that some forms of ocean noise can kill, injure, and deafen whales and other marine mammals.² In particular, a sequence of marine mammal strandings and mortalities has been linked to exposure to mid-frequency sonar.³ There is also evidence that some affected animals do not strand but die at sea. This has increased public concern about the effects of anthropogenic noise on marine mammals, which has been acknowledged in a variety of domestic and international fora.

Marine mammals have evolved over millions of years and rely on sound for vital life functions and have specialized sensory capabilities to take advantage of the physics of sound in the ocean. Anthropogenic noise in the oceans has increased since the start of the industrial revolution and increases in ambient noise levels,⁴ as well as individual sound sources, can cause adverse effects, the extent and type of which are not well understood. Military technology and scientific research using low frequency active acoustics attempting to cover large distances have specifically targeted the ecological sound niches that low frequency specialist whales have evolved to rely on, necessarily competing with those marine mammal species. Peer-reviewed scientific literature indicates that marine mammals are affected by exposure to anthropogenic noise in a variety of ways that can be harmful or even lethal. However, there are significant gaps in information available to understand

and manage these effects. This is particularly the case because marine mammals are extremely difficult to study and the marine environment is extraordinarily complex and dynamic. In addition, this is a relatively new field of concern and the amount of research undertaken to date has been limited in scope and duration.

Much of the information needed to understand the impacts of noise on populations and individuals will remain unknown for decades, if not longer. In the face of much uncertainty, the California Coastal Commission and other agencies must make decisions about proposed activities. Given the current data gaps and the uncertainties in information available about impacts of sound on the marine environment, and the potential for harm to occur before it is detected, it is appropriate for managers to apply precaution when allowing necessary activities to proceed. The current statutes presume that a precautionary approach should be taken and place the burden of proof on the applicant proposing the action. This is necessary because scientific certainty is difficult to obtain on most issues but will be particularly elusive in this field. Because many of these species reproduce very slowly, requiring scientific certainty before taking protective measures could very well result in their extinction.

While much remains to be learned about marine mammals and their responses to noise, one method of determining if there is a correlation between intense noise events (sonar and seismic) would be to be able to have more accurate information about strandings coincident with noise events. However, stranding teams are not necessarily available to cover all areas where strandings occur and funds for quick, accurate, and unbiased review of strandings are insufficient. In addition, knowledge of military activities is not always available. As a result, only publicized mass strandings are reviewed to see if they are coincident with naval or other sound-producing activities. Additionally, there has been no attempt to look at single strandings to see if there may have been sound-producing activities in the area. There also is no standardized form for reporting the results of necropsies and the public is frequently not allowed to observe necropsies or have access to the data for long periods of time (e.g., 2005 North Carolina stranding event). A more coordinated and complete analysis of all stranding data should be conducted.

While anthropogenic noise is only one of many serious threats facing marine mammals, such as fisheries by-catch, habitat degradation, ocean pollution, whaling, vessel strikes, global warming, and others, it is too early in our investigations to know where this issue sits in a relative sense. Most likely the answer will depend upon the species and a more complete knowledge of both cumulative and synergistic effects of noise. Long-term cumulative impacts to populations and synergistic effects that may heighten the impacts of other threats may turn out to be the greatest impact of noise on marine mammal populations. However, the indications are that this threat is significant enough to require efforts to reduce its potential impacts and should be taken seriously.

Extent of the Problem

How significant is the threat and what is the relative importance of sound?

There has been an attempt by some to downplay the significance of sound as a threat, particularly as it compares to other threats. However, it is impossible to say at this stage of our knowledge what the relative importance is. Underwater noise can prevent marine mammals from hearing their prey or predators, from avoiding dangers, from navigating or orienting toward important habitat, from finding mates, from contact with their young, and can cause them to leave important feeding and breeding habitat.⁵ Those who state that anthropogenic noise only affects a few individuals or who

insist on an irrefutable burden of proof are looking at this from a very narrow perspective, i.e., considering only known atypical mass strandings where the existence of a sound source was known as a measure of the impact and requiring that there be physical evidence of trauma. This ignores that:

- 1) the majority of strandings likely go unreported, particularly in remote areas;
- 2) mortalities that occur away from the coast are very difficult to detect since most whale carcasses sink immediately;⁶
- 3) knowledge of whether or not a sound source may be present during known strandings may not be available;
- 4) strandings of single whales where there is no other known cause of the stranding are not reviewed for a possible connection to sound;⁷
- 5) there may be cumulative and synergistic effects on individuals and populations that are difficult, if not impossible, to determine;
- 6) there may be significant impacts to a variety of biologically necessary functions;
- 7) strandings are not the only possible impact of sound; and
- 8) limiting the inclusion of strandings to those where there is proof of a cause and effect is inaccurate and misleading.

The significance of the impacts may vary with the species. Some species are more threatened by ship strikes, other by by-catch, and still others, such as beaked whales, by noise. We also know that human impacts on marine ecosystems interact to produce a magnified effect of other threats. There is no reason to believe that it is different with noise. Thus noise could, for instance, affect the ability of marine mammals to sense fishing gear or create stress that magnifies the impacts of pollution.

In conclusion, the impact of anthropogenic noise on marine mammals cannot be looked at in a simplistic way by only comparing the known number of mass strandings proven to be connected to sound to the total number of strandings, including those for which there is no explanation. The body of scientific literature on noise impacts on marine mammals is growing, pointing almost uniformly to a cause for concern. While the relative significance of this threat is yet to be determined, it is clear, even at this stage, that this threat should not be taken lightly.

Impact on populations

Impacts of noise on populations, even non-lethal impacts, can severely affect species survival. However, population impacts are difficult to detect, particularly where there is insufficient information about the population size and structure. Where the impacts are the result of long-term cumulative exposure, scientific observation and conclusions are particularly elusive but noise is believed to have contributed to the decline of several species of whales or their failure to recover.⁸ The NRC statement that “no scientific studies have conclusively demonstrated a link between exposure to sound and adverse effects on a marine mammal population”ⁱ is misleading at best, because there are also no scientific studies that conclusively demonstrate that there have been no effects on any marine mammal population. In other words, there is simply not sufficient information to make that conclusory statement. In addition, it ignores the information on noise-induced strandings of a well-studied local population of beaked whales that was either killed or did

ⁱ NRC 2005. Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects. National Academy Press Washington, D.C. 96 pp.

not return even five years after the sonar event believed to have caused the stranding.⁹ That local population impact, on a species about which we know little of the population numbers or structure, cannot be ignored as a possible population impact.

Additionally, the NRC conclusion ignores that:

- 1) in all but a few cetacean species our population estimates are too imprecise to be able to detect population declines;¹⁰
- 2) there have been no studies that have attempted to study population declines due to noise;
- 3) if we were able to detect a population decline, it would be difficult if not impossible to tie it to noise;
- 4) where we do know of population declines, most cannot be linked to one primary cause;¹¹ and
- 5) in instances where we have reason to believe there can be major impacts, such as in the case of known toxins, even those that accumulate in the tissues of marine mammals, it has not been possible to prove they are a cause of marine mammal decline.¹²

In conclusion, marine mammal population declines are difficult to document especially without accurate baseline population counts to start with. However, what we have learned in the very short time that attention has focused on these issues is that we have seriously underestimated the effects of noise on marine mammals. This indicates that the effects of anthropogenic noise could be far-ranging and severe and should not be discounted.

Degree of scientific uncertainty and the use of extrapolation

In the last few decades, knowledge of marine mammal biology has increased yet many aspects of marine mammal behavior, physiology, populations, and ecology remain unknown. An understanding of normal behavior and the biological significance of any resulting changes in behavior caused by sound exposure are critical to better answer questions regarding impacts. Unfortunately, much of the understanding of normal behavior required to answer these questions is unknown at this time.

At this time there is still a significant amount of uncertainty about how marine mammals hear, how they use sound, and the impacts of noise on them. In fact, the data gaps are so substantial that it is difficult to draw any definitive conclusions on this subject, other than to state that there is a high degree of probability that sound may impact marine mammals in significant ways necessitating the use of precaution.

Listed below are just some of the areas where it is generally agreed that there is uncertainty:

- Eighty-three different species of cetaceans are currently recognized, and audiograms have been developed for only 11 species, all of which are odontocetes.
- The hearing of mysticete whales remains unmeasured.
- Uncertainty regarding the specific uses of sound by marine mammals (e.g., extent, context) makes it difficult to detect or interpret changes in behaviors associated with sound.

- We know relatively little about the extent of marine mammals' use of sound from natural sources (for navigation, prey detection, predator avoidance, or other uses).
- There is uncertainty about how marine mammals use sound to communicate or carry out other functions.
- The ranges and circumstances of effective communication using sound are also unclear.
- There is limited information available on what constitutes normal behavior for many species.
- There is a lack of baseline behavioral data making it difficult to assess the impact of sound or determine what would constitute a biologically significant disturbance.
- There is uncertainty about whether an animal hears the same types of sounds that it produces, and therefore whether it is appropriate to estimate an animal's audiogram by examining its sound production.
- There is uncertainty about whether or not sounds to which animals are relatively insensitive are still important to their survival.
- There is uncertainty about the pathways by which sound travels to the inner ear and about other mechanisms for hearing in marine mammals.
- There is uncertainty about the onset of auditory trauma in marine mammals, including which types and levels of sound exposures will induce trauma in which species.
- There are limited experimental data on TTS (temporary threshold shift) in marine mammals, and no experimental data on PTS (permanent threshold shift, i.e., deafness).
- It is uncertain whether increased sound levels in the oceans could cause auditory developmental problems for young marine mammals.
- We do not know whether marine mammals have natural mechanisms to protect their hearing. If they do have protective mechanisms, they may not work in the same way as in the ears of terrestrial mammals. If marine mammals do have protective mechanisms, we do not know whether or how they might fatigue.
- There is uncertainty about whether the auditory systems of mysticetes may be more likely than those of odontocetes to be affected by low- to mid-frequency sounds because mysticetes' vocalizations consist of these same frequencies.
- While masking is known to be a common, naturally occurring phenomenon, there is uncertainty about the specific conditions under which, and the extent to which, it occurs in marine mammals, and when it is significant.
- The full range of options available to marine mammals to overcome masking is not known.
- There is uncertainty about the potential of general, non-directional ambient noise to cause masking, which results from a lack of information about ambient noise levels.
- Uncertainties exist about baseline feeding rates and hunting success, mate-searching behavior, and predator avoidance affecting scientists' understanding of whether masking is likely to adversely affect the survival or reproductive success of an individual or population.
- Direct effects of masking are difficult to demonstrate in the field.
- The prevalence of non-auditory physiological sound effects (e.g., stress, neurosensory effects, effects on balance, tissue damage from acoustic resonance, gas bubble growth in tissues and blood and blast-trauma injury) in marine mammals and the relative vulnerability of different species to such effects are uncertain.

- Little is known about how sound might induce stress in marine mammals.
- There have been no studies to date specifically investigating these stresses in marine mammals.
- There is uncertainty about the possible role of acoustic resonance in beaked whale strandings associated with sound exposure.
- The relationship of sound characteristics to gas bubble growth is unclear.
- Disagreement currently exists over the possible role of gas bubble growth in beaked whale strandings.
- It is unclear what, if any, specialized adaptations deep diving marine mammals may have evolved to avoid decompression-type effects during their routine diving behaviors.
- The biological significance (e.g., consequences for health, survival, reproduction) of behavioral responses to sound is largely unknown.
- The long-term, cumulative impacts of sound exposure on behavior are also unknown, making it more difficult to determine the significance of observed behavioral changes over time.
- Little is known about the extent to which marine mammals can or do adapt their behavior to changes in anthropogenic sound.
- It is also uncertain how most marine mammal species may respond behaviorally to long-term increases in background noise levels.
- The characteristics of sound that trigger a behavioral reaction are often unknown.
- There are few direct data concerning the behavioral effects of sound on marine mammals.

Uncertainties about the effects of sound on marine mammals are driven by several fundamental problems. First, the lack of baseline behavioral data for most marine mammals makes it difficult to measure and interpret behavioral responses to sound. Second, there are fundamental, practical challenges inherent to studying marine mammal behavior in the wild such that some types of responses (even acute responses) are difficult to detect with currently available monitoring capabilities. Third, even in cases where behavioral responses to sound have been documented, the mechanisms and implications of these changes are not always clear. Fourth, sample sizes in studies where behavioral changes are documented are often small, and the results are often specific to a particular location and scenario, making general conclusions difficult. In addition, even where behavioral changes are documented, interpreting the effects that are detected is extremely difficult, at best.

While the above is not meant to imply that we do not know anything about these issues, it highlights the significant gaps in our current understanding. We do not even know what the hearing range is for most cetaceans (only 11 out of the 83 known species), and we have no measurements on mysticetes at all. Most of what is known about the hearing range of these species comes from studies with one or a few individuals belonging to these 11 species. Extrapolation of these few data points is then used to determine the hearing range of the entire species. We know that there are great variations in the hearing ability and range of individuals within a species, and thus any extrapolation within the same species should include the probability of error and set possible bounds. To then use the extrapolated data to extrapolate again between species where there are no direct observations or experimental data is scientifically inaccurate and can only lead to erroneous conclusions. While extrapolation is a valid scientific tool, extrapolations must be used with great

care and underlying assumptions must be clearly stated. More confidence is placed in extrapolations where comparisons are made between more closely related species or where sample size is larger. Use of extrapolations in this field at this early stage of our knowledge is justifiably controversial. Extrapolation increases in validity as the body of knowledge and extent of data increase in robustness. Until such time as there are a greater number of data points, i.e., individuals measured, including those that are not captive, the risks of drawing the wrong conclusions that could lead to serious management decision errors is too great to justify.

The degree of uncertainty that exists in this newly emerging field of science should not be used as a justification for postponing action to prevent environmental degradation. The potential for harm to occur before it is detected necessitates the use of a precautionary approach to the review and permitting of activities that involve the intentional production of anthropogenic sound.

Relationship Between Stranding and Sound

Level of relationship: cause/effect, correlated, associated

Much has been made of the need to assess the relationship between strandings and sound by defining whether or not the relationship is a coincidence, association, or is correlated or related by cause and effect. Some stakeholders believe that to fully understand the nature of any relationship (e.g., coincidence or correlation) of an acoustic event with a stranding, scientists need, at a minimum, good information on:

- the sound sources involved and the propagation of energy from those sources;
- the animals' physiological and metabolic status and injuries;
- the animals' potential causes of death based on necropsy findings;
- the spatial and temporal correspondence between the sound sources and the animals; and
- the stranding pattern (e.g., atypical strandings having two or more animals stranded over several hours spread over kilometers of coast, rather than at the same time and location; or strandings involving more than one species).

