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subject merchandise that is appealing to customers in the United States, *i.e.*, not certified to meet ASTM, and its capacity to produce subject merchandise is relatively small when compared to both former Hylsa facilities, we preliminarily determine that although production facilities for LWRPT have changed between pre–transfer Hylsa and post–transfer Ternium (which includes both the former Hylsa facilities and the facility formerly operated by IMSA), the post–transfer Ternium's production facilities are not so significantly different from the former Hylsa production facilities that Ternium would be precluded from being a successor to Hylsa.

The documentation and analysis thereof described above, both with regard to the transfer of production and sales operations from Hylsa to Ternium as well as Ternium Luxemburg's acquisition of Grupo IMSA (and its subsidiary IMSA), demonstrates that there was little to no change in management structure, supplier relationships, production facilities, or customer base between pre–acquisition Hylsa and post–acquisition (after the acquisitions of Hylsamex and Grupo IMSA) Ternium. For these reasons, we preliminarily find that Ternium is the successor–in-interest to Hylsa and, thus, should be accorded the same antidumping duty treatment with respect to LWRPT from Mexico as Hylsa. If the above preliminary results are affirmed in the Department's final results, the cash deposit rate from this changed circumstances review will apply to all entries of the subject merchandise entered, or withdrawn from warehouse, for consumption on or after the date of publication of the final results of this changed circumstances review. *See Granular Polytetrafluoroethylene Resin from Italy; Final Results of Antidumping Duty Changed Circumstances Review*, 68 FR 25327 (May 12, 2003).

Public Comment

In accordance with 19 CFR 351.310(c), any interested party may request a hearing within 30 days of publication of this notice. Any hearing, if requested, will be held no later than 37 days after the date of publication of this notice, or the first workday thereafter. Case briefs from interested parties may be submitted not later than 30 days after the date of publication of this notice, in accordance with 19 CFR 351.309(c)(ii). Rebuttal briefs, limited to the issues raised in those comments, may be filed not later than 5 days after the time limit for filing the case brief, in accordance with 19 CFR 351.309(d). All written comments shall be submitted in accordance with 19 CFR 351.303. Persons interested in attending the hearing, if one is requested, should contact the Department for the date and time of the hearing. In accordance with 19 CFR 351.216(e), the Department will issue the final results of its antidumping duty changed circumstances review not later than 270 days after the date on which the review is initiated.

During the course of this antidumping duty changed circumstances review, deposit requirements for the subject merchandise exported and manufactured by Ternium will continue to be the all–others rate established in the investigation. *See Light–Walled Rectangular Pipe and Tube from Mexico, the People's Republic of China, and the Republic of Korea (Korea): Antidumping Duty Orders; Light–Walled Rectangular Pipe and Tube from Korea: Notice of Amended Final Determination of Sales at Less Than Fair Value*, 73 FR 45403 (August 5, 2008). The cash deposit rate will be altered, if warranted, pursuant only to the final results of this review.

We are issuing and publishing these preliminary results and notice in accordance with sections 751(b)(1) and 777(i)(1) and (2) of the Act and 19 CFR 351.216.

Dated: June 11, 2009.

Ronald K. Lorentzen,

Acting Assistant Secretary for Import Administration.

[FR Doc. E9–14369 Filed 6–17–09; 8:45 am]

BILLING CODE 3510–DS–S

DEPARTMENT OF COMMERCE

Foreign-Trade Zones Board

[Order No. 1615]

Expansion and Reorganization of Foreign-Trade Zone 147, Reading, Pennsylvania Area

Pursuant to its authority under the Foreign-Trade Zones (FTZ) Act of June 18, 1934, as amended (19 U.S.C. 81a–81u), the Foreign-Trade Zones Board (the Board) adopts the following Order:

Whereas, the Foreign-Trade Zone Corporation of Southern Pennsylvania, grantee of Foreign-Trade Zone No. 147, submitted an application to the Board for authority to expand and reorganize FTZ 147 by deleting Site 4—Parcels A and C (632 acres total) and adding four additional sites (Sites 16–19) in Franklin and Cumberland Counties, Pennsylvania, adjacent to the Harrisburg Customs and Border Protection port of entry (FTZ Docket 35–2008, filed 5/27/2008);

Whereas, notice inviting public comment was given in the **Federal Register** (73 FR 31812, 6/4/2008) and the application has been processed pursuant to the FTZ Act and the Board's regulations; and,

Whereas, the Board adopts the findings and recommendations of the examiner's report, and finds that the requirements of the FTZ Act and the Board's regulations are satisfied, and that the proposal is in the public interest;

Now, therefore, the Board hereby orders:

The application to expand and reorganize FTZ 147 is approved, subject to the Act and the Board's regulations, including Section 400.28, subject to the Board's standard 2,000-acre activation limit for the overall general-purpose zone project, and further subject to a sunset provision that would terminate authority on May 31, 2014, for Sites 16–19 where no activity has occurred under FTZ procedures before that date.

Signed at Washington, DC, this 29th day of May 2009.

Ronald K. Lorentzen,

Acting Assistant Secretary of Commerce for Import Administration, Alternate Chairman, Foreign-Trade Zones Board.

Attest:

Andrew McGilvray,

Executive Secretary.

[FR Doc. E9–14245 Filed 6–17–09; 8:45 am]

BILLING CODE 3510–DS–S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XO99

Incidental Takes of Marine Mammals During Specified Activities; Low-Energy Marine Seismic Survey in the Northwest Atlantic Ocean, August 2009

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

ACTION: Notice; proposed incidental take authorization; request for comments.

SUMMARY: NMFS has received an application from Rice University (Rice), for an Incidental Harassment Authorization (IHA) to take small numbers of marine mammals, by harassment, incidental to conducting a marine seismic survey in the Northwest Atlantic during August 2009. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS requests comments on its proposal to authorize Rice to

incidentally take, by Level B harassment only, small numbers of marine mammals during the aforementioned activity.

DATES: Comments and information must be received no later than July 20, 2009.

ADDRESSES: Comments on the application should be addressed to Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225. The mailbox address for providing e-mail comments is *PR1.0648-XO99@noaa.gov.* Comments sent via e-mail, including all attachments, must not exceed a 10-megabyte file size.

A copy of the application containing a list of the references used in this document may be obtained by writing to the address specified above, telephoning the contact listed below (see **FOR FURTHER INFORMATION CONTACT**), or visiting the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.*

Documents cited in this notice may be viewed, by appointment, during regular business hours, at the aforementioned address.

FOR FURTHER INFORMATION CONTACT: Howard Goldstein or Ken Hollingshead, Office of Protected Resources, NMFS, 301–713–2289.

SUPPLEMENTARY INFORMATION:

Background

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

Authorization for incidental taking shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined ''negligible impact'' in 50 CFR 216.103 as ''* * * an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.''

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as:

> any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [''Level A harassment'']; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [''Level B harassment''].

16 U.S.C. 1362(18).

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

Summary of Request

On April 21, 2009, NMFS received an application from Rice for the taking, by Level B harassment only, of small numbers of marine mammals incidental to conducting, under a cooperative agreement with the National Science Foundation (NSF), a low-energy marine seismic survey in the Northwest Atlantic Ocean. The funding for the survey is provided by the NSF. The proposed survey will occur off New England within the U.S Exclusive Economic Zone (EEZ). Seismic operations will occur over the continental shelf southeast of the island of Martha's Vineyard, Massachusetts, and likely also in Nantucket Sound (see Figure 1 of Rice's application). The cruise is currently scheduled to occur from August 12 to 25, 2009. The survey will use two Generator Injector (GI) airguns with a discharge volume of 90 in^3. Some minor deviation from these dates is possible, depending on logistics and weather.

Description of the Specified Activity

Rice plans to conduct a low-energy marine seismic survey and bathymetric program. The planned survey will involve one source vessel, the R/V *Endeavor* (*Endeavor*), which will occur in the Northwest Atlantic Ocean off of New England.

The proposed survey will examine stratigraphic controls on freshwater beneath the continental shelf off the U.S. east coast. In coastal settings worldwide, large freshwater volumes are sequestered in permeable continental shelf sediments. Freshwater storage and discharge have been documented off North and South America, Europe, and Asia. The proposed survey will investigate the Atlantic continental shelf off New England, where freshwater extends up to 100 km offshore. Using high-resolution mathematical models and existing data, it is estimated that approximately 1,300 km^3 (312 mi^3) of freshwater is sequestered in the continental shelf from New York to Maine. However, the models indicate that the amount of sequestered freshwater is highly dependent on the thickness and distribution of aquifers and aquicludes. The proposed survey will provide imaging of the subsurface and characterize the distribution of aquifers and aquicludes off Martha's Vineyard.

The study will provide data integral to improved models to estimate the abundance of sequestered freshwater and will provide site survey data for an Integrated Ocean Drilling Program (IODP) proposal to drill these freshwater resources for hydrogeochemical, biological, and climate studies. Combined seismic and drilling data could help identify undeveloped freshwater resources that may represent a resource to urban coastal centers, if accurately characterized and managed. On a global scale, vast quantities of freshwater have been sequestered in the continental shelf and may represent an increasingly valuable resource to humans. This survey will help constrain process-based mathematical models for more precise estimations of the abundance and distribution of freshwater wells on the continental shelf.

The source vessel, the *Endeavor,* will deploy two low-energy GI airguns as an energy source (with a discharge volume of 90 in^3) and a 600 m (1,969 ft) towed hydrophone streamer. The energy to the GI airgun is compressed air supplied by compressors onboard the source vessel. As the GI airgun is towed along the survey lines, the receiving systems will receive the returning acoustic signals.

The planned seismic program will consist of approximately 1,757 km (1,092 mi) of surveys lines and turns (see Figure 1 of Rice's application). Most of the survey effort (approximately 1,638 km or 1,018 mi) will take place in water <100 m deep, and approximately 119 km (74 mi) will occur just past the shelf edge, in water depths >100 m (328 ft). There may be additional seismic operations associated with equipment testing, start-up, and repeat coverage of any areas where initial data quality is sub-standard.

All planned geophysical data acquisition activities will be conducted with assistance by scientists who have proposed the study, Dr. B. Dugan of Rice University, Dr. D. Lizarralde of Woods Hole Oceanographic Institution, and Dr. M. Person of New Mexico Institute of Mining and Technology. The vessel will be self-contained, and the crew will live aboard the vessel for the entire cruise.

In addition to the seismic operations of the two GI airguns, a Knudsen 3260 echosounder, and EdgeTech sub-bottom profiler, and a ''boomer'' system to image sub-bottom seafloor layers will be used at times during the survey.

Vessel Specifications

The *Endeavor* has a length of 56.4 m (185 ft), a beam of 10.1 m (33.1 ft), and a maximum draft of 5.6 m (18.4 ft). The *Endeavor* has been operated by the University of Rhode Island's Graduate School of Oceanography for over thirty years to conduct oceanographic research throughout U.S. and world marine waters. The ship is powered by a single GM/EMD diesel engine, producing 3,050 hp, which drives a single propeller directly at a maximum of 900 revolutions per minute (rpm). The vessel also has a 320 hp bowthruster, which is not used during seismic acquisition. The optimal operation speed during seismic acquisition will be approximately 7.4 km/hour. When not towing seismic survey gear, the *Endeavor* can cruise at 18.5 km/hour. The *Endeavor* has a range of 14,816 km (9,206 mi). The *Endeavor* will also serve as the platform from which vessel-based Marine Mammal Visual Observers (MMVO) will watch for animals before and during GI airgun operations.

Acoustic Source Specifications

Seismic Airguns

During the proposed survey, the *Endeavor* will tow two GI airguns, with a volume of 90 in^3, and a 600 m long streamer containing hydrophones along predetermined lines. The two GI airguns will be towed approximately 25 m (82 ft) behind the *Endeavor* at a depth of approximately 3 m (10 ft). Seismic pulses will be emitted at intervals of approximately 5 seconds. At a speed of 7.4 km/hour, the 5 second spacing corresponds to a shot interval of approximately 10 m (33 ft). The operating pressure will be 2,000 psi. A single GI airgun will be used during turns.

The generator chamber of each GI airgun, the one responsible for introducing the sound pulse into the ocean, has a volume of 45 in^3. The larger (105 in^3) injector chamber injects air into the previously-generated bubble to maintain its shape, and does not introduce more sound into the water. Both GI airguns will be fired simultaneously, for a total discharge volume of 90 in^3. The GI airguns are relatively small compared to most other airgun arrays used for seismic arrays.

A single GI airgun, a single 15 in^3 watergun, or a boomer system may be used in shallow waters with sandy seafloors if the two GI airguns do not provide accurate seafloor imaging. The watergun is a marine seismic sound source that uses an implosive mechanism to provide an acoustic signal. Waterguns provide a richer source spectra in high frequencies (≤200 Hz) than those of GI or airguns. The 15 in^3 watergun potentially provides a cleaner signal for high-resolution studies in shallow water, with a short-pulse (<30 ms) providing resolution of approximately 10 m. The operating pressure will be 2,000 psi. Peak pressure of the single watergun and the boomer system is estimated to be approximately 212 dB (0.4 bar-m). Thus, both sources would have a considerably lower source level than the two GI airguns and single GI airgun.

The root mean square (rms) received levels that are used as impact criteria for marine mammals are not directly comparable to the peak (pk or 0-pk) or peak-to-peak (pk–pk) values normally used to characterize source levels of airgun arrays. The measurement units used to describe airgun sources, peak or peak-to-peak decibels, are always higher than the ''root mean square'' (rms) decibels referred to in biological literature. A measured received level of 160 dB re 1 μPa (rms) in the far field would typically correspond to a peak measurement of approximately 170 to 172 dB, and to a peak-to-peak measurement of approximately 176 to 178 dB, as measured for the same pulse received at the same location (Greene, 1997; McCauley *et al.,* 1998, 2000). The precise difference between rms and peak or peak-to-peak values depends on the frequency content and duration of the pulse, among other factors. However, the rms level is always lower than the peak or peak-to-peak level for an airgun-type source.

The sound pressure field of two 45 in^3 GI airguns has not been modeled, but those for two 45 in^3 Nucleus G airguns and one 45 in^3 GI airgun have been modeled by Lamont-Doherty Earth Observatory (L–DEO) of Columbia University in relation to distance and direction from the airguns (see Figure 2 and 3 of Rice's application). The GI airgun is essentially two G airguns that are joined head to head. The G airgun signal has more energy than the GI airgun signal, but the peak energy levels are equivalent and appropriate for modeling purposes. The L–DEO model does not allow for bottom interactions, and is most directly applicable to deep water. Based on the modeling, estimates of the maximum distances from GI airguns where sound levels of 190, 180, and 160 dB re 1 μPa (rms) are predicted to be received in deep (>1,000 m) water are shown in Table 1 of Rice's application. Because the model results are for G airguns, which have more energy than GI airguns of the same size, those distances are overestimates of the distances for the 45 in^3 GI airguns.

