FIVE ESTUARIES OFFSHORE WIND FARM

VOLUME 9, REPORT 14.1: OUTLINE MARINE MAMMAL MITIGATION PROTOCOL – PILING (TRACKED)

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In preparation of this document Five Estuaries Wind Farm Ltd has made reasonable efforts to ensure that the content is accurate, up to date and complete for purpose.

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CONTENTS

TABLES

FIGURES

DEFINITION OF ACRONYMS

Term	Definition
ADD	Acoustic Deterrent Device
BBC	Big Bubble Curtain
bl/min	Blows per minute
dB	Decibel
DBBC	Double Big Bubble Curtain
DCO	Development Consent Order
dML	deemed Marine Licence
EIA	Environmental Impact Assessment
ES	Environmental Statement
HSD	Hydrosound-Damper
JNCC	Joint Nature Conservation Committee
kJ	Kilojoules
km	Kilometres
M	Meter
m^3	Meters cubed
m/s	Metres per second
MDS	Maximum Design Scenario
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MMOb	Marine Mammal Observer
mins	Minutes
NAS	Noise Abatement System
NMS	Noise Mitigation System
ORJIP	Offshore Renewables Joint Industry Programme
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PTS	Permanent Threshold Shift
RaDIN	Range dependent nature of impulsive noise
SNCB	Statutory Nature Conservation Bodies

Term	Definition
UK	United Kingdom
UXO	Unexploded Ordnance
VE	Five Estuaries
WTG	Wind Turbine Generator

GLOSSARY OF TERMS

Term	Definition
Array Area	The areas where the WTGs will be located. These should be referred to as the northern and southern arrays to differentiate them.
Development Consent Order	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP) from the Secretary of State (SoS) for the Department for Energy Security and Net Zero (DESNZ).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact in question with the sensitivity of the receptor in question, in accordance with defined significance criteria.
ES	Environmental Statement (the documents that collate the processes and results of the EIA).
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial, resulting from the activities associated with the construction, operation and maintenance, or decommissioning of the project.
Magnitude	The extent of any interaction, the likelihood, duration, frequency and reversibility of any potential impact.
Maximum Design Scenario (MDS)	The maximum design parameters of the combined project assets that result in the greatest potential for change in relation to each impact assessed.
Mitigation	Mitigation measures, or commitments, are commitments made by the project to reduce and/or eliminate the potential for significant effects to arise as a result of VE.
Peak Sound Pressure Level	Characterised as a transient sound from impulsive noise sources, it is the maximum change in positive pressure as the wave propagates.
Pre-construction	The phases of the Project before construction takes place.
Sensitivity	The potential vulnerabilities of receptors to an impact from VE, their recoverability and the value/importance of the receptor.
Significant Effects	It is a requirement of the EIA Regulations to determine the likely significant effects of the development on the environment which should relate to the level of an effect and the type of effect. Where possible significant effects should be mitigated.
Sound Exposure Level	Measure that considers both the received level of the sound and duration of exposure.

Term	Definition
Sound Pressure Level	Measure of the average unweighted level of sound, usually a continuous noise source.
The Applicant	The company Five Estuaries Offshore Wind Farm Ltd.
VE	Five Estuaries Offshore Wind Farm (VE) including the proposed offshore and onshore infrastructure.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

1.1.1 The Five Estuaries Offshore Wind Farm (hereafter VE) is a proposed extension to the operational Galloper Offshore Wind Farm, which is located off the coast of Suffolk (England, United Kingdom (UK)) in the Southern North Sea. At its closest point, VE is located 37 kilometres (km) off the Suffolk coast. VE will consist of both onshore and offshore infrastructure, including two proposed array areas, up to two offshore substation platforms and subsea cables to transfer electricity onshore (see Volume 6, Part 2, Chapter 1: Offshore Project Description for full details).

1.2 PURPOSE OF THIS DOCUMENT

1.2.1 The main objective of this Outline Marine Mammal Mitigation Protocol (MMMP) for Piling Activities is to detail the potential contingency measures which may be proposed to reduce the risk of permanent threshold shift (PTS) auditory injury to marine mammals resulting from pile driving for VE monopile and pin-pile foundations to a negligible level. This document follows guidance from the Joint Nature Conservation Committee (JNCC, 2010) and integrates recommendations on the utilisation of Acoustic Deterrent Devices (ADD) as outlined by McGarry (2020), and established industry best practices.

