Vattenfall Wind Power Ltd.

HT1 Hydrogen Demonstrator Project

EPS Risk Assessment UXO Investigations Survey

81026

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RSK GENERAL NOTES

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1 INTRODUCTION

1.1 Survey Overview

Vattenfall are seeking to undertake unexploded ordnance (UXO) investigation surveys to investigate specified anomalies (targets) that have been classified as potential unexploded ordnance along, on or in proximity to the proposed HT1 flowline route corridor between Aberdeen offshore wind farm and Aberdeen South Harbour. Electromagnetic and visual surveys from a Remotely Operated Vehicle (ROV) will be used to determine the locations of non-UXO objects and potential UXO along the route.

1.2 Survey Programme

The survey for potential UXO target investigations is proposed to commence during August 2022 for an approximate duration of 2 months. The indicative programme for these works will be required to take into consideration any unforeseen weather or consenting delays and as such the overall timeframe is more difficult to estimate with certainty at this time. In order to allow a contingency for weather or any other delays it has been assumed that the overall survey window be for the period from the potential commencement of survey in August 2022 to the end of July 2023 (c. 12 months). This is also the anticipated European Protected Species (EPS) licence period. Irrespective of the licence period, the UXO investigations survey is expected to take c. 2 months to complete within that period. It is envisaged that UXO investigation surveys will not be able to take place during the winter months (November – March) due to the reduced likelihood of a suitable weather window in this period.

1.3 Proposed Vessel

While no specific survey vessel or vessel contractor has yet been appointed to undertake these works, the vessel will be suitably equipped to undertake the scope of work in the operational areas proposed and the vessel master and officers will be specifically trained for or experienced with offshore ROV campaigns and similar survey works. An example dynamically positioned (DP) ROV support vessel, the *EDT Protea*, is provided as an example of the type of vessel that would be used for much of the works. The *EDT Protea* is a DP Category 3 support vessel capable of deploying work class ROVs and it's specifications are included in Table 1.1 as an example.

Please note that the proposed vessel and associated USBL is subject to change but would be replaced with a vessel / equipment of similar specification and as such the *EDT Protea* is considered to be a suitable surrogate vessel for the purposes of this assessment.

Table 1.1: *EDT Protea* vessel specification and characteristics

Vessel	Length (m)	Gross Tonnage	Draught (m)	Max Speed (Kts)	DP
EDT Protea	91.2	3814	6.2	13	Kongsberg K-Pos series 8, backup K-Pos series 8, IJS cJoy

1.4 Proposed Survey Equipment

The UXO investigations will utilise an ROV to investigate targets. The ROV will be deployed from a suitable DP ROV support vessel (as discussed), and ultra-short baseline (USBL) positioning systems and transponder beacons will be used to monitor the position of the ROV. As noted above, survey equipment is subject to change but the potential impacts will be within the order of magnitude indicated below and discussed throughout this report.

The proposed USBL is to provide accurate positioning of 1.5 m (+/- 0.75 m) or better for the horizontal positioning of towed devices. These will only be used when the towed or remotely operated equipment is in operation. As soon as these are recovered to the deck of the vessel, the vessel's USBL can be switched off.

The USBL transceiver mounted on the vessel transmits an acoustic pulse that is detected by the transponder mounted on the ROV. The subsea transponder replies with its own acoustic pulse, which is detected by the shipboard transceiver. The two units work together to communicate the towed devices position relative to the vessel.

This increase in anthropogenic noise has the potential to affect marine mammals occurring in the Aberdeen Bay area due to the sensitivity of marine mammal hearing. As sound travels much further underwater compared to airborne noise, the resulting effects on marine mammals can be at distance from the sound source.

The USBL equipment likely to be used for the survey has a frequency between 19 and 34 kHz, and the assessment is based on a realistic worst-case scenario. Table 1.2 illustrates the operating frequencies and sound pressure levels of potential USBL devices.

It should be noted that the acoustic sources proposed for the survey are not primary survey sensors, such as Multi-beam Echo-sounders (MBES) or similar, but are for positioning and communication with the ROV and are a number of orders of magnitude lower in intensity than those used in conventional seismic surveys.

Any other survey equipment is not considered to cause disturbance to EPS and thus is not assessed further in this risk assessment. This includes the magnetometers, which are all unlikely to generate any significant noise and thus do not require any further consideration with respect to potential disturbance or injury to EPS.

Table 1.2: USBL positioning systems noise specifications

USBL	Operating Frequencies (kHz)	Sound Pressure Level (SPL) reported by Manufacturer (dB re 1 µPa at 1 m)
Sonardyne Wideband®Sub-Mini 6 Plus (WSM 6+)	19 - 34	196
Sonardyne HPT 3000	19-34	194

2 RISK ASSESSMENT

Cetaceans (EPS) have been recorded within the Aberdeen Bay area all year round. Harbour porpoises and bottlenose dolphins are resident while white-beaked dolphin and minke whale occur on a seasonal basis. Humpback whales and common dolphins are considered occasional to rare visitors to the area, while Risso's dolphin is considered an occasional visitor to the area.

