Determination of NEPA Adequacy

U.S. Geological Survey

Proposed Action Title/Type:

Propagation Characteristics of High-Resolution Geophysical Surveys: Open-Water Testing

Type of activity:

The USGS, in collaboration with BOEM and CSA (a firm contracted by BOEM), would conduct sound source characterization operations of low-energy/high-resolution acoustic sources from 27 June to 17 July, 2016, on the *R/V Hugh Sharp*, a 146-ft, acoustically-quiet research vessel owned by the University of Delaware and contracted for this activity by the USGS (Proposed Action). The *R/V Sharp* is considered part of the U.S. Academic Research Fleet and scheduled through the University-National Ocean Laboratory System (UNOLS), of which the USGS is a member. The goal of this interagency activity is to record the acoustic characteristics of a suite of low-energy sound sources/sound source configurations that are typically used by the USGS, other federal agencies, and affiliated researchers to image the seafloor, sediments below the seafloor, and gas emissions in the water column. Up to seventeen sound sources/configurations would be tested at five offshore sites in the Atlantic Ocean: muddy and sandy seafloor at 10 m water depth; muddy and sandy seafloor at 30 m; and sandy site on the outer shelf at 100 m. The tests would capture how the acoustic waves of the various sound sources react with the seafloor at different water depths (i.e., wave/seafloor interaction) and different bottom types (i.e., absorption and reflectivity of the seafloor).

During the cruise, the USGS would operate "active" sound sources (towed, pole mounted, or on the ship's hull) that transmit acoustic energy into the water. CSA would deploy "passive" acoustics (broadband hydrophones) to record data about the decibel level, propagation patterns, and related sound characteristics in the water column. Although the USGS typically deploys these types of sound sources continuously for days or longer along adjacent survey lines, the sources on this cruise would be operated for only a few hours at a time as the ship passes through the CSA hydrophone arrays. Thus, the use of each acoustic source for the planned activity would be intermittent/non-continuous and of short duration.

With the exception of a 30 in^3 GI-gun (airgun), all other acoustic sources (e.g., chirps, boomers, sparkers, single/split-beam/multibeam sonars) that would be used by the USGS during this activity (Table 1) are routinely operated under the guidelines in the current USGS NEPA Handbook under the application of the DOI Categorical Exclusion outlined in CFR 46.210(e). The 30 in^3 GI guns are low-energy airguns that would be operated only at the 100-m deepwater site (Site 5). The use of this source is covered by language in the Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey (henceforth "NSF-USGS PEIS";), completed in 2011, and the associated USGS Record of Decision (ROD), signed by Associate Director Dr. David Applegate in February 2013.

Based on analysis in existing NEPA documents, including the NSF-USGS PEIS, and with the proposed monitoring and mitigation measures, the USGS expects no Level A or Level B takes of marine mammals in the completion of the Proposed Action. In light of the distribution of known endangered or protected species and the small acoustic source sizes, the USGS also expects no disturbance of endangered or protected species. Owing to the short duration of the surveys, the USGS anticipates nocumulative impacts as a consequence of the Proposed Action. As no adverse effects are anticipated on marine species, including endangered or protected species, no further action is required under the Marine Mammal Protection Act or Endangered Species Act.

In addition, no impacts to coastal zone uses or resources would be anticipated from the Proposed Action. The USGS reviewed the relevant States' Federal Consistency listings and determined that the Proposed Action was unlisted; therefore, no further action is required by the USGS per the Coastal Zone Management Act (CZMA).

Location of Proposed Action:
All sites would be in the Atlantic Ocean, offshore Virginia and Maryland, from the inner continental shelf (sites 1 and 2) to the outermost shelf (Site 5). The five sites have been specifically chosen with various seafloor characteristics and water depths to optimize equipment testing and achieve the project objectives. The sites would be within the U.S. Exclusive Economic Zone (EEZ) and beyond the 3-nautical-mile (nm) nominal state water boundary (Submerged Lands Act), except for a site offshore the federally-maintained Wallops Island. The Wallops site (Location 1 in Figure 1) straddles the 3-nm state water limit for Virginia (light gray line in Figure 1) and is the only site with the required seafloor and depth characteristics based on exhaustive data compiled by the USGS over decades of research.

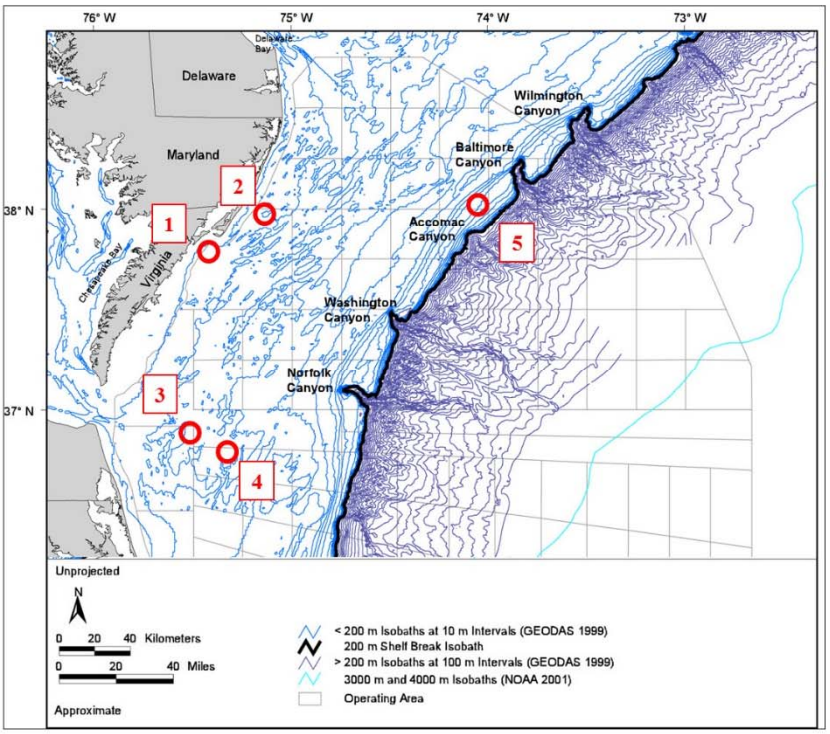

Figure 1. Map of the five sites chosen for this project based on seafloor characteristics and water depth.

A. Description of the Proposed Action and any applicable mitigation measures.

At the four shallow-water (10 m and 30 m; sandy and muddy seafloor; Sites 1-4) locations, CSA would first deploy its passive-acoustic hydrophone systems. Then the USGS would sequentially deploy up to 17 low-energy acoustic sources/configurations (two at a time and triggering alternately) so that the signals could be recorded by the hydrophone array as the ship passes by. The proposed low-energy non-airgun acoustic sources/configurations are numbered 1-11 and 14-17 in the table below, with red boxes corresponding to sources that would not be tested.