1.2.2 The measures outlined in this document should be considered as examples of potential mitigation measures which could be employed by VE at the point of construction to provide confidence to stakeholders that the Final MMMP will be sufficient to ensure the risk of injury is as low as reasonably possible. It is not intended to identify specific mitigation measures that will be implemented during pile-driving operations as this will be determined prior to construction by VE in consultation with the regulators and their advisors. Prior to the commencement of offshore construction for VE, a formal Piling MMMP will be drafted and submitted to the regulator in line with the deemed Marine Licence (dML) condition within the draft Development Consent Order (DCO). The content of this Final MMMP will be based on the best available evidence at that point in time.

1.2.3 VE has developed mitigation measures during the Environmental Impact Assessment (EIA) process to minimise potential impacts to marine mammals, which involves the creation and implementation of a piling MMMP (see Volume 6, Part 2, Chapter 7: Marine Mammal Ecology for full details).

1.3 IMPLEMENTATION OF THE OUTLINE MMMP FOR PILING ACTIVITIES

1.3.1 A Final Piling MMMP will be prepared once the final project design has been confirmed if a DCO is granted. That plan will follow the principles established in this Outline MMMP for Piling Activities, as required under Condition 1 of the generation assets dML within Part 2 of Schedule 10 the DCO). Details regarding the proposed mitigation can be found in Section 4 below.

2 PILE DRIVING SCENARIOS

2.1 SCENARIOS CONSIDERED

2.1.1 Both monopiles and pin piles may be installed at VE therefore, both foundation types have been assessed in the Environmental Statement (ES) (see Volume 6, Part 2, Chapter 7: Marine Mammal Ecology.) The construction programme comprises the installation of up to 81 total monopiles (79 WTGs and 2 OSPs) and up to 340 total pin piles (316 pin piles for 79 WTGs and 24 pin piles for 2 OSPs) foundation structures over a period of 12 months. A summary of the parameters assessed are presented in the sections below, with the outcome of the marine mammal assessment summarised in Section 3.2.

2.1.2 For this ES assessment, two different maximum design scenarios (MDS) have been considered:

- Monopile Foundation Scenario: Both the Array and OSPs will utilise a maximum monopile diameter of 15 m. The installation process entails driving the monopiles into the seabed using a pile with a maximum blow energy of 7,000 kJ. Up to two monopiles can be installed within a 24-hour period; and
- Pin pile Foundation Scenario: Both the Array and OSPs will use a 3.5 m maximum pin-pile diameter. The installation involves a 3,000 kJ maximum blow energy with up to four pin-piles being installed in a 24-hour period.

2.1.3 These two MDS' are presented in the sections below.

2.2 MONOPILE MDS

2.2.1 Table 2.1 details the piling parameters that represent the spatial MDS (monopiles). For full details of the piling parameters see Volume 6, Part 5, Annex 6.2: Underwater Noise Technical Report.

Table 2.1: Monopile MDS parameters

Parameter	Monopiles		
	Large WTG	Small WTG	OSP
Maximum hammer energy (kJ)	7,000		
Number of monopiles	41	79	2
Maximum pile diameter (m)	15		
Soft-start duration (mins)	10		
Ramp-up duration (mins)	25		
Maximum piling time per foundation (hours)	7.5		7.5
Maximum number of piling days	41	79	2

2.3 PIN PILE MDS

2.3.1 Table 2.2 details the piling parameters that represent the temporal MDS (pin piles). For full details of the piling parameters see Volume 6, Part 5, Annex 6.2: Underwater Noise Technical Report.

Table 2.2: Multi-leg pin-piled jackets MDS parameters

Parameter	Mult-leg pin-piled jackets		
	Large WTG	Small WTG	OSP
Maximum hammer energy (kJ)	3,000		
Number of jacket foundations	41	79	2
Maximum pile diameter (m)	3.5		
Soft-start duration (mins)	10		
Ramp-up duration (mins)	25		
Maximum legs per foundation	4		6
Total number of piles	164	316	24
Maximum piling time per foundation (hours)	16 hr assuming 4 piles/day		
Total number of piling days	41 (assuming 4 piles/day)	79 (assuming 4 piles/day)	6(assuming 4 piles/day)