Echosounder

The Knudsen 3260 is a deep-water, dual-frequency echosounder with operating frequencies of 3.5 and 12 kHz. The high frequency (12 kHz) can be used to record water depth or to track pingers attached to various instruments deployed over the side. The low frequency (3.5 kHz) is used for sub-bottom profiling. Both frequencies will be used simultaneously during the present study. It will be used with a hull-mounted, downward-facing transducer. A pulse up to 24 ms in length is emitted every several seconds with a nominal beam width of 80°. Maximum output power at 3.5 kHz is 10 kW and at 12 kHz it is 2 kW. The maximum source output (downward) for the 3260 is estimated to be 211 dB re 1 μPam at 10 kW.

Sub-bottom Profiler (SBP)

The SBP is normally operated to provide information about sedimentary features and bottom topography; it will provide a 10 cm resolution of the sub-floor. During operations in deeper waters (>30–40 m), an EdgeTech 3200–XS SBP will be operated from the ship with a SB–512i towfish that will be towed at a depth of 5 m. It will transmit and record a 0.5–12 kHz swept pulse (or chirp), with a nominal beam width of 16–32°. The SBP will produce a 30 ms pulse repeated at 0.5 to 1 s intervals. Depending on seafloor conditions, it could penetrate up to 100 m.

Boomer

The 'boomer' system will be an alternative source of sub-floor imaging in shallower waters (<30 to 40 m or 98 to 131 ft). The Applied Acoustics

AA200 'boomer' system, run by the National Oceanography Centre, operates at frequencies of approximately 0.3 to 3 kHz. The system will be surface-towed, and a 60 m (197 ft) hydrophone streamer will receive its pulses. The streamer will be towed at 1 m depth and approximately 25 to 30 m (82 to 98 ft) behind the *Endeavor*. A 0.1 ms pulse will be transmitted at 1 s intervals. The normal source output (downward) is 212 dB re 1 μPam.

Safety Radii

NMFS has determined that for acoustic effects, using acoustic thresholds in combination with corresponding safety radii is the most effective way to consistently apply measures to avoid or minimize the impacts of an action, and to quantitatively estimate the effects of an action. Thresholds are used in two ways: (1) To establish a mitigation shut-down or power-down zone, *i.e.*, if an animal enters an area calculated to be ensonified above the level of an established threshold, a sound source is powered down or shut down; and (2) to calculate take, in that a model may be used to calculate the area around the sound source that will be ensonified to that level or above, then, based on the estimated density of animals and the distance that the sound source moves, NMFS can estimate the number of marine mammals that may be ''taken.''

As a matter of past practice and based on the best available information at the time regarding the effects of marine sound compiled over the past decade, NMFS has used conservative numerical estimates to approximate where Level A harassment from acoustic sources begins: 180 re 1 μPa (rms) level for cetaceans and 190 dB re 1 μPa (rms) for pinnipeds. A review of the available scientific data using an application of science-based extrapolation procedures (Southall *et al.*, 2007) strongly suggests that Level A harassment (as well as TTS) from single exposure impulse events may occur at much higher levels than the levels previously estimated using very limited data. However, for purposes of this proposed action, Rice's application sets forth, and NMFS is using, the more conservative 180 and 190 dB re 1 μPa (rms) criteria. NMFS considers 160 re 1 μPa (rms) as the criterion for estimating the onset of Level B harassment from acoustic sources like impulse sounds used in the seismic survey.

Emperical data concerning the 180 and 160 dB distances have been acquired based on measurements during the acoustic verification study conducted by L–DEO in the northern Gulf of Mexico from May 27 to June 3, 2003 (Tolstoy *et al.*, 2004a,b). Although the results are limited the data showed that radii around the airguns where the received level would be 180 dB re 1 μPa (rms), the safety criterion applicable to cetaceans (NMFS, 2000), vary with water depth. Similar depth-related variation is likely in the 190 dB distances applicable to pinnipeds. Correction factors were developed for water depths 100–1,000 m and <100 m; the proposed survey will occur in depths approximately 20 to 125 m.

The empirical data indicate that, for deep water (>1,000 m), the L–DEO model tends to overestimate the received sound levels at a given distance (Tolstoy *et al.*, 2004a,b). However, to be precautionary pending acquisition of additional empirical data, it is proposed that safety radii during GI airgun operations in deep water will be values predicted by L–DEO's model (see Table 1 below). Therefore, the assumed 180 and 190 dB radii are 40 m (131 ft) and 10 m (33 ft) respectively.

Empirical measurements were not conducted for intermediate depths (100–1,000 m). On the expectation that results will be intermediate between those from shallow and deep water, a 1.5× correction factor is applied to the estimates provided by the model for deep water situations. This is the same factor that was applied to the model estimates during L–DEO cruises in 2003. The assumed 180 and 190 dB radii in intermediate depth water are 60 m (197 ft) and 15 m (49 ft), respectively (see Table 1 below).

Empirical measurements indicated that in shallow water (<100 m), the L–DEO model underestimates actual levels. In previous L–DEO projects, the exclusion zones were typically based on measured values and ranged from 1.3 to 15× higher than the modeled values depending on the size of the airgun array and the sound level measured (Tolstoy *et al.*, 2004a,b). During the proposed cruise, similar factors will be applied to derive appropriate shallow water radii from the modeled deep water radii (see Table 1 below). The assumed 180 and 190 dB radii in shallow depth water are 296 m (971 ft) and 147 m (482 ft), respectively (see Table 1 below).

TABLE 1

[Predicted distances to which sound levels ≥190, 180, and 160 dB re 1 μPa might be received in shallow (<100 m; 328 ft), intermediate (100–1,000 m; 328–3,280 ft), and deep (>1,000 m; 3,280 ft) water from the two 45 in³ GI airguns used during the seismic surveys in the northwest Atlantic Ocean during August 2009, and one 45 in³ GI airgun that will be used during turns. Distances are based on model results provided by L–DEO.]

Source and volume	Tow depth (m)	Water depth	Predicted RMS distances (m)		
			190 dB	180 dB	160 dB
One GI airgun 45 in³	3	Deep (>1,000 m)	8	23	220
		Intermediate (100–1,000 m)	12	35	330
		Shallow (<100 m)	95	150	570
Two GI airguns 45 in³	3	Deep (>1,000 m)	10	40	350
		Intermediate (100–1,000 m)	15	60	525
		Shallow (<100 m)	147	296	1,029

The GI airguns, watergun, or boomer will be shut-down immediately when cetaceans are detected within or about to enter the 180 dB re 1 μPa (rms) radius for the two GI airguns, or when pinnipeds are detected within or about to enter the 190 dB re 1 μPa (rms) radius for the two GI airguns. The 180 and 190 dB shut down criteria are consistent with guidelines listed for cetaceans and pinnipeds, respectively, by NMFS (2000) and other guidance by NMFS.

Proposed Dates, Duration, and Region of Activity

The *Endeavor* is expected to depart from Narragansett, Rhode Island, on approximately August 12, 2009, for an approximately four hour transit to the study area southeast of Martha's Vineyard (see Figure 1 of Rice's application). Seismic operations will commence upon arrival at the study area, with highest priority given to the central NNW–SSE line, followed by WSW–ENE lines, each of which cross the proposed IODP sites; lowest priority will be given to the survey lines in Nantucket Sound. The 14 day program will consist of approximately 11 days of seismic operations, and three contingency days in case of inclement weather. The *Endeavor* will return to Narragansett on approximately August 25, 2009. The exact dates of the proposed activities depend on logistics, weather conditions, and the need to repeat some lines if data quality is substandard.

The proposed seismic survey will encompass the area 39.8° to 41.5° N, 69.8° to 70.6° W (see Figure 1 of Rice's application). Water depths in the study area range from approximately 20 to 125 m (66 to 410 ft), but are typically <100 m. The proposed survey will take place in Nantucket Sound and south of Nantucket and Martha's Vineyard. The ship will approach the south shore of Martha's Vineyard within 10 km (6.2 mi). The seismic survey will be conducted within the Exclusive Economic Zone (EEZ) of the U.S.A.

Description of Marine Mammals in the Proposed Activity Area

A total of 34 marine mammal species (30 cetacean and 4 pinniped) are known to or may occur in the proposed study area (see Table 2, Waring *et al.,* 2007). Several species are listed as Endangered under the Endangered Species Act (ESA): the North Atlantic right, humpback, sei, fin, blue, and sperm whales. The Western North Atlantic Coastal Morphotype Stock of common bottlenose dolphins is listed as Depleted under the MMPA.

Table 2 below outlines the marine mammal species, their habitat, abundance, density, and conservation status in the proposed project area. Additional information regarding the distribution of these species expected to be found in the project area and how the estimated densities were calculated may be found in Rice's application.

TABLE 2

[The occurrence, habitat, regional abundance, conservation status, best and maximum density estimates, number of marine mammals that could be exposed to sound level at or above 160dB re 1μPa, best estimate of number of individuals exposed, and best estimate of number of exposures per marine mammal in or near the proposed low-energy seismic survey area in the Northwest Atlantic Ocean. See Tables 2–4 in Rice's application for further detail.]

Species	Habitat	Occurrence in study area	Regional best abundance est. (CV) [1]	ESA[a]	Density/ 1000km[2] (best)	Density/ 1000km[2] (max)
Mysticetes						
North Atlantic right whale (*Eubalaena glacialis*).	Coastal and shelf waters.	Common	325 (0) [2]	NL	N.A.	N.A.
Humpback whale (*Megaptera novaeangliae*).	Mainly nearshore waters and banks.	Common	11,570 [3]	EN	0.56	19.68
Minke whale (*Balaenoptera acutorostrata*).	Pelagic and coastal	Common	188,000 [4]	NL	0.05	7.35
Bryde's whale (*Balaenoptera brydei*)	Primarily offshore, pelagic.	Rare	N.A.	NL	N.A.	N.A.
Sei whale (*Balaenoptera borealis*)	Primarily offshore, pelagic.	Uncommon	10,300 [5]	EN	N.A.	N.A.
Fin whale (*Balaenoptera physalus*)	Continental slope, mostly pelagic.	Common	35,500 [6]	EN	3.86	26.09
Blue whale (*Balaenoptera musculus*)	Pelagic, shelf and coastal.	Uncommon?	1,186 [7]	EN	N.A.	N.A.
Odontocetes						
Sperm whale (*Physeter macrocephalus*)	Usually pelagic and deep seas.	Common?	13,190 [8]	EN	0.38	26.88
Pygmy sperm whale (*Kogia breviceps*)	Deep waters off shelf.	Uncommon	N.A.	NL	N.A.	N.A.
Dwarf sperm whale (*Kogia sima*)	Deep waters off the shelf.	Uncommon	N.A.	NL	N.A.	N.A.
Cuvier's beaked whale (*Ziphius cavirostris*).	Pelagic	Uncommon	N.A.	NL	N.A.	N.A.
Northern bottlenose whale (*Hyperodon ampullatus*).	Pelagic	Rare	40,000 [9]	NL	N.A.	N.A.
True's beaked whale (*Mesoplodon mirus*).	Pelagic	Rare	N.A.	NL	N.A.	N.A.
Gervais' beaked whale (*Mesoplodon europaeus*).	Pelagic	Rare	N.A.	NL	N.A.	N.A.
Sowerby's beaked whale (*Mesoplodon bidens*).	Pelagic	Rare	N.A.	NL	N.A.	N.A.
Blainville's beaked whale (*Mesoplodon densirostris*).	Pelagic	Rare	N.A.	NL	N.A.	N.A.
Unidentified beaked whale	Pelagic	Rare	N.A.	NL	0.01	0.82
Bottlenose dolphin (*Tursiops truncatus*)	Coastal, shelf and offshore.	Common	81,588 (0.17) [10]	NL	14.02	163.02

TABLE 2—Continued

[The occurrence, habitat, regional abundance, conservation status, best and maximum density estimates, number of marine mammals that could be exposed to sound level at or above 160dB re 1μPa, best estimate of number of individuals exposed, and best estimate of number of exposures per marine mammal in or near the proposed low-energy seismic survey area in the Northwest Atlantic Ocean. See Tables 2–4 in Rice's application for further detail.]

Species	Habitat	Occurrence in study area	Regional best abundance est. (CV) [1]	ESA[a]	Density/ 1000km [2] (best)	Density/ 1000km [2] (max)
Pantropical spotted dolphin (*Stenella attenuata*).	Coastal and pelagic	Rare	N.A.	NL	N.A.	N.A.
Atlantic spotted dolphin (*Stenella frontalis*).	Mainly coastal waters.	Uncommon?	50,978 (0.42)	NL	N.A.	N.A.
Spinner dolphins (*Stenella longirostris*)	Coastal and pelagic	Rare	N.A.	NL	N.A.	N.A.
Striped dolphin (*Stenella coeruleoalba*)	Off continental shelf.	Common?	94,462 (0.40)	NL	0.11	73.61
Short-beaked common dolphin (*Delphinus delphis*).	Continental shelf and pelagic.	Common	120,743 (0.23)	NL	128.88	1,108.71
White-beaked dolphin (*Lagenorhynchus albirostris*).	Continental shelf (<200 m).	Uncommon?	10s to 100s of 1,000s [11].	NL	N.A.	N.A.
Atlantic white-sided dolphin (*Lagenorhynchus acutus*).	Shelf and slope waters.	Common	10s to 100s of 1,000s [12].	NL	N.A.	N.A.
Risso's dolphin (*Grampus griseus*)	Shelf, slope, seamounts (waters 400–1,000 m).	Common	20,479 (0.59)	NL	0.48	322.67
False killer whale (*Pseudorca crassidens*).	Tropical, temperate, pelagic.	Extralimital	N.A.	NL	N.A.	N.A.
Killer whale (*Orcinus orca*)	Coastal, widely distributed.	Rare	N.A.	*NL	N.A.	N.A.
Long-finned pilot whale (*Globlicephala melas*).	Mostly pelagic	Common?	810,000 [13]	NL	N.A.	N.A.
Short-finned pilot whale (*Globicephala macrorhynchus*).	Mostly pelagic, high-relief topography.	Common?	810,000 [13]	NL	N.A.	N.A.
Unidentified pilot whale (*Globicephala* sp.).	Mostly pelagic	Common?	810,000 [13]	NL	6.44	382.52
Harbor porpoise (*Phocoena phocoena*)	Coastal and inland waters.	Common?	500,000 [14]	NL	N.A.	N.A.
Pinnipeds						
Harbor seal (*Phoca vitulina*)	Coastal	Common	99,340	NL	N.A.	N.A.
Gray seal (*Halichoerus grypus*)	Coastal	Common	52,500 [15]	NL	N.A.	N.A.
Harp seal (*Pagophilius groenlandicus*)	Coastal	Uncommon	5,500,000 [16]	NL	N.A.	N.A.
Hooded seal (*Cystophora cristata*)	Coastal	Uncommon	592,100 [17]	NL	N.A.	N.A.

N.A.—Data not available or species status was not assessed, ? indicated uncertainty

[a] U.S. Endangered Species Act: EN = Endangered, T = Threatened, NL = Not listed

[1] Abundance estimates are given from Waring *et al.* (2007), typically for U.S. Western North Atlantic stocks unless otherwise indicated; For species whose distribution is primarily offshore or not known, the estimates for the U.S. EEZ in Waring *et al.* (2007) are not considered for the study area and the regional population is given as N.A. unless it is available from another source.