		Depth (m)			
Rank	HRG Source	10	30	100	Frequency kHz
1	Edgetech 512i	Yes	Yes	Yes	0.5–12
2	Reson 7111	No	Yes	Yes	100
3	AA S-Boom 252	Yes	Yes	Yes	0.1–25
4	Edgetech 4200 ss	Yes	Yes	No	100
5	SIG 2 Mini-sparker	Yes	Yes	Yes	0.8–1.4
6	Knudsen 3260	Yes	Yes	Yes	3.5
7	Simrad EK60 38 kHz	No	Yes	Yes	38
8	Swath Plus-M	Yes	Yes	No	234
9	Edgetech 424 w 3100p Topside	Yes	Yes	No	4–24
10	Edgetech 424 w 3200XS Topside	Yes	Yes	No	4-24
11	Reson 7125 (Sharp)	Yes	Yes	Yes	200
12	GI Gun (30/30) One Gun (aka, Mini GI Gun)	No	No	Yes	2–1,000 Hz
13	GI Gun (30/30) Two Guns	No	No	Yes	2–1,000 Hz
14	AA Delta Sparker	No	Yes	Yes	0.3–5
15	Bubble Gun	Yes	Yes	Yes	0.020–1.7
16	Klein 3000 Side-scan	Yes	Yes	No	132
17	AA251 Boomer Plate	Yes	Yes	Yes	0.3–2.5

Table 1. Acoustic sources to be tested during this USGS-BOEM project.

At the deeper water site (100 m), CSA would deploy a specialized hydrophone system appropriate for these deeper water depths. The USGS would test a range of low-energy sources (green blocks in the table), including up to two 30 in^3 GI guns in various configurations. The GI gun configurations are listed as sources 12 and 13 in the table. All sources except the GI guns are covered by the USGS NEPA Handbook procedures for implementation of CFR 46.210(e) for marine acoustics cruises. The low-energy GI-gun operations would fall under the "Operations for Which Incidental Take of Marine Mammals is Not Anticipated or Authorized" described in the NSF-USGS PEIS.

Monitoring and mitigation for the non-GI gun sources

Mitigation measures for the non-GI sources would be as outlined in the USGS NEPA Handbook. The mitigation section of that document is reproduced in Table 2 to describe the procedures that would be followed for the proposed activity.

Sound Source	Operational Water Depth	Monitoring, Mitigation, and Compliance Measures
1. TOWED CHIRP OR BUBBLE PULSE Source level must be < 205 dB re 1 μPa-m	ANY	• Record species observations • 100m exclusion zone or smaller zone if justifying data are available • Restricted startup • Shutdowns • Restrictions for sensitive areas • Categorical Exclusion Checklist required unless using ONLY sources in Sound Source Groups #1 and/or #4
2. SPARKER OR BOOMER		
Operated at ≤700 J	ANY	
Operated at ≤ 1 kJ	>100 m	
Operated at ≤ 6 kJ	>500 m	
3. ANY OTHER NON-AIRGUN/WATER GUN/GI SOURCE OPERATED AT < 180 kHz 160 dB re 1 μPa (RMS) isopleth must be at < 200 m from source	ANY	• Record species observations • 200m exclusion zone or smaller zone if justifying data are available • Restricted startup • Shutdowns • Restrictions for sensitive areas • Categorical Exclusion Checklist required
4. ACOUSTIC IMAGING SYSTEMS OPERATED AT > 180 kHz^	ANY	NONE No Categorical Exclusion Checklist required if using ONLY sources in Groups #4 and/or #1

Table 2. Excerpted from the USGS NEPA Handbook regarding use of non-airgun low-energy seismic sources for marine activities.

Monitoring and Mitigation for the GI gun sources

Monitoring and mitigation measures for the GI gun sources would include those established by the NSF-USGS PEIS, described on page 2-68 and 2-69, and the associated USGS ROD. The NSF-USGS PEIS refers to a 180 dB mitigation zone of 100 m from the source, and mitigation must be applied out to the 160 dB (RMS) isopleth to ensure compliance with no-take criteria for this activity.

Justification for proposed GI-Gun source to be considered low-energy

For a source to be considered low-energy according to the criteria Section 2.4.2 of the NSF-USGS PEIS (see Section B below, which contains excerpts), received sound (in RMS) must be 180 dB at a maximum of 100 m from the source. Based on recent nearfield tests by the USGS, Navy, and BOEM (Crocker and Fratantonio, 2016) on two 30 in^3 GI-guns that are identical to

those that would be used during the summer 2016 operations at sea yielded a maximum received sound level (SEL) of 206 dB re 1 µPA @ 1 m. The 180 dB (RMS) is estimated to be at 65 m from the source using spherical spreading and the inverse square law and assuming a deep-water setting. We compare this value to the 73 m distance to the 170 dB SEL, which corresponds to the 180 dB RMS, for a single 40 in^3 Bolt airgun as described in the seismic modeling Appendix A of the Amended Environmental Assessment (EA) for the 2014/2015 New Jersey Shelf seismic project sponsored by NSF (https://www.nsf.gov/geo/oce/envcomp/nj-seismic-research/summer2015/amended-mountain-nj-margin-ea-final-revised.pdf; referred to below as the "New Jersey shelf NSF EA").

Proposed Airgun sources	**Deep water radii** (from L-DEO model results)		**Scaling factor** *[Deep-water radii for 18-gun 3300-in^3 array @ 6 m depth]*	**Shallow water radii (m)** *[Scaling factor x shallow water radii for 18-gun 3300 in^3 array @ 6 m depth]*
Source #1: 4-gun, 700-in^3 @ 4.5-m depth	150 dB SEL:	1544 m	0.3431	5240
	170 dB SEL:	155 m	0.3444	378
	180 dB SEL:	49 m	0.3451	101
Source #2: 4-gun, 700-in^3 @ 6-m depth	150 dB SEL:	1797 m	0.3993	6100
	170 dB SEL:	180 m	0.4000	439
	180 dB SEL:	57 m	0.4014	118
Source #3: Single 40-in^3 @ 6-m depth	150 dB SEL:	293 m	0.0651	995
	170 dB SEL:	30 m	0.0667	73
	180 dB SEL:	10 m	0.0704	21

Table 3. Numerical modeling results in dB SEL (add 10 dB for RMS) for deep and shallow water for various source configurations used in a 2014/2015 NSF activity on the New Jersey margin, from Appendix A of the Environmental Assessment. Note the last entries for a single 40 in^3 airgun, which produces 180 dB RMS (170 SEL) at 73 m and 150 dB SEL (160 RMS) at 995 m.

It is important to note that the modeling for the New Jersey shelf NSF EA did not rely on measured nearfield source characteristics, instead using the farfield received data on the seismic streamer to infer the source characteristics. We consider our determination of 65 m to the 180 dB (RMS) value for the (maximum of) two 30 in^3 GI guns that would be used for the proposed activity to be more accurate since we have actual nearfield measurements. Accounting for the shallow water effect (water depths of 100 m), we estimate that the 180 dB (RMS) value would never be exceeded within the 100 m mitigation zone that determines whether the activity is considered "low-energy" and can be operated according to Alternative B under the NSF-USGS PEIS.

Recent numerical modeling (Appendix A; personal communication, March 2016) provided to us by Dr. Anne Bécel, who is responsible for the modeling to support Environmental Assessments prepared by the US National Science Foundation for seismic programs on the R/V Langseth has relied on scaling of empirical results obtained by Lamont-Doherty Earth Observatory for a large seismic array deployed in the Gulf of Mexico to estimate the 180 dB (RMS) zone for the configuration of airguns proposed by the USGS. The scaled result predicts that the 180 dB is 62 m for the 2-GI gun configuration and ~28 m for the single GI-gun at water depths less than 100 m and ~42 m and ~23 m, respectively, for water depths greater than 100 m.