3 SUMMARY OF POTENTIAL IMPACTS

3.1 MAXIMUM DESIGN SCENARIO

3.1.1 For full details of the piling parameters please see Volume 6, Part 2, Chapter 7: Marine Mammal Ecology.

INSTANTANEOUS AND CUMULATIVE PTS-ONSET

3.1.2 The potential quantitative impacts from underwater noise from piling activities at VE has been assessed for PTS on grey seal, harbour porpoise and harbour seal referring to the PTS-onset thresholds presented by Southall *et al.* (2019). Table 3.1 provides the results at the maximum hammer energy for both monopiles (7,000 kJ) and pin piles (3,000 kJ). The maximum instantaneous PTS-onset range is 740 m. The maximum cumulative PTS-onset range is 8.6 km. Additional detail on the piling assessment on marine mammals can be found in Volume 6, Part 2, Chapter 7: Marine Mammal Ecology and Volume 6, Part 5, Annex 6.2: Underwater Noise Technical Report.

Table 3.1: Estimated instantaneous and cumulative PTS-onset impact ranges (m) of piling at full hammer energy

	Pile type	Monopile (7,000 kJ)			Pin pile (3,000 kJ)		
Species	**Location**	**S-SW**	**N-NE**	**N-N**	**S-SW**	**N-NE**	**N-N**
Instantaneous PTS (SPL_{peak})							
Harbour porpoise	Max range (m)	730	730	740	580	580	590
Harbour & Grey seals	Max range (m)	60	60	60	<50	<50	<50
Cumulative PTS (SEL_{cum})							
Harbour porpoise	Max range (m)	8,4~~,00~~0	8,500	8,600	6,400	6,500	6,600
Harbour & Grey seals	Max range (m)	300	280	330	<100	<100	<100

3.2 SUMMARY OF IMPACTS ASSESSED FOR MARINE MAMMALS IN RELATION TO PTS FOR PILING NOISE

3.2.1 Volume 6, Part 2, Chapter 7: Marine Mammal Ecology presents the full assessment of the impacts of PTS-onset for piling noise of marine mammals:

- Harbour porpoise: the unmitigated (i.e., without the MMMPs (see Volume 9, Reports 14.1 and 14.2) magnitude of the impact has been assessed as Low and the sensitivity of harbour porpoise as Medium. Therefore, the significance of unmitigated PTS from piling is concluded to be of Minor significance, which is not significant in terms of the EIA Regulations.

- Harbour and Grey seals: The unmitigated magnitude of the impact has been assessed as Negligible and the sensitivity of seals as Medium. Therefore, the significance of PTS from piling is concluded to be of Negligible significance, which is not significant in terms of the EIA Regulations.

3.2.2 The assessment then concluded that, with the use of mitigation methods (outlined within Volume 6, Part 2, Chapter 7: Marine Mammal Ecology), it is expected that the risk of PTS will be reduced to negligible under the MDS for both monopiles and pin-piles and is not therefore considered to have a significant effect on any marine mammal species considered in the assessment.

4 MITIGATION METHODOLOGY

4.1 INTRODUCTION

4.1.1 In order to minimise the risk of any auditory injury to marine mammals from underwater noise during pile driving, there are a suite of mitigation measures that the Applicant could implement for VE piling. These mitigation measures may include (but are not limited to) the following:

- Pre-piling deployment of ADDs;
- Marine Mammal Observation (MMOb);
- Passive acoustic monitoring (PAM) system; and
- Piling soft-start procedure

4.1.2 The specific mitigation measure (or suite of measures) that will be implemented during the construction of VE will be determined, in consultation with relevant Statutory Nature Conservation Bodies (SNCB), following the appointment of the installation contractors (and therefore, confirmation of final hammer energies and foundation types), collection of additional survey data (further noise and/ or geophysical data) and/ or information on maturation of emerging technologies. Furthermore, the Offshore Renewables Joint Industry Programme (ORJIP) funded Range dependent nature of impulsive noise (RaDIN) project is expected to become available in 2024 which consequently will inform future modelling of cumulative PTS for piling activities (Carbon Trust, 2023). This additional data and information will support the noise modelling that will be updated to feed into the Final MMMP and discussions on the appropriate mitigation measure(s).

4.1.3 The following sections provide a high-level methodology for each of these elements. A Final Piling MMMP will be produced for approval by the Marine Management Organisation (MMO) prior to the relevant works commencing.

