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# Marine Mammal Monitoring and Mitigation Plan

## SAExploration Colville 3D Seismic Survey Operation 2017

## INTRODUCTION

SAExploration (SAE) proposed marine mammal monitoring and mitigation plan for the proposed Colville (Beaufort Sea) seismic exploration program is described below. SAE understands that this monitoring and mitigation plan will be subject to review by NMFS, the North Slope Borough, and the Alaska Eskimo Whaling Commission (AEWC), and others, and that refinements may be required. In order to avoid any takes by injury (Level A), SAE will employ NMFS approved Protected Species Observers (PSOs) to monitor and implement mitigation measures. PSOs will conduct safety and harassment monitoring from both seismic vessels.

### Safety and Harassment Monitoring Radii

PSOs will establish and monitor a safety zone for cetaceans and pinnipeds surrounding the airgun array on the source vessel where the received level would be 180 dB and 190 dB. PSOs will establish and monitor a harassment zone for bowhead and gray whales surrounding the airgun array on the source vessel where the received level would be 160 dB. Whenever aggregations of bowhead whales or gray whales that appear to be engaged in non-migratory significant biological behavior (*e.g.*, feeding, socializing) are observed during a vessel monitoring program within the 160-dB harassment zone around the seismic activity, the seismic operation will not commence or will shut down.

Monitoring zones for the 190, 180, and 160 dB with the various airgun configurations were measured during SAE seismic operations in 2014. These estimates are provided in Table 1. SAE proposes to monitor these zones for marine mammals before, during, and after the operation of the airguns. Monitoring will be conducted using qualified PSOs on vessels.

**Table 1. Summary of distances to the NMFS sound level thresholds.**

| Array ($in^3$) | Distance to 190 dB Isopleth | Distance to 180 dB Isopleth | Distance to 160 dB Isopleth |
|---|---|---|---|
| 880 (<5 m deep) | 278 m | 0.75 km | 1.67 km |
| 1,760 (>5 m deep) | 830 m | 1.53 km | 4.27 km |

## Sound Source Verification

Sound source verification (SSV) testing of the 1,760-in$^3$ airgun array was conducted in 2014 (Heath *et al.* 2014a) and the 880-in$^3$ array and the proposed vessels were measured in 2008 (Aerts *et al.* 2008). However, the 1,760-in$^3$ airgun array testing occurred in Cook Inlet, not the Beaufort Sea. Therefore, the SSV of the 1,760-in$^3$ array is planned for 2017 at the first survey unit following the same methodology used in Heath *et al.* (2014a, b). It is possible that SAE may use a smaller 1,240-in$^3$ array, but no SSV testing will occur for this array. Heath *et al.* (2014b) measured this array in Colville River Delta in 2014.

## Visual Vessel-Based Monitoring

The vessel-based monitoring will be designed to cover the requirements of the Incidental Harassment Authorization (IHA) for this project. The objectives of the vessel-based monitoring will be to:

- ensure that disturbance to marine mammals is minimized and all permit stipulations are followed;
- document the effects of the proposed seismic activities on marine mammals; and
- collect data on the occurrence and distribution of marine mammals in the proposed project area.

The monitoring and mitigation plan will be implemented by a team of experienced PSOs, including both biologists and Inupiat communicators. PSOs will be stationed aboard both source vessels to monitor and implement mitigation measures during all daytime seismic operations. A lead PSO will be designated on each source vessel for effective communication and to oversee the monitoring and mitigation program. With NMFS consultation, PSOs will be hired by SAE. PSOs will follow a schedule so observers will monitor marine mammals near the seismic vessel during all ongoing operations and airgun ramp ups. PSOs will normally be on duty in shifts no longer than 4 hours and no more than a total of 12 hours per day.

Source vessels will employ PSOs to identify marine mammals during all hours of airgun operations. To better observe the exclusion zone, a lead PSO, one or two PSOs, and an Inupiaq communicator will be on primary source vessel and two PSOs will be stationed aboard the secondary source vessel. (The total number of observers is limited by available berthing space aboard the vessels.) The three to four total observers aboard the primary source vessel will allow two observers simultaneously on watch during daylight hours (as requested by the peer review committee). When marine mammals are about to enter or are sighted within designated exclusion zones, airgun operations will be shut down immediately. The vessel-based observers will watch for marine mammals at the seismic operation during all periods of source effort and for a minimum of 30 minutes prior to the planned start of airgun or pinger operations after an extended shutdown. SAE vessel crew and operations personnel will also watch for marine mammals (insofar as practical) to assist and alert the observers for the airgun(s) to be shut down if marine mammals are observed in, or about to enter, the exclusion zone. Seismic operations will not be initiated or continue when adequate observation of the designated applicable exclusion zone is not possible due to environmental conditions such as high sea state, fog, ice and low light. Termination of seismic operations will be at the discretion of the lead PSO based on continual observation of environmental conditions and communication with other PSOs.

