Open Water Peer Review Panel Monitoring Plan Recommendations for AGDC's Alaska LNG Proposed Construction Project in Prudhoe Bay, Alaska

The Open Water Peer Review Panel discussed and reviewed the marine mammal monitoring and mitigation plan (4MP) for the Alaska Gasline Development Group's Alaska LNG (AK LNG) Construction Project in Prudhoe Bay, Alaska. Panel members answered the questions below set forth by the National Marine Fisheries Service's (NMFS) Office of Protected Resources (OPR) and provide the following recommendations. Answers to, and recommendations based on, the specific questions were developed using the general monitoring requirements outlined in the Marine Mammal Protection Act (MMPA) implementing regulations and further guidance provided by OPR, which were included in the Instruction document and have been copied into this document below the questions.

Questions

I. Will the applicant's stated objectives effectively further the understanding of the impacts of their activities on marine mammals and otherwise accomplish the goals stated below? If not, how should the objectives be modified to better accomplish the goals below?

The specific objectives of AK LNG's 4MP are to provide:

1. The basis for avoiding and minimizing potential impacts to marine mammals;
2. The information needed to estimate the number of takes of marine mammals by harassment;
3. Data on the occurrence, distribution, and activities of marine mammals in the areas where project activities were conducted;
4. Information to compare the distances, distributions, behaviors, and movements of marine mammals relative to the project activities; and
5. Test the use of night vision and infrared technology for nighttime and low visibility monitoring

AGDC identified a different set of objectives in its presentation to the panel on 20 March 2020, as identified below:

--Monitor Level A and B harassment zones to avoid and minimize potential impacts to marine mammals

- Primary focus is Level A zone
- Monitor Level B zone to the extent possible,

--Record marine mammal data (e.g., occurrence, distribution, and behaviors),

--Compare sighting numbers, distances, behaviors, and movements relative to project activities,

--Estimate the number of takes, and

--Evaluate night vision devices when monitoring during periods of darkness.

The panel focused on the objectives outlined in the 4MP for its review. It was not clear whether the objectives presented at the March webinar were meant to supersede the 4MP, or provide additional detail. Overall, the panel was concerned that the objectives for the 4MP have not been consistently presented[1]. For instance, in Appendix B, one objective specifies a "[p]reventative 328-foot (100-meter) Shutdown Zone for all marine mammals," yet the Level A Exclusion Zone can be anywhere from 10 to 1,600 m, depending on activity and marine mammal. It is unclear how this "preventative" objective functions and what relationship it has to other stated objectives.

Although the objectives of the monitoring and mitigation plan (as stated on the 4MP) are laudable and could further our understanding of impacts. The ability of AGDC to accomplish some of these objectives is not likely to be fully successful based on the proposed mitigation and monitoring measures. As such, the panel has provided recommendations to improve the applicant's ability to achieve those objectives.

Panel members reviewed portions of AGDC's incidental harassment authorization (IHA) application and expressed concern over the inclusion of Level A harassment takes by the applicant. To the panel's knowledge, NMFS has never authorized a Level A harassment take as part of an IHA for northern Alaska (although apparently it has for other areas of the U.S.). If NMFS were to authorize a Level A harassment take under an IHA for the Beaufort or Chukchi Seas, it would be substantial change of policy and procedure. Further, there could be many unintended consequences if NMFS authorizes Level A harassment takes for subsistence species through an IHA (rather than rulemaking under section 101(a)(5)(A) of the MMPA). If NMFS intends to issue a Level A take under the AGDC IHA application, it would be appropriate to first consult with the co-management organizations, the subsistence hunters, Tribal Governments and North Slope communities about this change in policy and procedure.

II. Can the applicant achieve the stated objectives based on the methods described in the plan? (Note: in the past, applicants have sometimes submitted a strong monitoring plan that would accomplish a good objective that supports NMFS' goals, but the stated objective has been oddly disassociated from the planned work or badly worded. As you answer questions I & II – keep in mind if the objective might just needed to be re-worded to better fit the planned work).

Based on the objectives as stated in the 4MP, the panel believed that the applicant cannot achieve some of the stated objectives based on the methods described in the plan.