4.2 MITIGATION ZONE

4.2.1 The mitigation zone is defined as the maximum potential PTS-onset impact range. The Applicant will update the noise modelling prior to construction once the final project details are known. The JNCC (2010) guidelines recommend a mitigation zone of at least 500 m during piling activities. The actual mitigation zone for VE will be confirmed in the Final Piling MMMP as this will be determined based on the final noise modelling data. If the final noise modelling estimates a PTS-onset impact range larger than the 500 m suggested by JNCC, the mitigation zone will be increased to cover the PTS-onset impact.

4.3 PRE-PILING

MARINE MAMMAL OBSERVERS

4.3.1 The JNCC (2010) recommends a minimum of a 30-minute pre-piling search by a qualified MMOb(s) for both monopiles and pin piles within the mitigation zone and a 30-minute search prior to ADD activation[1]. If this mitigation measure is adopted the MMOb(s) would record monitoring periods, environmental conditions, and marine mammal sightings as per JNCC guidelines. Identified behavioral responses to ADD activation (if used) would also be documented.

4.3.2 If a marine mammal is detected during the pre-piling search, the soft-start would be delayed until the MMOb(s) confirms its departure from the mitigation zone. If a marine mammal is not observed leaving the mitigation zone, a delay of 20 minutes will be implemented from the last recorded sighting before the commencement of a soft-start. The ADD(s) would be checked to ensure it is operating correctly, and the MMOb would continue to monitor for sightings and animal behaviour during the soft-start.

4.3.3 The JNCC guidelines have stipulated fully-trained MMOb(s) are used in piling activities for minimising piling noise-related risks to marine mammals (JNCC, 2010). Specific details confirming MMObs and methods will be updated in the Final Piling MMMP, considering any available guidance at that time.

PASSIVE ACOUSTIC MONITORING (PAM)

4.3.4 A PAM system, used by a trained operator, would be used to supplement visual monitoring during daylight and in conditions of reduced visibility (e.g., night, fog, high sea state as per JNCC, 2023 guidance) prior to the commencement of piling at a foundation. If an animal is acoustically detected within the mitigation zone, the soft-start would be delayed until the PAM operator (or MMOb(s) if used) confirms its departure from the mitigation zone.

ADD CHOICE AND SPECIFICATION

4.3.5 The typical ADD used in UK waters for current construction phase projects is the Lofitech AS seal scarer. Extensive studies, such as those by Sparlin *et al.* (2015) and McGarry *et al.* (2017), have consistently demonstrated the high effectiveness of this ADD in deterring harbour seals, grey seals and harbour porpoise, particularly in conditions resembling offshore wind farm (OWF) construction sites.

4.3.6 Lofitech ADDs have been proven to significantly deter harbour porpoise up to 7.5 km, without causing complete displacement of this species (Brandt *et al.,* 2013). Moreover, these ADDs have elicited responses in seals within a radius of less than 1 km. However, it is noteworthy that the observed responses did not always lead to substantial movements away from the source, especially for seals that were travelling at the time of exposure (Gordon *et al.,* 2019).

[1] This may require the total visual watch time to be longer than 1 hour when the ADD activation time is longer than 30 minutes, as the watch will continue during the ADD deployment

4.3.7 The Lofitech AS seal scarer has a commendable track record in mitigating marine mammal interactions across various European OWF projects. Its successful application has been documented in projects such as C-Power Thornton Bank OWF in Belgium (Haelters *et al.,* 2012), Horns Rev II, Nysted and Dan Tysk OWFs in Denmark (Carstensen *et al.,* 2006; Brandt *et al.,* 2016), and has been widely used for UK projects including Hornsea Project One, Hornsea Project Two, Dogger Bank A and B and for the Sofia OWF unexploded ordnance (UXO) campaign among others.

4.3.8 It is important to note that there may be additional ADD models identified in the pre-construction phase for VE that are available and suitable for use at that point in time. As such, if an ADD is identified as part of the suite of mitigation measures set out in the Final Piling MMMP, the final ADD choice and specification would follow current best practice as advised by the relevant SNCB(s) and would be approved by the MMO.

ADD DEPLOYMENT PROCEDURE

4.3.9 If an ADD is used during piling operations, one ADD would be deployed from the platform/vessel deck, with the control unit and power supply on board in safe positions. Verification of ADD operations would be required before piling commences. The deployment procedure would be determined with the foundation installation contractor and would adhere to safe, standard practices, using experienced/ trained staff to ensure proper ADD equipment use.