[2] Estimate updated in NMFS 2008 draft stock assessment report.

[3] Estimate for the western North Atlantic (IWS, 2007a).

[4] Estimate for the North Atlantic (IWC, 2007; Waring *et al.,* 2007).

[5] Estimate for the Northeast Atlantic (Cattanach *et al.,* 1993).

[6] Estimate for the North Atlantic (IWC, 2007a; Waring *et al.,* 2007).

[7] Estimate for the North Atlantic (NMFS, 1998).

[8] Estimate for Northeast Atlantic (Whitehead, 2002).

[9] Estimate for Northeast Atlantic (NAAMCO, 1995: 77).

[10] Estimate for the Western North Atlantic and Offshore stock, and may include coastal forms. 43,951 animals estimated for all management units of the Coastal morphotype (Waring *et al.,* 2007).

[11] Tens to low hundreds of thousands (Reeves *et al.,* 1999a).

[12] High tens to low hundreds of thousands (Reeves *et al.,* 1999b).

[13] Estimate may include both long- and short-finned pilot whales.

[14] Estimate for the North Atlantic (Jefferson *et al.,* 2008)

[15] Estimate for the northwest Atlantic Ocean in the Gulf of St. Lawrence and along the Nova Scotia eastern shore (Hammill, 2005).

[16] Estimate for the northwest Atlantic Ocean (DFO, 2007).

[17] Estimate for the northwest Atlantic Ocean (ICES, 2006).

*Southern Resident killer whales in the eastern Pacific Ocean, near Washington state, are listed as endangered under the ESA, but not in the Atlantic Ocean.

^The Western North Atlantic Coastal Morphotype stock, ranging from NJ to FL, is listed as depleted under the MMPA.

Several Federal Marine Protected Areas (MPAs) or sanctuaries have been established near the proposed study area, primarily with the intention of preserving cetacean habitat (see Table 3 of Rice's application; Hoyt, 2005; Cetacean Habitat, 2009; see also Figure 1 of Rice's application). Cape Cod Bay is designated as Right Whale Critical Habitat, as is the Great South Channel Northern Right Whale Critical Habitat Area located to the east of Cape Cod.

The Gerry E. Studds Stellwagen Bank National Marine Sanctuary is located north of the proposed study area in the Gulf of Maine. The proposed survey is not located within any Federal MPAs or sanctuaries. However, a sanctuary designated by the state of Massachusetts occurs within the study area—the Cape & Islands Ocean Sanctuary. This sanctuary includes nearshore waters of southern Cape Cod, Martha's Vineyard, and Nantucket (see Table 3 of Rice's application). In addition, there are four National Wildlife Refuges within the study area (Monomoy, Nantucket, Mashpee, and Nomans Island) and a National Estuarine Research Reserve (Waquoit Bay). Except for Nomans Island, these refuges and reserves are located in Nantucket Sound. Three Canadian protected areas also occur in the Northwest Atlantic for cetacean habitat protection, including the Bay of Fundy and Roseway Basin Right Whale Conservation Areas (see Figure 1 of Rice's application), as well as the Gully Marine Protected Area off the Scotian Shelf.

There are several areas that are closed to commercial fishing on a seasonal basis to reduce the risk of entanglement or incidental mortality to marine mammals. To protect large whales like right, humpback, and fin whales, NMFS implemented seasonal area management zones for lobster, several groundfish, and other marine invertebrate trap/pot fisheries, prohibiting gear in the Great South Channel Critical Habitat Area from April through June; additional dynamic area management zones could be imposed for 15 day time periods if credible fisheries observers identify concentrations of right whales in areas north of 40° N (NMFS 1999, 2008). To reduce fishery impacts on harbor porpoises, additional time and area closures in the Gulf of Maine include fall and winter along the mid-coastal area, winter and spring in Massachusetts Bay and southern Cape Cod, winter and spring in offshore areas, and February around Cashes Ledge (NMFS, 1998). Fishermen are also required to use pingers, and New Jersey and mid-Atlantic waters could close seasonally for fishermen failing to apply specific gear modifications (NMFS, 1998).

Potential Effects on Marine Mammals

Potential Effects of Airguns

The effects of sounds from airguns might result in one or more of the following: tolerance, masking of natural sounds, behavioral disturbances, temporary or permanent hearing impairment, and non-auditory physical or physiological effects (Richardson *et al.,* 1995; Gordon *et al.,* 2004; Nowacek *et al.,* 2007; Southall *et al.,* 2007). Permanent hearing impairment, in the unlikely event that it occurred, would constitute injury, but temporary threshold shift (TTS) is not an injury (Southall *et al.,* 2007). Although the possibility cannot be entirely excluded, it is unlikely that the project would result in any cases of permanent hearing impairment, or any significant non-auditory physical or physiological effects. Some behavioral disturbance is expected, but this would be localized and short-term.

Tolerance

Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. For a brief summary of the characteristics of airgun pulses, see Appendix A of Rice's application. However, it should be noted that most of the measurements of airgun sounds would be detectable considerably farther away than the GI airguns planned for use in the proposed project.

Several studies have shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response–see Appendix A of Rice's application. That is often true even in cases when the pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of the mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to airgun pulses under some conditions, at other times, mammals of all three types have shown no overt reactions. In general, pinnipeds usually seem to be more tolerant of exposure to airgun pulses than are cetaceans, with relative responsiveness of baleen and toothed whales being variable. Given the relatively small and low-energy GI airgun source planned for use in this project, mammals are expected to tolerate being closer to this source more so than would be the case for a larger airgun source typical of most seismic surveys.

Masking

Obscuring of sounds of interest by interfering sounds, generally at similar frequencies, is known as masking. Masking effects of pulsed sounds (even from large arrays of airguns) on marine mammal calls and other natural sounds are expected to be limited, although there are few specific data of relevance. Because of the intermittent nature and low duty cycle of seismic pulses, animals can emit and receive sounds in the relatively quiet intervals between pulses. However in some situations, multi-path arrivals and reverberation cause airgun sound to arrive for much or all of the interval between pulses (Simard *et al.,* 2005; Clark and Gagnon, 2006), which could mask calls.

Some baleen and toothed whales are known to continue calling in the presence of seismic pulses. The airgun sounds are pulsed, with quiet periods between the pulses, and whale calls often can be heard between the seismic pulses (Richardson *et al.,* 1986; McDonald *et al.,* 1995; Greene *et al.,* 1999; Nieukirk *et al.,* 2004; Smultea *et al.,* 2004; Holst *et al.,* 2005a,b, 2006). In the northeast Pacific Ocean, blue whale calls have been recorded during a seismic survey off Oregon (McDonald *et al.,* 1995). Among odontocetes, there has been one report that sperm whales cease calling when exposed to pulses from a very distant seismic ship (Bowles *et al.,* 1994). However, more recent studies found that sperm whales continued calling in the presence of seismic pulses (Madsen *et al.,* 2002; Tyack *et al.,* 2003; Smultea *et al.,* 2004; Holst *et al.,* 2006; Jochens *et al.,* 2006, 2008). Given the small source planned for use during the proposed survey, there is even less potential for masking of baleen or sperm whale calls during the present study than in most seismic surveys. Masking effects of seismic pulses are expected to be negligible in the case of the small odontocetes given the intermittent nature of seismic pulses. Dolphins and porpoises commonly are heard calling while airguns are operating (Gordon *et al.,* 2004; Smultea *et al.,* 2004; Holst *et al.,* 2005a,b; Potter *et al.,* 2007). Also, the sounds important to small odontocetes are predominantly at much higher frequencies than the airgun sounds, thus further limiting the potential for masking. In general, masking effects of seismic pulses are expected to be minor, given the normally intermittent nature of seismic pulses. Masking effects on marine mammals are discussed further in Appendix A of Rice's application.

Disturbance Reactions

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement. Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors (Richardson *et al.,* 1995; Wartzok *et al.,* 2004; Southall *et al.,* 2007; Weilgart, 2007). If a marine mammal responds to an underwater sound by changing its behavior or moving a small distance, the response may or may not rise to the level of ''harassment,'' or affect the stock or the species as a whole. If a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on animals or on the stock or species could potentially be significant (Lusseau and Bejder, 2007; Weilgart, 2007). Given the many uncertainties in predicting the quantity and types of impacts of noise on marine mammals, it is common practice to estimate how many mammals are likely to be present within a particular distance of industrial activities, or exposed to a particular level of industrial sound. In most cases, this approach likely overestimates the numbers of marine mammals that are affected in some biologically-important manner.

The sound exposure thresholds that are used to estimate how many marine mammals might be disturbed to some biologically-important degree by a seismic program are based on behavioral observations during studies of several species. However, information is lacking for many species. Detailed studies have been done on humpback, gray, bowhead, and on ringed seals. Less detailed data are available for some other species of baleen whales, sperm whales, small toothed whales, and sea otters, but for many species there are no data on responses to marine seismic surveys. Most of those studies have concerned reactions to much larger airgun sources than planned for use in the proposed project. Thus, effects are expected to be limited to considerably smaller distances and shorter periods of exposure in the present project than in most of the previous work concerning marine mammal reactions to airguns.

Baleen Whales—Baleen whales generally tend to avoid operating airguns, but avoidance radii are quite variable. Whales are often reported to show no overt reactions to pulses from large arrays of airguns at distances beyond a few kilometers, even though the airgun pulses remain well above ambient noise levels out to much longer distances. However, as reviewed in Appendix A of Rice's application, baleen whales exposed to strong noise pulses from airguns often react by deviating from their normal migration route and/or interrupting their feeding activities and moving away from the sound source. In the case of the migrating gray and bowhead whales, the observed changes in behavior appeared to be of little or no biological consequence to the animals. They simply avoided the sound source by displacing their migration route to varying degrees, but within the natural boundaries of the migration corridors.

Studies of gray, bowhead, and humpback whales have demonstrated that received levels of pulses in the 160–170 dB re 1 μPa rms range seem to cause obvious avoidance behavior in a substantial fraction of the animals exposed. In many areas, seismic pulses from large arrays of airguns diminish to those levels at distances ranging from 4.5–14.5 km (2.8–9 mi) from the source. A substantial proportion of the baleen whales within those distances may show avoidance or other strong disturbance reactions to the airgun array. Subtle behavioral changes sometimes become evident at somewhat lower received levels, and studies summarized in Appendix A(5) of SIO's application have shown that some species of baleen whales, notably bowhead and humpback whales, at times show strong avoidance at received levels lower than 160–170 dB re 1 μPa (rms). Reaction distances would be considerably smaller during the proposed project, for which the 160 dB radius is predicted to be 220 to 570 m (722 to 1,870 ft) (see Table 1 above), as compared with several km when a large array of airguns is operating.

Responses of humpback whales to seismic surveys have been studied during migration, on the summer feeding grounds, and on Angolan winter breeding grounds; there has also been discussion of effects on the Brazilian wintering grounds. McCauley *et al.* (1998, 2000a) studied the responses of humpback whales off Western Australia to a full-scale seismic survey with a 16-airgun, 2,678 in^3 array, and to a single 20 in^3 airgun with a source level of 227 dB re 1 μPa m peak-to-peak. McCauley *et al.* (1998) documented that initial avoidance reactions began at 5 to 8 km (3.1 to 5 mi) from the array, and that those reactions kept most pods approximately 3 to 4 km (1.9 to 2.5 mi) from the operating seismic boat. McCauley *et al.* (2000) noted localized displacement during migration of 4 to 5 km (2.5 to 3.1 mi) by traveling pods and 7 to12 km (4.3 to 7.5 mi) by cow-calf pairs. Avoidance distances with respect to the single airgun were smaller (2 km (1.2 mi)) but consistent with the results from the full array in terms of received sound levels. The mean received level for initial avoidance reactions of an approaching airgun was a sound level of 140 dB re 1 μPa (rms) for humpback whale pods containing females. The standoff range, *i.e.,* the closest point of approach (CPA) of the whales to the airgun, corresponded to a received level of 143 dB re 1 μPa (rms). The initial avoidance response generally occurred at distances of 5 to 8 km (3.1 to 5 mi) from the airgun array and 2 km (1.2 mi) from the single airgun. However, some individual humpback whales, especially males, approached within distances of 100 to 400 m (328 to 1,312 ft), where the maximum received level was 179 dB re 1 μPa (rms).

Humpback whales on their summer feeding grounds in southeast Alaska did not exhibit persistent avoidance when exposed to seismic pulses from a 1.64–L (100 in^3) airgun (Malme *et al.,* 1985). Some humpbacks seemed ''startled'' at received levels of 150–169 dB re 1 μPa on an approximate rms basis. Malme *et al.* (1985) concluded that there was no clear evidence of avoidance, despite the possibility of subtle effects, at received levels up to 172 re 1 μPa on an approximate rms basis.

Among wintering humpback whales off Angola (n = 52 useable groups), there were no significant differences in encounter rates (sightings/hr) when a 24 airgun array (3,147 in^3 or 5,805 in^3) was operating vs. silent (Weir, 2008). There was also no significant difference in the mean CPA distance of the humpback whale sightings when airguns were on vs. off (3,050 m vs. 2,700 m or 10,007 vs. 8,858 ft, respectively).

It has been suggested that South Atlantic humpback whales wintering off Brazil may be displaced or even strand upon exposure to seismic surveys (Engel *et al.,* 2004). The evidence for this was circumstantial and subject to alternative explanations (IAGC, 2004). Also, the evidence was not consistent with subsequent results from the same area of Brazil (Parente *et al.,* 2006), or with results from direct studies of humpbacks exposed to seismic surveys in other areas and seasons. After allowance for data from subsequent years, there was ''no observable direct correlation'' between strandings and seismic surveys (IWC, 2007b:236).

There are no data on reactions of right whales to seismic surveys, but results from the closely-related bowhead whale show that their responsiveness can be quite variable depending on the activity (migrating vs. feeding). Bowhead whales migrating west across the Alaskan Beaufort Sea in autumn, in particular, are unusually responsive, with substantial avoidance occurring out to distances of 20–30 km (12.4–18.6 mi) from a medium-sized airgun source at received sound levels of around 120–130 dB re 1 μPa (rms) (Miller *et al.,* 1999; Richardson *et al.,* 1999; see Appendix A of Rice's EA). However, more recent research on bowhead whales (Miller *et al.,* 2005a; Harris *et al.,* 2007) corroborates earlier evidence that, during the summer feeding season, bowheads are not as sensitive to seismic sources. Nonetheless, subtle but statistically significant changes in surfacing-respiration-dive cycles were evident upon statistical analysis (Richardson *et al.,* 1986). In summer, bowheads typically begin to show avoidance reactions at a received level of about 160–170 dB re 1 μPa (rms) (Richardson *et al.,* 1986; Ljungblad *et al.,* 1988; Miller *et al.,* 2005a).