160 dB (RMS) full mitigation zone for GI-gun portion of the proposed no-take activity
If the GI-gun portion of the proposed activity would be carried out under the no-take precepts of the NSF-USGS PEIS, then the full 160 dB (RMS) mitigation zone must be continuously monitored for the appearance of marine mammals. In deep-water settings, the 160 dB RMS isopleth is calculated to occur at 1100 m from a source measured at 206 dB re 1 µPA @ 1 m (SEL) assuming spherical spreading and application of the inverse square law. In settings of about 100 m water depth, the modeling results from the New Jersey shelf NSF EA (Appendix A) are shown in Table 4. We infer that two 30 in^3 GI-guns, the maximum to be used in the proposed activity, would have 160 dB (RMS) at a distance of 1900 m from the source.

Source and Volume	Water Depth	Predicted RMS Radii (m)	
		180 dB	160 dB
4-airgun subarray (700 in^3) @ 4.5 m	<100 m	378	5240
4-airgun subarray (700 in^3) @ 6 m	<100 m	439	6100
Single Bolt airgun (40 in^3) @ 6 m	<100 m	73	995

Table 4. Numerical modeling results from the New Jersey shelf NSF EA. Note that a single 40 in^3 airgun yields 995 m to the 160 dB isopleth (RMS).

Recent numerical modeling (Appendix A; personal communication, March 2016) provided to us by Dr. Anne Bécel predicts that the 160 dB is at 660 m for the 2-GI gun configuration and 348 m for the single GI-gun at water depths less than 100 m and at ~410 m and 215 m, respectively, for water depths greater than 100 m.

As a rule of thumb, trained observers can see ~5 km from the ship at sea in clear, daylight conditions. With standard binoculars used by trained observers, they are able to make mammal identifications at distances of 2-3 km from the vessel and can spot animals that are even farther away. Thus, even if the full mitigation zone is as large as 1900-m for the 160 dB (RMS) for the largest source configuration (two 30 in^3 GI-guns) and 995-m-radius for a single 30 in^3 GI-gun are easily within observable range, and the activity would qualify for completion under the no-take precepts of the NSF-USGS PEIS.

Mitigation Measures for the GI-gun portion of the Proposed Activity

- GI-guns would be operated only for short periods of time and during daylight hours.
- The GI-guns will be ramped up to allow ample time for marine mammals to move out of the area before the operation commences at the full gun volumes.
- A member of the USGS operations staff who has completed NOAA-approved PSVO training would be on duty at all times and supplied with appropriate equipment (e.g., binoculars) during the GI-gun operation. The ship's crew on the bridge would also be asked to contribute information about animal sightings.
- A full mitigation zone monitoring the 160 dB zone (maximum estimated at 1900 m for simultaneous use of two 30 in^3 GI-guns and 995 for one 30 in^3 GI-gun) around the source

would be observed at all times, and this zone must be visible throughout any time that the source is in use (e.g., no GI-gun operation in heavy fog, at dusk).

- Power downs/shutdowns would be implemented if a marine mammal, including delphinid species, is observed entering or within the exclusion zone.

B. Identify applicable National Environmental Policy Act (NEPA) documents and other related documents that cover the proposed action.

List by name and date all applicable NEPA documents that cover the proposed action.

1. *Final Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey (referred to here as the "NSF-USGS PEIS"), June 2011*

   The document is available online: *http://woodshole.er.usgs.gov/project-pages/environmental_compliance/reports/nsf-usgs-final-eis-oeis-with-appendices.pdf*

According to section 2.4.2 of the NSF-USGS PEIS, the GI-guns to be used for the proposed activity qualify as "low-energy", as do all other sources to be tested. The following material is directly excerpted from Section 2.4.2 of the NSF-USGS PEIS.

"Alternative B: Conduct Marine Seismic Research using Cruise-specific Mitigation Measures with Generic Mitigation Measures for Low-energy Acoustic Sources (Preferred Alternative)

Alternatives A and B differ in how the proposed safety radii or MZs are determined. For operations with no request for MMPA incidental take authorization, the MZs are the same in Alternative A and Alternative B. Where take is expected and authorization is requested, Alternative A would require a specific calculation of MZs and FMZs for every proposed cruise, whereas Alternative B introduces a generic set of MZ conditions that would be applied to low-energy seismic operations (as defined below in Section 2.4.2.1) proposed in water depths greater than 328 ft (100 m).

As seen in Table 2-12, the use of small numbers of GI guns and other acoustic sources for low-energy seismic survey work in waters >328 ft (100 m) in depth, most often conducted on UNOLS and USGS vessels or in support of ocean-drilling operations, have modeled MZs of <328 ft (100 m). Therefore, in Alternative B, NSF and USGS would conservatively apply the use of a 328-ft (100-m) MZ for all low-energy acoustic sources (as defined below in Section 2.4.2.1) in water depths >328 ft (100 m).

Table 2-12. Summary of Modeled Level A Mitigation Radii for Low-Energy Sources used in Previous Seismic Survey Cruises or Proposed in this EIS/OEIS

DAA or Previous Cruise	*Source*	*Tow Depth (m)*	*Est. Max. Mitigation Radii (m) at RL of 180 dB** Depth (m) *100-1,000*	*>1,000*
DAA in this EIS/OEIS				
NW Atlantic DAA[(1)]	1 pair 105-in^3 GI guns	2.5	57	36
S California DAA[(1)]	1 pair 105-in^3 GI guns	2.5	64	

Low-Energy Acoustic Sources for Seismic Research

For the purposes of this EIS/OEIS, a low-energy source is defined as a towed acoustic source whose received level is ≤180 dB at 328 ft (100 m) (Table 2-13). Based on this definition and previous modeling results of various acoustic sources previously assumed to be low-energy sources (note: defined in the NSF-USGS PEIS), the following categories of acoustic sources are defined as low-energy seismic sources:

- GI Guns:
  - Any single or any two GI guns.
  - Three or four GI guns, within the allowable range of tow depths and element separations listed in Table 2-13 and explained in detail in Appendix F.
- Generic single-chamber airguns:
  - A tuned array of four airguns (volumes between 25 and 160 in^3 each) within the allowable range of tow depths and element separations listed in Table 2-13 and explained in detail in Appendix F.
  - A single pair of clustered airguns with individual volumes of 250 in^3 or less.
  - Two small 2-clusters (four airguns) with maximum volumes of 45 in^3.
  - Any single airgun 425 in^3 or smaller, at any tow depth.
- Any sparker, boomer, water gun, or chirp system towed from the research vessel at any depth and with a source level <205 dB re 1μPa-m.

Table 2-13. Defined Low-Energy Towed Sources under Alternative B

Acoustic Source	*Volume*	*Tow Depth*	*Source Spacing*
GI GUNS			
1-2 GI Guns	Any	Any	Any
3-4 GI Guns	See Appendix F	See Appendix F	See Appendix F
GENERIC SINGLE CHAMBER AIRGUNS			
Tuned array of 4	25-160 in^3 each	See Appendix F	See Appendix F
1 clustered pair	≤250 in^3 each	Any	Any
2 small clustered pairs	≤45 in^3 each	Any	Any
1 single	≤425 in^3	Any	Not applicable
Acoustic Source	*Source Level*	*Tow Depth*	
BOOMER, SPARKER, WATER GUN, AND CHIRP	≤205 dB re 1μPa-m	Any	

Under Alternative B, for any seismic survey cruise that proposes a low-energy source as defined above, there would be a standard MZ of 328 ft (100 m) for all marine mammals and turtles. For acoustic sources not defined as low-energy sources, cruise-specific MZs would need to be modeled to determine the effective MZs for marine mammals and turtles.