ADD DURATION OF DEPLOYMENT

4.3.10 The duration of ADD deployment would be calculated based on assumed swimming speeds to ensure that marine mammals are safely outside the mitigation zone when piling begins. An assumed swim speed of 1.5 m/s would be applicable to both porpoise and seals (Lepper *et al.,* 2012; Otani *et al.,* 2000). These selected swim speeds are considered precautionary, as evidence suggests that animals often flee at much higher initial speeds. For instance, a study by Kastelein *et al.,* (2018) showed that a captive harbour porpoise responded to playbacks of pile driving sounds by swimming at speeds significantly higher than baseline mean swimming speeds, with greatest speeds of up to 1.97 m/s which were sustained for the 30-minute test period. Another study by van Beest *et al.* (2018) showed that a harbour porpoise responded to airgun noise exposure with a fleeing speed of 2m/s.

4.3.11 During the soft-start and ramp-up, marine mammals are expected to continue moving away from the noise source. Additionally, the presence of other construction vessel activity on-site would be likely to induce animals to move away from the piling location and out of the mitigation zone prior to piling commencement, as indicated by studies (Brandt *et al.,* 2018; Graham *et al.,* 2019; Benhemma-Le Gall *et al.,* 2021, Benhemma-Le Gall *et al.,* 2023).

ADD OPERATOR TRAINING AND RESPONSIBILITIES

4.3.12 A trained ADD operator would be responsible for ADD maintenance, operation, and reporting. Their duties would include deploying the ADD, verifying its operations, maintaining charged batteries and spare equipment, recording and reporting ADD activities. Before the MMOb's and / or PAM operator's pre-piling watch, the ADD operator would test and deploy the ADD to the agreed depth and distance.

SOFT-START PROCEDURE

4.3.13 After pre-piling deployment of the ADDs and pre-piling watch by the MMOb and/or PAM operator, the foundations installation process would commence. The piling parameters for both monopiles and pin-piles are provided in Table 4.1. Initially, a maximum of 15% of the full hammer energy would be applied for a duration of 10 minutes (i.e. the soft-start), before the hammer energy would gradually increase (i.e. the ramp-up) until it reaches the level necessary for pile installation or the maximum hammer energy capacity.

4.3.14 If a marine mammal enters the mitigation zone during the soft-start, then whenever possible, the piling operation at that mitigation zone would cease, or at least the power would not be further increased until the marine mammal exits the mitigation zone.

4.3.15 It is important to note that the hammer energy would not be raised beyond what is required for the successful completion of each installation. If ground conditions permit the use of less than the maximum hammer energy for a complete installation, the energy will not be needlessly increased to its maximum level.

Table 4.1 Piling parameters used in the underwater noise modelling for WTGs.

	Soft-start	Ramp-up					Full
Monopile							
Energy (kJ)	1,050	1,050	1,400	2,800	4,200	5,600	7,000
# Strikes	100	100	200	200	200	200	15,563
Duration (s)	600	300	300	300	300	300	24,900
Strike rate (blows/min)	10	Burst*	40	40	40	40	37.5
Pin-pile							
Energy (kJ)	450	450	600	1,200	1,800	2,400	3,000
# Strikes	100	100	200	200	200	200	7,688
Duration (s)	600	300	300	300	300	300	12,300
Strike rate (blows/min)	10	Burst*[1]	40[*2]	40	40	40	37.5

*[1]the “Burst” stages represent 30 seconds of piling at 40 bl/min followed by a 30 second pause in piling, repeated for 5 minutes

*[2] This is an indicative typical maximum strike rate constrained by engineering parameters.

4.4 BREAKS IN PILING

4.4.1 Breaks in piling could result in marine mammals re-entering the mitigation zone. According to JNCC (2010) guidelines, if there is a pause in piling operations exceeding 10 minutes, the pre-piling search and soft-start procedures should be repeated before resuming piling activities. It should be noted that the agreed break duration before a full pre-piling search and soft-start required has been variable within recent MMMPs, subject to ongoing MMOb(s) and / or PAM operator watches during the break.

4.4.2 However, the feasibility of resuming with a soft-start depends on the piling stage and the pile / seabed conditions. If a soft-start is not possible, the pre-piling ADD deployment and pre-piling visual and / or acoustic search would be redone before continuing piling operations. The specific protocol for handling piling breaks would be determined in collaboration with the contracted piling company and SNCBs and documented in the Final Piling MMMP.