Reactions of migrating and feeding (but not wintering) gray whales to seismic surveys have been studied. Malme *et al.* (1986, 1988) studied the responses of feeding Eastern Pacific gray whales to pulses from a single 100 in^3 airgun off St. Lawrence Island in the northern Bering Sea. Malme *et al.* (1986, 1988) estimated, based on small sample sizes, that 50 percent of feeding gray whales ceased feeding at an average received pressure level of 173 dB re 1 μPa on an (approximate) rms basis, and that 10 percent of feeding whales interrupted feeding at received levels of 163 dB. Those findings were generally consistent with the results of experiments conducted on larger numbers of gray whales that were migrating along the California coast (Malme *et al.,* 1984; Malme and Miles, 1985), and with observations of Western Pacific gray whales feeding off Sakhalin Island, Russia, when a seismic survey was underway just offshore of their feeding area (Gailey *et al.,* 2007; Johnson *et al.,* 2007; Yazvenko *et al.,* 2007a,b), along with data on gray whales off British Columbia (Bain and Williams, 2006). Gray whales typically show no conspicuous responses to airgun pulses with received levels up to 150 to 160 dB re 1 μPa (rms), but are increasingly likely to show avoidance as received levels increase above that range.

Various species of *Balaenoptera* (blue, sei, fin, Bryde's, and minke whales) have occasionally been reported in areas ensonified by airgun pulses (Stone, 2003; MacLean and Haley, 2004; Stone and Tasker, 2006). Sightings by observers on seismic vessels off the United Kingdom from 1997 to 2000 suggest that, at times of good sightability, sighting rates for mysticetes (mainly fin and sei whales) were similar when large arrays of airguns were shooting and not shooting (Stone, 2003; Stone and Tasker, 2006). However, these whales tended to exhibit localized avoidance, remaining significantly (on average) from the airgun array during seismic operations compared with non-seismic periods (Stone and Tasker, 2006). In a study off Nova Scotia, Moulton and Miller (2005) found little difference in sighting rates (after accounting for water depth) and initial sighting distances of balaenopterid whales when airguns were operating vs. silent. However, there were indications that these whales were more likely to be moving away when seen during airgun operations. Similarly, ship-based monitoring studies of blue, fin, sei, and minke whales offshore of Newfoundland (Orphan Basin and Laurentian Sub-basin) found no more than small differences in sighting rates and swim direction during seismic vs. non-seismic periods (Moulton *et al.,* 2005, 2006a,b).

Data on short-term reactions (or lack of reactions) of cetaceans to impulsive noises do not necessarily provide information about long-term effects. It is not known whether impulsive noises affect reproductive rate or distribution and habitat use in subsequent days or years. However, gray whales continued to migrate annually along the west coast of North America with substantial increases in the population over recent years, despite intermittent seismic exploration and much ship traffic in that area for decades (see Appendix A in Malme *et al.,* 1984; Richardson *et al.,* 1995; Angliss and Outlaw, 2008). The Western Pacific gray whale population did not seem affected by a seismic survey in its feeding ground during a prior year (Johnson *et al.,* 2007). Bowhead whales continued to travel to the eastern Beaufort Sea each summer, and their numbers have increased notably, despite seismic exploration in their summer and autumn range for many years (Richardson *et al.,* 1987). In any event, brief exposures to sound pulses from the proposed airgun source are highly unlikely to result in prolonged effects.

Toothed Whales—Little systematic information is available about reactions of toothed whales to noise pulses. Few studies similar to the more extensive baleen whale/seismic pulse work summarized above have been reported for toothed whales. However, systematic studies on sperm whales have been done (Jochens and Biggs, 2003; Tyack *et al.,* 2003; Jochens *et al.,* 2006; Miller *et al.,* 2006), and there is an increasing amount of information about responses of various odontocetes to seismic surveys based on monitoring studies (Stone, 2003; Smultea *et al.,* 2004; Moulton and Miller, 2005; Bain and Williams, 2006; Holst *et al.,* 2006; Stone and Tasker, 2006; Potter *et al.,* 2007; Weir, 2008).

Seismic operators and MMOs on seismic vessels regularly see dolphins and other small toothed whales near operating airgun arrays, but in general there seems to be a tendency for most delphinids to show some avoidance of operating seismic vessels (Goold, 1996a,b,c; Calambokidis and Osmek, 1998; Stone, 2003; Moulton and Miller, 2005; Holst *et al.,* 2006; Stone and Tasker, 2006; Weir, 2008). Some dolphins seem to be attracted to the seismic vessel and floats, and some ride the bow wave of the seismic vessel even when large airgun arrays are firing (Moulton and Miller, 2005). Nonetheless, there have been indications that small toothed whales sometimes tend to head away or to maintain a somewhat greater distance from the vessel when a large array of airguns is operating than when it is silent (Stone and Tasker, 2006; Weir, 2008). In most cases, the avoidance radii for delphinids appear to be small, on the order of 1 km (0.62 mi) or less, and some individuals show no apparent avoidance. Weir (2008b) noted that a group of short-finned pilot whales initially showed an avoidance response to ramp-up of a large airgun array, but that this response was limited in time and space.

The beluga is a species that (at least at times) shows long-distance avoidance of seismic vessels. Aerial surveys during seismic operations in the southeastern Beaufort Sea during summer recorded much lower sighting rates of beluga whales within 10–20 km (6.2–12.4 mi) compared with 20–30 km (mi) from an operating airgun array, and observers on seismic boats in that area rarely see belugas (Miller *et al.,* 2005a; Harris *et al.,* 2007).

Captive bottlenose dolphins and beluga whales exhibited changes in behavior when exposed to strong pulsed sounds similar in duration to those typically used in seismic surveys (Finneran *et al.,* 2000, 2002, 2005; Finneran and Schlundt, 2004). The animals tolerated high received levels of sound (pk–pk level >200 dB re 1 μPa) before exhibiting aversive behaviors. For pooled data at 3, 10, and 20 kHz, sound exposure levels during sessions with 25, 50, and 75 percent altered behavior were 180, 190, and 199 dB re 1 μPa^2, respectively (Finneran and Schlundt, 2004).

Results for porpoises depend on species. Dall's porpoises seem relatively tolerant of airgun operations (MacLean and Koski, 2005) and, during a survey with a large airgun array, tolerated higher noise levels than did harbor porpoises and gray whales (Bain and Williams, 2006). However, Dall's porpoises do respond to the approach of large airgun arrays by moving away (Calambokidis and Osmek, 1998; Bain and Williams, 2006). The limited available data suggest that harbor porpoises show stronger avoidance (Stone, 2003; Bain and Williams, 2006; Stone and Tasker, 2006). This apparent difference in responsiveness of these two porpoise species is consistent with their relative responsiveness to boat traffic and some other acoustic sources in general (Richardson *et al.,* 1995; Southall *et al.* 2007).

Most studies of sperm whales exposed to airgun sounds indicate that this species shows considerable tolerance of airgun pulses (Stone, 2003; Moulton *et al.,* 2005, 2006a; Stone and Tasker, 2006; Weir, 2008). In most cases, the whales do not show strong avoidance and continue to call (see Appendix A of Rice's EA for review). However, controlled exposure experiments in the Gulf of Mexico indicate that foraging effort is somewhat altered upon exposure to airgun sounds (Jochens *et al.,* 2006, 2008). In the SWSS study, D-tags (Johnson and Tyack, 2003) were used to record the movement and acoustic exposure of eight foraging sperm whales before, during, and after controlled sound exposures of airgun arrays in the Gulf of Mexico (Jochens *et al.,* 2008). Whales were exposed to maximum received sound levels between 111 and 147 dB re 1 μPa (rms) (131 to 164 dB re 1 μPa pk–pk) at ranges of approximately 1.4 to 12. 6 km (0.9 to 7.8 mi) from the sound source. Although the tagged whales showed no horizontal avoidance, some whales changed foraging behavior during full array exposure (Jochens *et al.,* 2008).

Odontocete reactions to large arrays of airguns are variable and, at least for delphinids and Dall's porpoises, seem to be confined to a smaller radius than has been observed for the more responsive of the mysticetes, belugas, and harbor porpoises (Appendix A of Rice's application). Thus behavioral reactions of most odontocetes to the small GI airgun source to be used during the proposed survey are expected to be very localized.

Pinnipeds—In the event that any pinnipeds are encountered, they are not likely to show a strong avoidance reaction to the airgun array. Visual monitoring from seismic vessels has shown only slight (if any) avoidance of airguns by pinnipeds, and only slight (if any) changes in behavior (see Appendix A of Rice's application). In the Beaufort Sea, some ringed seals avoided an area of 100 m (at most) to a few hundred meters around seismic vessels, but many seals remained within 100 to 200 m of the trackline as the operating airgun array passed by (*e.g.,* Harris *et al.,* 2001; Moulton and Lawson, 2002; Miller *et al.,* 2005a). Ringed seal sightings averaged somewhat farther away from the seismic vessel when the airguns were operating than when they were not, but the difference was small (Moulton and Lawson, 2002). Similarly, in Puget Sound, sighting distances for harbor seals and California sea lions tended to be larger when airguns were operating (Calambokidis and Osmek, 1998). Previous telemetry work suggests that avoidance and other behavioral reactions may be stronger than evident to date from visual studies (Thompson *et al,* 1998). Nonetheless, reactions are expected to be confined to relatively small distances and durations, with no long-term effects on pinniped individuals or populations.

Additional details on the behavioral reactions (or the lack thereof) by all types of marine mammals to seismic vessels can be found in Appendix A of Rice's EA.

Hearing Impairment and Other Physical Effects

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds. Temporary threshold shift (TTS) has been demonstrated and studied in certain captive odontocetes (and pinnipeds) exposed to strong sounds (reviewed in Southall *et al.,* 2007). However, there has been no specific documentation of TTS let alone permanent hearing damage, *i.e.,* permanent threshold shift (PTS), in free-ranging marine mammals exposed to sequences of airgun pulses during realistic field conditions.

NMFS will be developing new noise exposure criteria for marine mammals that take account of the now-available scientific data on TTS, the expected offset between the TTS and PTS thresholds, differences in the acoustic frequencies to which different marine mammal groups are sensitive, and other relevant factors. Detailed recommendations for new science-based noise exposure criteria were published in late 2007 (Southall *et al.,* 2007).

Because of the small GI airgun source in this proposed project, along with the proposed monitoring and mitigation measures, there is little likelihood that any marine mammals will be exposed to sounds sufficiently strong enough to cause hearing impairment. Several aspects of the proposed monitoring and mitigation measures for this project (see below) are designed to detect marine mammals occurring near the airguns (and other sound sources), and to avoid exposing them to sound pulses that might, at least in theory, cause hearing impairment. In addition, many cetaceans and (to a limited degree) pinnipeds are likely to show some avoidance of the area where received levels of airgun sound are high enough such that hearing impairment could potentially occur. In those cases, the avoidance responses of the animals themselves will reduce or (most likely) avoid any possibility of hearing impairment.

Non-auditory physical effects may also occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that theoretically might occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage. It is possible that some marine mammal species (*i.e.,* beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds. However, as discussed below, there is no definitive evidence that any of these effects occur even for marine mammals in close proximity to large arrays of airguns. It is especially unlikely that any effects of these types would occur during the proposed project given the small size of the source, the brief duration of exposure of any given mammal, and the proposed monitoring and mitigation measures (see below). The following subsections discuss in somewhat more detail the possibilities of TTS, PTS, and non-auditory physical effects.

Temporary Threshold Shift—TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. At least in terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the noise ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound. Available data on TTS in marine mammals are summarized in Southall *et al.* (2007).

For toothed whales exposed to single short pulses, the TTS threshold appears to be, to a first approximation, a function of the energy content of the pulse (Finneran *et al.,* 2002, 2005). Given the available data, the received level of a single seismic pulse (with no frequency weighting) might need to be approximately 186 dB re 1 $\mu Pa^2 \cdot s$ (*i.e.,* 186 dB SEL or approximately 221–226 dB pk–pk) in order to produce brief, mild TTS. Exposure to several strong seismic pulses that each have received levels near 190 dB re 1 μPa (rms) (175–180 dB SEL) might result in cumulative exposure of approximately 186 dB SEL and thus slight TTS in a small odontocete, assuming the TTS threshold is (to a first approximation) a function of the total received pulse energy. The distances from the *Endeavor's* GI airguns at which the received energy level (per pulse, flat-weighted) would be expected to be ≥175–180 dB SEL are the distances shown in the 190 dB re 1 μPa (rms) column in Table 1 above (given that the rms level is approximately 10 to 15 dB higher than the SEL value for the same pulse). Seismic pulses with received levels ≥175 to 180 dB SEL (190 dB re 1 μPa (rms)) are expected to be restricted to radii no more than 150 m around the two GI airguns. The specific radius depends on the depth of the water. For an odontocete closer to the surface, the maximum radius with ≥ 190 dB 1 μPa (rms) would be smaller.

The above TTS information for odontocetes is derived from studies on the bottlenose dolphin and beluga. There is no published TTS information for other species of cetaceans. However, preliminary evidence from harbor porpoise exposed to airgun sound suggests that its TTS threshold may be lower (Lucke *et al.,* 2007).

For baleen whales, there are no data, direct or indirect, on levels or properties of sound required to induce TTS. The frequencies to which baleen whales are most sensitive are lower than those for odontocetes, and natural background noise levels at those low frequencies tend to be higher. As a result, auditory thresholds of baleen whales within their frequency band of best hearing are believed to be higher (less sensitive) than are those of odontocetes at their best frequencies (Clark and Ellison, 2004). From this, it is suspected that received levels causing TTS onset may also be higher in baleen whales (Southall *et al.,* 2007). In any event, no cases of TTS are expected given three considerations:

(1) Small size of the GI airgun source (90 in^3 total volume);

(2) The strong likelihood that baleen whales would avoid the approaching airguns (or vessel) before being exposed to levels high enough for TTS to possibly occur; and

(3) The proposed mitigation measures.

In pinnipeds, TTS thresholds associated with exposure to brief pulses (single or multiple) of underwater sound have not been measured. Initial evidence from prolonged (non-pulse) exposures suggested that some pinnipeds may incur TTS at somewhat lower received levels than do small odontocetes exposed for similar durations (Kastak *et al.,* 1999, 2005; Ketten *et al.,* 2001; Au *et al.,* 2000). The TTS threshold for pulsed sounds has been indirectly estimated as being an SEL of approximately 171 dB re 1 μPa^2·s (Southall *et al.,* 2007), which would be equivalent to a single pulse with received level approximately 181–186 re 1 μPa (rms), or a series of pulses for which the highest rms values are a few dB lower. Corresponding values for California sea lions and northern elephant seals are likely to be higher (Kastak *et al.,* 2005).