In practice, it is rare to have such complete information and requiring this level of information sets the standard at an unachievable level. Information available to draw conclusions about the causes of stranding events is limited, making it difficult to assess the relationship between strandings and sound. Requiring the determination of whether a stranding is related to sound by cause/effect, correlation, association, or coincidence as a prerequisite to listing it in a table of strandings is inappropriate and artificially narrows the list of strandings that may involve noise. When events, particularly ones that are rare, occur together repeatedly, data from such events can be used to determine a relationship between the two and should not be overlooked, even if a particular individual event cannot be proven to be correlated.

Number of relevant stranding or mortality events

Current understanding of the connection between sound and strandings has not advanced to the point where the relationship between sound exposure and mortality can be understood in terms of physiological, behavioral, and population-level responses, making it difficult to assess the magnitude of impacts. Recent attention directed towards marine mammal strandings and sound, and

particularly the potential impacts of sound on beaked whales, argues for the need to highlight this topic.

The National Marine Fisheries Service (NMFS) maintains a database of marine mammal strandings in the U.S.¹³ Some conclude the database indicates that the effects of noise are relatively insignificant when considering the number of strandings known to be caused by anthropogenic noise. However, it is extremely misleading to use the figures from this database. The vast majority of the strandings in the database involve pinnipeds (seals and sea lions) not cetaceans, and to date no strandings of pinnipeds have been linked to noise. In addition, most of these are strandings of one or two individuals where noise is not even considered a possible cause, and therefore no attempt was made to look at the relationship between the stranding and noise. Because 60% of the strandings cannot be explained by any known cause¹⁴, it is also possible that a percentage of these could be sound-related and that for others sound was a contributing factor.

Anthropogenic sound has only recently emerged as a probable cause of some marine mammal strandings and, prior to the early 1990s, was not even looked at as a possible cause of strandings. In 1998, exposure to military sonar was postulated as the cause of a beaked whale stranding event in Greece in 1996.¹⁵ Similar events have occurred in the Bahamas Islands in 2000, Madeira in 2002 and the Canary Islands in 2002.¹⁶ Mass strandings of Cuvier's beaked whales are considered to be highly unusual. Since the early 1960s, when the Navy's mid-frequency tactical sonar was first deployed and the use of arrays began, more than 40 mass strandings of Cuvier's beaked whales have been reported worldwide, some together with naval maneuvers and the use of active sonar or other noise sources such as seismic surveys. Some of these strandings that occur together with a noise event are undisputed in their association with noise. In other cases stakeholders consider them to be coincidental events. These stakeholders require that the exact source and level of noise be determined and also require evidence of the physiological condition of the animals, potential causes of death based on necropsy findings, the presence of a qualified biologist to document both the stranding and the noise event and the spatial and temporal correspondence between the sound source and the animals. Such information may be useful in determining a cause and effect relationship but is seldom available and raises the bar of proof to a level usually unattainable. It should not be necessary to prove a cause and effect, e.g., through a known mechanism, to be convinced that some strandings are linked with sonar. This is the manner in which the relationship between smoking and cancer and other diseases was elucidated. It is therefore necessary to include a very complete list of strandings, particularly of mass strandings, and all known possible sound sources operating in the area at the time, to enable a more accurate analysis of the potential connection between noise and strandings whether or not a cause and effect can be conclusively proved.

It is interesting to note that that a double standard is being used. These same stakeholders reject the use of extrapolation to determine received levels in a stranding, even with relatively good propagation models that are available, yet they accept extrapolation relative to hearing from a single odontocete to a mysticete.

The magnitude of the problem of acoustically-induced strandings remains unknown, but there are concerns that the number of these strandings identified may underestimate the number of animals affected. In general, an analysis of stranding data may underestimate the number of strandings related to sound events because: a) a substantial number of strandings, and especially mortalities at sea, may go undetected or undocumented; and b) a substantial proportion of any associated sound

events may go undocumented (e.g., because of the absence of a standardized reporting system). Stranding detection is affected by factors such as their proximity to relatively populated areas (i.e., whether humans are likely to observe them). Animals that die at sea are seldom detected. The documentation of strandings depends on reporting efforts (e.g., by local stranding response networks) and the availability of qualified personnel to conduct necropsies or other analysis. In addition, the question of possible underestimation of acoustically-induced strandings is a particular concern for species other than beaked whales that may strand more regularly due to other causes. In these latter species, a connection to sound exposure may go undetected and their susceptibility to sound-related injury and mortality may be underestimated.

While much remains to be learned about marine mammals and their responses to noise, having more accurate information about strandings that occur coincident with noise events would help us determine if there is a correlation between the two. However, stranding teams are not necessarily available to cover all areas where strandings occur and funds for quick, accurate, and unbiased review of strandings are insufficient. In addition, knowledge of military activities is not always available and may be classified. As a result, only publicized mass strandings are reviewed to see if they are coincident with naval or other sound-producing activities and there has been no attempt to correlate single strandings of whales with noise events. There is also no standardized form for reporting the results of necropsies and the public is frequently not allowed to observe necropsies, or have access to the data for long periods of time (e.g., North Carolina stranding), making the conclusions subject to suspicion by members of the public, particularly when public members are barred from observing while Navy-sponsored scientists conduct the necropsies (e.g., Haro Strait¹⁷).

It has taken 40 years to notice the connection between naval sonar and mass strandings of beaked whales, even though this is one of the most obvious connections. This underscores how easy it is to miss the connections between noise and a variety of impacts on marine mammals. Some stakeholders have attempted to limit the listing of strandings to the four events where there is very good evidence of the connection between strandings and anthropogenic noise. This paints a very deceptive picture of what may be happening. It is of particular importance that we not limit the list of strandings that may have a connection to sound sources. A complete list is necessary to more fully understand the magnitude of the problem and allow for an analysis to determine whether a statistical correlation of the relationship between noise and strandings exists. We have therefore included a more complete list of strandings (Table 1).

Table 1. Mass Strandings of Beaked Whales¹⁸ (Brownell et al. 2004; ICES 2005)

Year	Location	Species (numbers)	Associated activity, when available
1914	New York, U.S.	Zc (2)	
1960	Sagami Bay, Japan	Zc (2)	US Fleet
1963	Gulf of Genoa, Italy	Zc (15+)	Naval maneuvers
1963	Sagami Bay, Japan	Zc (8-10)	US Fleet
1964	Sagami Bay, Japan	Zc (2)	US Fleet
1965	Puerto Rico	Zc (5)	
1966	Ligurian Sea, Italy	Zc (3)	Naval maneuvers
1967	Sagami Bay, Japan	Zc (2)	US Fleet
1968	Bahamas	Zc (4)	
1974	Corsica	Zc (3), striped dolphin (1)	Naval patrol

Year	Location	Species (numbers)	Associated activity, when available
1974	Lesser Antilles	Zc (4)	Naval explosion
1975	Lesser Antilles	Zc (3)	
1978	Sagami Bay, Japan	Zc (9)	US Fleet
1978	Suruga Bay, Japan	Zc (4)	US Fleet
1979	Sagami Bay, Japan	Zc (13)	US Fleet
1980	Bahamas	Zc (3)	
1981	Bermuda	Zc (4)	
1981	Alaska, United States	Zc (2)	
1983	Galapagos	Zc (6)	
1985	Canary Islands	Zc (12+), Me (1)	Naval maneuvers
1986	Canary Islands	Zc (5), Me (1), <i>Ziphiid</i> sp. (1)	
1987	Canary Islands	Me (3)	
1987	Italy	Zc (2)	
1967	Suruga Bay, Japan	Zc (2)	
1987	Canary Islands	Zc (2)	
1988	Canary Islands	Zc (3), bottlenose whale (1), pygmy sperm whale (2)	Naval maneuvers
1989	Sagami Bay, Japan	Zc (3)	US Fleet
1989	Canary Islands	Zc (15+), Me (3), Md (2)	Naval maneuvers
1990	Suruga Bay, Japan	Zc (6)	US Fleet
1991	Canary Islands	Zc (2)	Naval maneuvers
1991	Lesser Antilles	Zc (4)	
1993	Taiwan	Zc (2)	
1994	Taiwan	Zc (2)	
1996	Greece	Zc (12)	Naval LFAS trials
1997	Greece	Zc (3)	
1997	Greece	Zc (9+)	Naval maneuvers
1998	Puerto Rico	Zc (5)	
1999	Virgin Islands	Zc (4)	Naval maneuvers
2000	Bahamas	Zc (9), Md (3), <i>Ziphiid</i> sp. (2), minke whale (2), <i>Balaenoptera</i> sp. (2), Atlantic spotted dolphin (1)	Naval mid-frequency sonar
2000	Galapagos	Zc (3)	Seismic research
2000	Madeira	Zc (3)	Naval mid-frequency sonar
2001	Solomon Islands	Zc (2)	
2002	Canary Islands	Zc (9), Me (1), Md (1), beaked whale spp. (3)	Naval mid-frequency sonar
2002	Mexico	Zc (2)	Seismic research
2004	Canary Islands	Zc (4)	Naval maneuvers

Zc=*Ziphius cavirostris* (Cuvier's beaked whale); Md=*Mesoplodon densirostris* (Blainville's beaked whale); Me=*Mesoplodon europaeus* (Gervais' beaked whale)

Range of species involved: beaked whales, other?

While marine mammal species other than beaked whales have been involved in mass strandings associated with anthropogenic sound, the connection is more readily apparent with beaked whales, in part because beaked whales are not known to regularly mass strand due to other causes (e.g., disease). In comparison with beaked whales, other species of cetaceans such as pilot whales mass strand more regularly, and these events are often attributed to causes other than anthropogenic sound exposure. Because beaked whale mass strandings are so rare, these strandings are likely to lead to questions about their possible causes. However, while the connection is more obvious in the case of beaked whales, other cetaceans have also been involved in strandings associated with anthropogenic noise. Minke whales, (Bahamas 2000), pygmy sperm whales (Canary Islands 1988), and bottlenose whales (Canary Islands 1988) have stranded concurrent with beaked whales. In other instances, melon-headed whales (Hawaii 2004), harbor porpoises (Haro Strait 2003¹⁷), and humpback whales (Brazil 2002) have stranded in events that did not involve beaked whales. In addition to these, NMFS is still investigating whether the pilot whales, minke whales, and dwarf sperm whales that stranded in North Carolina (January 2005) had traumas consistent with acoustic impacts. It should be noted that NMFS has not provided any report on the North Carolina incident, which occurred over ten months ago, and has not provided a final report on the Bahamas 2000 stranding almost five years after the event. This limits the ability to draw any conclusions about these events and the involvement of species other than beaked whales.

Table 2. Associated Mass Strandings Involving Species Other Than Beaked Whales¹⁹
(Engel et al. 2004; Martin et al. 2004; NOAA and U.S. Navy 2001; NMFS 2005; Tomaszeski 2004)

Year	Location	Species (numbers)	Associated activity (when available)
1988	Canary Islands	Pygmy sperm whale (2), Zc (3), bottlenose whale (1)	Naval maneuvers
2000	Bahamas	Minke whale (2), <i>Balaenoptera</i> sp. (2), Atlantic spotted dolphin (1), Zc. (9), Md. (3), Ziphiid sp. (2)	Naval mid-frequency sonar
2002	Brazil	Humpback whale (8)	Seismic exploration
2003	Washington, United States	Harbor porpoise (14), Dall's porpoise (1)	Naval mid-frequency sonar
2004	Hawaii, United States	Melon-headed whale (~200)	Naval mid-frequency sonar
2005	North Carolina, United States	Long-finned pilot whale (34), dwarf sperm whale (2), minke whale (1)	Naval maneuvers; investigation pending

Range of sound sources involved: sonar, airguns

Much has been made of the impact of Naval sonar, particularly mid-frequency sonar, and the connection to strandings, particularly of beaked whales. That there is a connection is clear.²⁰ Whether or not there is a connection to the strandings of other species is still a matter of disagreement, although for those non-beaked whale species stranding alongside beaked whales during a noise event, it would be hard to believe that there is no connection. It is unnecessary to dwell on this type of sound source as being the only one having impacts on marine mammals.

Other sources of sound, particularly seismic and shipping, should be of equal concern. Seismic surveys use sound that can travel across entire ocean basins. A single seismic survey in the northwest Atlantic was found to flood an area almost 100,000 square miles with one hundred fold greater than ambient noise levels, persisting so as to be nearly continuous for days.²¹ This form of intense underwater sound has been used for many years but has only recently undergone any scrutiny as to its possible impacts on marine mammals. Scripps Institution of Oceanography

scientific research to study deep ocean temperatures to assist global climate change models (i.e., Acoustic Thermometry of Ocean Climate (ATOC) was specifically intended to be both transoceanic and operational over decades. The U.S. Navy's Low Frequency Active Sonar (LFA) is intended to ensonify an underwater area of several million km² at greater than ambient levels.²²

In 2004, the International Whaling Commission's Scientific Committee concluded that increased sound from seismic surveys was "cause for serious concern."²³ Its conclusion was based on a substantial and growing body of evidence that shows that seismic pulses can kill, injure, and disturb a wide variety of marine animals, including whales, fish, and squid. Impacts range from strandings, to temporary or permanent hearing loss and abandonment of habitat and disruption of vital behaviors like mating and feeding. The IWC Scientific Committee expressed great concern about the effects of seismic surveys on blue, fin, and other endangered large whales,²⁴ particularly in their critical habitats, and some scientists have asserted that the persistent use of seismic surveys in areas known to contain large whales in significant numbers should be considered sufficient to cause population-level impacts.²⁵ The State of California (State Lands Commission) banned further high-energy seismic surveys within its waters until such time as a programmatic Environmental Impact Report is completed, due to concerns about the impact of seismic surveys on fish eggs and larvae.²⁶

In 2002, in the Gulf of California, Mexico, two beaked whales (*Ziphius cavirostris*) were found to have stranded coincident with geophysical surveys that were being conducted in the area.²⁷ That same year, the stranding rate of adult humpback whales was unusually high compared with that of juvenile humpbacks along Brazil's Abrolhos Banks, where oil and gas surveys were conducted.²⁸ Studies suggest that substantial numbers of western Pacific gray whales, a population that is considered critically endangered, were displaced from important feeding grounds in response to seismic surveys off Russia's Sakhalin Island.²⁹ Other marine mammal species known to be affected by airgun arrays include sperm whales, whose distribution in the northern Gulf of Mexico has been observed to change in response to seismic operations;³⁰ bowhead whales, which have been shown to avoid survey vessels to a distance of more than twenty kilometers while migrating off the Alaskan coast;³¹ harbor porpoises, which have been seen to engage in dramatic avoidance responses at significant distances from an array³², and all small odontocetes in U.K. waters where sighting rates (combined) are significantly higher when air gun arrays are not shooting.³³

Until sufficient stranding teams are in place to report, monitor and correlate possible strandings that might be associated with the use of seismic surveys and until there is a long-term study on the possible cumulative and synergistic effects on populations it will not be possible to have an accurate picture of the extent of the problem, and it will remain a major concern.