4.5 NOISE ABATEMENT

4.5.1 Technologies are available which can reduce the amount of noise emitted at source (noise abatement). Such technologies are being deployed in other parts of the North Sea to reduce the risk of impact on marine life, particularly marine mammals (Merchant and Robinson, 2019). It is important to note that metocean conditions, ground conditions and water depth all influence or constrain the selection of suitable noise abatement measures.

4.5.2 Various noise abatement technologies have distinct constraints dictated by water depth and prevailing oceanographic conditions (Weilgart, 2023; Bellmann *et al.,* 2020; Merchant and Robinson, 2019; Verfuss *et al.,* 2019).

NOISE REDUCTION PRINCIPLES

4.5.3 The approximate level of noise reduction which can be achieved by some of available noise abatement methods, alone and in-combination, are outlined in Table 4.2 and Figure 4.1, based on the review of NAS and their limitations provided by Verfuss *et al.,* 2019 and Koschinski and Lüdemann, 2020.

Table 4.2: Minimum and maximum noise reduction efficacy. Data obtained from Verfuss *et al.,* 2019 and Koschinski and Lüdemann, 2020.

Noise Abatement System	Water Depth (m)	Noise Reduction SELs (dB) range
BBC (>0.3m^3/min*m)	~ 40	7-11
DBBC (>0.3m^3/min*m)	~ 40	8-13
DBBC (>0.4m^3/min*m)	~ 40	12-18
DBBC (>0.5m^3/min*m)	> 40	~ 15-16 (based on 1 pile)
NMS	Up to 40	13-16
HSD	Up to 40	10-12

Noise Abatement System	Water Depth (m)	Noise Reduction SELs (dB) range
NMS + optimised BBC (>0.4m^3/min*m)	~ 40	17-18
NMS + optimised BBC (>0.5m^3/min*m)	~ 40	18-20
HSD + optimised BBC (>0.4m^3/min*m)	~ 30	15-20
HSD + optimised DBBC (0.48m^3/min*m)	20-40	15-28
HSD + optimised DBBC (>0.5m^3/min*m)	< 45	18-19
BLUE Hammer	30	19-24

Acronyms:
BBC = Big Bubble Curtain, DBBC = Double Bubble Curtain, NMS = IHC Noise Mitigation Screen, HSD = Hydrosound Damper
Bubble curtain air volume flow rate is provided in m3/(min*m)
Water depth = the depth of the OWF project where noise reduction was used and where these noise measurements were obtained.