The source and support vessels are suitable platforms for marine mammal observations. When stationed on the flying bridge, the observer will have an unobstructed view around the entire vessel. If surveying from the bridge, the observer's eye level will be about 6 m (20 ft) above sea level. During operations, the PSO(s) will scan the area around the vessel systematically with standard reticle binoculars or long-range big-eye binoculars. Laser range finders (Leica LRF 1200 laser rangefinder or equivalent) will be available to assist with distance estimation. Range finders will be used for training observers to estimate distances visually, but are generally not useful in measuring distances to animals directly.

All observations and airgun shut downs will be recorded in a standardized format. Data will be entered into a custom database using a notebook computer. The accuracy of these data entries will be verified daily by the lead PSOs by a manual checking of the database. These procedures will allow initial summaries of data to be prepared during and shortly after the field program, and will facilitate transfer of these data to statistical, graphical, or other programs for further processing and archiving.

The vessel-based observation will provide:

- the basis for real-time mitigation, if necessary, as required by the IHA;
- information needed to estimate the number of " Level B takes" of marine mammals by harassment, which must be reported to NMFS;
- data on the occurrence, distribution, and activities of marine mammals in the areas where the seismic operations are conducted;
- information to compare the distances, distributions, behavior, and movements of marine mammals relative to the source vessels at times with and without seismic activity;
- a communication channel to coastal communities including Inupiat whalers; and
- employment opportunities for local residents and development/experience for Inupiat Communicators and PSOs.

## Mitigation Measures

### *Shutdown Procedure*

A shutdown occurs when all airgun activity is suspended. The operating airgun(s) will be shut down completely if a marine mammal approaches the applicable exclusion zone. The shutdown procedure will be accomplished within several seconds (of a "one shot" period) of the determination that a marine mammal is either in or about to enter the applicable exclusion zone.

The operations will not proceed with airgun activity until the marine mammal has cleared the zone and the trained PSOs on duty are confident that no marine mammals remain within the appropriate exclusion zone. The animal will be considered to have cleared the exclusion zone if it:

- is visually observed to have left the applicable exclusion zone;
- has not been seen within the zone for 15 min in the case of pinnipeds;

- has not been seen within the zone for 30 min in the case of cetaceans.

### *Power Down Procedure*

Whenever a marine mammal is detected outside the exclusion zone radius and based on its position and motion relative to the ship track is likely to enter the exclusion zone, PSOs may request that the seismic operations implement a power down (de-energize the airgun array). A power down procedure involves reducing the number of airguns in use such that the radius of the 180 dB (or 190 dB) zone is decreased to the extent that marine mammals are not in the exclusion zone. Alternatively, a shutdown procedure occurs when all airgun activity is suspended. During a power down, a mitigation airgun (airgun of small volume such as the 10 cubic inch) is operated. If a marine mammal is detected outside the safety radius (either injury or harassment) but is likely to enter that zone, the airguns may be powered down before the animal is within the safety radius, as an alternative to a complete shutdown.

Similar to a shutdown, after a power down, airgun activity will not resume until the marine mammal has cleared the applicable exclusion zone.

### *Ramp Up Procedure*

A "ramp up" procedure gradually increases airgun volume at a specified rate and involves a step increase in the number and total volume of airguns until the full volume is achieved. The purpose of the ramp up or "soft start" is to warn marine mammals potentially in the area and provide sufficient time for them to leave the project area and avoid any potential injury. Ramp up is used at the start of airgun operations, including power down, shut down, and after any period greater than 10 minutes in duration without airgun operations. The airgun array begins operating after a specified-duration period without airgun operations. The rate of ramp up will be no more than 6 dB per 5 minute period. Ramp up will begin with the smallest gun in the array that is being used for all airgun array configurations. During the ramp up, the applicable exclusion zone for the full airgun array will be maintained.

If the complete applicable exclusion zone has not been visible for at least 30 minutes prior to the start of operations, ramp up will not start unless the mitigation gun has been operating during the interruption of seismic survey operations. This means that it will not be permissible to ramp up the full source from a complete shut-down in thick fog or at other times when the outer part of the applicable exclusion zones are not visible.

It will not be permissible to commence ramp-up if the complete safety radii are not visible for at least 30 minutes prior to ramp-up in either daylight or nighttime and not commence ramp-up at night unless the seismic source has maintained a sound source pressure level at the source of at least 180 dB during the interruption of seismic survey operations.