Estimating Actual Takes (Objective 2)

In reference to objective 2, the extent of the Level A and B harassment zones are beyond the effective visual detection range of the protected species observers (PSOs) and this complicates the applicant's ability to estimate takes by Level A or B harassment. The Level A harassment zone for low-frequency cetaceans (bowhead and gray whales) is 1,200 m for impact driving of the 11.5" and 14" H-piles and 1,600 m for impact driving of the 48" piles. It is unlikely that

[1] AGDC referenced a third set of objectives in its July 2019 presentation to the Alaska Eskimo Whaling Commission (AGDC's IHA application at page 239).

shore-based PSOs will be able to see large whales beyond about 1,000 m. Additionally, PSOs will not be able to effectively monitor the entirety of the Level B harassment zones because the zones are simply too large. The Level B harassment zone is 2,200 m for impact driving of the 48” pile and 4,700 m for vibratory driving of the sheet piles. Based on data from ship-based PSOs operating in the Chukchi Sea, a realistic estimate of effective sighting distance is approximately 200 m for seals and harbor porpoise, and 1 km for mysticetes (LGL et al. 2011, Figures 3.28 and 3.44). The effective sighting distance for belugas might be slightly larger than 200 m due to their conspicuous coloration in open water, although during windy conditions with white caps belugas are difficult to see (DeMaster et al. 2001). Given the extent of the Level A harassment zones, the applicant is not likely to be able to adequately monitor the entirety of the zones even under good viewing conditions. If the entirety of the Level A harassment zones cannot be monitored, the requirement to shut down pile driving cannot be effectively implemented to prevent takes by Level A harassment. Additional methods would be needed to adequately monitor the entirety of both the Level A and B harassment zones.

Estimated Actual Takes

The proposed monitoring methods cannot provide accurate and reliable estimates of actual takes, i.e., the number of marine mammals actually exposed to sound at or exceeding the established thresholds for Level A or Level B harassment. Two issues led the panel to this conclusion. First, as described above, the PSOs’ effective sighting distance does not cover the entirety of the Level A harassment zone for baleen whales during impact driving of the 11.5”, 14” and 48” piles and the Level B harassment zones for impact driving of the 48” piles or vibratory driving of the sheet piles. Second, fundamental assumptions of the analytical methods that AK LNG proposes to use to estimate actual takes from PSO sighting data are likely violated.

As proposed in the 4MP, estimating takes that occur during project activities involves estimating the probability of detecting animals that are located within effective the visible range of the PSOs and extrapolating those data to infer the number of animals located beyond visible range but still within the Level A and B harassment zones. The probability of detecting an animal within visible range depends on the distance between the PSO and the animal, the animal’s time at the surface, the animal’s dive time, and possibly additional variables that affect visibility, such as Beaufort Sea State, precipitation, and glare. When the assumption holds that the distribution of animals is uniform, distance sampling methods can be used to reliably estimate the effects of distance and other variables on detection probability, allowing estimation of effective sighting distance. Combining effective sighting distance with an estimate of the probability that an animal will be at the surface and available to be seen by the PSO will result in an estimate of the actual number of animals (or animal density) within effective visible range. If animal density is constant throughout the entirety of the harassment zones (i.e., within and outside of effective visible range), it is a simple procedure to extrapolate animal density within effective visible range to estimate the total number of animals exposed within the entirety of the harassment zones.

Unfortunately, this approach may not be valid for the AK LNG project. First, the assumption of uniform animal density both within and outside of visible range but within the Level A and B harassment zones is not likely to hold. There may be various density gradients for each species relative to water depth, distance from shore, and other habitat attributes. Additionally, the sound and physical disturbance associated with the pile driving activities will vary with distance from the construction site and could be influenced by an individual animals' behavioral responses. If animals are attracted to the construction activities, there will be a higher animal density near the construction site and the shore-based PSOs. If animals are displaced by construction activities, there will be a lower animal density nearshore. In the AK LNG situation, where the effects of diminishing detection probability due to distance are confounded with gradients in habitat and disturbance, and likely vary among species, distance sampling methods alone cannot be used to derive an accurate estimate of Level A and B harassment takes in the activity area.