While Navy sonar and seismic surveys are the most obvious and easily recognizable as causing direct adverse impacts to marine mammals, the effects of shipping also rise to the level of significance. Shipping, however, unlike sonar and seismic noise, is not a single source of noise that can be as easily studied. Shipping is diffuse and spread throughout the world's oceans, raising the ambient levels of sound. Shipping noise creates the same frequencies used by many marine species, including baleen whales.³⁴ The most probable impacts of shipping relate to the masking of biologically meaningful sounds, and to chronic and sublethal effects including disruptions to breeding, migration

patterns, and communication. In addition, shipping noise may create stress that could contribute to a variety of synergistic impacts that affect the longevity of individuals and have possible long-term population impacts.

Other sources of anthropogenic sound in the oceans that are of significant concern include underwater explosives, anti-predator devices (e.g., acoustic harassment devices (or AHDs)) and whale watching boats. Whale watching boats have been linked to possible population-level impacts and are of particular concern because they are specifically directed at whales.³⁵

Mechanisms of injury: auditory, behavioral, non-auditory

There is currently considerable scientific debate about the mechanisms of injuries sustained by marine mammals that lead to strandings. While this is of obvious scientific interest and importance, it should not be considered important relative to the regulatory agencies' decisions regarding the management of sound-producing activities. Knowledge of the mechanisms of injury could result in a better understanding of how to mitigate for these lethal impacts. Until this knowledge gap is filled, agencies must make decisions about allowing these activities to proceed. Regardless of how the injuries take place, the fact that sound sources cause them, affecting not only individuals but possibly populations, must be factored into agencies' decisions about permitting and management.

Recommendations:

- 1) Provide funding to have sufficient stranding teams available to review and obtain information on strandings in a timely manner.
- 2) Increase the level of monitoring to detect strandings or mortalities at sea associated with noise events.
- 3) Develop a standardized form for the reporting of data from strandings, including consistent necropsy examinations to detect acoustically-related injuries.
- 4) Allow for a limited number of members of the public to be present during necropsies to increase the transparency of the process.
- 5) Require reporting of any activities involving sound in areas where there was a stranding, including date, time, and location of the activity.

Effectiveness of Current Management/Mitigation

What are the best practices?

Many sound-producing activities serve important social, economic, or other purposes, and effective management of their effects is therefore essential, particularly when prevention of adverse effects is not practicable. Addressing human-caused acoustic impacts on marine mammals through a comprehensive and transparent management system should be a high priority, and potential and known adverse effects associated with anthropogenic sound should be minimized in the marine environment. Scientists have not conclusively identified all situations in which anthropogenic sound will have adverse effects, but a range of mitigation and management techniques or approaches currently exist, that, if implemented, may reduce potential adverse effects.

The components of systems for managing the effects of sound on marine mammals include knowledge and research, risk assessment, permit and authorization processes, mitigation tools and monitoring, evaluation, enforcement, and compliance activities. Mitigation consists of a suite of tools designed to prevent, reduce, eliminate, or rectify the impacts of sound introduced into the

environment. When considering the application of mitigation strategies, managers begin with the ultimate goal of preventing adverse effects (e.g., through source removal or exclusion zones). If that prevention is not practicable, they modify their strategies to minimize impacts on marine mammals (e.g., through source or exposure reduction) consistent with existing statutes. It is important to note that sound-producing activities may not be allowed to proceed in cases where mitigation is inadequate or impossible and the potential adverse effects warrant such action.

The application of fully integrated mitigation systems that bring together an appropriate combination of the tools at managers' disposal is likely to be the best way to maximize effective mitigation efforts. There is not, and probably never will be, a single "silver bullet" solution to designing and carrying out effective mitigation. The effectiveness of source removal is obvious but the effectiveness of other commonly used mitigation measures (e.g., ramp-up and safety zones) has generally not been systematically assessed, and may vary greatly from one case to another. Certain mitigation tools, such as exclusion zones, are inherently effective. However, under certain circumstances, some of these may be impractical for the sound-producers. Mitigation tools currently available include:

- Operational procedures (such as ramp-ups and speed limits);
- Temporal, seasonal, and geographic restrictions; and
- Removal or modification of the sound sources (such as ship-quieting technologies and reductions in sound-producing activities).

Fundamentally, the primary goal of any management system must be to reduce or eliminate the intensity, and thus the potential for negative impacts, of noise sources by either not undertaking these activities to begin with, or through modifications to those activities (including the use of alternative, quieter technologies), and geographic and seasonal restrictions or exclusions.

Mitigation strategies that have the greatest potential for reducing risks to marine mammals include, as a matter of priority, reduction of source levels or source removal. Moreover, reducing overall sound levels is a general premise of mitigation, and should be a goal of any management system attempting to prevent adverse effects on marine mammals, and in so doing, pursuing targeted mitigation of discrete noise-producing activities. To this end, we highlight several proactive mitigation tools that we believe are the most effective and should be improved upon and employed expeditiously for managing the impacts of human-generated noise on marine mammals and their habitats.

Seasonal and geographic exclusions. Geographic areas or regions that are biologically important for marine mammals (i.e. breeding, feeding, calving and migratory habitats) should be off-limits to noise-producing activities on a seasonal or permanent basis. This tool is the most effective in preventing harmful effects of noise on marine mammals by excluding noise-producing activities from critical habitats during important biological activity.

Marine reserves. Designating and enforcing marine reserves can be an extremely effective tool for protecting marine mammals and other marine life from noise-producing activities. Commercial activity, such as oil and gas exploration and extraction and other habitat-altering activities, should be off limits in marine reserves.

Source removal, reduction and modification. Where forms of marine habitat protection such as marine reserves and seasonal restrictions are not possible, lowering noise levels or removing them altogether are possible options through the use of alternative technologies.

The above tools are inherently the most effective at reducing or eliminating the impacts to marine mammals, but there are also practical limitations on their use and they may not always be “practicable” under current statutes. The use of safety zones with adequate monitoring is the next best level of protection that can and should be used.

Safety zones. Safety zones are centered around a sound source, rather than an animal. A safety zone is a specified distance from the source (generally based on an estimated received sound pressure level) that must be free of marine mammals before an activity can commence and/or must remain free of marine mammals during an activity.

The sizes of safety zones are typically determined using a variety of information, including prior observations of marine mammal impacts, sound propagation models, sound source information, real-time acoustic measurements, and consideration of other mitigation measures employed.

There are several limitations on the effectiveness of safety zones, including our lack of scientific knowledge about what levels of sound may be safe for a particular marine mammals species and thus the appropriate “received level” that is required to be set. In addition there are significant limitations on the ability to detect marine mammals prior to their entering the safety zone.

Safety zones are generally used in conjunction with marine mammal observers. These observers are individuals ranging from marine mammal biologists and trained observers to crew members who conduct visual surveys of marine mammals (i.e., watching for their presence or behavior) for various reasons including maintenance of marine mammal-free safety zones.

The limitations inherent in visual observations are well known. A variety of factors affect sighting rates. Effective visual observations are also generally limited to hours of daylight. Visual detection is also limited because it can only be achieved at or very near the water’s surface. Sighting rates in good conditions are much higher for species that spend more time at the surface, or for those which are more visible when they breathe. However, many cryptic species that spend very little time at the surface (e.g., deep diving beaked whales) are difficult to detect even under ideal conditions.

The limitations of using marine mammal observers to enforce a safety zone can be offset through the use of Passive Acoustic Monitoring (PAM), especially for some deep diving species, if they vocalize. There are some technical limitations to PAM; for example, stationary hydrophones or Acoustic Recording Devices (ARDs) are not particularly useful for monitoring a highly mobile sound source unless there is a bottom array covering the area. Using these methods together, it is still unlikely that 100% of all marine mammals will be detected.

While there are no known mitigation techniques that guarantee elimination of potential and known impacts — other than denying an activity or creating seasonal and geographic exclusion zones — management and regulatory agencies must deal with the need for requests for permits for sound-producing activities. They must therefore, consistent with current statutes, look to all possible mitigation tools to reduce the impact to the level of least practicable adverse impact.

Recommendations for Management and Mitigation:

- 1) The management agencies should identify, and implement immediately, mitigation measures that are effective for noise-producing activities (e.g., source reduction and removal; geographic and seasonal restrictions) while a sustained national research program that includes systematic study of the effectiveness of mitigation tools is being developed.
- 2) The agencies should work with the U.S. Navy, air gun users (including scientists, geophysical contractors, and oil and gas companies), and the shipping industry to prioritize and ensure the development and use of quieter technologies, and other source reduction tools or methods. In addition, management should be extended to unaddressed sources and activities that have the potential to produce adverse effects (including, but not limited to, commercial shipping, recreational watercraft use, whale watching, and the development and use of AHD (Acoustic Harassment Devices, e.g., sounds to keep mammals away from fishing areas), and ADD (Acoustic Deterrent Devices, e.g., use of sound to keep mammals from entangling in fishing nets).
- 3) The National Marine Fisheries Service and the U.S. Fish and Wildlife Service (the Services) should examine novel applications of conservation tools such as designation of critical habitats, marine protected areas and ocean zoning to protect populations from chronic or episodic anthropogenic noise.
- 4) The Services should develop standardized and transparent systems and formats for the collection of monitoring data to be able to systematically take advantage of appropriate opportunities to collect data that can be used for statistical analysis, and facilitate the review, aggregation, and publication of data and results of those analyses.
- 5) The Services should establish training and certification programs to ensure that observers are qualified to conduct effective monitoring, enabling data to be utilized effectively.

Cost-effectiveness and practicality/practicability

Current statutes authorize the Services to issue permits for taking marine mammals that meet specific requirements, and to authorize small incidental takings of small numbers of marine mammals for activities “within a certain geographical region... during periods of not more than five consecutive years...” provided (1) that “the total of such taking... will have a negligible impact on such species or stock” and (2) that the agency “prescribes regulations setting forth... permissible methods of taking... effecting the least practicable adverse impact” on marine mammals. The MMPA has been working relatively well and there is no reason to believe it needs changing. The current statutes do not include cost or cost-effectiveness as a consideration in the application of mitigation to reduce the impact to the least practicable adverse impact. NMFS must provide meaningful protections for species regardless of the resulting economic costs. In addition, while some military exemptions may be warranted, broad-scale and unneeded military exemptions from the MMPA are not appropriate. This is critically important because the purpose of these statutes is to protect and preserve these species. To include cost and cost-effectiveness as considerations in the protection of species would undermine those protections and complicate the statutes to the point where requiring mitigations would become almost impossible. Protections provided for under the MMPA, NEPA, and ESA would become meaningless. There is no definition of what is meant by “cost-effective” and, as has been stated under the Mitigation Best Practices Section above, no mitigations to date have been studied for their effectiveness. To determine if a mitigation is “cost effective” would first require a determination of the mitigation’s effectiveness relative to potential

and known impacts to the species. It is clear that at this point there are huge data gaps and high uncertainty in all aspects of this field. It would first require a series of long-term studies to better understand marine mammals and to look at the impacts of noise along with a determination of the mitigation's ability to reduce that impact. While we highly recommend that such studies be conducted, the results and ability to interpret them are decades away. In the meantime, decision-makers cannot be stripped of the only mechanisms they have at their disposal to reduce the potential and known impacts of anthropogenic sound on marine mammals.

Assignment of burden of proof: sound producers vs. regulators

The current regulatory system, NEPA (National Environmental Policy Act), MMPA (Marine Mammal Protection Act), ESA (Endangered Species Act), and CZMA (Coastal Zone Management Act), requires that the impacts of activities affecting marine mammals be reduced to the least practicable adverse impact and sets the burden of proof for determining what those impacts are with the sound producer.ⁱⁱ This is essential to retain. Given the scientific uncertainty surrounding this issue, the difficulty in studying marine mammals, our expectation that the data gaps will not be filled perhaps for decades, and the likelihood that scientific certainty can be achieved in the near future, or ever, is very remote, the need to have those proposing an activity show that their activity can be mitigated to reduce the potential for impact is essential. If agencies are required to prove that a sound-producing activity causes harm before requiring reasonable protection through mitigation, no mitigations will be able to be required and serious and/or irreparable harm to these important species could occur.

Precautionary approach—addressing the uncertainty

Given the level of uncertainty, the data gaps, and the serious – even lethal – potential effects of sound on marine mammals, precaution is necessary to protect and conserve these species that have a special place and role in nature and in our culture. While there is no clear-cut, agreed upon definition of precaution or the precautionary approach, some level of precaution is appropriate, given the difficulty of studying marine mammals in the wild, our lack of knowledge of marine mammal populations, and the potential for harm to occur before it is detected. The current regulatory system, through provisions in NEPA, MMPA, and ESA, incorporates precaution. Scientific uncertainty should not be used as a justification for postponing action to protect these species. Failure to take a precautionary approach until scientific certainty is achieved, which may never be possible, and attempting to shift the current burden of proof from the applicant to the agencies, could result in direct population effects, leading to the extinction of some species.

The California Coastal Commission believes that protecting marine mammals, which it considers to be coastal resources, is important to this State. As such the Coastal Commission applies precaution in its decision-making process in two ways. Under the CZMA, precaution is applied to mean that given uncertainties that might impact coastal resources the applicant is required to

ⁱⁱ Under the ESA, the take (harm/harassment) of listed species is strictly prohibited and consultation is required under the regulations whenever a federal activity/permit “may affect” a listed species. Following consultation, “take” may be authorized only where the agency/applicant can “insure” that the authorized action “is not likely to jeopardize” the survival of the species or adversely modify its critical habitat. “Any person who wants to be shielded from Section 9 liability for a take by an exemption or take permit “shall have the burden of proving that the exemption or permit is applicable has been granted”. Taken together this puts the burden on anyone who wants to undertake an activity that could affect a listed species. The MMPA has language that similarly applies.

mitigate possible impacts to the maximum extent practicable and to monitor for impacts. Under the Coastal Act, if there is uncertainty the Coastal Commission takes the position that the applicant must avoid or mitigate the impacts to a negligible level. If avoidance is not possible, or if mitigation is not possible, or if it is unknown whether mitigation will work, then the Coastal Commission may deny the project. In each case, the Coastal Commission applies the generally accepted legal principal that the applicant bears the burden of proof that the proposed project/action will *not* impact coastal resources.

The California Coastal Commission believes that the current regulatory system should be retained and even strengthened to enable regulatory decision-makers the ability to factor in the current and evolving field of science that indicates that the impact of anthropogenic noise on marine mammals may be significant.

International or multi-lateral approach

Few marine mammals are restricted to the waters of any one country. While the problem of anthropogenic sound is international in scope, the California Coastal Commission's jurisdiction extends only to this State's waters, federal waters off its coast, and impacts on this State's coastal resources, i.e., marine mammals that pass through or live in or on California's coast. It is therefore beyond the scope of our jurisdiction to deal with marine mammals on an international level and we will not comment on this aspect of the problem.

Priorities and Conduct of Research

Diversification and distribution of research funding/Safeguards against bias in research

Bias in scientific research is recognized as a significant problem in all fields of research. The issue of bias in science is not a new one and is not specific to this field of inquiry. Many articles have been written on this subject and scientists and those who work with the scientific community have struggled over ways to deal with this issue. This issue becomes of even greater concern when there are limited sources of funding and the major sources are tied to those who have a vested interest in the outcome of the research. In addition, the very manner in which research funds are typically allocated may frustrate consideration of less damaging alternatives.