According to Section 2.4.3 of the NSF-USGS PEIS, the sources for the proposed activity may be operated with a 100 m mitigation zone (MZ; exclusion zone, corresponding to the 180 dB RMS isopleth) for water depths >100 m for the preferred Alternative B accepted in the USGS Record

of Decision in 2013. The USGS NEPA Handbook outlines generally stricter criteria (Table 2) that will be observed for the deployed acoustic sources, particularly since most of the operations for the proposal activity would be at water depths < 100 m. For the Proposed Activity under Alternative B, the GI-guns will be operated using a cruise-specific criteria of 1900 m for the full 160 dB RMS mitigation zone for simultaneous use of two 30 in^3 and 995 m for the full 160 dB RMS mitigation zone for a single 30 in^3 gun.

The following is excerpted from Section 2.4.3. of the NSF-USGS PEIS.

Comparison of Alternative A and Alternative B

Table 2-14 provides a summary of the MZs proposed under Alternative A and Alternative B.

Table 2-14. Comparison of Alternatives A and B

Stipulation	*Alternative A*	*Alternative B (Preferred Alternative)*
200-m FMZ for expected no-take situations	X	X
100-m MZ for defined low-energy sources		X
Cruise-specific calculations of MZs for all sources defined as low energy	X	
Cruise-specific calculations of FMZs for all sources defined as low or high energy	X	X

According to Section 2.4.1.1 of the NSF-USGS PEIS, the sources for the proposed activity may be operated under the scenario described by "Operations for Which Incidental Take of Marine Mammals is Not Anticipated or Authorized". This section is excerpted here:

<u>Proposed Safety Radii or MZ: Operations for Which Incidental Take of Marine Mammals is not Anticipated or Authorized</u>

Shutdowns or power downs would be required whenever marine mammals or turtles are detected within an FMZ, defined as an extended MZ encompassing the full region in which NMFS estimates behavioral disturbance (≥160 dB re 1 μPa [rms]), also called 'Level B harassment', might occur. The FMZ must be clearly visible and PSVOs available to monitor it throughout any period of seismic source use. These operations would use low-energy seismic sound sources in which 180 dB re 1 μPa (rms) is not exceeded or within close proximity to the source and the extent of 160 dB re 1 μPa (rms) sound levels are within 200 m of the source.

While technically the FMZ may be an overestimation of the area potentially ensonified to 160 dB re 1 μPa (rms), it must be within a range that can be effectively monitored. Proposed use of sources would be on the order of hours or

short-duration shooting over several days (not extensive track-lines). Examples of proposed actions would be the use of 1 to 2 GI-guns for bore-hole testing (e.g., VSP). The small number of airguns in these situations limits application of ramp-ups and power-downs. Immediate shut-down for a marine mammal or turtle approaching the FMZ would be the primary mitigation response.

With mitigation, no takes would be expected. When proposed research cannot avoid an area of particular sensitivity, the action would require additional considerations and potentially an incidental take authorization. In general, surveying with small sources as well as VSP carried out in the vicinity of drill sites (stationary vessel sources) that have habitat sensitivity or other issues that might require a specific incidental take authorization (e.g., IHA or LOA) would be determined in consultation with NMFS OPR.

2. *Record of Decision on the NSF-USGS PEIS, signed by David Applegate (AD Hazards), February 2013*

   Available online: *http://woodshole.er.usgs.gov/project-pages/environmental_compliance/reports/FINAL_USGSROD_textonly_signed27Feb2013.pdf*

Additional informal guidance document: *USGS NEPA Handbook, 2015*

List by name and date other documentation relevant to the proposed action (e.g., biological opinion, historical/cultural resource consultations).

The only available Biological Opinion issued to the USGS for Atlantic activities in the past 5 years commences at water depths greater than those that are the focus of this activity.

The USGS and other agencies have previously worked at Sites 1 through 4, and none has historical or cultural significance.

C. NEPA Adequacy Criteria

1. Is the new proposed action a feature of, or essentially similar to, an alternative analyzed in the existing NEPA document(s)? Is the project within the same analysis area, or if the project location is different, are the geographic and resource conditions sufficiently similar to those analyzed in the existing NEPA document(s)? If there are differences, can it be explained why they are not substantial?

None of the non-GI gun sources require further consideration beyond application of the DOI Categorical Exclusion. The section below focuses only on the GI-gun activity at Site 5.

The proposed action is similar to that modeled for the Northwest (NW) Atlantic Detailed Analysis Area (DAA) analyzed in the NSF-USGS PEIS and would comply with Alternative B

described in the associated USGS ROD. In this NW Atlantic DAA scenario, an area of the New Jersey shelf and upper continental slope assuming two 45/105 in^3 GI-guns as sources and water depths of 0-160 m at location 1 (Figure 3; This is NSF-USGS PEIS Figure 2-23 and A5-10) along continuous shiptracks oriented NW-Southeast was analyzed.

The GI-gun activity proposed here would be entirely on the outer shelf at ~100 m water depth, would be conducted with up to two 30 in^3 GI-guns, and would involve limited operations, no true "survey tracks," and short duration.

The overall characteristics for the NW Atlantic NSF-USGS PEIS Alternative B scenario are most similar to those at the Site 5 for our proposed activity. Overall, however, the proposed activity would use smaller seismic sources and would not conduct operations along long, densely spaced tracklines for a 3-dimensional survey as compared with the NW Atlantic DAA survey scenario.

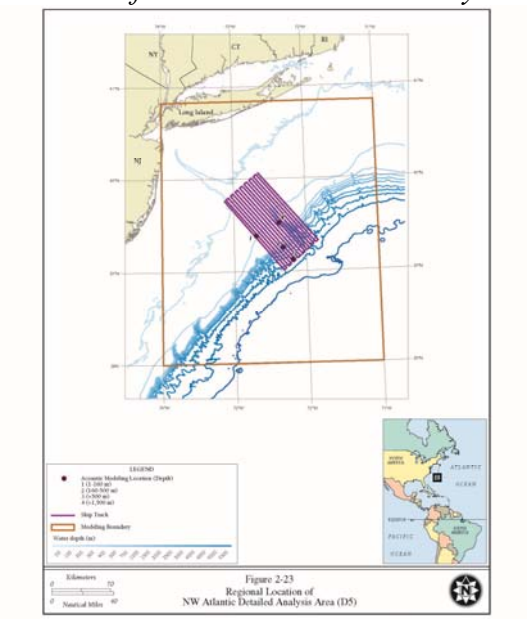

Figure 3. Location map (top) and acoustic modeling (bottom) of sound exposure levels from the NSF-USGS PEIS at the NW Atlantic "detailed analysis area" (DAA) offshore New Jersey, north of Hudson Canyon.

The GI-gun component of the proposed activity is in a location very similar to #1 shown at the bottom, superposed on purple tracklines through the DAA. However, the USGS would use significantly smaller volume GI-guns than used for this analysis. For determination of the no-take nature of this activity, we use the 180 dB standard for Level A harassment and 160 dB for Level B harassment, which we mitigate for with the mandatory exclusion radius. As demonstrated by this modeling, the Level A and B zones would only be encountered close to the source within the area where visual monitoring is wholly possible.

