Marine Mammal and Monitoring Mitigation Plan

SAExploration Colville 3D Seismic Survey Operations - 2014

Introduction

SAExploration's (SAE) proposed marine mammal monitoring and mitigation plan for the proposed Colville (Beaufort Sea) seismic exploration program is described below. 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 monitor both from the seismic vessels and from a dedicated mitigation vessel to provide both early warning of approaching migrating whales and to assist in monitoring the 160 dB harassment zone.

Proposed 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.

Preliminary monitoring zones for the 190, 180, and 160 dB with the various airgun configurations were estimated. 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. All the preliminary monitoring zones will be adjusted as needed based on the results of the sound source verification test (see below).

Table 1. Summary of Distance to NMFS Sound Level Thresholds

Source	Source Level	190 dB	180 dB	160 dB
440 cubic inch airgun array	221.08 dB re 1 µPa (rms)	126 m	325 m	1.33 km
880 cubic inch airgun array	226.86 dB re 1 µPa (rms)	167 m	494 m	1.5 km
1,760 cubic inch airgun array	236.55 dB re 1 µPa (rms)	321 m	842 m	2.99 km

Sound Source Verification

Sound source verification (SSV) testing of the air gun arrays (440, 880, and 1,760 cui) is planned to be conducted for this project as soon as the first seismic surveys commence. (No SSV testing is planned for the vessels as the same vessels planned for this operation were previously tested in association with the BP Liberty project [Aerts et al. 2008]). The SSV will be conducted by an acoustical firm with prior experience conducting SSV tests in Alaska.

The preferred method will involve the deployment (from a small boat) of six drift buoys with a hydrophone attached 1.9 meters below the buoy. These buoys will continually log time, GPS location, and received noise levels. The buoys will be deployed in line, with 1-km separation, 8 km upstream of the active airgun arrays and allowed to drift with the tidal flow into the vicinity of the active source. The buoys will provide a range of distances from multiple directions as they pass the sound source. The data will be stored on removable data storage units within the buoys which will be replaced for each pass of the buoys. By using the known position of the vessel combined with the position of each buoy (from its GPS position) the sound propagation can be calculated and absolute values of sound pressure level stated for each buoy position.

The results of the test will be used to establish and monitor new 180-dB and 190-dB marine mammal safety zones, and the 160-dB harassment zone. It will also be used to model and extrapolate the distance to the 120 dB isopleth. Results of the SSV will be available and implemented within 72 hours of the completion of the test.

Visual Vessel-Based Monitoring

The vessel-based monitoring will be designed to cover the requirements of the Incidental Harassment Authorization 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 source and mitigation vessels to monitor and implement mitigation measures during all daytime seismic operations. A lead PSO will be designated on the source and mitigation 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 air-gun 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 air gun operations. Two PSOs will be on the source vessels and three PSOs on the support vessel in order to better observe the exclusion zone. As in the past, the mitigation vessel will be positioned north and east of the source vessels, or essentially upstream of the bowhead and beluga migration route. When marine mammals are

about to enter or are sighted within designated exclusion zones, air gun 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 air gun or pinger operations after an extended shut down. SAE vessel crew and operations personnel will also watch for marine mammals (insofar as practical) to assist and alert the observers for the air gun(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 platform 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 meters (20 feet) above sea level. During operations, the PSO(s) will scan the area around the vessel systematically with reticle binoculars (e.g., 7×50 and 16-40x80) and with the naked eye. 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 air gun shut downs will be recorded in a standardized format. Data will be entered into a custom database using a notebook computer. The accuracy of the data entry 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 the 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

Shut-Down Procedure

A shut-down occurs when all air gun activity is suspended. The operating air gun(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 air gun 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 air gun array). A power down procedure involves reducing the number of air guns 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 air gun activity is suspended. During a power down, a mitigation air gun (air gun of small volume such as the 10 cu in) is operated. If a marine mammal is detected outside the safety radius (either injury or harassment) but is likely to enter that zone, the air guns 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, air gun activity will not resume until the marine mammal has cleared the applicable exclusion zone. The animal will be considered to have cleared the applicable exclusion zone if it:

- is visually observed to have left the applicable exclusion zone, or
- has not been seen within the zone for 15 min in the case of pinnipeds, or
- has not been seen within the zone for 30 min in the case of cetaceans.

Ramp Up Procedure

A “ramp up” procedure gradually increases air gun 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 air gun operations, including a power down, shut down, and after any period greater than 10 minutes in duration without air gun operations. The air gun array begins operating after a specified-duration period without air gun 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 air gun array configurations. During the ramp up, the applicable exclusion zone for the full air gun 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

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 an alternative ship speed or track. 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's 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 air gun(s).

As an additional mitigation procedure, with or without seismic operations taking place, SAE proposes to reduce vessel speed when within 1 kilometer 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 kilometer 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 and mitigation 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.

Protected Species Observers

PSO teams will consist of Inupiat observers and experienced field biologists. An experienced field crew leader and an Inupiat observer will be members of every PSO team onboard the source and mitigation 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 and the mitigation vessel to meet the following criteria:

- 100 percent 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:

1) Observe and record sensitive wildlife species.
2) Ensure mitigation procedures are followed accordingly.
3) 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 radii 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;
- time, location, speed, and activity of the source and mitigation vessels, sea state, ice cover, visibility, and sun glare; and positions of other vessel(s) in the vicinity.

Passive Acoustical Monitoring

Equipment

SAE proposes to conduct Passive Acoustical Monitoring (PAM) using a specialized autonomous passive acoustical recorders. These recorders will be deployed on the seabed and will record continuously at 64 kHz sample rate and 24-bit samples. The recorders will be calibrated using piston phone calibrators immediately before and after each deployment. These calibrations are accurate to less than 0.5 dB absolute.