A marine mammal within a radius of less than 100 m (328 ft) around a typical large array of operating airguns might be exposed to a few seismic pulses with levels of greater than or equal to 205 dB, and possibly more pulses if the mammal moved with the seismic vessel. (As noted above, most cetacean species tend to avoid operating airguns, although not all individuals do so.) In addition, ramping up airgun arrays, which is standard operational protocol for large airgun arrays, should allow cetaceans to move away form the seismic source and to avoid being exposed to the full acoustic output of the airgun array. Even with a large airgun array, it is unlikely that the cetaceans would be exposed to airgun pulses at a sufficiently high level for a sufficiently long period to cause more than mild TTS, given the relative movement of the vessel and the marine mammal. The potential for TTS is much lower in this project. With a large array of airguns, TTS would be most likely in any odontocetes that bow-ride or otherwise linger near the airguns. While bow-riding, odontocetes would be at or above the surface, and thus not exposed to strong pulses given the pressure-release effect at the surface. However, bow-riding animals generally dive below the surface intermittently. If they did so while bow-riding near airguns, they would be exposed to strong sound pulses, possibly repeatedly. If some cetaceans did incur TTS through exposure to airgun sounds, this would very likely be mild, temporary, and reversible.

To avoid the potential for injury, NMFS has determined that cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding, respectively, 180 and 190 dB re 1 μPa (rms). As summarized above, data that are now available imply that TTS is unlikely to occur unless odontocetes (and probably mysticetes as well) are exposed to airgun pulses stronger than 180 dB re 1 μPa (rms).

Permanent Threshold Shift—When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness, while in other cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

There is no specific evidence that exposure to pulses of airgun sound can cause PTS in any marine mammal, even with large arrays of airguns. However, given the possibility that mammals close to an airgun array might incur TTS, there has been further speculation about the possibility that some individuals occurring very close to airguns might incur PTS (Richardson *et al.,* 1995). Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, but are assumed to be similar to those in humans and other terrestrial mammals. PTS might occur at a received sound level at least several decibels above that inducing mild TTS if the animal were exposed to strong sound pulses with rapid rise time (see Appendix A(5) of SIO's application). Based on data from terrestrial mammals, a precautionary assumption is that the PTS threshold for impulse sounds (such as airgun pulses as received close to the source) is at least 6 dB higher than the TTS threshold on a peak-pressure basis, and probably >6 dB (Southall *et al.,* 2007). On an SEL basis, Southall *et al.* (2007) estimated that received levels would need to exceed the TTS threshold by at least 15 dB for there to be risk of PTS. Thus, for cetaceans they estimate that the PTS threshold might be an M-weighted SEL (for the sequence of received pulses) of approximately 198 dB re 1 μPa^2·s (15 dB higher than the TTS threshold for an impulse). Additional assumptions had to be made to derive a corresponding estimate for pinnipeds, as the only available data on TTS thresholds in pinnipeds pertain to non-impulse sound. Southall *et al.* (2007) estimate that the PTS threshold could be a cumulative M_{pw}-weighted SEL of approximately 186 dB 1 μPa^2·s in the harbor seal to impulse sound. The PTS threshold for the California sea lion and northern elephant seal the PTS threshold would probably be higher, given the higher TTS thresholds in those species.

Southall *et al.* (2007) also note that, regardless of the SEL, there is concern about the possibility of PTS if a cetacean or pinniped receives one or more pulses with peak pressure exceeding 230 or 218 dB re 1 μPa (3.2 bar · m, 0-pk), which would only be found within a few meters of the largest (600-in^3) airguns in the planned airgun array (Caldwell and Dragoset, 2000). A peak pressure of 218 dB re 1 μPa could be received somewhat farther away; to estimate that specific distance, one would need to apply a model that accurately calculates peak pressures in the near-field around an array of airguns.

In the proposed project employing two GI airguns, marine mammals are unlikely to be exposed to received levels of seismic pulses strong enough to cause TTS, as they would need to be quite close to the GI airguns for that to occur. Given the higher level of sound necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur. A mammal would not be exposed to more than one strong pulse unless it swam immediately alongside the GI airguns for a period longer than the inter-pulse interval. Baleen whales generally avoid the immediate area around operating seismic vessels, as do some other marine mammals. The planned monitoring and mitigation measures, including visual monitoring and shut downs of the airguns when mammals are seen about to enter or within the exclusion zone (EZ), will further reduce the probability of exposure of marine mammals to sounds strong enough to induce PTS.

Non-auditory Physiological Effects—Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.,* 2006; Southall *et al.,* 2007). Studies examining such effects are limited. However, resonance (Gentry, 2002) and direct noise-induced bubble formation (Crum *et al.,* 2005) are not expected in the case of an impulsive source like an airgun array. If seismic surveys disrupt diving patterns of deep diving species, this might perhaps result in bubble formation and a form of ''the bends,'' as speculated to occur in beaked whales exposed to sonar. However, there is no specific evidence of this upon exposure to airgun pulses.

In general, little is known about the potential for seismic survey sounds to cause auditory impairment or other physical effects in marine mammals. Available data suggest that such effects, if they occur at all, would presumably be limited to short distances of the sound source and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall *et al.,* 2007), or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. Marine mammals that show behavioral avoidance of seismic vessels, including most baleen whales, some odontocetes, and some pinnipeds, are especially unlikely to incur auditory impairment or non-auditory physical effects. Also, the planned mitigation measures, including shut downs of the airgun, would reduce any such effects that might otherwise occur.

Strandings and Mortality

Marine mammals close to underwater detonations of high explosives can be killed or severely injured, and their auditory organs are especially susceptible to injury (Ketten *et al.,* 1993; Ketten, 1995). However, explosives are no longer used for marine seismic research or commercial seismic surveys, and have been replaced entirely by airguns or related non-explosive pulse generators. Airgun pulses are less energetic and have slower rise times, and there is no specific evidence that they can cause injury, death, or stranding even in the case of large airgun arrays. However, the association of mass strandings of beaked whales with naval exercises and, in one case, an L–DEO seismic survey (Malakoff, 2002; Cox *et al.,* 2006), has raised the possibility that beaked whales exposed to strong ''pulsed'' sounds may be especially susceptible to injury and/or behavioral reactions that can lead to stranding (Hildebrand 2005; Southall *et al.,* 2007). Appendix A of Rice's application provides additional details.

Specific sound-related processes that lead to strandings and mortality are not well documented, but may include:

(1) Swimming in avoidance of a sound into shallow water;

(2) A change in behavior (such as a change in diving behavior) that might contribute to tissue damage, gas bubble formation, hypoxia, cardiac arrhythmia, hypertensive hemorrahage or other forms of trauma;

(3) A physiological change such as a vestibular response leading to a behavioral change or stress-induced hemorrahagic diathesis, leading in turn to tissue damage; and

(4) Tissue damage directly from sound exposure, such as through acoustically mediated bubble formation and growth or acoustic resonance of tissues.

As noted in Rice's application, some of these mechanisms are unlikely to apply in the case of impulse sounds. However, there are increasing indications that gas-bubble disease (analogous to ''the bends''), induced in super-saturated tissue by a behavioral response to acoustic exposure, could be a pathologic mechanism for the strandings and mortality of some deep diving cetaceans exposed to sonar. The evidence for this remains circumstantial and associated with exposure to naval mid-frequency sonar, not seismic surveys (Cox *et al.,* 2006; Southall *et al.,* 2007).

Seismic pulses and mid-frequency sonar pulses are quite different, and some mechanisms by which sonar sounds have been hypothesized to affect beaked whales are unlikely to apply to airgun pulses. Sounds produced by airgun arrays are broadband with most of the energy below 1 kHz. Typical military mid-frequency sonars operate at frequencies of 2–10 kHz, generally with a relatively narrow bandwidth at any one time. A further difference between seismic surveys and naval exercises is that naval exercises can involve sound sources on more than one vessel. Thus, it is not appropriate to assume that there is a direct connection between the effects of military sonar and seismic surveys on marine mammals. However, evidence that sonar pulses can, in special circumstances, lead (at least indirectly) to physical damage and mortality (Balcomb and Claridge, 2001; NOAA and USN, 2001; Jepson *et al.,* 2003; Fernández *et al.,* 2004, 2005a,b; Hildebrand, 2005; Cox *et al.,* 2006) suggests that caution is warranted when dealing with exposure of marine mammals to any high-intensity pulsed sound.

There is no conclusive evidence of cetacean strandings or deaths at sea as a result of exposure to seismic surveys, but a few cases of strandings in the general area where a seismic survey was ongoing have led to speculation concerning a possible link between seismic surveys and strandings. Suggestions that there was a link between seismic surveys and strandings of humpback whales in Brazil (Engel *et al.,* 2004) were not well founded based on available data (IAGC, 2004; IWC, 2006). In September 2002, there was a stranding of two Cuvier's beaked whales (*Ziphius cavirostris*) in the Gulf of California, Mexico, when the L–DEO vessel R/V *Maurice Ewing* (*Ewing*) was operating a 20 airgun, 8,490 in^3 array in the general area. The link between the stranding and the seismic survey was inconclusive and not based on any physical evidence (Hogarth, 2002; Yoder, 2002). Nonetheless, the Gulf of California incident plus the beaked whale strandings near naval exercises involving use of mid-frequency sonar suggests a need for caution when conducting seismic surveys in areas occupied by beaked whales until more is known about effects of seismic surveys on those species (Hildebrand, 2005).

No injuries of beaked whales are anticipated during the proposed study because of (1) the high likelihood that any beaked whales nearby would avoid the approaching vessel before being exposed to high sound levels, (2) the proposed monitoring and mitigation measures, including avoiding submarine canyons, where deep diving species (like beaked whales and sperm whales) may congregate, and (3) differences between the sound sources operated by Rice and those involved in the naval exercises associated with strandings.

Potential Effects of Other Acoustic Devices

Echosounder Signals

The Knudsen echosounder will be operated from the source vessel during most of the proposed study. Sounds from the echosounder are short pulses, occurring for up to 24 ms once every few seconds. Most of the energy in the sound pulses is at 3.5 and 12 kHz, and the beam is directed downward. The source level of the echosounder is expected to be relatively low compared to the GI airguns. Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when an echosounder emits a pulse is small, and if the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause TTS.

Marine mammal communications will not be masked appreciably by the echosounder signals given their directionality and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of most baleen whales, the signals do not overlap with the predominant frequencies in the calls, which would avoid significant masking.

Behavioral reactions of free-ranging marine mammals to echosounders and other sound sources appear to vary by species and circumstance. Observed reactions have included silencing and dispersal by sperm whales (Watkins *et al.,* 1985), increased vocalizations and no dispersal by pilot whales (Rendell and Gordon, 1999), and the previously mentioned beaked whales. During exposure to a 21 to 25 kHz whale-finding sonar with a source level of 215 dB re 1 µPam, gray whales showed slight avoidance (approximately 200 m) behavior (Frankel, 2005). When a 38 kHz echosounder and a 150 kHz acoustic Doppler current profiler were transmitting during studies in the Eastern Tropical Pacific, baleen whales showed no significant responses, while spotted and spinner dolphins were detected slightly more often and beaked whales less often during visual surveys (Gerrodette and Pettis, 2005).

During a previous low-energy seismic survey from the R/V *Thomas G. Thompson,* several echosounders were in operation most of the time, and a fathometer was also used during part of the survey. Many cetaceans and small numbers of fur seals were seen by the observers aboard the ship, but no specific information about echosounder effects (if any) on mammals were obtained (Ireland *et al.,* 2005). These responses (if any) could not be distinguished from responses to the GI airguns (when operating) and to the ship itself.

Captive bottlenose dolphins and a beluga whale exhibited changes in behavior when exposed to 1 s pulsed sounds at frequencies of approximately 30 kHz and to shorter broadband pulsed signals. Behavioral changes typically involved what appeared to be deliberate attempts to avoid the sound exposure (Schlundt *et al.,* 2000; Finneran *et al.,* 2002; Finneran and Schlundt, 2004). The relevance of those data to free-ranging odontocetes is uncertain, and in any case, the test sounds were quite different in either duration or bandwidth as compared with those from an echosounder.

Very few data are available on the reactions of pinnipeds to echosounder sounds at frequencies similar to those used during seismic operations. Hastie and Janik (2007) conducted a series of behavioral response tests on two captive gray seals to determine their reactions to the underwater operation of a 375 kHz multi-beam imaging sonar that included significant signal components down to 6 kHz. Results indicated that the two seals reacted to the sonar signal by significantly increasing their dive durations. Based on observed pinniped responses to other types of pulsed sounds, and the likely brevity of exposure to the echosounder sounds, pinniped reactions are expected to be limited to startle or otherwise brief responses of no lasting consequence to the animals.

During the proposed operations, the individual pulses will be very short, and a given mammal would not receive many of the downward-directed pulses as the vessel passes by. In the case of baleen whales, the echosounder will operate at too high a frequency to have any effect.

Given recent stranding events that have been associated with the operation of naval sonar, there is concern that mid-frequency sonar sounds can cause serious impacts to marine mammals (see above). However, the echosounder proposed for use is quite different than sonars used for Navy operations. Pulse duration of the echosounder is very short relative to naval sonars. Also, at any given location, an individual marine mammal would be in the beam of the echosounder for much less time given the generally downward orientation; Navy sonars often use near-horizontally-directed sound.

Given the maximum source level of 211 dB re 1 µPam (rms), the received energy level from a single pulse of duration 24 ms would be approximately 195 dB re 1 $\mu Pa^2 \cdot s$ at 1 m, *i.e.,* 211 dB + 10 log (0.024 s). As the TTS threshold for a cetacean receiving a single non-impulse sound is 195 dB re 1 $\mu Pa^2 \cdot s$ and the anticipated PTS threshold is 215 dB re 1 $\mu Pa^2 \cdot s$ (Southall *et al.,* 2007), it is very unlikely that an animal would ever come close enough to the transducer to incur TTS (which would be fully recoverable), let alone PTS. As noted by Burkhardt *et al.* (2007, 2008), cetaceans are very unlikely to incur PTS from operation of scientific echosounders on a ship that is underway.

For the harbor seal, the TTS threshold for non-impulse sounds is approximately 183 dB re 1 $\mu Pa^2 \cdot s$, as compared with approximately 195 dB re 1 $\mu Pa^2 \cdot s$ in odontocetes (Kastak *et al.,* 2005; Southall *et al.,* 2007). TTS onset occurs at higher received energy levels in the California sea lion and northern elephant seal than in the harbor seal. The received level for a harbor seal within the echosounder beam 10 m below the ship would be approximately 191 dB re 1 µPam (rms), assuming 40 dB of spreading loss over 100 m (circular spreading). Given the narrow beam, only one pulse is likely to be received by a given animal as the ship passes overhead. At 10 m, the received energy level from a single pulse of duration 24 ms would be approximately 175 dB re 1 $\mu Pa^2 \cdot s$, *i.e.,* 191 dB + 10 log (0.024 s). Thus, a harbor seal would have to come very close to the transducer in order to receive a single echosounder pulse with a received energy level of ≥183 dB re 1 $\mu Pa^2 \cdot s$. Given the intermittent nature of the signals and the narrow echosounder beam, only a small fraction of the pinnipeds below (and close to) the ship would receive a pulse as the ship passed overhead. Thus, it seems unlikely that a pinniped would incur TTS, let alone PTS, is exposed to a single pulse by the echosounder.