### *Speed or Course Alteration*

If a marine mammal is detected outside the safety radius and, based on its position and the relative motion, is likely to enter the safety radius, the vessel speed and/or direct course may, when practical and safe, be changed that also minimizes the effect on the seismic operations. This can be used in coordination with a

power down procedure. The marine mammal activities and movements relative to the seismic and support vessels will be closely monitored to ensure that the marine mammal does not approach within the applicable exclusion zone. If the mammal appears likely to enter the exclusion zone, further mitigation actions will be taken; for example, either further course alterations, power down, or shut down of the airgun(s).

As an additional mitigation procedure, with or without seismic operations taking place, SAE proposes to reduce vessel speed when within 1 km of whales and those vessels capable of steering around such groups will do so. Vessels may not be operated in such a way as to separate members of a group of whales from other members of the group. Vessel captains will avoid multiple changes in direction and speed when within 1 km of whales.

## Protected Species Observers

Vessel-based monitoring for marine mammals will be done by trained PSOs throughout the period of seismic operations to comply with expected provisions in the IHA and CAA. The observers will monitor the occurrence and behavior of marine mammals near the source vessels during all daylight periods during operation, and during most daylight periods when seismic operations are not occurring. PSO duties will include watching for and identifying marine mammals; recording their numbers, distances, and reactions to the seismic acquisition operations; and documenting exposures of animals to sound levels that may constitute harassment as defined by NMFS.

PSO teams will consist of Inupiat observers and experienced field biologists. An experienced field crew leader and an Inupiat observer will be onboard each source vessel during the seismic acquisition program. Inupiat PSOs will also function as Native language communicators with hunters and whaling crews and with the Communications and Call Centers (Com Centers) in Native villages along the Beaufort Sea coast.

A sufficient number of PSOs will be required onboard each seismic vessel to meet the following criteria:

- 100% monitoring coverage during all periods of seismic operations in daylight;
- maximum of 4 consecutive hours on watch per PSO; and
- maximum of ~12 hours of watch time per day per PSO.

### *PSO Role and Responsibilities*

When onboard the seismic and support vessels, there are three major parts to the PSO position:

- observe and record sensitive wildlife species;
- ensure mitigation procedures are followed accordingly; and
- follow monitoring and data collection procedures.

The main roles of the PSO and the monitoring program are to ensure compliance with regulations set in place by NMFS and other agencies to ensure that disturbance of marine mammals is minimized, and potential effects on marine mammals are documented. The PSOs will implement the monitoring and

mitigation measures specified in the NMFS issued IHA and in this 4MP. The primary purposes of the PSOs on board of the vessels are:

- Mitigation: Implement mitigation clearing and ramp up measures, observe for and detect marine mammals within, or about to enter the applicable safety zone and implement necessary shut down, power down and speed/course alteration mitigation procedures when applicable. Advise marine crew of mitigation procedures.
- Monitoring: Observe for marine mammals and determine numbers of marine mammals exposed to sound pulses and their reactions (where applicable) and document those as required.

The PSOs will observe for marine mammals, stationed at the best available vantage point on the source and support vessels. Ideally this vantage point is an elevated stable platform such as the bridge or flying bridge from which the PSO has an unobstructed 360 degree view of the water. The observer(s) will scan systematically with the unaided eye and 7x50 reticle binoculars, supplemented with 16-40x80 long-range binoculars and night-vision equipment when needed. New or inexperienced PSOs will be paired with an experienced PSO or experienced field biologist so that the quality of marine mammal observations and data recording is kept consistent.

The following information about marine mammal sightings will be carefully and accurately recorded:

- species, group size, age/size/sex categories (if determinable);
- physical description of features that were observed or determined not to be present in the case of unknown or unidentified animals;
- behavior when first sighted and after initial sighting, heading (if consistent);
- bearing and distance from observer, apparent reaction to activities (*e.g.*, none, avoidance, approach, paralleling, etc.), closest point of approach, and behavioral pace; and
- time, location, speed, and activity of the source vessels; sea state, ice cover, visibility, and sun glare; and positions of other vessel(s) in the vicinity.

## Passive Acoustical Monitoring

During SAE's 2014 operations in the Beaufort Sea, SAE's bioacoustics contractor (Yack *et al.* 2014) deployed four second-generation Ecological Acoustic Recorders (EARs) around the Colville River Delta to measure ambient noise levels and monitor marine mammal calls relative to SAE's seismic surveys. The pattern of deployment was designed to capture both seismic and biological noise, and to estimate the level of seismic sound reaching the deeper waters where bowhead whale migration generally occurs (taking into account the effects of shallow water and barrier islands on EAR deployment and sound transmission). A similar program was considered for the canceled 2015 and 2016 programs, but, as presented at the 2015 peer review meeting, would have involved the use of micro Marine Autonomous Recording Systems (microMARS).