There is not now, nor has there ever been, such a thing as pure science. Science does not have absolutes and scientific certainty is relative. However, scientists strive to achieve as much independence and integrity in their work as possible, but they are human. Bias can affect the questions that are asked, the hypotheses posed, the method of research and analysis, which projects are funded, and the interpretations of the results and how they are presented. Bias can be unwittingly introduced or intentional. It is based on personal, social, political, and religious viewpoints. To attempt to deny that it is possible within this field of science, when it occurs in EVERY field of science, is to prevent taking steps to deal with and minimize it. An attempt to ignore it and fail to put into place mechanisms to reduce it can only lead to greater suspicion on the part of the public. This causes a heightened perception of bias and serves no purpose. In addition, because we are aware that one of the principal issues regarding bias and the perception of bias comes from a direct connection between the source of funding and the user, it is necessary to distance the funding from the noise producer and diversify and distribute as much as possible the funding sources for research.³⁶

Some believe that peer review and ethical guidelines remove the possibility of bias, but this is not the case. While peer review helps, it does not solve the problem. Peer review does not remove many of the aspects of research that bias can affect as outlined above. It can be prone to bias itself (depending upon the reviewers), poor at detecting gross defects, almost useless for detecting fraud, and does not address the issue of which projects are funded.³⁷ In addition, the pre-publication “vetting” of manuscripts by the funder, actual interference by the sponsor into the research, or withholding of complete data by the researcher preventing independent analysis, are problems not solved by peer review. Other mechanisms must also be put in place to help reduce the problem.

One of the first questions always asked when reviewing any research is, who funded it? If the only source of funding is from those with an interest in seeing one point of view and that is the only research that has been published on that subject, then the research will too easily be dismissed as biased, even if it may be valid.ⁱⁱⁱ As decision-makers involved in determining approval and mitigations we believe it is counterproductive to only have research that could be considered biased. If only sound producers and the agencies that regulate them fund all research, that research is subject to question and therefore could be of reduced use to decision-makers. Although we support the creation and funding of a national program to understand the impacts of sound on marine mammals, we do not support funding unless the issue of bias is dealt with explicitly.

There are numerous models for increasing funding diversity, independence, and public transparency. For instance, the National Oceanographic Partnership Program (NOPP) is a collaboration of fifteen federal agencies. NOPP brings the public and private sectors together to support larger, more comprehensive projects. Another model for achieving funding diversification is the National Whale Conservation Fund administered by the National Fish & Wildlife Foundation (NFWF). Legislation could establish a targeted fund at NFWF for research into the effects of undersea sound on marine mammals and other species. Still other models would be the establishment of jointly funded, independent non-profit organizations or expanded funding for federal research through NSF, NMFS, Fish & Wildlife Service, and the MMC.

The research programs should be well coordinated across the government and examine a range of issues relating to noise generated by scientific, commercial, and operational activities. Diversification can produce more comprehensive programs, improve opportunities for researchers, and reduce the perception that bias may occur. Also important in achieving these aims is the use of procedural mechanisms such as stakeholder and public participation, and alternative funding structures, such as quasi-independent agencies, that can further insulate decisions about research funding from dominant, sound-producing funders of research.

It is important to set up transparent safeguards and guidelines that aim to minimize the potential for bias or conflict of interest to occur and to expand study into important areas of research that are not as directly relevant to mission agencies’ specific objectives and mandates. Transparency and credibility in research should be supported by mechanisms to create full post-publication access to research data. However, any such mechanisms would need to address concerns about the ownership of the data. Full disclosure of data is necessary to allow others to confirm that any

ⁱⁱⁱ ** NRC (2000), “sponsors of research need to be aware that studies funded and led by one special interest are vulnerable to concerns about conflict of interest. For example, research on the effects of smoking funded by U.S. National Institute of Health is likely to be perceived to be more objective than research conducted by the tobacco industry,” *Marine Mammals and Low Frequency Sound*, National Academy Press, Wash D.C. pg 84.

unpublished data do not contradict the conclusions of a published study. Data issues already have been addressed for many subdisciplines in ocean sciences and there is no reason to believe why similar data issues cannot be addressed in this discipline.

We strongly urge that sufficient funding be put into place to study this form of pollution and its impacts, which we believe represents a substantial threat to marine mammal populations. Funding for this critically needed research should not be taken from other existing research programs. Any commitment must be a real one, which means that it is in addition to other programs.

What are priority research areas?

Baseline studies on marine population size, population structure, location of critical habitats, and highest concentrations of marine mammals and their behavior are the most pressing priorities. When projects come for permitting it is essential to know precise information about the species and their population size and structure to do an accurate risk assessment. There is a big difference in considering allowing a possible impact to a species that is threatened or endangered or one whose population is essentially unknown or may be structured in such a way as to have small, localized sub-populations, and species whose populations are relatively healthy. Without adequate knowledge of the population, regulatory agencies cannot determine whether the activity can be reduced to the least practicable impact and projects may be denied unnecessarily. Because managers are faced with making these decisions routinely and these decisions cannot wait for long-term studies to determine more precisely the nature of the impacts, this baseline research must proceed immediately. Having better information about the location of critical habitats, where the highest concentrations of marine mammals are located and at what times of year will make it easier for managers and regulatory bodies to determine whether or not exclusion zones and/or seasonal closures are appropriate.

Studies that should also be given high priority are those that will allow for a valid interpretation of what a biologically significant reaction to anthropogenic sound is. To conduct other research, i.e., to use Controlled Exposure Experiments (CEEs) to determine impacts, without knowing more fully what normal behavior is and what it means will not answer the questions we need answered (see additional discussion below). Current efforts to focus on understanding the effects of noise on marine mammals have not resulted in greater protection to them. More importantly, without a more complete understanding of the baseline behavior of un-impacted animals, it will be extremely difficult to ever gain even a moderately complete insight into the impacts and we believe that funds expended will not be efficiently used.

One avenue that is readily available to obtain baseline information through systematic and observational research, and that does not involve the introduction of additional sound into the environment, is to utilize ongoing permitted sound-producing activities. Many of these currently permitted sound-producing activities carry with them the requirement for monitoring and reporting of the monitoring. Unfortunately, there is no standardized form for obtaining the data required in a way that would make these data available for statistical analysis or for research purposes. Additionally, although required as part of the mitigation for the impacts of the activity, sound producers may, and frequently do, keep the actual data obtained as proprietary. This is inappropriate, given that these are mitigation requirements. If all data were required to be made public and if these data were collected in a systematic way, funds expended for the purpose of mitigation could have a dual benefit of providing answers to many questions and result in a significant saving on research funding.

Other areas of priority for research include:

- 1) Conduct more complete analysis of past and present stranding data, including obtaining more information on whether or not there were sound activities in the area at the time of the stranding, for both naval sonars and seismic surveys.
- 2) Develop more effective ways to do monitoring before, during and after noise activity as part of current mitigation required of sound producers so that such monitoring data can be analyzed for impacts. This also requires that pre-activity baseline information be available.

Relative importance of research and mitigation efforts

Research on the effectiveness of current mitigations, the improvement of current tools, and the development of additional tools needs to be given the highest priority. While much of what scientists are attempting to learn about marine mammals is of importance to science and our understanding of these species, managers and regulatory bodies such as the Coastal Commission need information immediately to be able to meet the mandates of current statutes and concerns about protection of these species. Basic research and understanding of animal physiology and behavior requires long-term studies. Answers do not come easily, quickly, or cheaply. In the interim, sound producers need to have some degree of certainty about their ability to get permits and regulators need to have information about the value and advisability of requiring mitigations. Given the high degree of probability that noise does cause adverse impact to marine mammals, regulators cannot wait for long-term answers and must have more information on mitigation as soon as possible.

Permitting and authorization for research

The Coastal Commission agrees that researchers who undertake research on or who incidentally take marine mammals in the course of sound-producing research are in need of timely, predictable, and cost-effective permitting and authorization processes that maintain or enhance current levels of protection for marine mammals under the statutory regimes of the Marine Mammal Protection Act (MMPA) and other federal and state laws. The challenge is implementing an effective process that protects marine mammals while allowing much-needed research to be undertaken.

There are many issues of concern facing researchers and federal and state agencies. These include:

- 1) inadequate resources available to conduct permitting and authorization processes in a timely and efficient manner;
- 2) the funds, time, and regulatory and scientific expertise needed by a researcher seeking to obtain a permit or authorization to conduct acoustic research that could impact marine mammals;
- 3) lack of clarity regarding the applicability of other statutes like the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA) that may require documentation in addition to that required by the MMPA (Marine Mammal Protection Act);
- 4) lack of clarity regarding when programmatic authorizations or permits are appropriate for repetitive activities that do not change significantly over time; and
- 5) the underlying circular situation in which the lack of information needed, in part, to make permitting and regulatory decisions is perpetuated by the challenges in permitting research activities that could help address those information needs.

To address this situation, there are several steps that could be taken by the Services, researchers, and funding entities to improve the permitting and authorization processes. The California Coastal Commission does not believe that there is any need for statutory changes for the permitting and authorization processes. In 1996 the California Coastal Commission was instrumental in convening the HESS (High Energy Seismic Survey) Team, one of whose primary purposes was to find ways to streamline the permit process for review of seismic surveys in federal OCS off the coast of California. Based on that experience the California Coastal Commission believes that the needs of the researchers for an improved and streamlined process could be accomplished within the current regulatory framework and existing statutes.

The following suggestions to improve the current process include:

- The Services should receive increased funding for their permitting and authorization divisions and that increased funding should be made available to all relevant federal and state agencies for their permitting and authorization divisions to meet compliance needs.
- The Services should adopt a more coordinated approach to:
 - i. provide research funding entities and researchers with clear guidelines to use in determining whether or not a particular research activity requires an application under federal or state law;
 - ii. provide standard background documents, application information, and references to reduce the cost and time of preparing applications; and
 - iii. develop mechanisms, where appropriate, to collectively process and issue permits and authorizations that are similar based on species, region, or activity.
- The Services, research funding entities, and researchers should work together when appropriate:
 - i. to develop programmatic environmental impact statements and assessments and to identify mechanisms to collectively process and issue permits and authorizations especially for repetitive activities that do not change over time;
 - ii. to achieve better timing linkages between the process for authorization and permitting, securing funding, and scheduling research operations to minimize potential issues;
 - iii. to achieve a more comprehensive and coordinated approach to implementation of both the MMPA and the ESA among the Services; and
 - iv. to identify innovative ways to meet regulatory requirements through reductions in potential impacts on marine mammals.

Animal welfare aspects of research—ABR, CEE

There are two experimental techniques that raise significant controversy as to their effectiveness and their implications relative to the welfare of animals: ABRs (Auditory Brainstem Response) and CEEs (Controlled Exposure Experiments). While the Coastal Commission is concerned about the welfare of marine mammals and would not like to see anything done that could harm or kill any individual, its primary concern is to obtain information that will enable it to regulate activities that produce

sound in such a way as to eliminate or minimize the effects of that sound. ABRs raise very serious issues regarding the ethical treatment of animals, particularly those that are stranded and in highly stressful situations. This technique provides for the determination of hearing abilities of animals and may also expand the knowledge base to include the hearing values of a variety of species that may likely not be kept in captive situations, but the use of this technique calls for ethical guidelines. The Coastal Commission does not have a position relative to the use of ABR as a technique except to express its concern about making certain that the welfare of an animal is carefully weighed against the possible benefits of using ABR. When using ABR the primary priority when dealing with stranded animals must be their welfare and not the research objective. Nothing should be allowed that will compromise an animal's ability to survive the stranding. With that in mind, the ultimate decision to use ABR or not must be left to those at the scene charged with the rescue and care of these animals.

CEEs, on the other hand, raise an entirely different set of both ethical and research questions. CEEs are experiments in which animals in the wild are exposed to controlled doses of sound for purposes of assessing their behavior or physiological responses.

CEEs are problematic because they introduce additional sound into the ocean and expose not only the target species and/or individuals to be studied, but many additional ones. By doing so, they place animals at risk. In addition, CEEs may tell us whether or not there is an effect, but a better understanding of the behavior and physiology of marine mammals is required to understand the significance of that effect. Thus even a well-designed experiment may not eliminate controversy over a particular activity or project, but may only shift the nature of the debate. Unfortunately, our ignorance regarding the biology and physiology of many marine mammal species is so great that the potential effects of noise and the sound exposures causing these effects is poorly understood. A top priority for understanding what kinds of reactions may be most important for marine mammals exposed to noise must involve studies of baseline behavior of undisturbed animals prior to conducting other research. Until we have a greater understanding of what is a biologically significant response, CEEs may not give us the answers to our questions and thus should be used judiciously and then probably only in concert with other research or as part of a larger research program.

Given the controversial nature of CEEs and the ethical questions they raise, and because they are not a benign form of research, it is particularly important that when CEEs are used, they be carefully designed and their limitations acknowledged. If CEEs are to be used, it is important to have accurate information about the population status of both the target animals and any others that may be exposed. When endangered species or small local populations are involved, the use of CEEs could result in population effects and therefore should be avoided. In some cases, where the species is highly endangered or where there is little or no information about that population, CEEs should not be used, since the risk associated with the experiment may be too great.

For long-term effects, long-term research is required. It is not practical to use CEEs over long time periods or large spatial scales, i.e., the larger the area the more non-target species will be impacted. CEEs should use, as much as possible, sound exposures that are realistic and with the same characteristics of sound that the mammals are likely to be exposed to by ongoing sound operations. Further, for CEEs to be effective they must be preceded, as stated above, by baseline studies of behavior and physiology that enable the results of the experiments to be interpreted as to their

significance. To eliminate possible bias and arguments that will make the research valueless for regulatory purposes, if CEEs are conducted, there should be agreement, in advance, as to what constitutes a biologically significant effect.

Lastly, research that can yield conclusive results with less risk of harm to the animals should be preferred. Systematic observations using ongoing sound-producing activities should be used in place of CEEs if they can provide similar information. Systematic studies of ongoing sound-producing activities can strengthen monitoring efforts required as mitigation, while retaining the benefit that such studies do not introduce additional sound directed at the mammals. The advantages of observational studies are increased as more attention is given to optimizing measurement methods and study designs with the greatest power to detect real effects and provide convincing results.

No single research approach solves all of our data needs. Monitoring will always be required for regulated activities, and if monitoring data are collected systematically, gathered, and analyzed, they can provide important information on effects. Long-term correlational studies can provide added detail on effects of ongoing activities, and are especially useful for long-term exposures or difficult to reproduce sounds, and CEEs can constitute one component of a larger research and management program, designed to give us additional information where controlled exposures are necessary.