Sub-Bottom Profiler Signals

A SBP will be operated from the source vessel at all times during the planned study. Sounds from the SBP are very short pulses, occurring for 30 ms once every 0.5 to 1 s. The SBP will transmit a 0.5–12 kHz swept pulse (or chirp). The source level of the SBP is expected to be similar to or less than that of the Knudsen echosounder. Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when a SBP emits a pulse is small—if the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause TTS.

Marine mammal communications will not be masked appreciably by the SBP signals given their directionality and the brief period when an individual mammal is likely to be within its beam.

Marine mammal behavioral reactions to other pulsed sound sources are discussed above, and responses to the SBP are likely to be similar to those for other pulsed sources if received at the same levels. Therefore, behavioral responses are not expected unless marine mammals are very close to the source.

It is unlikely that the SBP produces pulse levels strong enough to cause hearing impairment or other physical injuries even in an animal that is (briefly) in a position near the source. The SBP is usually operated simultaneously with other higher-power acoustic sources. Many marine mammals will move away in response to the approaching higher-power sources or the vessel itself before the mammals would be close enough for there to be any possibility of effects from the less intense sounds from the SBP. In the case of mammals that do not avoid the approaching vessel and its various sound sources, mitigation measures that would be applied to minimize effects of other sources would further reduce or eliminate any minor effects of the SBP.

Boomer Signals

The boomer will be operated from the source vessel at times during the proposed study (see Acoustic Source Specifications above). Details about this boomer are provided in Rice's IHA application, see above. Sounds from the boomer are very short pulses, occurring for 0.1 ms once every second. The boomer will transmit a 0.3 to 3 kHz pulse. The source level of the boomer is similar to that of the Knudsen echosounder—212 dB re 1 μPam. If the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause TTS.

Marine mammal communications will not be masked appreciably by the boomer signals given the directionality and brief period when an individual mammal is likely to be within its beam.

Marine mammal behavioural reactions to other pulsed sound sources are discussed above, and responses to the boomer are likely to be similar to those for other pulsed sources if received at the same levels. Behavioral responses are not expected unless marine mammals are very close to the source.

It is unlikely that the boomer produces pulse levels strong enough to cause hearing impairment or other physical injuries even in an animal that is (briefly) in a position near the source. The boomer will be operated simultaneously with the higher-power GI airguns. Many marine mammals will move away in response to the approaching GI airguns or the vessel itself before the mammals will move away in response to the approaching GI airguns or the vessel itself before the mammals would be close enough for there to be any possibility of effects from the less intense sounds from the boomer. In the case of mammals that do not avoid the approaching vessel and its various sound sources, mitigation measures that would be applied to minimize effects of other sources would further reduce or eliminate any minor effects to the boomer.

As stated above, NMFS is assuming that Level A harassment onset corresponds to 180 and 190 dB re 1 μPa (rms) for cetaceans and pinnipeds, respectively. The precautionary nature of these criteria is discussed in Rice's application, including the fact that the minimum sound level necessary to cause permanent hearing impairment is higher, by a variable and generally unknown amount, than the level that induces barely-detectable TTS and the level associated with the onset of TTS is often considered to be a level below which there is no danger of permanent damage. NMFS also assumes that cetaceans or pinnipeds exposed to levels exceeding 160 re 1 μPa (rms) may experience Level B harassment.

Estimated Take by Incidental Harassment

All anticipated takes would be ''takes by harassment,'' involving temporary changes in behavior. The proposed monitoring and mitigation measures are expected to minimize the possibility of injurious takes. (However, as noted earlier and in Appendix A of Rice's application, there is no specific information demonstrating that injurious ''takes'' would occur even in the absence of the planned monitoring and mitigation measures.) The sections below describe methods to estimate ''take by harassment'', and present estimates of the numbers of marine mammals that might be affected during the proposed seismic program in the Northwest Atlantic Ocean. The estimates of ''take by harassment'' are based on (1) cetacean densities (numbers per unit area) obtained during aerial surveys off New England during 2002 and 2004 by NMFS Northeast Fisheries Science Center (NEFSC), and (2) estimates of the size of the area where effects could potentially occur. Few, if any, pinnipeds are expected to be encountered during the proposed survey in the summer.

The following estimates are based on a consideration of the number of marine mammals that might be disturbed appreciably by operations with the GI airgun to be used during approximately 1,757 line km (1,092 mi) of surveys (including turns) off the New England coast. The anticipated radii of influence of the other sound sources (*i.e.,* SBP, boomer system, and echosounder) are less than those for the GI airguns. It is assumed that, during simultaneous operations of the GI airguns and other sound sources, any marine mammals close enough to be affected by the other sound sources would already be affected by the GI airguns. However, whether or not the GI airguns are operating simultaneously with the other sound sources, marine mammals are expected to exhibit no more than short-term and inconsequential responses to the other sound sources given their characteristics (*e.g.,* narrow downward-directed beam in the echosounder). Therefore, no additional allowance is included for animals that could be affected by the other sound sources.

Extensive systematic aircraft and ship-based surveys have been conducted for marine mammals offshore from New England (*e.g.,* see Palka, 2006). Those that were conducted in the proposed seismic survey area were used for density estimates. Oceanographic conditions influence the distribution and numbers of marine mammals present in the study area, resulting in year-to-year variation in the distribution and abundance of many marine mammal species. Thus, for some species the densities derived from these surveys may not be representative of the densities that will be encountered during the proposed seismic survey. To provide some allowance for these uncertainties, ''maximum estimates'' as well as ''best estimates'' of the numbers potentially affected have been derived. Best and maximum estimates are based on the average and maximum estimates of densities calculated from the appropriate densities reported by Palka (2006).

Table 4 of Rice's application gives the average and maximum densities for each species of cetacean reported in the proposed survey area off New England, corrected for effort, based on the densities as described above. The densities from those studies had been corrected, by the original authors, for both detectability bias and availability bias. Detectability bias associated with diminishing sightability with increasing lateral distance from the tracklines [*f*(0)]. Availability bias refers to the fact that there is less-than-100-percent probability of sighting an animal that is present along the survey trackline, and it is measured by g(0).

It should be noted that the following estimates of ''takes by harassment'' assume that the surveys will be undertaken and completed. As is typical on offshore ship surveys, inclement weather, and equipment malfunctions are likely to cause delays and may limit the number of useful line kms of seismic operations that can be undertaken. Furthermore, any marine mammal sightings within or near the designated safety zones will result in the shut-down of seismic operations as a mitigation measure. Thus, the following estimates of the numbers of marine mammals potentially exposed to 160 dB sounds are precautionary, and probably overestimate the actual numbers of marine mammals that might be involved. These estimates assume that there will be no weather, equipment, or mitigation delays, which is highly likely.

There is some uncertainty about the representativeness of the data and the assumptions used in the calculations. However, the approach used is believed to be the best available approach. Also, to provide some allowance for these uncertainties ''maximum estimates'' as well as ''best estimates'' of the numbers potentially affected have been derived. The estimated number of potential individuals exposed are presented below based on the 160 dB re 1 μPa (rms) criterion for all cetaceans and pinnipeds. It is assumed that a marine mammal exposed to airgun at that received level might change their behavior sufficiently to be considered ''taken by harassment.''

The number of different individuals that may be exposed to GI airgun sounds with received levels ≥160 dB re 1 μPa (rms) on one or more occasions was estimated by considering the total marine area that would be within the 160-dB radius around the operating airgun array on at least one occasion. The proposed seismic lines do not run parallel to each other in close proximity, which minimizes the number of times an individual mammal may be exposed during the survey. Table 5 of Rice's application shows the best and maximum estimates of the number of marine mammals that could potentially be affected during the seismic survey.

The number of different individuals potentially exposed to received levels ≥160 dB re 1 μPa (rms) was calculated by multiplying:

- The expected species density, either ''mean'' (*i.e.,* best estimate) or ''maximum,'' times;
- The anticipated area to be ensonified to that level during GI airgun operations.

The area expected to be ensonified was determined by entering the planned survey lines into a MapInfo Geographic Information System (GIS), using the GIS to identify the relevant areas by ''drawing'' the applicable 160 dB buffer around each seismic line (two GI airgun buffer) and turns (one GI airgun buffer) (depending on water and tow depth) and then calculating the total area within the buffers. Areas where overlap occurred (because of intersecting lines) were included only once to determine the area expected to be ensonified.

Applying the approach described above, approximately 2,877 km^2 (1,111 mi^2) would be within the 160 dB isopleth on one or more occasions during the survey. This approach does not allow for ''turnover'' in the mammal populations in the study area during the course of the studies. That might underestimate actual numbers of individuals exposed, although the conservative distances used to calculate the area may offset this. In addition, the approach assumes that no cetaceans will move away or toward the trackline as the *Endeavor* approaches in response to increasing sound levels prior to the time the levels reach 160 dB. Another way of interpreting the estimates that follow is that they represent the number of individuals that are expected (in the absence of a seismic survey) to occur in the waters that will be exposed to ≥160 dB re 1 μPa (rms).

TABLE 3

[The estimates of the possible numbers of marine mammals exposed to sound levels greater than or equal to 160 dB during Rice's proposed seismic survey off the coast of New England in August 2009. The proposed sound source is two GI airguns. Received levels are expressed in dB re 1 μPa (rms) (averaged over pulse duration), consistent with NMFS' practice. Not all marine mammals will change their behavior when exposed to these sound levels, but some may alter their behavior when levels are lower (see text). See Tables 3–5 in Rice's application for further detail.]

Species	Number of individuals exposed (best) [1]	Number of individuals exposed (max) [1]	Approx. % regional population (best) [2]
Mysticetes			
North Atlantic right whale [3] (*Eubalaena glacialis*)	1	1	0.31
Humpback whale (*Megaptera novaeangliae*)	2	57	0.02
Minke whale (*Balaenoptera acutorostrata*)	0	21	<0.01
Bryde's whale (*Balaenoptera brydei*)	0	0	0
Sei whale (*Balaenoptera borealis*)	0	0	0
Fin whale (*Balaenoptera physalus*)	11	75	0.02
Blue whale (*Balaenoptera musculus*)	0	0	0
Odontocetes			
Sperm whale (*Physeter macrocephalus*)	2	77	0.02
Pygmy sperm whale (*Kogia breviceps*)	0	0	0
Dwarf sperm whale (*Kogia sima*)	0	0	0
Cuvier's beaked whale (*Ziphius cavirostris*)	0	0	0
Northern bottlenose whale (*Hyperodon ampullatus*)	0	0	0
True's beaked whale (*Mesoplodon mirus*)	0	0	0

TABLE 3—Continued

[The estimates of the possible numbers of marine mammals exposed to sound levels greater than or equal to 160 dB during Rice's proposed seismic survey off the coast of New England in August 2009. The proposed sound source is two GI airguns. Received levels are expressed in dB re 1 μPa (rms) (averaged over pulse duration), consistent with NMFS' practice. Not all marine mammals will change their behavior when exposed to these sound levels, but some may alter their behavior when levels are lower (see text). See Tables 3–5 in Rice's application for further detail.]

Species	Number of individuals exposed (best) [1]	Number of individuals exposed (max) [1]	Approx. % regional population (best) [2]
Gervais' beaked whale (*Mesopldon europaeus*)	0	0	0
Sowerby's beaked whale (*Mesoplodon bidens*)	0	0	0
Blainville's beaked whale (*Mesoplodon densirostris*)	0	0	0
Unidentified beaked whale	0	2	N.A.
Bottlenose dolphin [3] (*Tursiops truncatus*)	39	4,700	0.05
Pantropical spotted dolphin (*Stenella attenuata*)	0	0	0
Atlantic spotted dolphin (*Stenella frontalis*)	0	0	0
Spinner dolphins (*Stenella longirostris*)	0	0	0
Striped dolphin (*Stenella coeruleoalba*)	0	212	<0.01
Common dolphin[5] (*Delphinus* sp.)	349	3,189	0.17
White-beaked dolphin (*Lagenorhynchus albirostris*)	0	0	0
Atlantic white-sided dolphin[3] (*Lagenorhynchus acutus*)	0	0	0
Risso's dolphin (*Grampus griseus*)	2	929	0.01
False killer whale (*Pseudorca crassidens*)	0	0	0
Killer whale (*Orcinus orca*)	0	0	0
Long-finned pilot whale (*Globicephala melas*)	N.A.	N.A.	<0.01
Short-finned pilot whale (*Globicephala macrorhynchus*)	N.A.	N.A.	<0.01
Unidentified pilot whale (*Globicephala* sp.)	10	1,101	<0.01
Harbor porpoise (*Phocoena phocoena*)	0	0	0
Pinnipeds			
Harbor seal [4] (*Phoca vitulina*)	10	N.A.	0.01
Gray seal (*Halichoerus grypus*)	5	N.A.	<0.01
Harp seal [4] (*Pagophilius groenlandicus*)	0	0	0
Hooded seal (*Cystophora cristata*)	0	0	0

N.A.—Data not available or species status was not assessed.
[1] Best estimate and maximum estimates of exposure are from Table 5 of Rice's application. Best and maximum density estimates are from Table 4 of Rice's application.
[2] Regional population size estimates are from Table 2 (above) and Table 2 of Rice's application.
[3] Species not sighted in the surveys used for density estimates, but that could occur in low densities in the proposed survey area.
[4] Species for which summer densities in the study area are unavailable, but could occur there in low numbers.
[5] Not identified to species level.

Table 5 of Rice's application shows the best and maximum estimates of the number of exposures and the number of individual marine mammals that potentially could be exposed to greater than or equal to 160 dB re 1 μPa (rms) during the different legs of the seismic survey if no animals moved away from the survey vessel.

The ''best estimate'' of the number of individual marine mammals that could be exposed to seismic sounds with received levels greater than or equal to 160 dB re 1 μPa (rms) (but below Level A harassment thresholds) during the survey is shown in Table 5 of Rice's application and Table 3 (shown above). That includes 1 North Atlantic right (0.31 percent of the regional population), 2 humpback (0.02 percent of the regional population), 11 fin (0.03 percent of the regional population), and 2 sperm whales (0.02 percent of the regional population), and no beaked whales. Based on the best estimates, most (93 percent) of the marine mammals potentially exposed are dolphins. The common dolphin and bottlenose dolphin are estimated to be the most common species exposed to 160 dB re μPa (rms); the best take estimates for those species are 349 (0.17 percent of the regional population) and 39 (0.05 percent of the regional population), respectively. Estimates for the other dolphin species that could be exposed are lower (see Table 5 of Rice's application). In addition, it is estimated that 10 harbor seals (0.01 percent) and 5 gray seals (<0.01 percent) may be exposed to sound levels greater than or equal to 160 dB re 1 μPa (rms).