To properly estimate actual take, it is necessary to know either know the true density distribution of animals in the harassment zones or use mark-recapture methods (Burt et al. 2014). Although it is theoretically possible to analyze data from multiple PSOs in a mark-recapture framework, it is practically very difficult to determine which sightings are matches between observers; therefore, the panel does not recommend this approach. Alternatively, it is possible to combine data from passive acoustic monitoring with that from visual observers in a mark-recapture analysis, but, again, it is challenging to identify matches between the acoustic and visual platforms.

<u>Ability to Achieve Objectives 1, 3, and 4</u>

Due to the relatively short effective sighting distance of PSOs, the large Level A and B harassment zones, and the inability to estimate exposures outside of the effective visual range of the PSOs, the applicant will only partially be able to minimize, and probably not be able to eliminate, Level A impacts to the marine mammal species present in the project area through implementation of the proposed mitigation procedures (objective 1).

Due to the limited effective visual range of the land-based PSOs, the applicant will only partially be able to monitor the Level A and B harassment zones to document marine mammal occurrence, distribution, activities, and responses to project operations (objectives 3 and 4). PSO data on occurrence and behavior of marine mammal species in the project area should not be considered baseline information because it would be collected coincident with disturbance from the construction activities.

III. Are there technical modifications to the proposed monitoring techniques and methodologies proposed by the applicant that should be considered to better accomplish the objectives?

The panel **recommends** the following technical modifications to the proposed monitoring techniques and methodologies to better accomplish the stated objectives:

1. To better understand the spatial variability in animal density throughout the Level B monitoring zone (and Level A Exclusion Zone associated with impact pile driving activities), PSO observations (and the PAM recommended in IV below) should occur 2-3 weeks before operations commence; during the entire operation season, including days on

which construction activities do not occur; and 2-3 weeks after construction activities end for the season.

2. PSOs should focus on scanning the shoreline and water, alternately with visual scans and using binoculars, to detect as many animals as possible rather than following individual animals for any length of time to collect detailed behavioral information.
3. The PSOs should be stationed on elevated platforms, if possible, to increase sighting distance. Specially-constructed observation scaffolding towers or use of existing structures (e.g., rooftops) should be considered.
4. PSOs should record visibility conditions at regular intervals and as they change throughout the day. Laser range finders might reliably accomplish this. Alternatively, a series of "landmarks" at varying distances from each observer could be identified, measured on the ground once before operations begin, and referenced throughout the season to record visibility. The landmarks could be buildings, signs, or other stationary objects on land that are located at increasing distances from each observation platform. At regular intervals (e.g., every 5 minutes) or whenever conditions change, each observer should record visibility according to the *farthest* landmark the laser range finder can detect or the PSO can clearly see.
5. A designated person who is on site and associated with AK LNG construction operations should keep an activity log to record the precise start and stop dates and times of each type of operation mode.
6. The Panel commends the action to be taken on potential use of and experimentation the effectiveness of night vision devices (NVD) and infrared technology (objective 5); however, it should be noted that there are many devices that have a broad range of capabilities that should be thoroughly understood before the experiment is conducted. (See Tattersall, GJ 2016; Minkina, W. and Dudzik, S. 2009).

IV. Are there techniques not proposed by the applicant (i.e., additional monitoring techniques or methodologies) that should be considered for inclusion in the applicant's monitoring program to better accomplish the objectives?

NOTE: Mention of trade names or commercial products does constitute endorsement or recommendation for use.

Passive Acoustic Monitoring

Real-time passive acoustic monitoring (PAM) technology is readily available and could provide many benefits to this project. Examples are the CAB system by SMRU Ltd. or the Observer buoy by JASCO. First, it would improve detection of marine mammals in the portion of the Level A and B harassment zones where visual detection probability is reduced or zero, thereby providing data to estimate the number of takes by Level A or B harassment in the far field. Second, PAM could be used to record received sound levels in the far field and calculate propagation loss, which could be used to back-calculate source levels and verify if the predicted isopleth distances used correct source levels and propagation loss

If real-time PAM is used, it is important that acoustic detections remain independent from PSO observations. Using real-time PAM to guide PSOs to sightings would bias the distance sampling estimate of density if it were not incorporated into the detection function model as a cue. Notification by PAM that an object is in the area likely affects PSO detection probability because a PSO who is warned of an incoming animal would likely detect it farther than if they were not warned. This effect on detectability would bias the effective visibility range for the PSO to be larger than it is in reality (i.e., without notification by PAM). The effective visibility range is in the denominator of the distance sampling density estimator, so the resulting take estimate would be biased low.