Recommendations:

- 1) Anthropogenic sound with the potential to harm marine life should be eliminated where possible or otherwise minimized (e.g., through source reduction and removal; geographic and seasonal restrictions).
- 2) Given the likelihood that anthropogenic sound may have significant impacts on marine mammals, the degree of uncertainty regarding the nature and extent of those impacts, and the need to consider cumulative and synergistic effects, a precautionary approach should be taken with respect to management of marine mammals.
- 3) Anthropogenically caused acoustic impacts on marine mammals need to be addressed through a comprehensive and transparent management system. The management system should address chronic and acute anthropogenic noise, long-term and short-term effects, cumulative and synergistic effects, and impacts on individuals and populations.
- 4) The Services should receive increased funding for their permitting and authorization divisions and that increased funding should be made available to all relevant federal and state agencies for their permitting and authorization divisions to meet compliance needs.
- 5) Congress should provide funding to have sufficient stranding teams available to review and obtain information on strandings in a timely manner and to increase the level of monitoring to detect strandings or mortalities at sea associated with noise events.
- 6) The Services should develop a standardized form for the reporting of data from strandings, including consistent necropsy examinations to detect acoustically related injuries. The Services should allow for a limited number of members of the public to be present during necropsies to increase the transparency of the process.
- 7) Congress should require reporting of any activities involving sound in areas where there was a documented stranding, including date, time, and location of the activity.

- 8) The management agencies should identify and immediately implement mitigation measures that are effective for noise-producing activities (e.g., source reduction and removal; geographic and seasonal restrictions) as a part of a sustained national research program that includes systematic study of the effectiveness of various mitigation tools.
- 9) There should be a commitment to fund a national research program, with emphasis on baseline behavior, physiology, and population size, location, and structure. That program should have procedures in place to minimize bias and the perception of bias and should include diversification of funding, a prohibition on the pre-publication vetting by funders, and a requirement that all data obtained with public funds be publicly available.
- 10) The agencies should work with the U.S. Navy, air gun users (including scientists, geophysical contractors, and oil and gas companies), and the shipping industry to prioritize and ensure the development and use of quieter technologies, and other source reduction tools or methods. In addition, management should be extended to unaddressed sources and activities that have the potential to produce adverse effects (including, but not limited to, commercial shipping, recreational watercraft use, whale watching, and the development and use of AHD and ADDs).
- 11) The Services should examine novel applications of conservation tools such as designation of critical habitats, marine protected areas, and ocean zoning to protect populations from chronic or episodic anthropogenic noise.
- 12) The Services should develop standardized and transparent systems and formats for the collection of monitoring data to be able to systematically take advantage of appropriate opportunities to collect data that can be used for statistical analysis, and facilitate the review, aggregation, and publication of data and results of those analyses.
- 13) All data obtained as a result of mitigation monitoring requirements should be public.
- 14) The Services should establish training and certification programs to ensure that marine mammal observers are qualified to conduct effective monitoring, enabling data to be utilized for observational research.

Conclusion

Although we know that anthropogenic sound in the ocean is a serious threat, we do not have sufficient information at this time to understand the full extent of the problem. One of the biggest challenges faced in regulating the effects of noise is our ignorance of the characteristics and levels of sound exposures that may pose risks to marine mammals. Given the current state of our knowledge we must therefore take a precautionary approach in the regulation of noise. We must also expand our efforts to protect and preserve marine mammals by instituting and using effective mitigation measures – such as geographic exclusion zones – now, to keep marine mammals at a distance from noise sources that have the potential to harm or kill them. In addition, we must commit to understanding this problem better by funding a national research program. Only through a combined approach – precaution, mitigation, and research – can we assure that these very special resources will be here for the enjoyment of future generations.

Notes

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30. See e.g., Mate, B.R., K.M. Stafford, and D.K. Ljungblad, "A change in sperm whale (*Physeter macrocephalus*) distribution correlated to seismic surveys in the Gulf of Mexico," *J. Acoustical Soc. Am.* 96 (1994): pp. 3268-69 (sperm whales).
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32. Calambokidis, J., D.E. Bain and S.D. Osmek, "Marine Mammal Research and Mitigation in Conjunction with Air Gun Operation for the USGS 'SHIPS' Seismic Surveys in 1998" (1998) (Final report to Minerals Management Service).
33. Stone, C.J. 2003 The effects of seismic activity on marine mammals in UK waters, 19998-2000. JNCC Report Number 323.
34. Croll et. al 2002.
35. Bejder, L. 2005, Linking short and long term effects of nature-based tourism on Cetaceans. Ph. D thesis Dalhousie Univ. Halifax, Nova Scotia.
36. See for example: Weilgart, L., Whitehead, H., Rendell, L., and Calambokidis, J. 2005. Signal-to-noise: funding structure versus ethics as a solution to conflict of interest. *Mar. Mamm. Sci.* 21 (4): 779–781.
37. Smith, R 1999 Opening up BMJ Peer Review, *BMJ* 318:4–5.

MEMORANDUM FOR: Monterey Bay National Marine Sanctuary Advisory Council

FROM: Paul Michel, Superintendent

SUBJECT: Proposed PG&E Seismic Survey Project

In preparation for the October 18 SAC meeting in Cambria and the agenda item regarding the proposed PG&E Seismic Surveys, I have prepared the following summary for your information.

PG&E and the National Science Foundation (NSF) are proposing to conduct a high energy seismic survey in the vicinity of the Diablo Canyon power plant and known offshore fault zones. PG&E's seismic research was called for by the state and includes the use of on-shore and off-shore low and high-energy seismic studies, as well as the installation of ocean-bottom sensors to detect seismic activity. The data will provide a more accurate and detailed picture of the region's complex geology, and will help further define the level of seismic activity in the region of Diablo Canyon. PG&E will use this data to support its ongoing seismic safety program.

NOAA is reviewing federal and state environmental documents regarding potential biological impacts from marine seismic tests on whales and other federally protected species. The agency will determine if the project can be conducted in a manner compliant with federal natural resource protection laws, which include the Marine Mammal Protection Act, the Endangered Species Act, the Magnuson Stevens Fisheries Act, and the National Marine Sanctuaries Act. The proposed survey would occur south of the boundary of the Monterey Bay National Marine Sanctuary and models used to estimate potential impacts to marine life predict that the intensity of sound reaching the southern boundary of the sanctuary would likely not be high enough to affect sanctuary resources, based on threshold values used by NOAA. However, levels within the sanctuary are predicted to approach these thresholds, leading to interest in validation of model predictions and in comprehensive monitoring of sound levels and marine mammal distributions and densities before, during and after the survey.

The National Science Foundation (NSF), which prepared the NEPA document and plans to carry out the surveys using their research vessel (in partnership with PG&E), has committed to complete a "source verification phase" prior to beginning the survey. This phase is designed to measure the actual level of underwater ensonification that occurs to determine whether these values match those predicted by models. This will help determine whether predictions that sanctuary resources are unlikely to be affected by the survey are accurate.

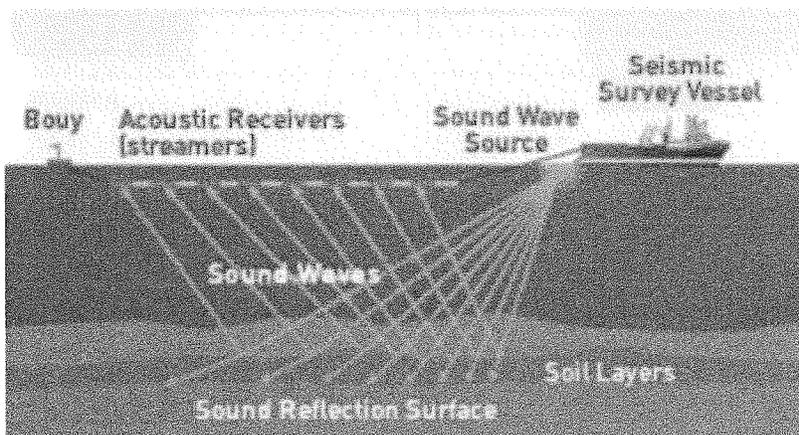
Regardless of the outcome of this verification phase, NOAA has asserted that should the proposed project go forward, the need for impacts analysis to sanctuary resources be addressed within the comprehensive mitigation and monitoring plans funded by PG&E. As the sanctuary's concerns relate to the impacts of sound on marine mammal and fish species, they overlap with NOAA Fisheries' concerns and thus several line offices within NOAA have worked collectively to identify and recommend appropriate mitigation and monitoring. These plans include fishery resource assessments south of the sanctuary, shoreline stranding response spanning the survey area and inclusive of the southern sanctuary, aerial survey efforts targeting both large whales and smaller coastal populations (sea otters and harbor porpoises), and "listening" based monitoring which uses three types of passive acoustic technologies. Two forms of passive acoustic monitoring will focus mainly on monitoring the behavior of inshore populations of concern, sea otters and harbor porpoises in particular, south of the sanctuary and central to the seismic survey area. However, one listening station for these systems will be placed in the southern sanctuary. A final form of passive acoustic monitoring will focus on the offshore levels of sound from the seismic surveys and detection of large whales in the sanctuary, with an additional listening station further south.

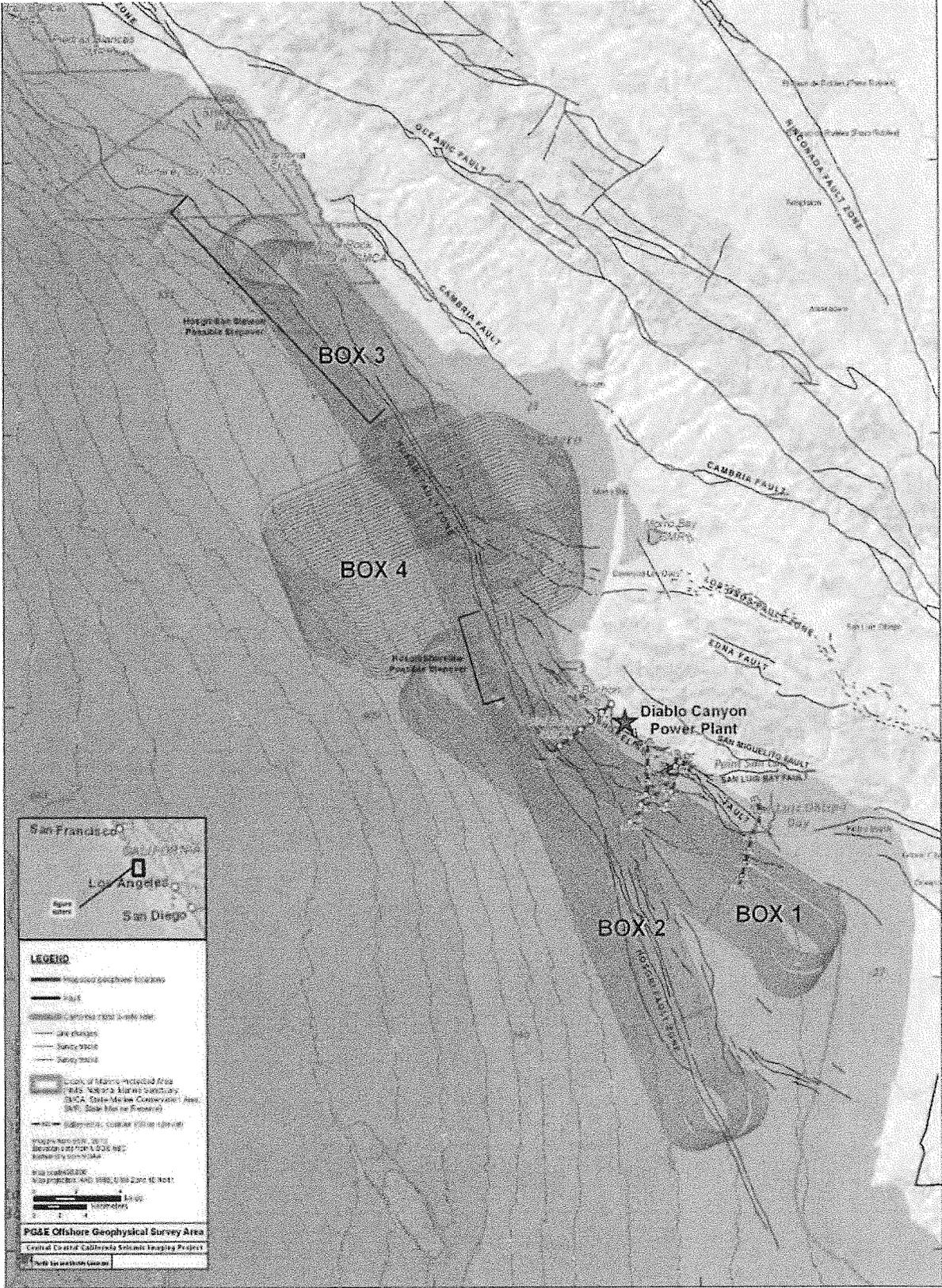
Currently, PG&E is seeking approval from the California Coastal Commission for its revised seismic survey focused on the area referred to as "Box #4" (PG&E had planned to conduct testing this fall in two of the four "boxes" or zones outlined on the project map. Now it only plans to survey Box 4 off the coast of Morro Bay, postponing the testing in Box 2, which ranges from Morro Bay to northern Santa Barbara County).