The ''maximum estimate'' column of Table 5 of Rice's application shows an estimated total of 9,479 cetaceans exposed to seismic sounds ≥160 dB during the surveys. Those estimates are based on the highest calculated density in any survey stratum; in this case, the stratum with the highest density invariably was one of the areas where very little of the proposed seismic survey will take place, *i.e.,* Georges Central or Shelf Central. In other words, densities observed in the 2002 and 2004 aerial surveys were lowest in the Georges West operation area, where most of the proposed seismic surveys will take place. Therefore, the numbers for which ''take authorization'' is requested, given in the far right column of Table 5 of Rice's application, are the best estimates. For three endangered species, the best estimates were set at the species' mean group size. The North Atlantic right whale, which was not sighted during the aerial surveys, could occur in the survey area, and is usually seen individually (feeding aggregations are not expected to occur in the study area). The humpback and sperm whales, each of whose calculated best estimate was one, have a mean group size of two.

Potential Effects on Marine Mammal Habitat

The proposed Rice seismic survey will not result in any permanent impact on habitats used by marine mammals, or to the food sources they use. The main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals, as described above. The following sections briefly review effects of airguns on fish and invertebrates, and more details are included in Rice's application and associated EA.

Potential Effects on Fish and Invertebrates

One reason for the adoption of airguns as the standard energy source for marine seismic surveys is that, unlike explosives, they have not been associated with large-scale fish kills. However, existing information on the impacts of seismic surveys on marine fish populations is very limited (see Appendix C of Rice's application). There are three types of potential effects on fish and invertebrates from exposure to seismic surveys: (1) Pathological, (2) physiological, and (3) behavioral. Pathological effects involve lethal and temporary or permanent sub-lethal injury. Physiological effects involve temporary and permanent primary and secondary stress responses, such as changes in levels of enzymes and proteins. Behavioral effects refer to temporary and (if they occur) permanent changes in exhibited behavior (*e.g.,* startle and avoidance behavior). The three categories are interrelated in complex ways. For example, it is possible that certain physiological and behavioral changes potentially could lead to an ultimate pathological effect on individuals (*i.e.,* mortality).

The specific received sound levels at which permanent adverse effects to fish potentially could occur are little studied and largely unknown. Furthermore, the available information on the impacts of seismic surveys on marine fish is from studies of individuals or portions of a population; there have been no studies at the population scale. Thus, available information provides limited insight on possible real-world effects at the ocean or population scale. This makes drawing conclusions about impacts on fish problematic because ultimately, the most important aspect of potential impacts relates to how exposure to seismic survey sound affects marine fish populations and their viability, including their availability to fisheries.

The following sections provide a general synopsis of available information on the effects of exposure to seismic and other anthropogenic sound as relevant to fish. The information comprises results from scientific studies of varying degrees of rigor plus some anecdotal information. Some of the data sources may have serious shortcomings in methods, analysis, interpretation, and reproducibility that must be considered when interpreting their results (see Hastings and Popper, 2005). Potential adverse effects of the program's sound sources on marine fish are then noted.

Pathological Effects—The potential for pathological damage to hearing structures in fish depends on the energy level of the received sound and the physiology and hearing capability of the species in question (see Appendix C of Rice's application). For a given sound to result in hearing loss, the sound must exceed, by some specific amount, the hearing threshold of the fish for that sound (Popper, 2005). The consequences of temporary or permanent hearing loss in individual fish on a fish population is unknown; however, it likely depends on the number of individuals affected and whether critical behaviors involving sound (*e.g.,* predator avoidance, prey capture, orientation and navigation, reproduction, *etc.*) are adversely affected.

Little is known about the mechanisms and characteristics of damage to fish that may be inflicted by exposure to seismic survey sounds. Few data have been presented in the peer-reviewed scientific literature. As far as we know, there are only two valid papers with proper experimental methods, controls, and careful pathological investigation implicating sounds produced by actual seismic survey airguns with adverse anatomical effects. One such study indicated anatomical damage and the second indicated TTS in fish hearing. The anatomical case is McCauley *et al.* (2003), who found that exposure to airgun sound caused observable anatomical damage to the auditory maculae of pink snapper (*Pagrus auratus*). This damage in the ears had not been repaired in fish sacrificed and examined almost two months after exposure. On the other hand, Popper *et al.* (2005) documented only TTS (as determined by auditory brainstem response) in two of three fish species from the Mackenzie River Delta. This study found that broad whitefish (*Coregonus nasus*) that received a sound exposure level of 177 dB re 1 $\mu Pa^2 \cdot s$ showed no hearing loss. During both studies, the repetitive exposure to sound was greater than would have occurred during a typical seismic survey. However, the substantial low-frequency energy produced by the airgun arrays [less than approximately 400 Hz in the study by McCauley *et al.* (2003) and less than approximately 200 Hz in Popper *et al.* (2005)] likely did not propagate to the fish because the water in the study areas was very shallow (approximately 9 m in the former case and less than 2 m in the latter). Water depth sets a lower limit on the lowest sound frequency that will propagate (the ''cutoff frequency'') at about one-quarter wavelength (Urick, 1983; Rogers and Cox, 1988).

Wardle *et al.* (2001) suggested that in water, acute injury and death of organisms exposed to seismic energy depends primarily on two features of the sound source: (1) The received peak pressure, and (2) the time required for the pressure to rise and decay. Generally, as received pressure increases, the period for the pressure to rise and decay decreases, and the chance of acute pathological effects increases. According to Buchanan *et al.* (2004), for the types of seismic airguns and arrays involved with the proposed program, the pathological (mortality) zone for fish and invertebrates would be expected to be within a few meters of the seismic source. Numerous other studies provide examples of no fish mortality upon exposure to seismic sources (Falk and Lawrence, 1973; Holliday *et al.,* 1987; La Bella *et al.,* 1996; Santulli *et al.,* 1999; McCauley *et al.,* 2000a,b, 2003; Bjarti, 2002; Hassel *et al.,* 2003; Popper *et al.,* 2005).

Some studies have reported, some equivocally, that mortality of fish, fish eggs, or larvae can occur close to seismic sources (Kostyuchenko, 1973; Dalen and Knutsen, 1986; Booman *et al.,* 1996; Dalen *et al.,* 1996). Some of the reports claimed seismic effects from treatments quite different from actual seismic survey sounds or even reasonable surrogates. Saetre and Ona (1996) applied a 'worst-case scenario' mathematical model to investigate the effects of seismic energy on fish eggs and larvae. They concluded that mortality rates caused by exposure to seismic surveys are so low, as compared to natural mortality rates, that the impact of seismic surveying on recruitment to a fish stock must be regarded as insignificant.

Physiological Effects—Physiological effects refer to cellular and/or biochemical responses of fish to acoustic stress. Such stress potentially could affect fish populations by increasing mortality or reducing reproductive success. Primary and secondary stress responses of fish after exposure to seismic survey sound appear to be temporary in all studies done to date (Sverdrup *et al.,* 1994; McCauley *et al.,* 2000a, 2000b). The periods necessary for the biochemical changes to return to normal are variable, and depend on numerous aspects of the biology of the species and of the sound stimulus (see Appendix C of Rice's application).

Summary of Physical (Pathological and Physiological) Effects—As indicated in the preceding general discussion, there is a relative lack of knowledge about the potential physical (pathological and physiological) effects of seismic energy on marine fish and invertebrates. Available data suggest that there may be physical impacts on egg, larval, juvenile, and adult stages at very close range. Considering typical source levels associated with commercial seismic arrays, close proximity to the source would result in exposure to very high energy levels. Whereas egg and larval stages are not able to escape such exposures, juveniles and adults most likely would avoid it. In the case of eggs and larvae, it is likely that the numbers adversely affected by such exposure would not be that different from those succumbing to natural mortality. Limited data regarding physiological impacts on fish and invertebrates indicate that these impacts are short term and are most apparent after exposure at close range.

The proposed seismic program for 2009 is predicted to have negligible to low physical effects on the various stags of fish and invertebrates for its relatively short duration (approximately 15 days) and unique survey lines extent. Therefore, physical effects of the proposed program on fish and invertebrates would not be significant.

Behavioral Effects—Behavioral effects include changes in the distribution, migration, mating, and catchability of fish populations. Studies investigating the possible effects of sound (including seismic survey sound) on fish behavior have been conducted on both uncaged and caged individuals (Chapman and Hawkins, 1969; Pearson *et al.,* 1992; Santulli *et al.,* 1999; Wardle *et al.,* 2001; Hassel *et al.,* 2003). Typically, in these studies fish exhibited a sharp ''startle'' response at the onset of a sound followed by habituation and a return to normal behavior after the sound ceased.

The existing body of information on the impacts of seismic survey sound on marine invertebrates is very limited. However, there is some unpublished and very limited evidence of the potential for adverse effects on invertebrates, thereby justifying further discussion and analysis of this issue. The three types of potential effects of exposure to seismic surveys on marine invertebrates are pathological, physiological, and behavioral. Based on the physical structure of their sensory organs, marine invertebrates appear to be specialized to respond to particle displacement components of an impinging sound field and not to the pressure component (Popper *et al.,* 2001; see Appendix D of Rice's application).

The only information available on the impacts of seismic surveys on marine invertebrates involves studies of individuals; there have been no studies at the population scale. Thus, available information provides limited insight on possible real-world effects at the regional or ocean scale. The most important aspect of potential impacts concerns how exposure to seismic survey sound ultimately affects invertebrate populations and their viability, including availability to fisheries.

The following sections provide a synopsis of available information on the effects of exposure to seismic survey sound on species of decapod crustaceans and cephalopods, the two taxonomic groups of invertebrates on which most such studies have been conducted. The available information is from studies with variable degrees of scientific soundness and from anecdotal information. A more detailed review of the literature on the effects of seismic survey sound on invertebrates is provided in Appendix D of Rice's application.

Pathological Effects—In water, lethal and sub-lethal injury to organisms exposed to seismic survey sound could depend on at least two features of the sound source: (1) The received peak pressure, and (2) the time required for the pressure to rise and decay. Generally, as received pressure increases, the period for the pressure to rise and decay decreases, and the chance of acute pathological effects increases. For the single GI gun planned for the proposed program, the pathological (mortality) zone for crustaceans and cephalopods is expected to be within a few meters of the seismic source; however, very few specific data are available on levels of seismic signals that might damage these animals. This premise is based on the peak pressure and rise/decay time characteristics of seismic airgun arrays currently in use around the world.

Some studies have suggested that seismic survey sound has a limited pathological impact on early developmental stages of crustaceans (Pearson *et al.,* 1994; Christian *et al.,* 2003; DFO, 2004). However, the impacts appear to be either temporary or insignificant compared to what occurs under natural conditions. Controlled field experiments on adult crustaceans (Christian *et al.,* 2003, 2004; DFO, 2004) and adult cephalopods (McCauley *et al.,* 2000a,b) exposed to seismic survey sound have not resulted in any significant pathological impacts on the animals. It has been suggested that exposure to commercial seismic survey activities has injured giant squid (Guerra *et al.,* 2004), but there is no evidence to support such claims.

Physiological Effects—Physiological effects refer mainly to biochemical responses by marine invertebrates to acoustic stress. Such stress potentially could affect invertebrate populations by increasing mortality or reducing reproductive success. Any primary and secondary stress responses (*i.e.,* changes in haemolymph levels of enzymes, proteins, *etc.*) of crustaceans after exposure to seismic survey sounds appear to be temporary (hours to days) in studies done to date (Payne *et al.,* 2007). The periods necessary for these biochemical changes to return to normal are variable and depend on numerous aspects of the biology of the species and of the sound stimulus.

Behavioral Effects—There is increasing interest in assessing the possible direct and indirect effects of seismic and other sounds on invertebrate behavior, particularly in relation to the consequences for fisheries. Change in behavior could potentially affect such aspects as reproductive success, distribution, susceptibility to predation, and catchability by fisheries. Studies investigating the possible behavioral effect of exposure to seismic survey sound on crustaceans and cephalopods have been conducted on both uncaged and caged animals. In some cases, invertebrates exhibiting startle responses (*e.g.,* squid in McCauley *et al.,* 2000a,b). In other cases, no behavioral impacts were noted (*e.g.,* crustaceans in Christian *et al.,* 2003, 2004; DFO, 2004). There have been anecdotal reports of reduced catch rates of shrimp shortly after exposure to seismic surveys; however, other studies have not observed any significant changes in shrimp and catch rate (Andriguietto-Filho *et al.,* 2005). Any adverse effects on crustacean and cephalopod behavior or fisheries attributable to seismic survey sound depend on the species in question and the nature of the fishery (season, duration, fishing method).

Because of the reasons noted above and the nature of the proposed activities, the proposed operations are not expected to cause significant impacts on habitats that could cause significant or long-term consequences for individual marine mammals or their populations or stocks. Similarly, any effects to food sources are expected to be negligible.

Subsistence Activities

There is no subsistence hunting for marine mammals in the waters off of the coast of New England that implicates MMPA Section 101(a)(5)(D).

Proposed Mitigation and Monitoring

Mitigation and monitoring measures proposed to be implemented for the proposed seismic survey have been developed and refined during previous NSF-funded seismic studies and associated environmental assessments (EAs), IHA applications, and IHAs. The mitigation and monitoring measures described herein represent a combination of procedures required by past IHAs for other similar projects and on recommended best practices in Richardson *et al.* (1995), Pierson *et al.* (1998), and Weir and Dolman (2007). The measures are described in detail below.

Mitigation measures proposed for the survey include:

(1) Speed or course alteration, provided that doing so will not compromise operational safety requirements;

(2) GI airgun shut-down procedures;

(3) GI airgun power-downs procedures (including turns);

(4) GI airgun ramp-up procedures;

(5) Procedures for species of particular concern, *e.g.,* emergency shut-down procedures if a North Atlantic right whale is sighted at any distance, and concentrations of humpback, fin, sperm, blue, and/or sei whales will be avoided.

The thresholds for estimating take are also used in connection with proposed mitigation. The radii in Table 2 (above) will be used as shut-down criteria for the other sound sources (single GI airgun, watergun, and boomer), all of which have lower source levels than the two GI airguns.

Vessel-Based Visual Monitoring

Marine Mammal Visual Observers (MMVOs) will be based aboard the seismic source vessel and will watch for marine mammals near the vessel during daytime GI airgun operations and during start-ups of airguns at night. MMVOs will also watch for marine mammals near the seismic vessel for at least 30 minutes prior to the start of airgun operations and after an extended shut-down of the airguns. When feasible MMVOs will also make observations during daytime periods when the seismic system is not operating for comparison of sighting rates and animal behavior with vs. without GI airgun operations. Based on MMVO observations, the GI airgun will be shut-down (see below) when marine mammals are detected within or about to enter a designated EZ. The EZ is an area in which a possibility exists of adverse effects on animal hearing or other physical effects (see Table 1 above for the isopleths as they correspond to the relevant EZs). The MMVOs will continue to maintain watch to determine when the animal(s) are outside the safety radius, and airgun operations will not resume until the animal has left that zone. The predicted distances for the safety radius are listed according to the sound source, water depth, and received isopleths in Table 1.