Several real-time PAM systems are currently commercially available for leasing. Some involve onboard processing which allows non-specialized users to be able to deploy and interpret data collected using this technology. Some real-time PAM buoys are small, with anchors weighting ~100 lbs, allowing deployment/retrieval operations with just two people in a small raft. Transmission of detections is made via wireless technology (as well as cell phone or satellite channel if needed) to a receiving station that can report simple alerts of detections or more complex data. These systems are calibrated and can be configured to report received levels in different metrics (SEL, SPL, peak, etc.). In general, all data can be archived for further post-processing. The Level A and B harassment zones proposed by the applicant can be easily covered by wireless technology with an omnidirectional antenna at the buoy, and a directional antenna in a mast at the observer's station. For example, a 900 MHz radio system on a base station at 30 feet above water can effectively transmit to 4 km. Using directional or dish antennae, transmission can exceed 10 km. Buoys can be deployed for ~2 weeks before batteries need to be replaced or charged. As a rough reference, the cost of these real-time buoys range in the order of $6-10k per month per buoy. Implementation of real-time PAM protocols would involve a field technician to go to the site and spend few days helping with initial setup and basic training, but it would not be required to be present for the entire operation.

The panel **recommends** using a minimum of at least 3 real-time or archival PAM buoys, although 6 buoys would allow a better coverage of the large monitoring zones, located in different configurations:

1) Sound source verification: At the start of pile installation for each type of pile type, dimension, or installation method, the three units (or more for improved accuracy) should be deployed in a line perpendicular to shore from the pile driver location at different distances. The simplest approach would be to follow a near, medium, and far approach with equidistances between moorings. For example, one unit in the near field at 10 to 50 meters from the pile, a second unit at a farther distance, such as 500 meters from the pile, and a third buoy at 1000 meters (Fig. 1). However, a possible better alignment of the placement of the moorings would be following a logarithmic approach, where distance between moorings represent values which are in an equal ratio, for example 10, 100, 1000 m from the pile driver, as the results will likely provide a better fitting for an exponential regression curve to calculate propagation loss. Distances should be discussed with the manufacturer of the PAM system to make sure the dynamic range and system gain is appropriate for this task (i.e., they might want a lower gain for the closer buoys, and higher gain for the farther units). This configuration should be maintained for at least

60 minutes of noise producing activity, to allow calculating median values from a representative time series. For example, after 1 hour of pile driving, the buoy at 50 and 500 m (or 10 and 100 m for the logarithmic approach) can be moved from its location to another farther away, closer to the edge of the Level B harassment zone, to start the monitoring configuration.