The recorders will be configured with a single channel using a sensitive hydrophone and will be configured with an appropriate duty cycle to record at 64 kHz for up to 80 days. The recorders will sit directly on the seabed and will be attached to a ground line with a small weight at its end. Each recorder will be retrieved by using a grapple to catch the ground line and recover the unit. This simple deployment configuration and retrieval procedure has proven to be very effective for deployments in the Beaufort Sea.

PAM Deployment

Four recorders be deployed in an arrangement surrounding the survey area for the purposes of PAM. These data would be used for post-season analysis of marine mammal vocalization detections to help inform an assessment of potential disturbance effects. The PAM data will also provide information about the long-range propagation of the airgun noise.

Recorder Arrangement

The proposed arrangement of recorders would be to place one AMAR to the east of the survey region, one to the west, and two in the offshore direction (Figure 3). The exact arrangement will be defined based on the specific survey line configuration and will encompass the boundaries of the survey area. The recorders will be positioned at ranges where the sound levels are expected to have decayed to levels at or below 120 dB re 1 µPa, to be determined following analysis of the SSV data.

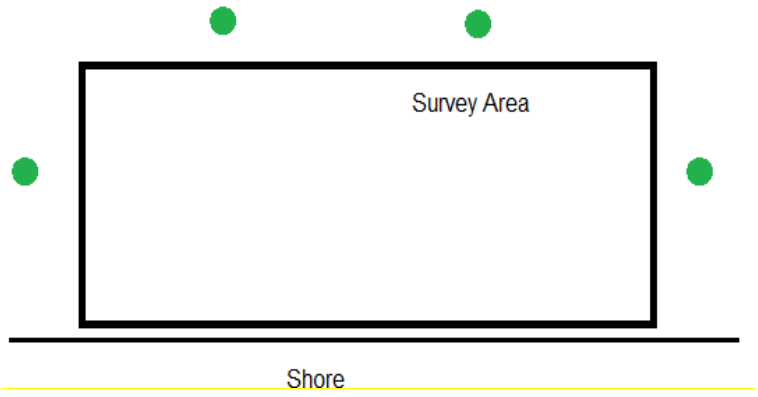

Figure 1. Schematic of a proposed recorder (green dots) arrangement for PAM monitoring.

Data Analysis

PAM recordings will be processed at the end of the season using marine mammal detection and classification software capable of detecting vocalizations from bowhead, walrus, beluga, ringed seals, bearded seals, ribbon seals, fin whales, humpbacks, killer whales, gray whales, and minke whales. Particular attention will be given to the detection of bowhead whale vocalizations since this is a species of particular concern due to its importance for local subsistence hunting.

A specialized computing platform will be used to perform automated detection tasks. A selection of the data will also be processed manually for validation of the automated classifier and for further species identification. The automated processing software will also be used to detect and quantify airgun pulses from the survey as recorded on the PAM recorders, to provide information about the long range propagation of the survey noise.

Spotted Seal Haulout Monitoring

An aerial-based seal monitoring program using Tulugaq's (Fairweather) Diamond DA42 aircraft outfitted with high-definition video and cameras was originally proposed by SAE for the Colville project that would estimate ringed and spotted seal use of the project area. That program, however, was eliminated after a request from the village of Nuiqsut to avoid aircraft activity, and a recognized lack of accurate correction factors for seals that might be missed during the surveys (observer and availability bias). Spotted seal haulout use remains a concern given that the Colville River Delta is one of the few areas seasonally used by this species in the Beaufort Sea, and little is known about the locations of active haulouts. On April 22nd, 2014, representatives with SAE met with members of the Kuukpikmiut Subsistence Oversight Panel (KSOP) to gather traditional knowledge baseline information on spotted seal haulout use that could be used to develop a monitoring program. The meeting results indicated that 1) Colville River Delta spotted seals do not haulout at specific locations and 2) during August and September most of the haulout use is on the islands within the Colville River proper where the seals are feeding on migrating salmon. Seal use within the river would not be affected by proposed seismic activity.

Given that information on seasonal use of haulout sites by spotted seals remains elusive, SAE is proposing a monitoring program in 2014 largely designed to identify where seals haulout in the action area and to determine whether some areas would need additional monitoring later in 2014 or 2015 based on SAE's schedule and shot layout. The monitoring would include a biweekly boat-based survey with the first survey on August 1 and the last two weeks after the seismic survey is completed for the year. The survey would begin at the village of Nuiqsut and would initially follow the far west channel of the Colville River, survey all the outer islands of the river delta, and then return to Nuiqsut following the farthest east river channel. The survey would traverse approximately 75 miles and take about a day to complete. All seals will be identified to species, GPS location, and whether the animals were hauled out or in the water. Collected data will be combined with available traditional knowledge and historical information available from Mr. Jim Helmericks to determine whether there are locations of consistent seal haulout use that might be affected by proposed seismic surveys. If sites of suspected high use are found, SAE will contact NMFS and the North Slope Borough Department of Wildlife to identify mitigation measures to minimizing impacts to these sites.

The surveys will be conducted by a team including one representative from the Nuiqsut seal hunting community (through Kuukpik Corporation) and one qualified PSO.

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.
- Participate with other operators in the Communications Call Centers (Com-Center) Program. The Com-Centers will be operated 24 hours/day during the 2013 subsistence bowhead whale hunt. SAE proposes to routinely call the communications center according to the established protocol while in the Beaufort Sea.

Reporting

A final report will be submitted to NMFS within 90 days after the end of the project. The report will describe the operations that were conducted and the marine mammals that were observed. The report will include 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, marine mammal behavior and any observed behavioral changes).