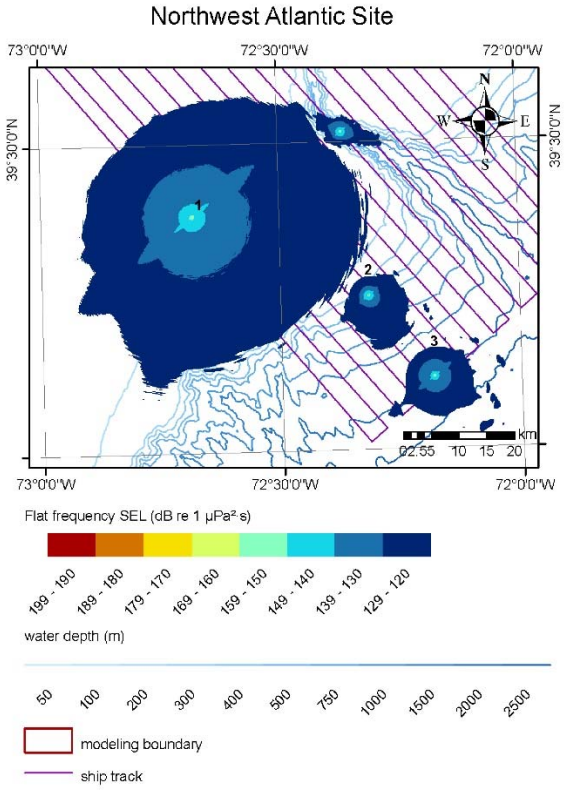

Figure A5-10. Predicted SELs for NW Atlantic Modeling Sites
Notes: Source is a pair of 45/105 in^3 GI guns at a depth of 2.5 m. See also Figure A5-11 below.

2. Is the range of alternatives analyzed in the existing NEPA document(s) appropriate with respect to the new proposed action, given current environmental concerns, interests, and resource values?

Yes, the range of alternatives in the NSF-USGS PEIS is appropriate with respect to the Proposed Action, and the Proposed Action will comply with the USGS ROD for the NSF-USGS PEIS. There have been no significant changes since the completion of the analysis in the NSF-USGS PEIS to alter the conclusions of the NSF-USGS PEIS or USGS ROD. The USGS is increasingly acquiring data, however, that demonstrate that the mitigation zones described in the NSF-USGS PEIS for low-energy sources were conservative (too large). Nonetheless, we would continue to honor mitigation zones outlined in our existing NEPA documents/USGS handbook during the proposed activity.

3. Is the existing analysis valid in light of any new information or circumstances (such as recent endangered species listings)? Can it be reasonably concluded that new information and new circumstances would not substantially change the analysis of the new proposed action?

With the proposed monitoring and mitigation measures, no effects to threatened or endangered species nor takes of marine mammals would be anticipated. No recent ESA listings in the proposed area of operations and in the summer season have substantially changed the analysis in the existing NEPA documentation. Furthermore, in 2014 and 2015, during similar dates as our proposed 2016 period of operations, the USGS acquired thousands of kilometers of low-energy acoustics data in nearshore areas close to the Proposed Action area and had no marine mammal or endangered species encounters, no need to apply mitigation procedures, or no space-use conflicts with recreation or fishing activities.

In 2015, the USGS completed two research cruises that included Site 5 on the outer continental shelf and upper continental slope. Both cruises used low-energy acoustic sources and encountered no endangered species or marine mammals, apart from delphinids that occasionally interacted with the vessel.

4. Are the direct, indirect, and cumulative effects that would result from implementation of the new proposed action similar (both quantitatively and qualitatively) to those analyzed in the existing NEPA document?

As discussed in #1 above, the proposed GI-gun testing would have less impact than the GI-gun scenario analyzed in the NSF-USGS PEIS since the proposed GI-guns are significantly smaller than those modeled in the PEIS. The cumulative impacts would be significantly smaller than the analyzed scenario since the GI-guns for the proposed activity would be run non-continuously for less than 10 hours total, not along continuous, densely spaced tracklines for multiple days. The impact would also be less since the water depth is greater than 100 m, not within the 0-160 m depth range used for the modeling analysis in the PEIS.

The other low-energy sources to be used for the proposed activity were not explicitly analyzed in the PEIS and fall under uniform no-take rules because their impact was considered too small to rise to the level of need for source-by-source analysis. As noted above, the source-by-source measures used for deployment and mitigation of non-GI-gun sources are fully covered by the USGS NEPA Handbook procedures for implementation of the DOI Categorical Exclusion under CFR 46.210(e). The USGS routinely operates these low-energy sources and has in some cases used them for decades. The impact of the proposed activity would be far less than our routine survey operations due to the minimal duration of the acoustic signals, the wide geographic distribution of the sites, and the lack of continuous survey lines.

5. Are the public involvement and interagency review associated with existing NEPA document(s) adequate for the current proposed action?

The NSF-USGS PEIS was formulated by NSF and the USGS as action agencies and the regulator (NMFS) as a cooperating agency. Thus, we have confidence that the NEPA document was adequately formulated and vetted and applies to the proposed activity.

The public had several opportunities to comment on the NSF-USGS PEIS through public meetings and written input. Specifically, the public, NGOs, and other federal agencies were able to comment during public scoping meetings, on the draft PEIS in late 2010-early 2011, and the Final PEIS was issued in 2011. Public comments were addressed by NSF and the USGS in the final PEIS and in the associated agency RODs. Note that NMFS was a cooperating agency, but not an action agency, on the PEIS, so the regulatory agency was involved in each stage of the process and in some cases changed language to reflect the then-current regulatory climate.

D. Persons/Agencies /USGS Staff Consulted

Prepared by Carolyn Ruppel, *Research Geophysicist, Coastal & Marine Geology, USGS*
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Esther Eng, *USGS, Chief, Environmental Management Branch*
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Geoff Wikel, BOEM, *Branch Chief for Coordination, Division of Environmental Assessment*

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Crocker, S.E. and F.D. Fratantonio, 2016, Characteristics of sounds emitted during high-resolution marine geophysical surveys, NUWC-NPT Technical Report 12,203, 265 pp.

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U.S. Geological Survey, 2015, NEPA Handbook. (internal guidance document)

Conclusion

Based on the review documented above, I conclude that the existing NEPA documentation fully covers the proposed action and constitutes USGS's compliance with the requirements of the NEPA.

_____	_____.
Project Manager	Date
_____	_____.
Environmental Program Coordinator	Date
_____	_____.
RO	Date

Signatures on file in internal documentation and removed for posting on web.

The document was signed as follows:

Project Manager: Jane Denny (Woods Hole Coastal & Marine Science Center, USGS), April 13, 2016

Environmental Program Coordinator: Esther Eng (Chief, Environmental Affairs, USGS), April 13, 2016

RO (Responsible Official): Dr. David Applegate (Associate Director, Hazards Mission area, USGS) April 18, 2016

Appendix A: Results of Numerical Modeling of Mitigation Zones for one or two 30 cubic inch GI-guns

Modeling completed by Dr. Anne Bécel (Lamont-Doherty Earth Observatory (LDEO)), 19 March 2016 at the request of the National Science Foundation in support of the proposed USGS Sound Source Verification Project

Received sound levels have been predicted by LDEO's model (Diebold et al. 2010), as a function of distance for a single 30-in^3 mini G-gun. This modeling approach uses ray tracing for the direct wave traveling from the array to the receiver and its associated source ghost (reflection at the air-water interface in the vicinity of the array), in a constant-velocity half-space (infinite homogeneous ocean layer, unbounded by a seafloor). In addition, propagation measurements of pulses from the 36-airgun array at a tow depth of 6 m have been reported in deep water (~1600 m), intermediate water depth on the slope (~600–1100 m) and shallow water (~50 m) in the Gulf of Mexico (GoM) in 2007–2008 (Tolstoy et al. 2009; Diebold et al. 2010).