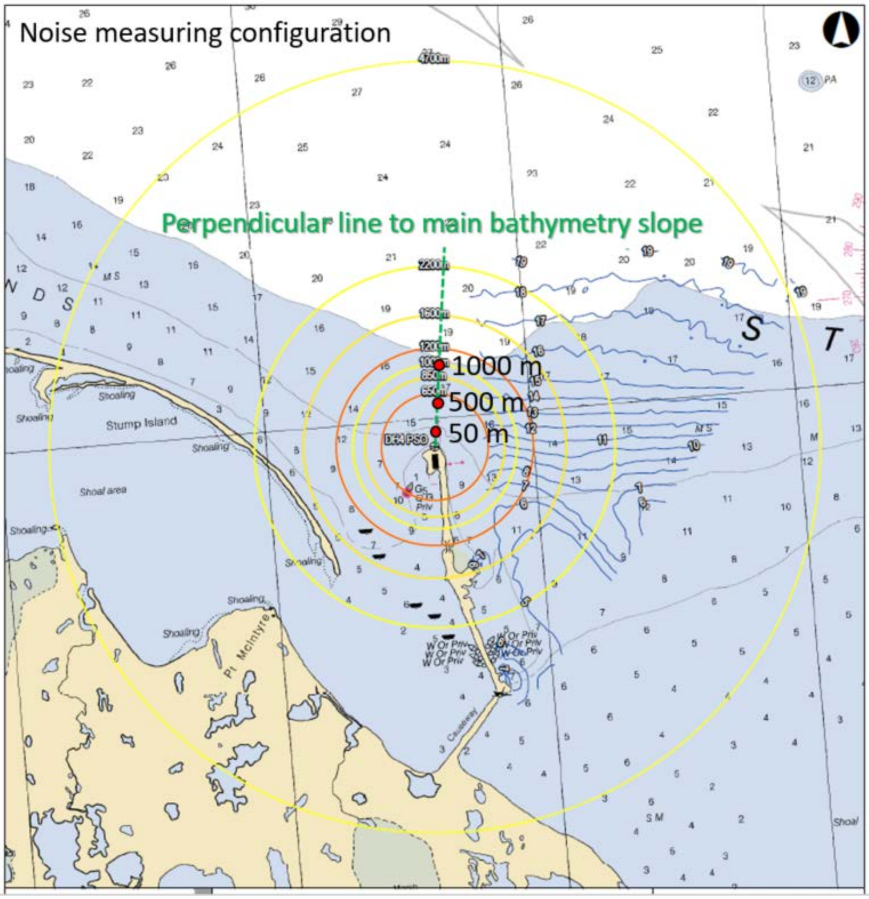

Figure 1: Example of the recommended configuration of the PAM buoys for sound source verification. Three PAM buoys (red dots) would be placed at different distances in line from the pile driver. At least one near-field buoy and one far-field buoy would be required to calculate propagation loss, but a third middle sampling point would increase accuracy.

2) Detection of marine mammals in the far field: Figures 2-3 present monitoring configuration designed to maximize detection of marine mammals entering the Level B harassment zone, in those portions of the zone too far for observers to see. Ideally, the three (or preferably six) buoys should be placed at equidistant intervals from each other to maximize and homogeneously distributed coverage, and all at the same distance to the edge of the Level B harassment zone. In order to assume that each acoustic detection is a take, the acoustic detection range from the target marine mammal species should be considered (see Table 1), and that range should be used to place the buoy inside the Level

B harassment zone at that specific distance from the edge of the Level B harassment zone. For example, if the detection range for beluga whale vocalizations is estimated to be 860 m, all buoys should be placed 860 m from the offshore border of the Level B harassment zone. To determine buoy placement in a scenario such as this, where multiple species with different source levels may be present, the panel recommends using the detection range associated with the most likely species. In this case, small pinnipeds (e.g., spotted and ringed seals) are by far the most likely marine mammals to be present in the operation area.

Table 1: Suggested approach to obtain detection distances for different marine mammals. Source level of their vocalizations (from Richardson et al. 1995; Lebot 2016 for beluga; Matthews et al. 2017 for harbor seal as a proxy for spotted seal; Guazzo et al. 2017 for gray whale) are used to calculate distance at which received levels drop to ambient noise levels and thus are no longer detectable. This table assumes a generic ambient noise of 100 RMS dB and practical spreading. If needed, these suggested distances should be corrected with appropriate ambient noise level and propagation loss obtained when real-time acoustic buoys are deployed.

Species	Source Level (RMS dB)	Detection Distance (m)
Ringed seal (social calls)	130	100
Beluga whale (calls and whistles)	144	860
Harbor seal (proxy for spotted seal)	144	860
Gray whale (M3 call)	157	6,300
Bowhead whale (mean of moan, tonal, and pulsive calls)	161	11,700
Bearded seal (trills)*	155	4,650

*****Median value of the source level for bearded seal trills (Fournet et al. 2019).

If the detection range is larger than the Level B harassment zone, this approach cannot assume each detection yields a take as the calling animal can easily be outside the take zone. Thus, in this case an alternative method could be to use the received level of the call, and only assume it is a take if the level exceeds a threshold. This threshold should reflect the propagation loss equivalent to the distance from the mooring to the monitoring zone border. For example, consider that moorings are placed at 860 m from the border of the monitoring zone for beluga whales. The propagation loss for 860 m is 44 dB; thus any bearded seal trill (assumed to be emitted at 155 dB; Table 1) exceeding 111 dB should be considered a take.

One caution is that practical spreading might not be the best approach to estimate propagation loss for these types of signals. For example, beluga whales in Cook Inlet have a maximum range of 3.3 km for calls and whistles, and a maximum range of 900 m for echolocation (Lammers et al. 2013, Castellote et al. 2016). These distances differ substantially from what is listed in Table 1. Thus, these detection ranges should be properly calculated with the actual results for propagation loss and ambient noise levels in the area.