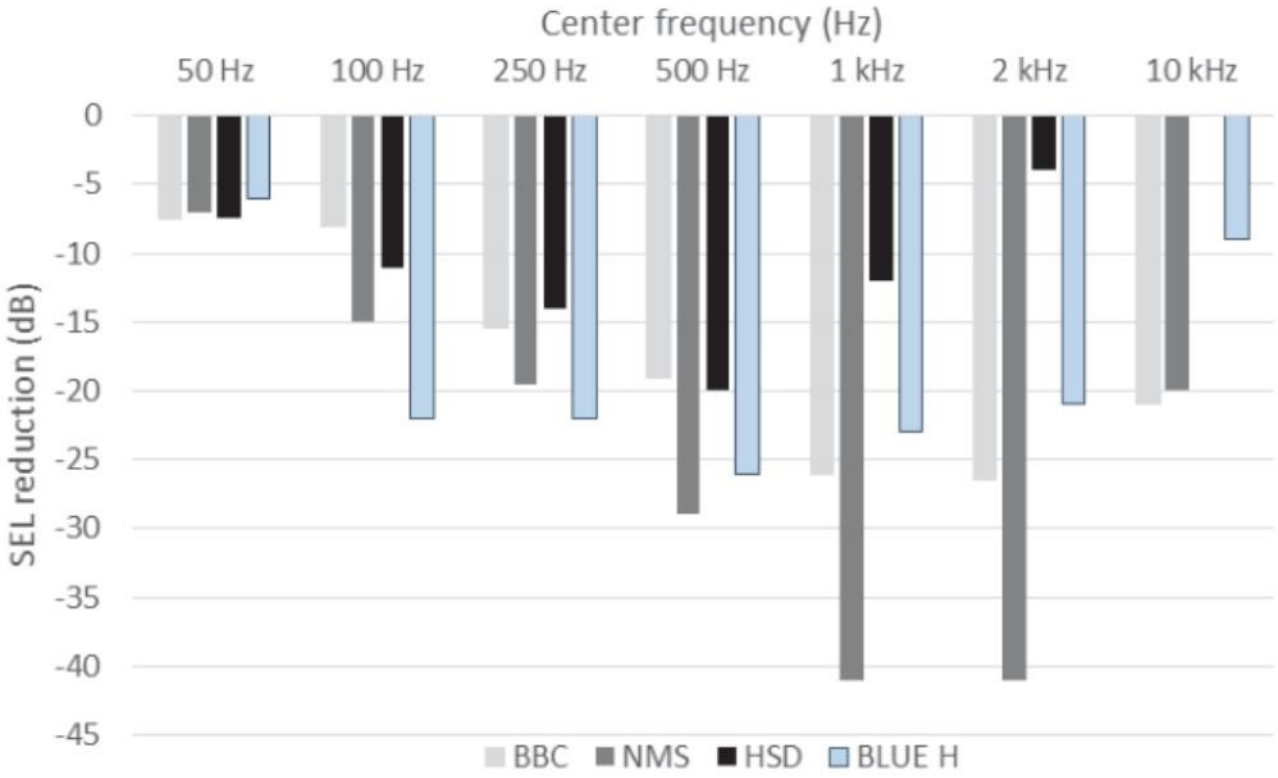

Figure 4.1: Reduction in SEL at frequencies 10Hz, 250Hz, 1kHz and 2kHz in the 1/3rd octave and frequency spectrum of a pile strike when comparing mitigated and unmitigated piling from Verfuss *et al.*, 2019.

4.5.4 It is worth noting that the techniques discussed here may not be exhaustive, as new technologies continue to emerge over time. Noise abatement measures will be re-assessed pre-construction taking into account the most recent methods, specifications, industry practices and project site conditions.

MODELLING MITIGATED PILING SCENARIOS

4.5.5 VE has modelled mitigated piling scenarios, assuming the employment of noise mitigation methods leading to a 10 dB reduction in source level. This reduction is expected to significantly decrease the maximum cumulative PTS-onset impact range for harbour porpoise at the N location from 8.6 km to 0.68 km. Additional information is provided in Volume 6, Part 2, Chapter 7: Marine Mammal Ecology

4.6 DELAY IN COMMENCEMENT OF PILING

4.6.1 If piling is delayed, there would be a risk of animals re-entering the mitigation zone when ADDs are switched off. However, turning on ADDs for extended periods may lead to habituation. Therefore, ADDs would be promptly turned off during delays and reactivated when piling is ready to commence. The break in ADD use would be for greater than 20 minutes to ensure a startle and flee response once the ADD is reactivated. ADDs would then be used for the minimum duration required to ensure animals leave the mitigation zone, alongside ongoing visual and / or acoustic monitoring. The MMOb(s) and / or PAM Operator would continue their visual or acoustic searches during this time.

4.7 CONTINGENCY MEASURES

4.7.1 In addition to the mitigation approach set out in Section 4.1, contingency measures may be specified that could be used in the unlikely event that the monitored noise levels exceed those assessed in the Environmental Statement after the approved mitigation has been applied. The approach to contingency measures will be set out in the Final Piling MMMP.

~~4.7~~4.8 COMMUNICATIONS

~~4.7.1~~4.8.1 The Final Piling MMMP would specify a communications protocol to ensure that all marine mammal mitigation measures, including any delays in commencing piling due to marine mammals being present in the area, are undertaken for all piling activities. It would also outline the roles and responsibilities of key personnel to ensure these mitigation measures are effectively carried out. Personnel details and roles would be finalised based on contractual agreements and mitigation needs.

~~4.8~~4.9 REPORTING

~~4.8.1~~4.9.1 Reports detailing the piling activity and mitigation measures would be prepared. Where appropriate these include, but are not necessarily limited to:

- Activity refence number (if applicable);
- Date and location of activity;
- Operation details (*e.g.,* soft-start and piling duration, watch times by MMOb(s), PAM use, hammer energy soft-start and piling, any operational issues for each foundation);
- Summaries marine mammal sightings using “Marine Mammal Recording Forms”;
- Information on ADD and its effectiveness; and
- Noted problems and instances of non-compliance with JNCC guidelines.

~~4.8.2~~4.9.2 The final report would cover piling events, mitigation methods, issues, sightings, behavioural observations, and potential protocol improvements. It will be submitted to the regulator as agreed following completion of piling activities.

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