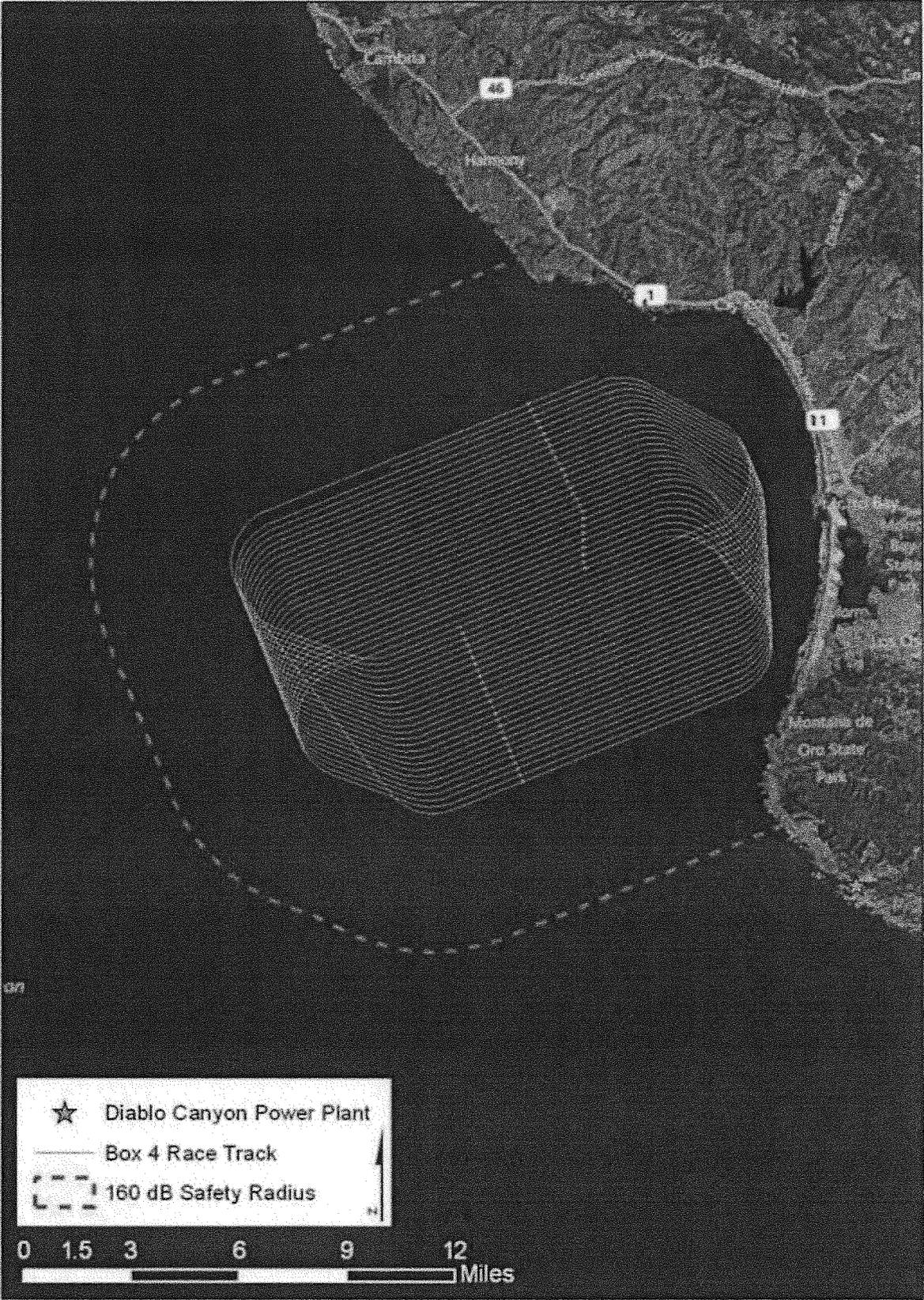
The Commission intends to consider this item at its November 14 meeting in Santa Monica. The utility company had planned to begin seismic testing offshore of Diablo Canyon nuclear power plant in early November, but now it must wait until the conclusion of its mid-November hearing before the Coastal Commission — if the permit application is approved.

PG&E also is seeking a permit from NMFS.

Seismic Survey Process







Fw: Letter to SLO County Board of Supes on PGE Seismic Testing

Dan Buckshi to: cr_board_clerk Clerk Recorder

Cc: Kristi Gutierrez

10/22/2012 05:27 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/22/2012 05:26 PM -----

From: James Patterson/BOS/COSLO
To: Dan Buckshi/Admin/COSLO@Wings
Date: 10/21/2012 06:38 PM
Subject: Fw: Letter to SLO County Board of Supes on PGE Seismic Testing

More seismic input.

James Patterson
Supervisor, District Five
County of San Luis Obispo
1055 Monterey St., Room D430
San Luis Obispo, CA 93408
ph: 805 781.5450 fax: 805 781.1350

----- Forwarded by James Patterson/BOS/COSLO on 10/21/2012 06:36 PM -----

From: Board of Supervisors/BOS/COSLO
To: BOS_Legislative Assistants@co.slo.ca.us
Date: 10/19/2012 10:03 AM
Subject: Fw: Letter to SLO County Board of Supes on PGE Seismic Testing
Sent by: Amber Wilson

----- Forwarded by Amber Wilson/BOS/COSLO on 10/19/2012 10:03 AM -----

From: "Mary E. Webb" <maryewebb@charter.net>
To: <boardofsups@co.slo.ca.us>, <dbuckshi@co.slo.ca.us>, "Cherie Aispuro" <caispuro@co.slo.ca.us>
Cc: "Jerry Gruber" <JGruber@cambriacsd.org>, "Board" <board@cambriacsd.org>, <georgem@moonstonehotels.com>, <bhensley@thetribunenews.com>, <skniffen1@charter.net>, <clbartist@gmail.com>, <sansimeonlodge@earthlink.net>, <lputnam@hearstcastletheater.com>, <info@cambriachamber.org>, <mmccolloch@yahoo.com>, "Marjorie Ott" <info@olallieberry.com>
Date: 10/19/2012 10:02 AM
Subject: RE: Letter to SLO County Board of Supes on PGE Seismic Testing

Attached is a revision to Greenspace letter – it was the Monterey County Board of Supervisors (letter was incorrect) who wrote a letter opposing.

Thanks and please let me know you received this.

Mary Webb

From: Mary E. Webb [<mailto:maryewebb@charter.net>]

Sent: Friday, October 19, 2012 9:14 AM

To: boardofsups@co.slo.ca.us

Cc: 'Jerry Gruber'; 'Board'; 'georgem@moonstonehotels.com'; 'bhensley@thetribunenews.com';

Item # 22 Meeting Date: 10/30/2012

Presented by: Mary Webb

Received prior to meeting and posted to web on: October 23, 2012

'skniffen1@charter.net'; 'clbartist@gmail.com'; 'sansimeonlodge@earthlink.net';
'lputnam@hearstcastletheater.com'; 'info@cambriachamber.org'; 'mmccolloch@yahoo.com'; 'Marjorie Ott'
Subject: Letter to SLO County Board of Supes on PGE Seismic Testing

Good morning,

We understand the SLO County Board of Supervisors will make recommendations to the CA Coastal Commission regarding this Seismic Testing project at their Oct. 30 meeting. Greenspace - the Cambria Land Trust, in unity with Commercial and Recreational Fisherman, NRDC, the Ocean Conservancy, Greenpeace, Save the Whales, the Morro Bay Harbor, the Sierra Club and many other organizations, agencies and nonprofits in SLO County oppose this project.

Over 80,000 people have signed 3 or more circulating petitions opposing Seismic Testing on the Central Coast of California. We urge the Board of Supervisors and your organizations to protect the outstanding resources the Central Coast has to offer, which attract visitors from all over the world.

Thank you for your consideration,
Mary Webb, on behalf of the Board of Directors of

Greenspace –the Cambria Land Trust

rev. Greenspace Seismic Testing SLOCounty.pdf



101212 - CCC LTR re PGE Seismic Study.pdf





October 19, 2012

SLO County Board of Supervisors
boardofsups@co.slo.ca.us
dbuckshi@co.slo.ca.us

By Electronic Mail

**RE: Marine Geophysical Survey off the Central Coast of California,
November to December, 2012**

Greenspace Mission: The North Coast area of San Luis Obispo County is a national treasure. Greenspace will protect and enhance its ecological systems, cultural resources and marine habitats through land acquisition and management, public education and advocacy.

Thank you for considering this critical project that will negatively impact local coastal resources, businesses, tourism, commercial and recreational fishing, and enjoyment of the waters along our coast. Greenspace was an active advocate for the establishment of Marine Protected Areas for the Central Coast. Pt. Piedras Blancas State Marine Reserve, the Cambria State Marine Park, White Rock (Cambria) State Marine Conservation Area, Pt. Buchon State Marine Reserve and Pt. Buchon State Marine Conservation Area were created under the MLPA as areas for habitat protection and ecosystem based management of species. This project affects these Marine Protected Areas.

Thanks to a decision by CA State Lands Commission and increasing citizen awareness and opposition this project has been significantly reduced in size and scope. Northern Zone Box 3 (Cambria State Marine Park and White Rock State Marine Conservation Area) was eliminated, the time frame was reduced to Nov. 1 thru Dec. 31, 2012, and the project will be phased over several years. Boxes 1 and 2 have been deferred and will be scheduled for the 2013-2014 work window (if approved by the CA Coastal Commission Nov. 14, 2012). Refinement of the Box 1 and 2 survey components will be completed following the 2012 survey and will be subject to a supplemental review process. (see attached map)

The most recent report now describes the proposed 3D seismic survey race track to be completed during the 2012 survey period will be Box 4 which is located within Estero Bay. However, the CA Coastal Commission will not be making a decision on this project until November 14, 2012. Therefore, this year's project activities (if approved) are being squeezed into a very short timeframe of November 19 –December 31, 2012.

Central Coastal California Seismic Imaging Project 1.0 Expanded Project Description Revision No. 9 9-28-2012.

This project is constantly changing and has been significantly reduced in size and scope at every level of agency permitting due to new findings of negative impacts to marine life, ecosystems and people. At the same time, agencies created to protect marine life are scrambling to try to perform baseline studies that should have been completed before low intensity surveys were conducted last year. These baseline studies that are designed to protect marine life should not be rushed in order to meet a deadline that has now been shown to be false. (PGE Safety Committee statement 10/10/12). The results of low intensity surveys have not been analyzed and made public.

New information includes:

- Senate Bill AB 1632 does not mandate that Seismic Tests be conducted in order to relicense Diablo Nuclear plant.
- Supervisor Bruce Gibson opposes this project as designed (10/17/12 NCAC).
- North Coast Advisory Council unanimously opposes this project as designed 10/17/12.
- Less intensive alternatives exist to High Energy Seismic surveys but have not been analyzed. Greenspace comments to NOAA October 15, 2012 have not received response.
- Inconsistencies exist between the State EIR and Federal EIS especially in regard to “Level A take” versus “Level B harassment” of Marine Mammals.
- San Simeon Community Services District opposes Seismic Testing (SS CSD 10/10/12)
- Monterey County Board of Supervisors opposes Seismic Testing (letter attached)
- Morro Bay City Council opposes Seismic Testing (9/11/12)

Greenspace respectfully requests that this project be denied as designed, and that more analysis and effort be directed toward alternatives that exist to High Energy Seismic Surveys.

Sincerely,

Mary Webb VP
Greenspace – the Cambria Land Trust

Richard Hawley, Exec. Director
Greenspace-the Cambria Land Trust

cc: Board Cambria Community Services District board@cambriacsd.org
General Mgr. Jerry Gruber jgruber@cambriacsd.org
Cambria Chamber of Commerce
North Coast Advisory Council

MONTEREY COUNTY



BOARD OF SUPERVISORS

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DAVE POTTER, *Chair, District 5*

October 12, 2012

Mary Shallenberger
Chair, California Coastal Commission
North Central Coast District Office
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

**SUBJECT: PG&E Offshore High-Energy Seismic Study
(November 2012 - Coastal Committee Meeting Agenda Item)**

Dear Chair Shallenberger:

On behalf of the Monterey County Board of Supervisors, I am writing to express our concerns regarding the Pacific Gas & Electric (PG&E) proposal for offshore high-energy seismic study near the Diablo Canyon Power Plant.

While we are concerned with the seismic safety of the region surrounding PG&E's Diablo Canyon Nuclear facility, those concerns must be balanced with the disturbance of marine mammals and fish in the environmentally sensitive survey areas.

PG&E plans to use the research vessel *Langseth* to tow an array of air guns through the waters that include two state marine protected areas which is adjacent to the Monterey Bay National Marine Sanctuary, the largest national marine sanctuary and one of the largest marine protected areas in the United States. The air guns emit loud sounds into the ocean that penetrate Earth's crust resulting in three-dimensional images of the earthquake faults near Diablo Canyon which are intended to give seismologists a better picture of the seismic danger facing the nuclear power plant. However, dozens of endangered species use these waters and the loud sounds emitted by the air guns could injure marine wildlife or drive it away from the area (McCauley, R.D. et al 2000).

One of the main concerns is that the high-energy sound blasts could disturb and/or damage animal life, particularly cetaceans such as whales, porpoises and dolphins, all of which use the area off of the Central Coast as a migratory route to and from their annual feeding and birthing areas. Marine mammals such as whales, porpoises and dolphins use sonar and hearing to navigate and communicate, such seismic testing could damage their sensitive systems leading them off-route and possibly missing critical milestones along their routes putting them at risk to be in the wrong areas at the wrong time of the year.

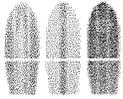
We request that PG&E seek alternatives to the manner in which it researches potential seismic safety concerns so that to the maximum degree practical these efforts protect and respect the marine protected areas and Monterey Bay National Marine Sanctuary, thereby preserving the environment and economic viability of our pristine coastal areas while simultaneously safeguarding the public.

Sincerely,



Dave Potter, Chair
Monterey County Board of Supervisors

cc: Congressman Sam Farr
Senator Dianne Feinstein
Senator Barbara Boxer
Governor Gerald Brown
Assembly Member Luis Alejo
Assembly Member Bill Monning
Senator Anthony Cannella
Senator Sam Blakeslee
John Laird – Secretary, California Resources Agency
Monterey County Board of Supervisors
Lew C. Bauman – CAO, Monterey County
Charles J. McKee – County Counsel, Monterey County
Benny Young – Director, Resources Management Agency, Monterey County
Nicholas E. Chiulos – Director, Intergovernmental & Legislative Affairs, Monterey County
Clerk of the Board, Monterey County
John E. Arriaga – JEA & Associates
Brent R. Heberlee – Nossaman LLP



Seismic Studies to Post Thanks

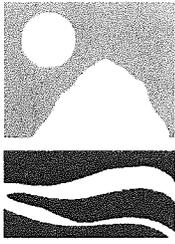
Kristi Gutierrez to: cr_board_clerk Clerk Recorder

10/23/2012 10:26 AM



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Item # 22 Meeting Date: 10/30/2012
Presented by: William Yates
Received prior to meeting and posted to web
on: October 23, 2012



City of Morro Bay

Morro Bay, CA 93442

(805) 772-6200

October 19, 2012

San Luis Obispo County Board of Supervisors
James Patterson, Chair
Room D-430, County Government Center
San Luis Obispo, CA 93408

Dear Chairman Patterson,

On April 23, 2012 I sent a letter to the California State Lands Commission expressing the City of Morro Bay's concerns with PG&E's proposed Central Coastal California Seismic Imaging Project (Project). A copy of that letter is attached.

On September 11, 2012 the Morro Bay City Council unanimously approved Resolution 49-12 opposing the Project as proposed by PG&E for several reasons. A copy of that resolution is attached. In addition, the Morro Bay Harbor Advisory Board voted unanimously to support the Council resolution. A copy of a letter being sent to various agencies on behalf of the Harbor Advisory Board is also attached.

While the Project has seen several hearings and other public processes, the City of Morro Bay continues to be deeply concerned with certain aspects of the Project and offers the following comments:

- The Project's known and unknown effects on fish stocks, and therefore the effects on commercial and recreational fishing, must be thoroughly assessed in both the immediate and long-term basis. This assessment must be independent and peer-reviewed and include real-time monitoring of the biological and catch rate effects, and assess those effects on an economic basis to the local, regional, and state economies. The economic assessment must account for not only the direct effects on fishermen, but the many "trickle-down" and ex-vessel land-side economic effects.