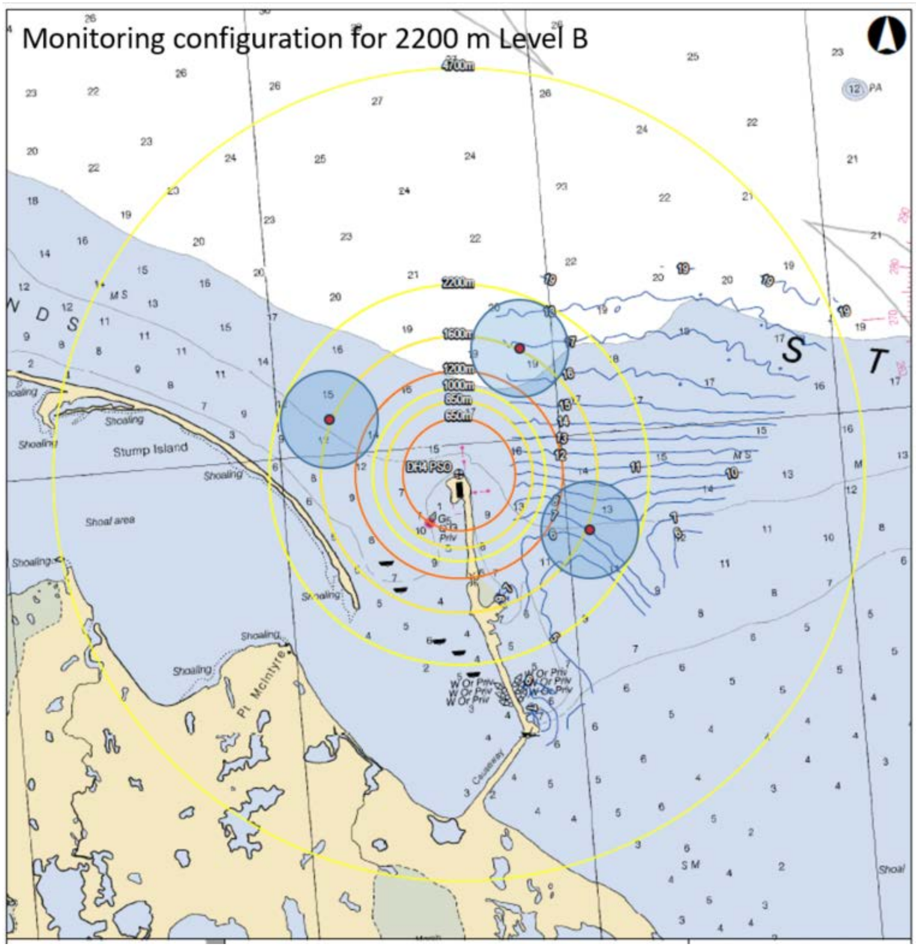

Figure 2. Example of monitoring configuration for real-time PAM. Three moorings (red dots) placed at equidistant intervals from each other with their respective detection ranges of 860 m (blue areas) corresponding to their distance to the edge of the 4,700 m monitoring zone.