In shallow water (<100 m), the depth of the calibration hydrophone (18 m) used during the GoM calibration survey was appropriate to sample the maximum sound level in the water column, and the field measurements reported in Table 1 of Tolstoy et al. (2009) for the 36-airgun array at a tow depth of 6 m can be used to derive mitigation radii.

The proposed USGS-BOEM Sound Source Verification survey would acquire data with one or two 30 in^3 mini GI-guns at a tow depth of 2 m. The shallow-water radii are obtained by scaling the empirically derived measurements from the GoM calibration survey to account for the differences in size and tow depth between the calibration survey (6600 in^3, 6 m) and the proposed survey (30 or 60 in^3, 2 m).

Single 30 in^3 airgun

L-DEO model results are used to determine the 160-dB$_{rms}$ radius for the 30-in^3 airgun at 2-m tow depth in deep water. For intermediate-water depths, a correction factor of 1.5 was applied to the deep-water model results. For shallow water, a scaling of the field measurements obtained for the 36-gun array is used: the 150-dB SEL level corresponds to a deep-water radius of 142.8 m for the 30-in^3 airgun at 2-m tow depth, and 7244 for the 36-gun array at 6-m tow depth (Fig. 2), yielding a scaling factor of 0.0197. Similarly, the 170-dB SEL level corresponds to a deep-water radius of 15.17 m for the 30-in^3 airgun at 2-m tow depth (Fig. 1) and 719 m for the 36-gun array at 6-m tow depth (Fig. 1), yielding a scaling factor of 0.02110. Measured 160, and 180 re 1μPa$_{rms}$ distances in shallow water for the 36-gun array towed at 6-m depth were 17.5 km and 1.6 km, respectively, based on a 95th percentile fit (Tolstoy et al. 2009, Table 1). Multiplying by 0.0197 for the 150-dB SEL level and 0.2110 for 170dB-SEL level to account for the difference in array sizes and tow depths yields distances of 348 m and 32 m, respectively.

Two 30 in^3 airguns

L-DEO model results are used to determine the 160-dB$_{rms}$ radius for the two 30-in^3 airguns at 2-m tow depth in deep water. For intermediate-water depths, a correction factor of 1.5 was applied to the deep-water model results. For shallow water, a scaling of the field measurements obtained for the 36-gun array is used: the 150-dB SEL level

corresponds to a deep-water radius of 273.29 m for the two 30-in^3 airguns at 2-m tow depth (Fig. 3) and 7244 for the 36-gun array at 6-m tow depth (Fig. 1), yielding a scaling factor of 0.0377. Similarly, the 170-dB SEL level corresponds to a deep-water radius of 27.822 m for the two 30-in^3 airguns at 2-m tow depth (Fig. 3) and 719 m for the 36-gun array at 6-m tow depth (Fig. 2), yielding a scaling factor of 0.0386. Measured 160 and 180 re 1μPa$_{rms}$ distances in shallow water for the 36-gun array towed at 6-m depth were 17.5 km and 1.6 km respectively, based on a 95th percentile fit (Tolstoy et al. 2009, Table 1). Multiplying by 0.0377 and 0.0386 to account for the difference in array sizes and tow depths yields distances of 660 m and 62 m respectively.

Table 1 shows the distances at which the 160- and 180- dB re 1μPa$_{rms}$ sound levels are expected to be received for the single or two 30 cu.in airguns. The 180-dB re 1 μPa$_{rms}$ distance is the safety criterion as specified by NMFS (2000) for cetaceans.

TABLE 1. Predicted distances to which sound levels ≥190-, 180- and 160-dB re 1 μPa$_{rms}$ are expected to be received during the proposed survey.

Source and Volume	Tow Depth (m)	Water Depth (m)	Predicted levels	
			160 dB	180 dB
Single mini G-gun, 30 in^3	2	>1000 m	142.8[1] m	15.2[1] m
		100–1000 m	215.2 m	22.8[2] m
		<100 m	348[3] m	32[3] m
2 x 30 in^3 mini G-guns, 60 in^3	2	>1000 m	273.3[1] m	27.8[1] m
		100–1000 m	409.9[2] m	41.7[2] m
		<100 m	660[3] m	62[3] m

[1] Distance is based on L-DEO model results
[2] Distance is based on L-DEO model results with a 1.5 x correction factor between deep and intermediate water depths
[3] Distance is based on empirically derived measurements in the GoM with scaling applied to account for differences in size and tow depth

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Diebold, J. B., M. Tolstoy, L. Doermann, S. L. Nooner, S. C. Webb, and T. J. Crone (2010), R/V *Marcus G. Langseth* seismic source: Modeling and calibration, Geochem. Geophys. Geosyst., 11, Q12012, doi:10.1029/2010GC003216.

Tolstoy, M., J. Diebold, L. Doermann, S. Nooner, S. C. Webb, D. R. Bohnenstiehl, T. J. Crone, and R. C. Holmes (2009),Broadband calibration of the R/V *Marcus G. Langseth* four-string seismic sources, Geochem. Geophys. Geosyst., 10, Q08011, doi:10.1029/2009GC002451.