With commercial fishing alone accounting for \$7.4 million in earnings in 2011 for Morro Bay commercial fishermen, those earnings are reinvested in wages, related expenses, local purchases, and reinvestment in equipment/vessels. In turn, an operational and viable commercial fishing fleet is critical in supporting the numerous land-side support facilities such as fish docks, ice houses, fuel docks, etc. To date PG&E has not even come to agreement with the two regional commercial fishing organizations on mitigation for just the direct impacts on commercial fishermen.

Tourism is Morro Bay's largest economic sector, and the potential negative impacts that the Project would have on the local and regional tourism economies must be analyzed and assessed. This includes effects to hotels/motels, the food and beverage industry, fuel and transportation, arts, entertainment, and recreation, and retail sales. Adequate assessment of the economic effects that would result from the Project, and mitigation plans acceptable to those individuals, businesses, and communities affected must be in place before the Project begins.

ADMINISTRATION
595 Harbor Street

ADMINISTRATIVE SERVICES
595 Harbor Street

FIRE DEPT.
715 Harbor Street

PUBLIC SERVICES
955 Shasta Avenue

HARBOR DEPT.
1275 Embarcadero Road

CITY ATTORNEY
595 Harbor Street

POLICE DEPT.
850 Morro Bay Boulevard

RECREATION & PARKS
1001 Kennedy Way

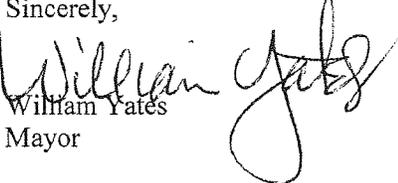
- The Project will have known and unknown adverse effects on marine mammals, some of which effects are mortality on several species. These effects are not only unacceptable from an environmental standpoint but will have profound effects on the economies that rely on a healthy marine mammal population including but not limited to tourism and whale watching.
- The Project will have adverse effects on the state's new Marine Protected Areas (MPAs), especially the nearby Point Buchon Marine Reserve. City of Morro Bay staff participated in the regional stakeholder group that established those areas, and great concessions were made by commercial and recreational fishermen that were based largely on the acknowledgement that the MPAs were for the greater good and to protect against all threats. It would be unfortunate, and in fact it would be a complete rebuff to the principals and procedure that the Governor, the Department of Fish and Game, the Fish and Game Commission, the Blue Ribbon Task Force, the Regional Stakeholders, and the citizens of the State of California committed to in establishment of those MPAs.
- Although the Project will not "close" Morro Bay harbor in a legal sense, the fact that there will be a 36-square-mile moving exclusion zone around the Project's operating vessel will result in significant disruption to vessel traffic to the point of preventing vessels from traveling in and out of the harbor at certain times. This will create unacceptable safety, economic, and inconvenience issues with both local and transient commercial and recreational vessels that have not been adequately addressed.

The effect to the environment and economy are potentially enormous, and this project seems to be on a fast-track only because PG&E deems it is so. Sufficient time must be allowed for a thorough assessment of the potential effects, and for real and adequate mitigation measures being agreed upon by those affected and implemented. In addition, an independent, peer-reviewed assessment must be made of the proposed Project and its methodologies and technology to be certain that it is the "best available science" to both obtain the data needed and to minimize the environmental and economic impacts.

Certain proponents of this Project paint it in the light of being a moral decision between knowing and possibly mitigating the effects to Diablo Canyon from an unknown-size earthquake by doing this seismic testing vs. the potential effects on the environment from the testing. This is a false comparison as the potential effects of this Project on the environment and economy are not fully known at this time, and must be thoroughly assessed and addressed before that comparison can be made, let alone decide which aspect is for the "greater good."

Until these issues are resolved, the City of Morro Bay continues to be opposed to this Project as proposed and is a supporter of the Citizens Opposed to Acoustic Seismic Testing (COAST) alliance. Thank you for taking the concerns of the City of Morro Bay into consideration.

Sincerely,


William Yates
Mayor

cc: California Coastal Commission
Director, California Department of Fish and Game



City of Morro Bay

595 Harbor Street
Morro Bay, CA 93442
(805) 772-6200



April 23, 2012

Jennifer DeLeon, Project Manager
California State Lands Commission
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825

RE: Draft Environmental Impact Report for the Central Coastal California Seismic Imaging Project (State Clearinghouse No. 2011061085)

Dear Ms. DeLeon:

The following comments on the Draft Environmental Impact Report for the Central Coastal California Seismic Imaging Project are submitted by the City of Morro Bay.

The City of Morro Bay shares the concerns in the Draft Environmental Impact Report (DEIR) for Pacific Gas & Electric Company's (PG&E) proposed Central Coastal California Seismic Imaging Project related to the severe impacts resulting from seismic blasting from arrays of towed massive airguns during an 82-day, 24/7 period from September to December 2012. Therefore, the City of Morro Bay agrees with the findings in the Draft Environmental Impact Report that states:

The Project would generate potentially significant environmental impacts on air quality, terrestrial and marine biological resources, greenhouse gases (GHGs), land use and recreation, and noise. Impacts to air quality, marine biological resources, and land use and recreation, remain Significant and Unavoidable even after all appropriate and feasible mitigation measures are applied. The EIR found Significant and Unavoidable impacts to fin, humpback and blue whales resulting from noise. Substantial impact on the Morro Bay stock of the harbor porpoise is also considered to be significant; based on this threshold, is Significant and Unavoidable. Project impacts on sea otters are also considered to be Significant and Unavoidable because of the proximity of the survey to sea otter habitat. The Project is also expected to have Significant and Unavoidable impacts on air quality and greenhouse gases. Significance thresholds for air pollutants are developed by taking into consideration the levels at which individual project emissions would result in cumulatively considerable impacts.

ADMINISTRATION
595 Harbor Street

CITY ATTORNEY
595 Harbor Street

FINANCE DEPARTMENT
595 Harbor Street

FIRE DEPARTMENT
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HARBOR DEPARTMENT
1275 Embarcadero Road

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850 Morro Bay Boulevard

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955 Shasta Avenue

RECREATION & PARKS
1001 Kennedy Way

Clearly, the impacts from the Central Coastal California Seismic Imaging Project would be tremendous and would have significant known and unknown effects on our local ecosystem, in addition to effects to our City's and the local fishing community's economy, both recreational and commercial, from revenue lost from the study's effects on commercial fishing, sport fishing, and whale and marine mammal watching.

Although the City of Morro Bay agrees with the above findings, that the Seismic surveying proposed by the Pacific Gas & Electric threatens "significant and unavoidable impacts" to fish, mammals, persons in the water and to fishing seasons, many of the Applicant Proposed Measures fall far short of realistic and meaningful mitigations for those impacts. In addition, the DEIR fails to adequately address many other concerns for the City of Morro Bay.

The DEIR fails to take into account the need for vessels to enter and leave the Morro Bay Harbor. The project proposes to keep all vessels out of the entire Project Boundary for the entire 82 days (Pages 4.10-13 to 4.10-16). The Project Boundary goes completely across the mouth of the Morro Bay Harbor and would preclude any vessels from leaving or entering the harbor for 82 days. This is an extremely important issue since the Morro Bay Harbor is designated as a "Harbor of Safe Refuge" and is the only protected harbor between Monterey and Santa Barbara, as well as home to United States Coast Guard and Morro Bay Harbor Patrol. Both of these entities cannot have any restrictions on access to the harbor mouth or elsewhere due to patrol responsibilities and in case of emergency.

The DEIR fails to take into account that the recreational rockfish season has been extended from the more recent November 15 close date to December 31. This impact will extend over into our local community, which will suffer significant losses due to their inability to sell coffee, fuel, breakfasts, bait, etc., because of the closure of fishing areas. This will also result in a trickle-down effect on a number of other community businesses such hotels/motels, restaurants, retail businesses and gas stations as they too will significantly suffer financially as a result of less fishing activity in the area.

The DEIR fails to take into account that a portion of the project boundary is within a highly rich Marine Protection Area (MPA). The MPAs are intended to protect the State's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational and study opportunities provided by marine ecosystems subject to minimal human disturbance. The Marine Protection Areas have been designed to create areas of no fishing in order to enhance areas outside MPAs. This project will result in the "take" of fish, larvae and eggs in violation of and destroying the whole purpose of the MPA. In addition, "take" will also occur in the Federally protected Rock Cod Conservation Area (RCA). The fishermen are not exempt from a "take" of fish in protected areas, and the same should be the case under the law for PG&E.

The DEIR incorrectly states that operations of the project will be occurring during a slower fishing production time period as the City experiences its best fishing during the fall and early winter months. The DEIR at page 4.12-13 / 4.13-14 establishes that the three primary fisheries in the City's ports have high production levels during the project time frame, only really dropping off somewhat during the holidays in December. Obviously this is the best weather time of year, and is the reason why PG&E has designated this time of year to commence the project.

The DEIR, on page 4.13-3, incorrectly states that the commercial fishing activity of the area is in "precipitous" decline by quoting an outdated study, the *2008 Morro Bay and Port San Luis Commercial Fisheries Business Plan*, when in fact, according to the *2011 Morro Bay Commercial Fisheries Economic Impact Report*, "Earnings for fishermen at the dock (EVV) in Morro Bay have jumped to \$4.3 million in 2010 from a 20 year low of \$1.7 million in 2007, an increase of over 250%. Earnings are translated into wages for crew, purchases of fuel, ice, supplies, offloading fees, bait and baiting services as well as vessel and gear repair, gear purchases, association dues and slip fees" (Lisa Wise Consulting, May 2011, page 3). And on page 9 of this report it is stated, "Fishing activity has been on the rise in San Luis Obispo County and the number of trips has increased from 3,102 in 2007 to 4,211 in 2010, an approximate 36% increase." Figures from calendar year 2011 indicate an additional increase to near \$7 million (see attached graphs). The City has serious issue with the DEIR in that regard as it downplays the commercial fishing industry and activity and its importance to the local and regional economies, and therefore the Commercial Catch and Landing Data Trends section of the DEIR starting on page 4.13-3 is highly suspect. And finally, the applicable mitigation measures summarized for commercial fishing impacts on Table 4.10-11 consist entirely of developing and implementing a "Communication Plan" with local fishing and boating interests. This is completely unacceptable and does not address the real impacts that will be experienced by the fishing fleet now and well into the future.

In addition, effects to the recreational fishing fleet, both passenger-for-hire sportfishers as well as private boaters, will be similarly significant and the mitigations proposed under Table 4.10-4 consist of the same "Communication Plan" approach. This too is unacceptable.

The DEIR fails to take into account that the National Marine Fisheries/NOAA has placed the Individual Fish Quota (IFQ) program into affect and is working on implementing this program in Morro Bay. IFQs are allocated according to the recent catch history of the fishery. Those with bigger catches generally get bigger quotas. This project would be very costly as fisherman would lose one fourth of the year's overall production lowering the local IFQ'S to the fishermen of this area and cause a loss of the annual income to local fishermen over the long term.

PG&E has publicly stated that, while they acknowledge that there will be impacts to Morro Bay's commercial fishing industry during the survey period, they have been in discussions with the fishermen in order to minimize those impacts. It has been brought to the City's attention that there have been **NO** contacts with the Morro Bay Commercial Fishing Organization either as a group or to any of their Board Members or their Counsel regarding this proposed project. The City is appalled at the inconsistencies of PG&E's statements and believes that PG&E is being incredibly disingenuous as they attempt to move this project forward.

Lastly, while the State Lands Commission and PG&E may have met the minimum noticing requirements for this project and its documentation, given the nature and scope of this project, and its potential known and unknown impacts, the timeline for comment on this DEIR is woefully inadequate for meaningful analysis and comment by the public and seems on a fast track suited only to PG&E and their project calendar and commitments.

Based upon the foregoing, it is the City of Morro Bay's position that if this study goes on as planned, there will be serious damage to our local economy from revenue lost from the study's effects on commercial fishing, sport fishing and whale and marine mammal watching, as well as the countless other businesses that depend on them for their livelihood. Therefore, if this project were to proceed as proposed, there must be fair mitigation, both short term and long term, to the City and fishermen of Morro Bay, as well as full account of the effects on the local ecosystem and meaningful and effective mitigation measures to offset those effects.