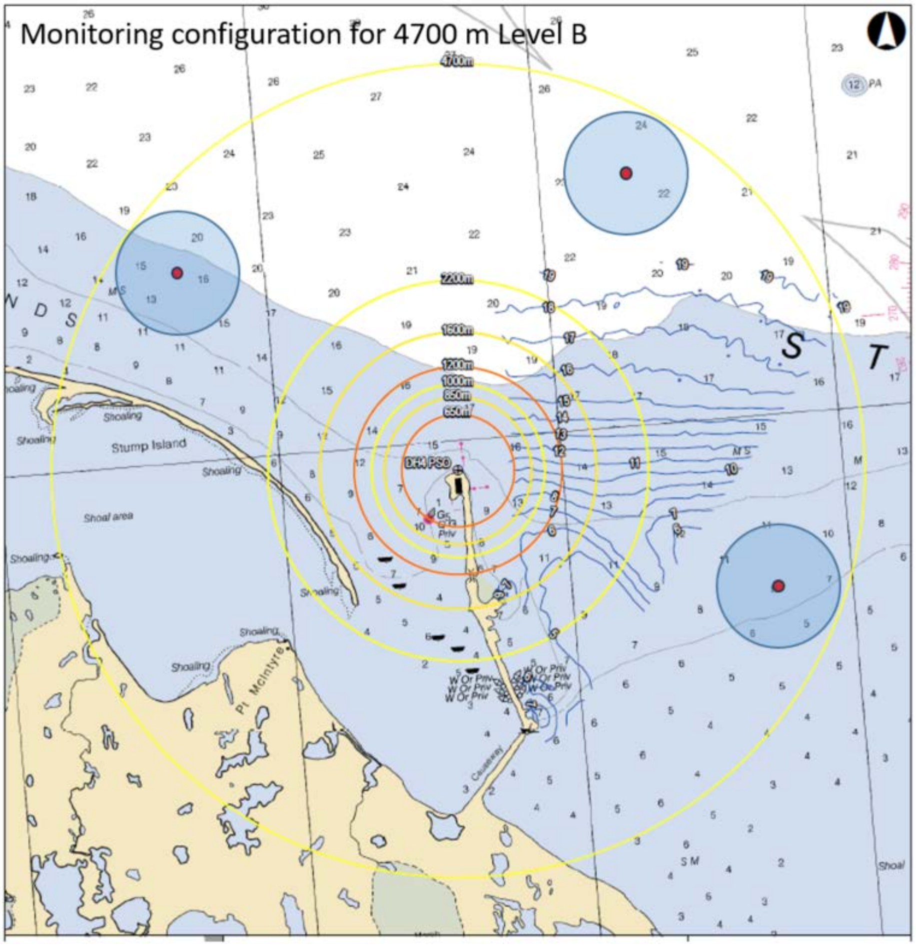

Figure 3. Example of monitoring configuration for real-time PAM. Three moorings (red dots) placed at equidistant intervals from each other with their respective detection ranges of 860 m (blue areas) corresponding to their distance to the edge of the 4,700 m monitoring zone.

The buoy configuration should be revised for every change in monitoring zone. For example, when monitoring of the Level A harassment zone changes from1,200 to 1,600 m, the buoys should be moved to their respective new locations to capture this increase in distances.

An alternative to real-time PAM would be to use archival bottom mounted recorders instead of real-time units. However, these will not involve a simple operation for relocation, as they do not typically contain a surface buoy to reduce self-noise. Also, data can only be accessed after recovery, thus missing the real-time benefits (i.e., sound source verification, shut downs). An alternative would be for real-time recorders for closer monitoring and archival recorders for the more distant monitoring.

Estimating Actual Take

The panel **recommends** the following modification to the methods for estimating actual takes by Level A and B harassment. To estimate takes within the effective visual range of the PSOs, the panel encourages the use of distance sampling methods (Burt et al. 2014) to correct for animals that may not be detected or detectable by PSOs, in spite of the concerns listed above about violating assumptions underlying the analytical methods.

To estimate takes by Level B harassment outside of the effective visual range of the PSOs, the panel recommends that the following two methods both be used and the results compared and reported to NMFS. First, as proposed in the original IHA application and 4MP, assume that animal density is uniform throughout the Level B harassment zone and use distance sampling methods (Burt et al. 2014) based only on the shore-based PSOs to estimate actual takes by Level B harassment for the entire Level B harassment zone.

Second, use real-time passive acoustic monitoring (PAM) to estimate takes by Level B harassment only in the far field. For simplicity, each acoustic detection that occurs during pile driving or removal should be considered a take by Level B harassment, despite uncertainties as to whether a single acoustic detection is equivalent to a take. Variability in marine mammal group size and the fact that PAM detects only animals that are making sounds within the detection range of the recording instrument would tend to result in underestimates of number of takes by Level B harassment. In contrast, if a single marine mammal is detected multiple times within the Level B harassment zone, takes by Level B harassment would be overestimated. The magnitude and direction of the overall bias from these factors is unknown. Nevertheless, the panel believes that this method may provide a reasonable estimate of actual takes by Level B harassment for the area beyond the effective visual range of PSOs.