MMVOs will be appointed by the academic institution conducting the research cruise, with NMFS Office of Protected Resources concurrence. During seismic operations off the coast of New England, a total of three MMVOs are planned to be aboard the *Endeavor.* At least one MMVO will monitor the EZ during daytime GI airgun operations and any nighttime startups of the airguns. MMVOs will normally work in daytime shifts of 4 hour duration or less. The vessel crew will also be instructed to assist in detecting marine mammals and implementing mitigation measures (if practical). Before the start of the seismic survey the crew will be given additional instruction regarding how to do so.

The *Endeavor* is a suitable platform from which MMVOs will conduct marine mammal observations. Two locations are likely as observation stations onboard the *Endeavor*; observations may take place from the flying bridge approximately 11 m (36 ft) above sea level or the bridge (8.2 m or 27 ft).

During the daytime, the MMVO(s) will scan the area around the vessel systematically with standard equipment such as reticle binoculars (*e.g.,* 7x50), optical range finders, and with the naked eye. During darkness, night vision devices (NVDs) will be available, when required. Vessel lights and/or NVDs are useful in sightings some marine mammals at the surface within a short distance from the ship (within the EZ for the two GI airguns). The MMVOs will be in wireless communication with ship's officers on the bridge and scientists in the vessel's operations laboratory, so they can advise promptly of the need for avoidance maneuvers or GI airgun shut-down.

Speed or Course Alteration—If a marine mammal is detected outside the EZ, but is likely to enter based on its position and the relative movement of the vessel and animal, then if safety and scientific objectives allow, the vessel speed and/or course may be adjusted to minimize the likelihood of the animal entering the EZ. Typically, during seismic operations, major course and speed adjustments are often impractical when towing long seismic streamers and large source arrays, but are possible in this case because only two GI airguns and a relatively short streamer will be used.

Shut-down Procedures—The operating airgun(s) will be shut-down if a marine mammal is detected within or approaching the EZ for the GI airgun source. Following a shut-down, GI airgun activity will not resume until the marine mammal is outside the EZ for the two GI airguns. The animal will be considered to have cleared the EZ if it:

- Is visually observed to have left the EZ;
- Has not been seen within the EZ for 10 min in the case of species with shorter dive durations—small odontocetes and pinnipeds; and
- Has not been seen within the EZ for 15 min in the case of species with longer dive durations—mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales;

The 10 and 15 min periods specified above are shorter than would be used in a large-source project given the small 180 and 190 dB (rms) radii for the two GI airguns.

Power-down Procedures—A power-down involves decreasing the number of GI airguns in use from two to one. During turns between successive survey lines, a single GI airgun will be operated. The continued operation of one airgun is intended to alert marine mammals to the presence of the survey vessel in the area.

Ramp-up Procedures—A ramp-up procedure will be followed when the GI airguns begin operating after a specified period without GI airgun operations. It is proposed that, for the present cruise, this period would be approximately five minutes. This period is based on the 180 dB radii for the GI airguns (see Table 1 above) in relation to the planned speed of the *Endeavor* while shooting.

Ramp-up will begin with a single GI airgun (45 in^3). The second GI airgun (45 in^3) will be added after five min. During ramp-up, the MMVOs will monitor the EZ, and if marine mammals are sighted, a shut-down will be implemented as though both GI airguns were operational.

If the complete EZ has not been visible for at least 30 min prior to the start of operations in either daylight or nighttime, ramp-up will not commence. If one GI airgun has been operating, ramp-up to full power will be permissible at night or in poor visibility, on the assumption that marine mammals will be alerted to the approaching seismic vessel by the sounds from the single GI airgun and have an opportunity to move away if they choose. A ramp-up from a shut-down may occur at night, but only in intermediate-water depths, where the safety radius is small enough to be visible. Ramp-up of the GI airguns will not be initiated if a marine mammal is sighted within or near the applicable EZs during the day or close to the vessel at night.

Procedures for Species of Particular Concern—Several species of concern could occur in the study area. Special mitigation procedures will be used for these species as follows:

(1) The GI airguns will be shut-down if a North Atlantic right whale is sighted at any distance from the vessel;

(2) Concentrations or groups of humpback, fin, sperm, blue, and/or sei whales will be avoided.

A typical ''concentration or group'' of whales for this survey consists of three or more individuals visually sighted. If a concentration or group of the whale species listed above is sighted and does not appear to be traveling (*i.e.* feeding, socializing), then Rice will avoid them by implementing a power-down or shut-down, delay seismic operations, or move to another area for seismic data acquisition. If the concentration or group of whales appears to be traveling, then Rice will power-down or shut-down seismic operations and wait for approximately 30 min for the individuals to move out of the study area before re-initiating seismic operations. Rice and NSF will coordinate their planned marine mammal monitoring program associated with the seismic survey off the coast of New England with applicable U.S. agencies (*e.g.,* NMFS), and will comply with their requirements.

Proposed Reporting

MMVO Data and Documentation

MMVOs will record data to estimate the numbers of marine mammals exposed to various received sound levels and to document apparent disturbance reactions or lack thereof. Data will be used to estimate numbers of animals potentially ''taken'' by harassment. They will also provide information needed to order a shut-down of the seismic source when a marine mammal is within or near the EZ.

When a sighting is made, the following information about the sighting will be recorded:

(1) Species, group size, and age/size/sex categories (if determinable); behavior when first sighted and after initial sighting; heading (if consistent), bearing, and distance from seismic vessel; sighting cue; apparent reaction to the seismic source or vessel (*e.g.,* none, avoidance, approach, paralleling, *etc.*); and behavioral pace.

(2) Time, location, heading, speed, activity of the vessel, sea state, visibility, and sun glare.

The data listed (time, location, *etc.*) will also be recorded at the start and end of each observation watch, and during a watch whenever there is a change in one or more of the variables.

All observations, as well as information regarding seismic source shut-down, will be recorded in a standardized format. Data accuracy will be verified by the MMVOs at sea, and preliminary reports will be prepared during the survey and summaries forwarded to the Rice's shore facility and to NSF weekly or more frequently. MMVO observations will provide the following information:

(1) The basis for decisions about shutting-down airgun arrays.

(2) Information needed to estimate the number of marine mammals potentially ''taken by harassment.''

(3) Data on the occurrence, distribution, and activities of marine mammals in the area where the seismic study is conducted.

(4) Data on the behavior and movement patterns of marine mammals seen at times with and without seismic activity.

A report will be submitted to NMFS within 90 days after the end of the cruise. The report will describe the operations that were conducted and sightings of marine mammals near the operations. The report will be submitted to NMFS, providing full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report will summarize the dates and locations of seismic operations, and all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities). The report will also include estimates of the amount and nature of potential ''take'' of marine mammals by harassment or in other ways.

All injured or dead marine mammals (regardless of cause) will be reported to NMFS as soon as practicable. The report should include species or description of animal, condition of animal, location, time first found, observed behaviors (if alive) and photo or video, if available.

Endangered Species Act (ESA)

Under Section 7 of the ESA, NSF has begun consultation with the NMFS, Office of Protected Resources, Endangered Species Division on this proposed seismic survey. NMFS will also consult on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity. Consultation will be concluded prior to a determination on the issuance of the IHA.

National Environmental Policy Act (NEPA)

NSF has prepared a draft EA titled ''Marine Seismic Survey in the Northwest Atlantic Ocean, August 2009.'' NSF's draft EA incorporates an ''Environmental Assessment (EA) of a Marine Geophysical Survey by the R/V *Endeavor* in the Northwest Atlantic Ocean, August 2009,'' prepared on behalf of NSF and Rice by LGL Limited, Environmental Research Associates. NMFS will either adopt NSF's EA or conduct a separate NEPA analysis, as necessary, prior to making a determination on the issuance of the IHA.

Preliminary Determinations

NMFS has preliminarily determined that the impact of conducting the low-energy marine seismic survey in the Northwest Atlantic Ocean may result, at worst, in a temporary modification in behavior (Level B harassment) of small numbers of marine mammals. Further, this activity is expected to result in a negligible impact on the affected species or stocks. The provision requiring that the activity not have an unmitigable impact on the availability of the affected species or stock for subsistence uses is not implicated for this proposed action.

For reasons stated previously in this document, this determination is supported by:

(1) The likelihood that, given sufficient notice through relatively slow ship speed, marine mammals are expected to move away from a noise source that is annoying prior to its becoming potentially injurious;

(2) The fact that cetaceans would have to be closer than 40 m (131 ft) in deep water, 60 m (197 ft) in intermediate depths, and 296 m (971 ft) in shallow water when the two GI airguns are in use from the vessel to be exposed to levels of sound (180 dB) believed to have even a minimal chance of causing PTS;

(3) The fact that pinnipeds would have to closer than 10 m (33 ft) in deep water, 15 m (49 ft) in intermediate depths, and 147 m (482 ft) in shallow water when the two GI airguns are in use from the vessel to be exposed to levels of sound (190 dB) believed to have even a minimal chance of causing PTS;

(4) The fact that cetaceans would have to be closer than 23 m (76 ft) in deep

water, 35 m (115 ft) in intermediate depths, and 150 m (492 ft) in shallow water when the single GI airgun is in use from the vessel to be exposed to levels (180 dB) believed to have even a minimal chance of causing PTS;

(5) The fact that pinnipeds would have closer than 8 m (26 ft) in deep water, 12 m (39 ft) in intermediate depths, and 95 m (312 ft) in shallow water when the single GI airgun is in use from the vessel to be exposed to levels (190 dB) believed to have even a minimal chance of causing PTS.

(6) The fact that marine mammals would have to be closer than 350 m (1,148 ft) in deep water, 525 m (1,722 ft) at intermediate depths, and 1,029 m (3,376 ft) in shallow water when the two GI airguns are in use from the vessel to be exposed to levels of sound (160 dB) believed to have even a minimal chance at causing TTS;

(7) The fact that marine mammals would have to be closer than 220 m (721 ft) in deep water, 330 m (1,083 ft) at intermediate depths, and 570 m (1,870 ft) in shallow water when the single GI airgun is in use from the vessel to be exposed to levels of sound (160 dB) believed to have even a minimal chance at causing TTS; and

(8) The likelihood that marine mammal detection ability by trained observers is high at those short distances from the vessel and will trigger shut-downs to prevent injury, and due to the implementation of the other mitigation measures such as ramp-ups. As a result, no take by injury or death is anticipated, and the potential for temporary or permanent hearing impairment is very low and will be avoided through the incorporation of the proposed mitigation measures.

While the number of marine mammals potentially incidentally harassed will depend on the distribution and abundance of marine mammals in the vicinity of the survey activity, the number of potential harassment takings is estimated to be small, less than a few percent of any of the estimated population sizes, and has been mitigated to the lowest level practicable through incorporation of the measures mentioned previously in this document.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to Rice for conducting a low-energy marine seismic survey in the Northwest Atlantic Ocean in August, 2009, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: June 12, 2009.

James H. Lecky,

Director, Office of Protected Resources, National Marine Fisheries Service.

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DEPARTMENT OF COMMERCE

Bureau of Industry and Security

Action Affecting Export Privileges; TAK Components, Inc.

In the Matter of:

TAK Components, Inc., 2140 Fulham Dr., Apt. 18, Naperville, IL 60564, Respondent.

Mr. Saied Shahsavarani, President, 2140 Fulham Dr., Apt. 18, Naperville, IL 60564, Related Person.

Order Denying Export Privileges

A. Denial of Export Privileges of TAK Components, Inc.

On October 11, 2007, in the U.S. District Court for the Northern District of Illinois, TAK Components, Inc. (''TAK'') pled guilty to and was convicted of 16 counts of violating the International Emergency Economic Powers Act (50 U.S.C. 1701–1706 (2000)) (''IEEPA''). Specifically, TAK pled guilty to willfully exporting and transferring, and causing to be exported and transferred, from the United States to Iran, via the United Arab Emirates, replacement and service parts and equipment for agricultural machinery, without first having obtained the required authorization from the Department of Treasury's Office of Foreign Assets Control. TAK was sentenced to one year probation per count (to run concurrently), ordered to pay a special assessment of $400.00 per count (for a total special assessment of $6,400.00), and forfeited approximately $181,000 that had been obtained from the transactions.

Section 766.25 of the Export Administration Regulations (''EAR'' or ''Regulations'')[1] provides, in pertinent part, that ''[t]he Director of the Office of Exporter Services, in consultation with the Director of the Office of Export Enforcement, may deny the export privileges of any person who has been convicted of a violation of the [Export Administration Act (''EAA'')], the EAR, or any order, license or authorization issued thereunder; any regulation, license, or order issued under the International Emergency Economic Powers Act (50 U.S.C. 1701–1706); 18 U.S.C. 793, 794 or 798; section 4(b) of the Internal Security Act of 1950 (50 U.S.C. 783(b)), or section 38 of the Arms Export Control Act (22 U.S.C. 2778).'' 15 CFR 766.25(a); *see also* Section 11(h) of the EAA, 50 U.S.C. app. 2410(h). The denial of export privileges under this provision may be for a period of up to 10 years from the date of the conviction. 15 CFR 766.25(d); see also 50 U.S.C. app. 2410(h). In addition, Section 750.8 of the Regulations states that the Bureau of Industry and Security's Office of Exporter Services may revoke any Bureau of Industry and Security (''BIS'') licenses previously issued in which the person had an interest in at the time of his conviction.

I have received notice of TAK's conviction for violating the IEEPA, and have provided notice and an opportunity for TAK to make a written submission to BIS, as provided in Section 766.25 of the Regulations. I have not received a submission from TAK. Based upon my review and consultations with BIS's Office of Export Enforcement, including its Director, and the facts available to BIS, I have decided to deny TAK's export privileges under the Regulations for a period of five years from the date of TAK's conviction. I have also decided to revoke all licenses issued pursuant to the Act or Regulations in which TAK had an interest at the time of its conviction.

B. Denial of Export Privileges of Related Person

Pursuant to Sections 766.25(h) and 766.23 of the Regulations, the Director of BIS's Office of Exporter Services, in consultation with the Director of BIS's Office of Export Enforcement, may take action to name persons related to a Respondent by ownership, control, position of responsibility, affiliation, or other connection in the conduct of trade or business in order to prevent evasion of a denial order. Saied Shahsavarani (''Shahsavarani'') was the corporate president and registered agent of TAK responsible for all aspects of TAK's day-to-day operations. Shahsavarani pled guilty to Count 17 of the information, 18.U.S.C. 1960(a), for knowingly aiding and abetting the operation of an unlicensed money transmitting business. Shahsavarani is related to TAK by ownership, control, position of responsibility, affiliation, or other

[1] The Regulations are currently codified in the Code of Federal Regulations at 15 CFR Parts 730–774 (2009). The Regulations issued pursuant to the EAA, which is currently codified at 50 U.S.C. app. 2401–2420 (2000). Since August 21, 2001, the EAA has been in lapse and the President, through Executive Order 13222 of August 17, 2001 (3 CFR, 2001 Comp. 783 (2002)), which has been extended by successive Presidential Notices, the most recent being that of July 23, 2008 (73 FR 43603, July 25, 2008), has continued the Regulations in effect under the International Emergency Economic Powers Act (50 U.S.C. 1701–1706 (2000)).