Due to contractual processes, SAE has not yet been able to select a bioacoustics contractor for 2017. However, SAE does anticipate a program similar to that proposed for 2015, which is described below.

*The goal of this PAM effort is to collect data using microMARS deployments to address the following questions:*

- *Are marine mammal species present in the study area during the period of deployment and if so, what species?*
- *When and where are marine mammals detected (i.e. temporal/spatial patterns)?*
- *What are ambient noise levels, and how do they vary in time and space?*
- *Are there any obvious relationships between seismic survey activity and acoustic detections?*

*As soon as logistically possible before seismic survey activities commence, (depending on weather and vessel availability), AAR mooring packages will deployed at the four corners of the study site. Each AAR mooring package site will include two microMARS units coupled with an ARC-1 release device, a float and a retrievable mooring. Deploying two microMARS at each monitoring location will allow redundancy in the system to reduce the likelihood of failures and/or data loss.*

*The deployments will occur for approximately 4-6 weeks or until ice-conditions require removal of the packages. Ideally, recording would begin at least one week prior to the start of seismic operations and end at least one week after seismic operations cease. This would allow for a minimum amount of baseline monitoring activity so that occurrence of marine mammals acoustic events could be compared before, during, and after operations. However, this plan may need to be modified depending on weather, logistics, and other considerations.*

*Acoustic data will be analyzed for two frequency bands, low (below 2 kHz for walruses, baleen whales and low-frequency noise) and high (2 kHz - 32 kHz for beluga whales and high-frequency noise). This will allow sounds produced by different species and anthropogenic sources to be reviewed and analyzed in greater detail. Specialized acoustic review and analysis software, Trition will be used to create long-term spectral averages (LTSAs) for all acoustic files downloaded from the recorders.*

*Once LTSAs of all the acoustic data have been created and preliminarily reviewed, experienced bioacoustic data analysts will perform a detailed review of the data. Analysts will log the time of occurrence of all biological sounds, seismic source events (if audible), and other relevant acoustic signals (e.g. ships, small boats, and other noise events). Combined event log data will then be organized into tables to provide summaries including 1) the number and type of acoustic events 2) the number of days each event occurred at each site and 3) event durations for each deployment and site. Graphs of daily event occurrence will be made for each identified marine mammal species that have sufficient data to plot. Graphs of the percentage of time for which signals from each species were detected with respect to total recording time at each site will be plotted by species.*

*Noise analysis will be performed on all recorded acoustic data. Sound levels will be measured for full and octave frequency bands. This analysis will be conducted using automated algorithms that measure root-mean-square (RMS) sound pressure level (SPL) each octave bands. These results will be averaged both hourly and daily to provide a synoptic representation of the ambient noise levels present at each location for each of the different frequency bands measured.*

## Spotted Seal Haulout Monitoring

As requested during the 2014 peer review, SAE monitored spotted seal haulout sites located at the Colville River Delta during the SAE's 2014 seismic program. The boat-based monitoring program was largely ineffective for the following reasons: 1) spotted seal haul out use was largely confined to the river channels (where the seals feed on migrating channels) based both on the surveys and interviews with Nuiqsut hunters; 2) weather conditions precluded some survey attempts and actual seal use of the marine haulouts; 3) not enough is known about seal haulout use at the delta to separate the influence of environmental patterns from industrial activities; 4) SAE was specifically asked not to conduct an aerial-based monitoring program to avoid disturbance of village activities; 5) a separate (aerial-based) spotted seal monitoring program was simultaneously being conducted by an another party; and 6) actual 2015 seismic activities came no closer than 5 km of a marine haulout site. In addition, during a community meeting in Nuiqsut, local hunters described marine haulouts as ephemeral sandbars and mudflats, with large seasonal differences between use areas. SAE does not plan to conduct a spotted seal monitoring program in 2017.

## Measures to Reduce Impacts to Subsistence Users

In-water seismic activities will follow mitigation procedures to minimize effects on the behavior of marine mammals and; therefore, opportunities for subsistence harvest by Alaska Native communities. These include:

- Inupiat Communicators and Inupiat PSOs will record marine mammal observations along with marine mammal biologists during the monitoring program and be provided annual reports;
- fully implement the measures consistent with the CAA; and
- participate with other operators in the Communications Call Centers (Com-Center) Program, *if* the program is active in 2017. The Com-Centers would be operated 24 hours/day during the 2017 subsistence bowhead whale hunt. SAE proposes to routinely call the communications center according to the established protocol while in the Beaufort Sea.