Regardless of the degree of similarity between the two estimates of take by Level B harassment for the far field, both estimates should be reported to NMFS.

Sound Attenuation Devices

Due to the limited visible range of the land-based PSOs and the inability of PAM to estimate group size and detect silent animals, the applicant should consider deployment of one or more sound attenuation devices to decrease the size of the Level A and B harassment zones. The deployment of sound attenuation devices has become standard practice during pile driving in the marine environment to minimize disturbance of marine mammals, fish, and other marine wildlife. As such, the deployment of sound attenuation devices would more effectively address objective 1 (avoiding and minimizing potential impacts to marine mammals). Examples of sound attenuation devices to consider include bubble curtains, noise mitigation screens, and hydro sound dampers (nets with air-filled or foam-filled elastic balloons) (Bellman 2014; Elmer and Savery 2014). The panel **recommends** that AGDC consider deploying some type of sound attenuation device to minimize the potential for takes by Level A and B harassment.

V. What is the best way for an applicant to present their data and results (formatting, metrics, graphics, etc.) in the required reports that are to be submitted to NMFS (i.e., 90-day report and comprehensive report)?

The panel **recommends** that the applicant provide tables or figures summarizing the following:

a. Total number of hours during which each construction activity type occurred;
b. Total number of hours that PSOs were on watch during each construction activity type;
c. Total number of hours that PSOs were on watch during periods of no construction activity;
d. Number of hours of observation that occurred during various visibility and sea state conditions;
e. Number of animals sighted, by species and operation mode (including no activity periods as an undisturbed condition);
f. Number of acoustic detections, by species and operation mode (including no activity periods as an undisturbed condition);
f. Elevation of observers above sea level;
g. Histograms of perpendicular distances to PSO sightings, by species (or species group, if sample sizes are small);
h. Maps showing visual and acoustic detections by species and construction activity type.
i. Obtained calculations of received levels in metrics applicable to the NOAA Acoustic Guidelines (dB RMS, dBpeak, SEL 24h), propagation loss results, isopleth distances, and estimated source levels.
j. Sighting and acoustic detection rates summarized into daily or weekly periods for the before, during, and after construction periods, if available.

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Monitoring Plan Requirements

The MMPA implementing regulations generally indicate that each Incidental Harassment Authorization (IHA) applicant's monitoring program should be designed to accomplish one or more of the following: document the effects of the activity (including acoustic) on marine mammals; document or estimate the actual level of take as a result of the activity (in this case, seismic surveys or exploratory drilling programs); increase the knowledge of the affected species; or increase knowledge of the anticipated impacts on marine mammal populations. As additional specific guidance beyond that provided in the MMPA regulations, NMFS further recommends that monitoring measures prescribed in MMPA authorizations should be designed to *accomplish or contribute to one or more of the following top-level goals*:

(a) An increase in our understanding of the likely occurrence of marine mammal species in the vicinity of the action, i.e., presence, abundance, distribution, and/or density of species.

(b) An increase in our understanding of the nature, scope, or context of the likely exposure of marine mammal species to any of the potential stressor(s) associated with the action (e.g., sound, explosive detonation, or expended materials), through better understanding of one or more of the following: 1) the action itself and its environment (e.g., sound source characterization, propagation, and ambient noise levels); 2) the affected species (e.g., life history or dive patterns); 3) the likely co-occurrence of marine mammal species with the action (in whole or part) associated with specific adverse effects, and/or; 4) the likely biological or behavioral context of exposure to the stressor for the marine mammal (e.g., age class of exposed animals or known pupping, calving or feeding areas).

(c) An increase in our understanding of how individual marine mammals respond (behaviorally or physiologically) to the specific stressors associated with the action (in specific contexts, where possible, e.g., at what distance or received level).

(d) An increase in our understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: 1) the long-term fitness and survival of an individual; or 2) the population, species, or stock (e.g., through effects on annual rates of recruitment or survival).

(e) An increase in our understanding of the effectiveness of mitigation and monitoring measures.

(f) A better understanding and record of the manner in which the authorized entity complies with the incidental take authorization and incidental take statement.

(g) An increase in the probability of detecting marine mammals (through improved technology or methodology), both specifically within the exclusion zone (thus allowing for more effective implementation of the mitigation) and in general, to better achieve the above goals.