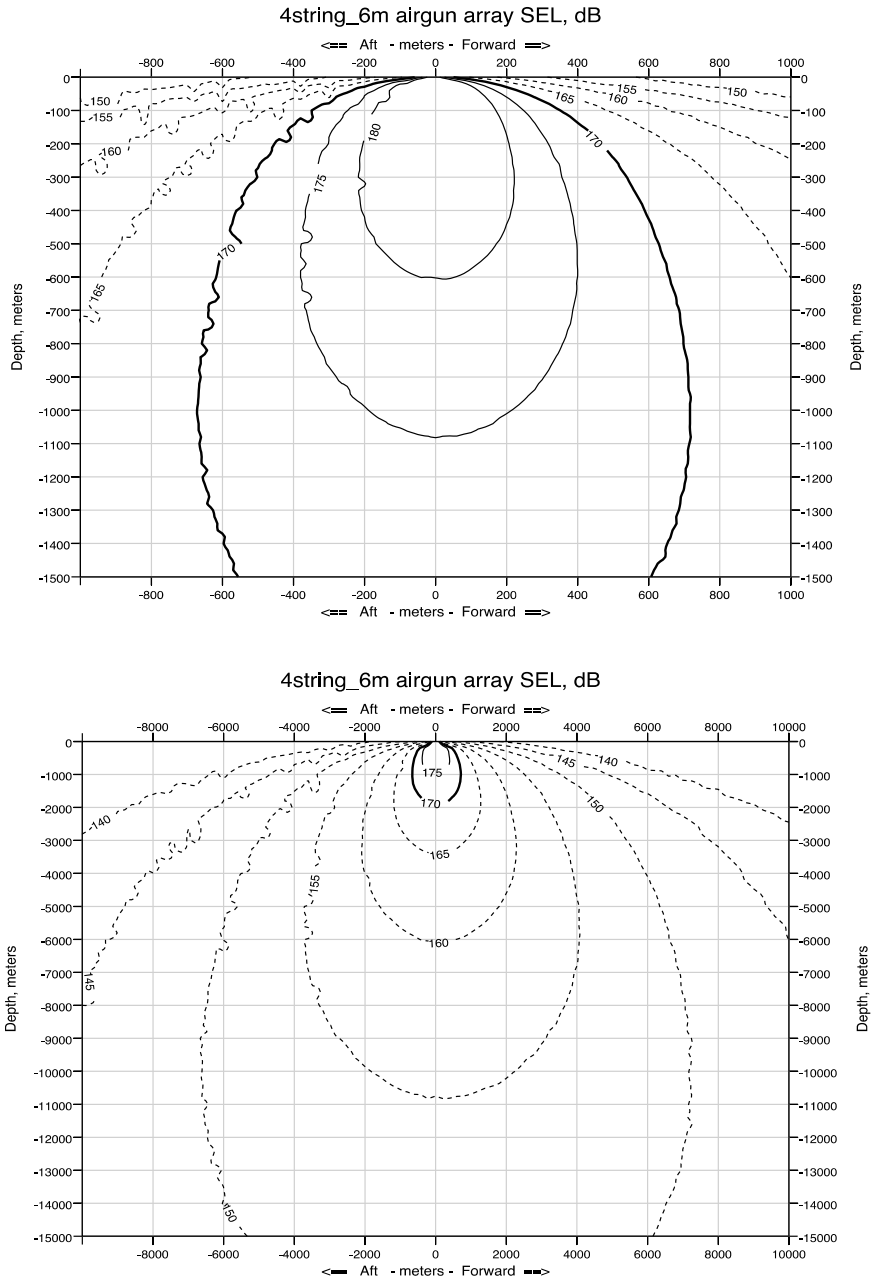

FIGURE 1. Modeled deep-water received sound levels (SELs) from the 36-airgun array at a 6-m tow depth used during the GoM calibration survey. Received rms levels (SPLs) are expected to be ~10 dB higher. The plot at the top provides the radius to the 170 dB SEL isopleth as a proxy for the 180-dB rms isopleth, and the plot at the bottom provides the radius to the 150-dB SEL isopleth as a proxy for the 160-dB rms isopleth. These data can be scaled to determine the received sound levels for the proposed USGS-BOEM Sound Source Verification cruise.

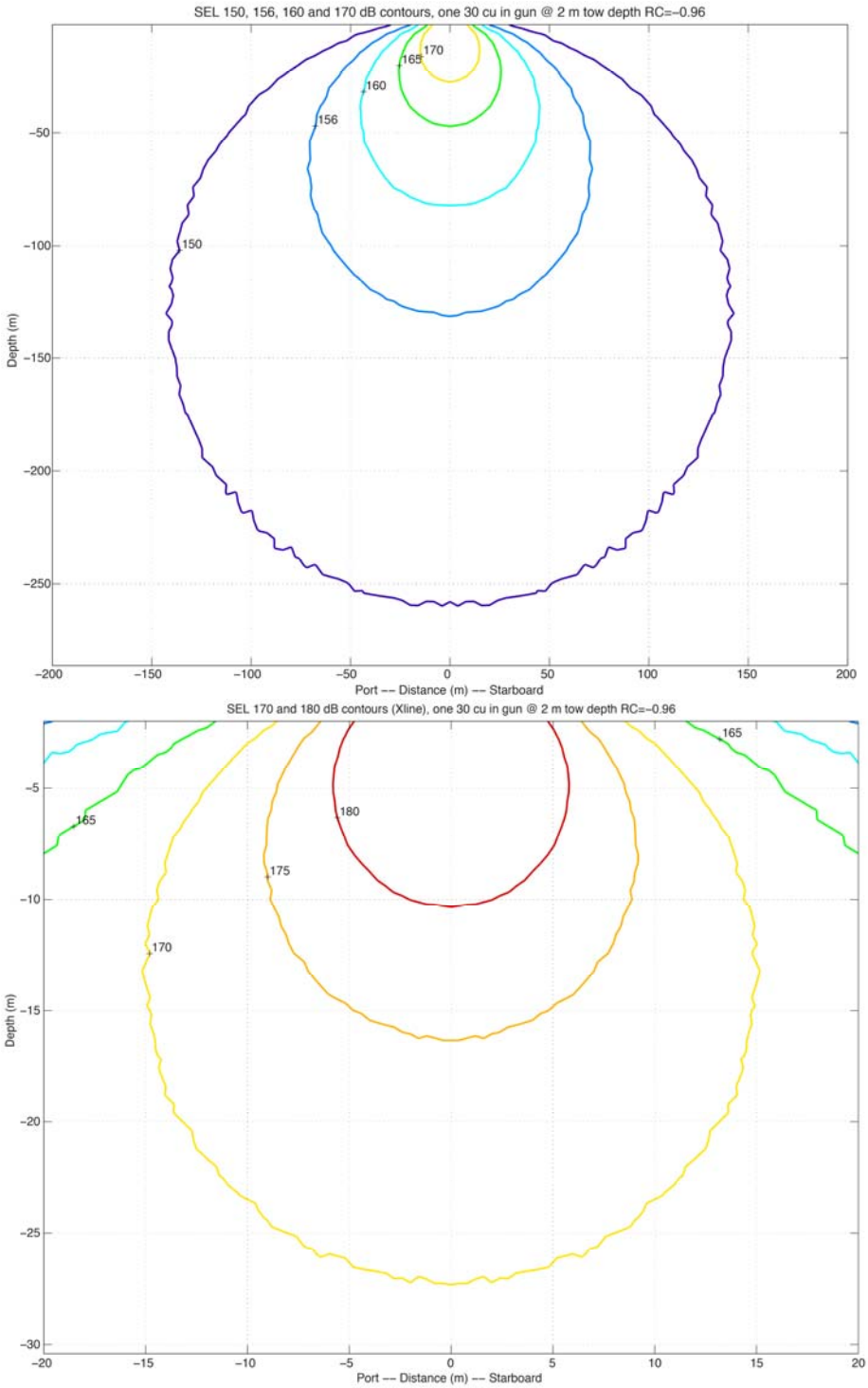

FIGURE 2. Modeled deep-water received sound levels (SELs) from a single 30 cu.in mini G-gun at a 2-m tow depth. Received rms levels (SPLs) are expected to be ~10 dB higher. The plot at the top provides the radius to the 150-dB SEL isopleth as a proxy for the 160-dB rms isopleth, and the plot at the bottom provides the radius to the 170-dB SEL isopleth as a proxy for the 180-dB rms isopleth.