Sincerely,

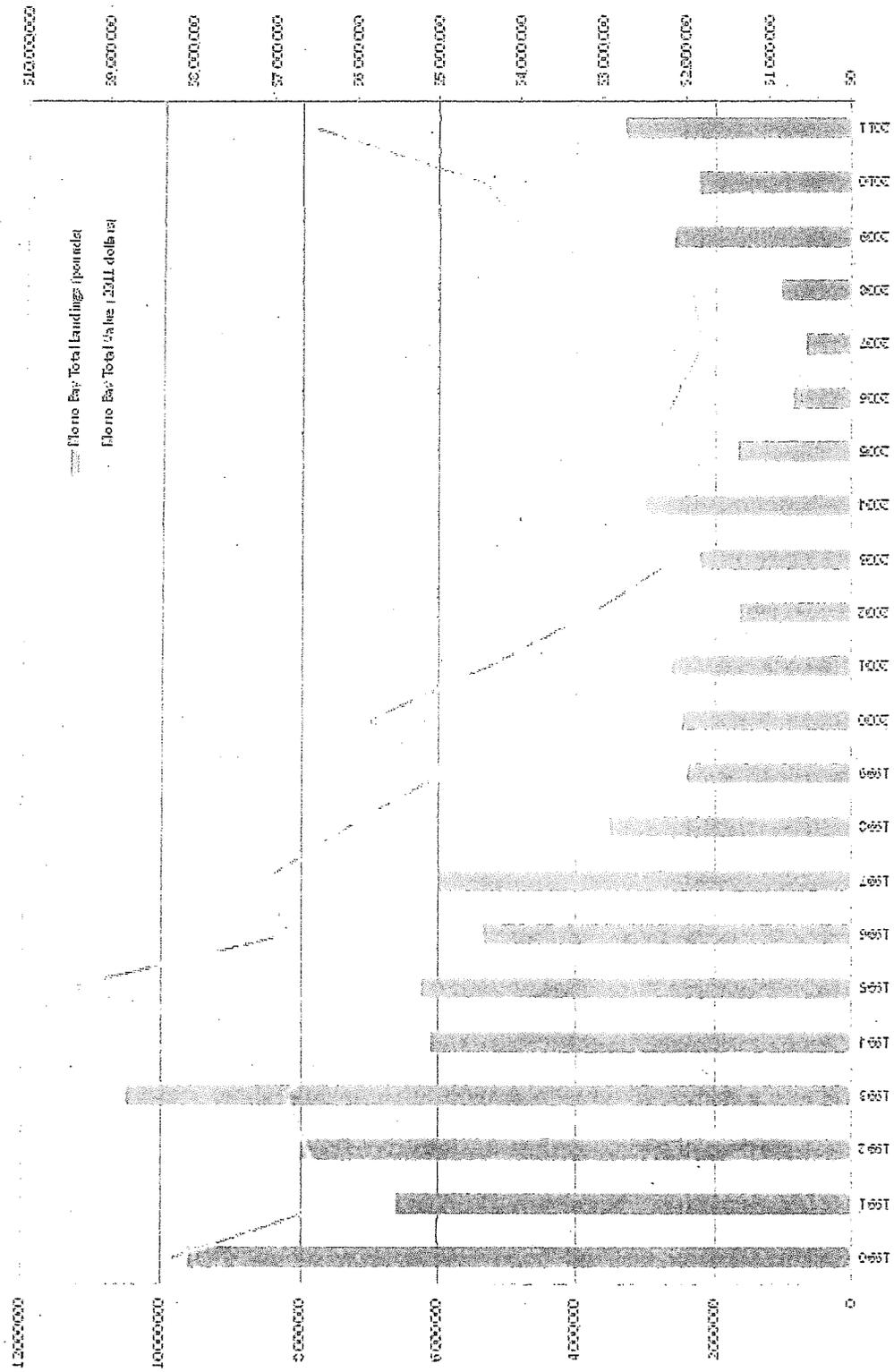


William Yates
Mayor

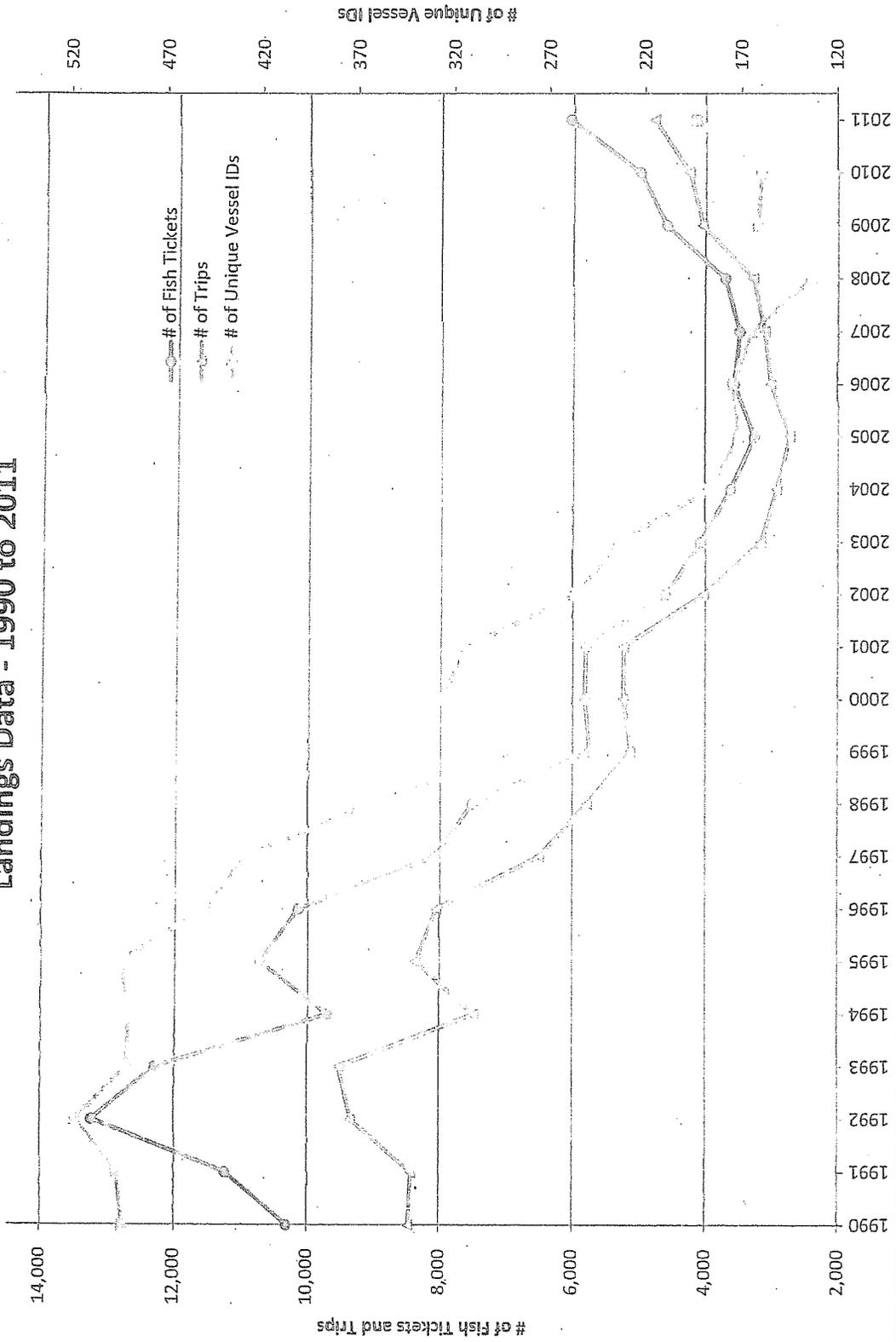
Enc.

cc: City Council
City Attorney
City Manager
Harbor Director

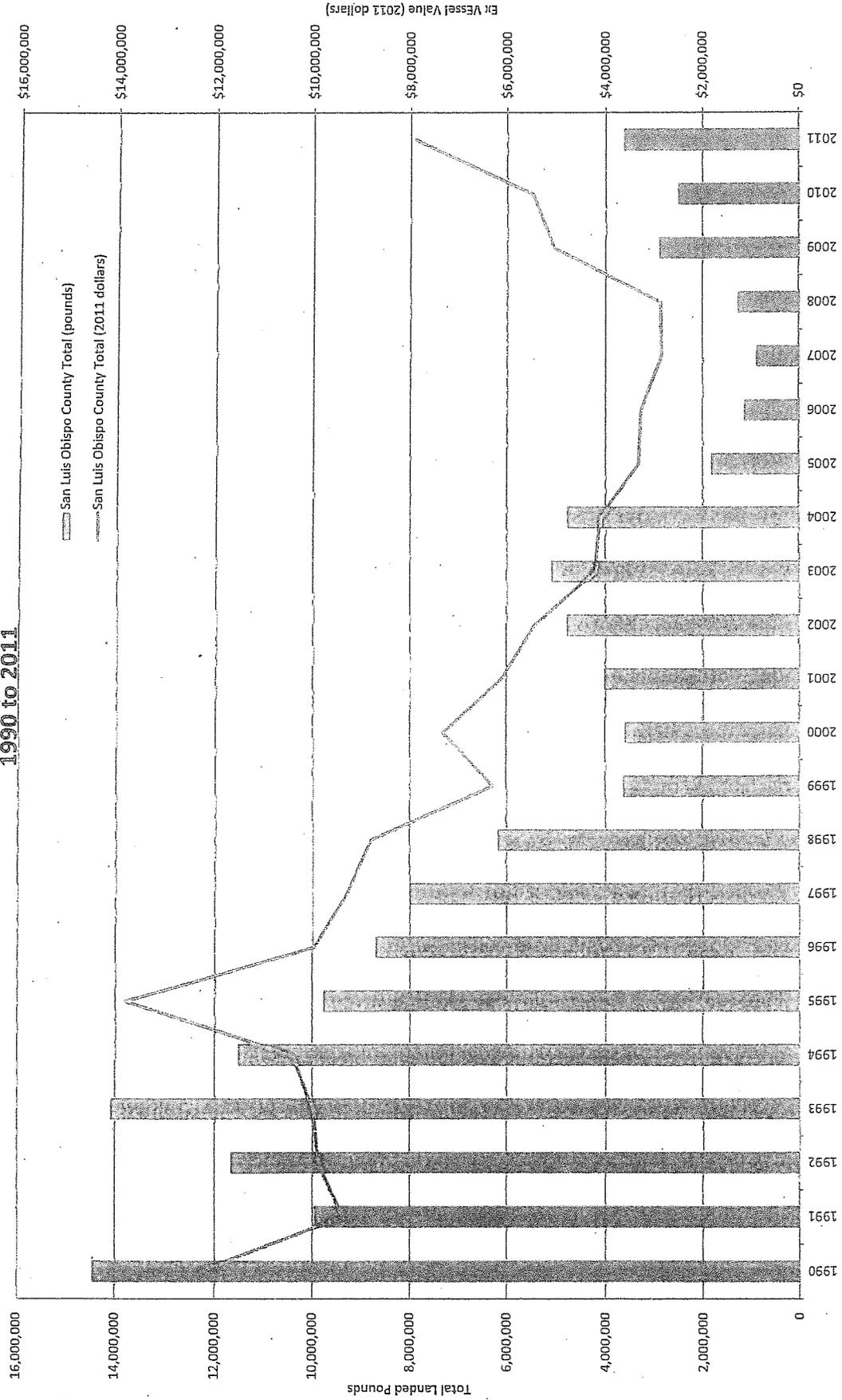
Morro Bay Total Landings and EVV 1990 to 2011



San Luis Obispo County Landings Data - 1990 to 2011



San Luis Obispo County Total Landings (lbs) and Ex Vessel Value (\$) 1990 to 2011



RESOLUTION NO. 49-12

RESOLUTION OF THE CITY COUNCIL
OF THE CITY OF MORRO BAY, CALIFORNIA
OPPOSING THE CENTRAL COASTAL CALIFORNIA
SEISMIC IMAGING PROJECT

THE CITY COUNCIL
City of Morro Bay, California

WHEREAS, the Central Coastal California Seismic Imaging Project proposes to perform seismic testing from November 1, 2012 through December 31, 2012 in and around the waters of Morro Bay; and,

WHEREAS, the City of Morro Bay sent a letter to the California State Lands Commission regarding the Draft Environmental Impact Report outlining numerous concerns; and,

WHEREAS, those concerns included the extension of recreational rockfish season to December 31st, the short-term, long-term and permanent effects on fish, fishing, and fish stocks; the short-term, long-term and permanent effects on marine mammals; a portion of the seismic project boundary being located within a highly rich Marine Protected Area; and, the inability for vessels to leave and enter the Morro Bay Harbor; and,

WHEREAS, the project has not taken into consideration the land side impacts related to fishing that include, but are not limited to, reduced fish landing and processing activity, fish availability for restaurants, tourism and other environmental issues; and,

WHEREAS, the project has not identified an adequate mitigation and claims process for those affected; and,

WHEREAS, the project does not include an adequate monitoring plan for assessing fish stock recovery in either the short or long term periods.

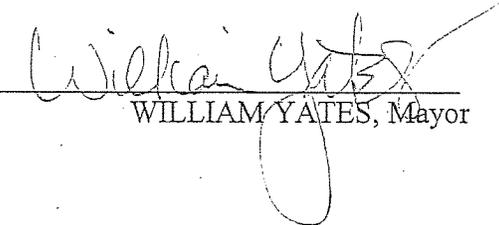
NOW, THEREFORE, BE IT RESOLVED, that the City of Morro Bay opposes the Central Coastal California Seismic Imaging Project being proposed by Pacific Gas and Electric.

PASSED AND ADOPTED by the City Council of the City of Morro Bay at a regular meeting thereof held on the 11th of September 2012, by the following vote:

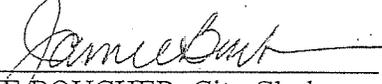
AYES: Borchard, Johnson, Leage, Smukler, Yates

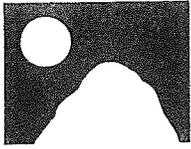
NOES: None

ABSENT: None


WILLIAM YATES, Mayor

ATTEST:


JAMIE BOUCHER, City Clerk



City of Morro Bay

HARBOR DEPARTMENT
1275 Embarcadero
Morro Bay, CA 93442
Ph. 805-772-6254
Fax: 805-772-6258

October 2, 2012

California Coastal Commission
Dan Carl, Deputy Director
725 Front St., Suite 300
Santa Cruz, CA 95060-4508

RE: OPPOSITION TO PG&E'S PROPOSED SEISMIC IMAGING PROJECT
ON THE CENTRAL CALIFORNIA COAST

Dear Mr. Carl,

On September 6, 2012 the Morro Bay Harbor Advisory Board voted unanimously to support the Morro Bay City Council's resolution #49-12 (attached) unanimously opposing PG&E's proposed seismic imaging project on the Central California Coast. The Harbor Advisory Board is a diverse group of seven members appointed from the public representing the public and our working waterfront to advise the Morro Bay City Council on a broad array of harbor and ocean-related topics and issues.

In addition, the Harbor Advisory Board went unanimously on record with the following comments on the proposed project:

- That other, less damaging technology is sought to accomplish the seismic imaging needs of PG&E.
- That due to the unknown effects on marine life the seismic imaging as proposed is ill advised and should not be conducted unless more studies are done to gauge the true effects on marine life.
- That should the project go forward in any form an adequate compensation/mitigation plan must be in place for fishermen and impacted individuals/businesses for damages caused by the testing. At the least, said plan must be acceptable to the Morro Bay and Port San Luis Commercial Fisherman's Organizations.

Thank you for taking the comments of the Morro Bay Harbor Advisory Board into consideration.

Jim Phillips, Chair
Marine Oriented Business

Jeff Eckles, Vice Chair
Waterfront Leaseholders

Brett Cunningham
Commercial Fishing

Gene Doughty
Los Osos/Baywood

Bill Luffee
Marine Oriented Business

Dana McClish
Recreational Boating

Lynn Meissen
Member At Large

Fw: stop seismic testing!

Dan Buckshi to: cr_board_clerk Clerk Recorder
Cc: Kristi Gutierrez

10/23/2012 12:29 PM

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/23/2012 12:29 PM -----

From: The Texs <thetexs@charter.net>
To: dbuckshi@co.slo.ca.us
Date: 10/23/2012 10:21 AM
Subject: stop seismic testing!

October 23, 2012

County Board of Supervisors,

I understand that you enjoy a reputation of being accessible to the general public. Thank you for that, and because of it, I know you will take my comments seriously. I am a member of the general public, living in San Luis Obispo, and I vehemently oppose the proposed seismic testing slated to be conducted in Central Coast waters this fall by PG & E.

I realize that AB 42 (the bill sponsored by San Luis Obispo-based State Senator, Sam Blakeslee, that requires PG & E to conduct seismic testing in our waters) was an attempt by policymakers to look after the safety of the Central Coast residents following the tragedy in Japan last year. But, as Tom Franciskovich, publisher of *SLO Life Magazine* , asks in his article "Seismic Testing" (October-November 2012), "...how do highly detailed three-dimensional maps of the area's spider web of fault lines change anything currently taking place at Diablo Canyon? Eventually, they will produce an earthquake... and there is nothing that can be done to stop it."

But the cost of this testing with dubious information to offer is the probable devastation of the Central Coast's unique and abundant marine life. I read in Franciskovich's article that many in our local fishing industry were at first interested in what they could "get" in terms of compensation from PG & E for damage to sea life in our waters. But now they are more interested in the preservation of that sea life.

I beg you to use your influence to stop this testing debacle from happening.

Sincerely,

Lorna Teixeira
376 Buena Vista Ave
San Luis Obispo, CA 93405

Item # 22 Meeting Date: 10/30/2012

Presented by: Lorna Teixeira

Received prior to meeting and posted to web
on: October 23, 2012