## Reporting

### *Weekly Reports*

Weekly reports will be submitted to NMFS no later than the close of business (Alaska Time) each Thursday during the weeks during thein-water seismic surveys. The field reports will summarize species detected, in-water activity occurring at the time of the sighting, behavioral reactions to in-water activities, and the number of marine mammals exposed to harassment level noise.

### *Monthly Reports*

Monthly reports will be submitted to NMFS for all months during in-water seismic surveys. The monthly report will contain and summarize the following information:

Dates, times, locations, heading, speed, weather, sea conditions (including Beaufort Sea state and wind force), and associated activities during the seismic survey and marine mammal sightings.

- Species, number, location, distance from the vessel, and behavior of any sighted marine mammals, as well as associated seismic survey activity (number of shutdowns), observed throughout all monitoring activities.
- An estimate of the number (by species) of: (i) pinnipeds that have been exposed to the geophysical activity (based on visual observation) at received levels greater than or equal to 160 dB re 1 µPa (rms) and/or 190 dB re 1 µPa (rms) with a discussion of any specific behaviors those individuals exhibited; and (ii) cetaceans that have been exposed to the geophysical activity (based on visual observation) at received levels greater than or equal to 160 dB re 1 µPa (rms) and/or 180 dB re 1 µPa (rms) with a discussion of any specific behaviors those individuals exhibited.
- An estimate of the number (by species) of pinnipeds and cetaceans that have been exposed to the geotechnical activity (based on visual observation) at received levels greater than or equal to 120 dB re 1 µPa (rms) with a discussion of any specific behaviors those individuals exhibited.
- A description of the implementation and effectiveness of the: (i) terms and conditions of the Biological Opinion's Incidental Take Statement; and (ii) mitigation measures of the IHA. For the Biological Opinion, the report shall confirm the implementation of each Term and Condition, as well as any conservation recommendations, and describe their effectiveness, for minimizing the adverse effects of the action on ESA-listed marine mammals.

### *90-Day Technical Report*

A report will be submitted to NMFS within 90 days after the end of the project or at least 60 days before the request for another Incidental Take Authorization for the next open water season to enable NMFS to incorporate observation data into the next Authorization. The report will summarize all activities and monitoring results (*i.e.*, vessel-based visual monitoring) conducted during in-water seismic surveys. The Technical Report will include the following:

Summaries of monitoring effort (*e.g.*, total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals).

- Analyses of the effects of various factors influencing detectability of marine mammals (*e.g.*, sea state, number of observers, and fog/glare).
- Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/gender categories (if determinable), group sizes, and ice cover.
- Analyses of the effects of survey operations.
- Sighting rates of marine mammals during periods with and without seismic survey activities (and other variables that could affect detectability), such as: (i) initial sighting distances versus survey activity state; (ii) closest point of approach versus survey activity state; (iii) observed behaviors and

types of movements versus survey activity state; (iv) numbers of sightings/individuals seen versus survey activity state; (v) distribution around the source vessels versus survey activity state; and (vi) estimates of Level B harassment based on presence in the 120 or 160 dB harassment zone.

### *Notification of Injured or Dead Marine Mammals*

In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by the IHA (if issued), such as an injury (Level A harassment), serious injury or mortality (*e.g.*, ship-strike, gear interaction, and/or entanglement), the Applicant would immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the Alaska Regional Stranding Coordinators. The report would include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Name and type of vessel involved;
- Vessel's speed during and leading up to the incident;
- Description of the incident;
- Status of all sound source use in the 24 hours preceding the incident;
- Water depth;
- Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

Activities would not resume until NMFS is able to review the circumstances of the prohibited take. NMFS would work with the Applicant to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The seismic survey program would not be able to resume activities until notified by NMFS via letter, email, or telephone.

In the event that the seismic survey program discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (*i.e.*, in less than a moderate state of decomposition as described in the next paragraph), the Applicant would immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the NMFS Alaska Stranding Hotline and/or by email to the Alaska Regional Stranding Coordinators. The report would include the same information identified in the paragraph above. Activities would be able to continue while NMFS reviews the circumstances of the incident. NMFS would work with the Applicant to determine if modifications in the activities are appropriate.

In the event that the seismic survey program discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in the IHA (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the Applicant would report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the NMFS Alaska Stranding Hotline and/or by email to the Alaska Regional Stranding Coordinators, within 24 hours of the discovery. The Applicant would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network.

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