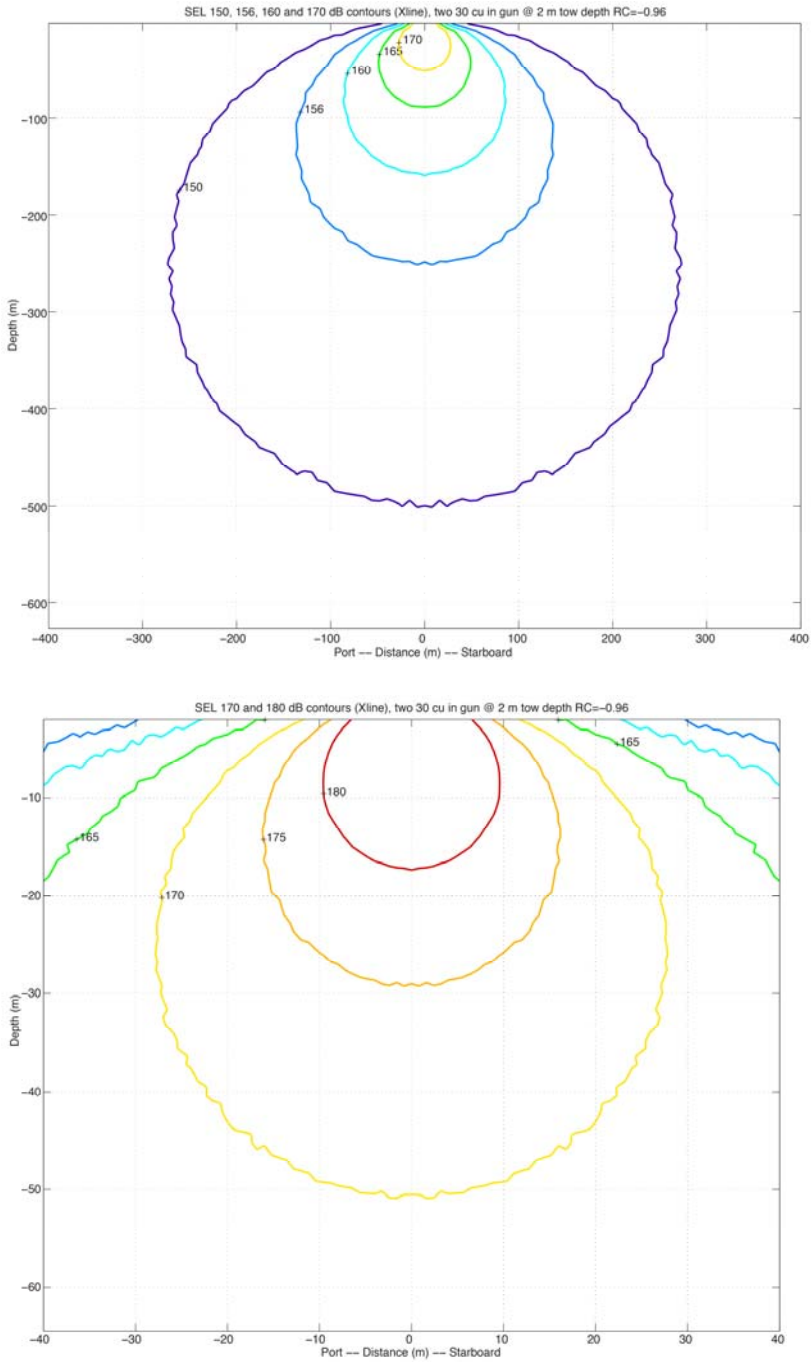

FIGURE 3. Modeled deep-water received sound levels (SELs) from two 30 cu.in mini G-gun at a 2-m tow depth, separated by 2.5m in the x direction. Received rms levels (SPLs) are expected to be ~10 dB higher. The plot at the top provides the radius to the 150-dB SEL isopleth as a proxy for the 160-dB rms isopleth, and the plot at the bottom provides the radius to the 170-dB SEL isopleth as a proxy for the 180-dB rms isopleth.

Amendment to:

Determination of NEPA Adequacy

U.S. Geological Survey

Proposed Action Title/Type:
Propagation Characteristics of High-Resolution Geophysical Surveys: Open-Water Testing

Clarification of Proposed Action and Mitigation:

Acoustic source 14 listed in the "Determination of NEPA Adequacy document" (henceforth referred to as "original determination") that was signed by Associate USGS Director Dr. David Applegate on 18 March, 2016 refers to an Applied Acoustics Delta sparker, a towed acoustic source used by the USGS for subbottom imaging in certain scenarios. This is an amendment to that determination based on new information.

During discussions with project collaborators in May 2016, USGS staff recognized that there had been an oversight in the *original determination* regarding the mode of operation for this sparker. At the 100 m water depth testing site, the USGS intends to operate the sparker for short periods (a few hours) in non-survey mode at 3 kJ and 6 kJ to test the sound source characteristics at these often-used power levels. These power levels fall outside of the internal guidance provided in the USGS NEPA Handbook for application of DOI Categorical Exclusion in CFR 46.210(e) to marine operations. The use of this towed sparker source for non-continuous surveys for short periods in a no-take scenario falls under the NSF-USGS Programmatic Environmental Impact Statement (NSF and USGS, 2011). Based on sound source levels measured by Crocker and Fratantonio (2016) and our numerical modeling, the 180 dB (Level A harassment) zone lies less than 100 m from the source, as is required for application of the low-energy towed precepts in the NSF-USGS PEIS. The 160 dB (Level B harassment) radii for this Delta sparker operated at 3 kJ and 6 kJ are estimated to be at 300 m and 600 m, respectively.

The following mitigation procedures, derived from those in the NSF-USGS PEIS, will be observed when the Delta sparker is deployed at power levels above 1 kJ:

- The Delta sparker would be operated at power levels greater than 1 kJ only for short periods of time and during daylight hours and only at the nominal 100 m water depth site.
- The sparker will be ramped up in at least 2 power steps to provide ample time for marine mammals to move out of the area before the operation commences at the full power level.
- A staff member who has completed NOAA-approved PSVO training will be on duty at all times and supplied with appropriate equipment (e.g., binoculars) during the sparker operations at 3 kJ and above. The ship's crew on the bridge would also be asked to contribute information about animal sightings.

- A full mitigation zone monitoring the 160 dB zone (maximum estimated at 600 m for the 6 kJ power setting) would be observed at all times, and this zone must be visible throughout any time that the source is in use (e.g., no sparker operation at the 3-6 kJ power levels in heavy fog, at dusk).
- Power downs/shutdowns would be implemented if a marine mammal, including delphinid species, is observed entering or within the exclusion zone.

The sparker operations at 3-6 kJ will fall under "Operations for Which Incidental Take of Marine Mammals is Not Anticipated or Authorized" in the NSF-USGS PEIS.

This amendment does not alter these findings from the *original determination*:

Based on analysis in existing NEPA documents, including the NSF-USGS PEIS, and with the proposed monitoring and mitigation measures, the USGS expects no Level A or Level B takes of marine mammals in the completion of the Proposed Action. In light of the distribution of known endangered or protected species and the small acoustic source sizes, the USGS also expects no disturbance of endangered or protected species. Owing to the short duration of the surveys, the USGS anticipates no cumulative impacts as a consequence of the Proposed Action. As no adverse effects are anticipated on marine species, including endangered or protected species, no further action is required under the Marine Mammal Protection Act or Endangered Species Act.

In addition, no impacts to coastal zone uses or resources would be anticipated from the Proposed Action. The USGS reviewed the relevant States' Federal Consistency listings and determined that the Proposed Action was unlisted; therefore, no further action is required by the USGS per the Coastal Zone Management Act (CZMA).

For this reason, the agency conclusions document is not deemed to be in need of updating.

References

Crocker, S.E. and F.D. Fratantonio, 2016, Characteristics of sounds emitted during high resolution marine geophysical surveys, NUWC-NPT Technical Report 12,203, 265 pp.

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Conclusion

Based on the review documented above, I conclude that the existing NEPA documentation fully covers the proposed action and constitutes USGS's compliance with the requirements of the NEPA.

_____ _____.
Project Manager (Jane Denny) Date

_____ _____.
Environmental Program Coordinator (Esther Eng) Date

_____ _____.
RO (Dr. David Applegate, Assoc Director) Date

Signatures on file in internal documentation and removed for posting on web.

The document was signed as follows:

Project Manager: Jane Denny (Woods Hole Coastal & Marine Science Center, USGS), May 20, 2016

Environmental Program Coordinator: Esther Eng (Chief, Environmental Affairs, USGS), May 19, 2016

RO (Responsible Official): Dr. David Applegate (Associate Director, Hazards Mission area, USGS) May 20, 2016