The conservation status of the four most common species in Aberdeen Bay Area (harbour porpoise, bottlenose dolphin, white-beaked dolphin and minke whale) is "Unknown". However, there has been no genuine change in conservation status of any of the four most commonly occurring EPS in the Aberdeen Bay area (JNCC, 2019).

The main routes to impact are considered to be:

- anthropogenic noise from USBL positioning systems
- increased noise from vessels
- collision risk.

Due to the operating frequencies of the USBL devices (19-34 kHz), this assessment considers harbour porpoise, bottlenose dolphin and white-beaked dolphin, with harbour porpoise considered as a proxy species to illustrate the worst case scenario. This is because the harbour porpoise is considered part of the very high frequency (VHF) functional hearing group with a generalised hearing range of 25 Hz to 180 kHz; and the dolphin species are part of the high frequency (HF) functional hearing group with a generalised hearing range of 150 Hz to 160 kHz.

Although minke whales are common in Aberdeen Bay they are not considered further in this assessment as they are considered part of the low frequency functional hearing group (generalised hearing range of 7 Hz to 35 kHz, however, indirect evidence suggests they are most sensitive to frequencies between 20 Hz and 19 kHz (Erbe, 2002; Tubelli *et al*., 2012)), and as such are unlikely to be impacted by the USBL.

2.1 Anthropogenic Noise from USBL positioning systems

The use of USBL positioning systems may increase the levels of anthropogenic noise in the marine environment. There are various potential effects of exposure to sound from anthropogenic activities, the main potential effects can be summarised as:

- auditory injury
- behavioural response, such as disturbance effects.

The source pressure levels for the USBL equipment listed (Table 1.2) are lower than the lethal effects and physical injury criteria (240 and 220 dB re. 1 µPa respectively; Parvin *et al*., 2007). Therefore there is no potential for lethal effects or physical injury as a consequence of increased anthropogenic noise.

2.1.1 Auditory Injury

The USBL positioning systems and transponder beacons operate at a much lower frequency than most geophysical equipment such as multibeam echo sounder or side-scan sonar, and are therefore audible to the resident cetaceans present in the survey

area. However, the USBL equipment are operating at a much lower sound pressure intensity level. The onset of permanent threshold shifts (PTS) from this equipment may be induced at greater distances from source if animals remain stationary and/or associated with the vessel. In modelling done for Vattenfall (Binnerts *et al*., 2020), stationary harbour porpoise within 2.8 km of USBL equipment operating at 18 kHz in 35 m water depth may suffer PTS onset, while stationary animals would need to be within 1.7 km of the USBL equipment operating at 32 kHz; this is considered overly precautionary as animals are unlikely to be stationary. Passing harbour porpoise within 970 m of equipment operating at 18 kHz and 570 m of equipment operating at 32 kHz in 35 m water depth may be at risk of PTS onset. In shallower waters the effect distances increase: harbour porpoise passing equipment operating in 5 m of water may be at risk of the onset of PTS at 2.3 km (18 kHz) and 1.1 km (32 kHz). The risk of the onset of PTS for all other species was negligible unless the animal was assumed stationary throughout the entire period of USBL operation (Binnerts *et al*., 2020).

Using the US National Marine Fisheries Service (NMFS) / NOAA thresholds for potential onset of permanent threshold shifts (PTS) and/or temporary threshold shifts (TTS) – Table 2.1 – the maximum source levels for all types of USBL equipment listed in Table 1.2 are below the level which has the potential to induce the onset of PTS at close range for all cetacean species. There is a small potential for TTS in harbour porpoise (VHF cetaceans) as the highest peak sound pressure level of the USBL reported by the manufacturer is 196 dB re 1 µPa Peak (Table 1.2).

Table 2.1: Unweighted SPL onset thresholds for PTS and TTS (dB re 1 µPa Peak)

Functional Hearing Group	PTS	TTS
HF cetaceans	230	224
VHF cetaceans	202	196

Source: adapted from NMFS (2018) and Southall *et al*. (2019)

2.1.2 Behavioural Response

The lower frequencies generated by USBL positioning systems and transponder beacons have the potential to cause localised short-term impacts on behaviour for all cetaceans present in the survey area, possibly resulting in avoidance at close proximities (Nedwell *et al*., 2008).

Thompson *et al*. (2013) observed harbour porpoise avoidance of (seismic) survey vessels in the Moray Firth out to 10 km, with animals detected again at the affected sites within a few hours. This 10 km disturbance radius is considered highly conservative as

a) it was observed as a consequence of oil and gas seismic surveys, using equipment that produces significantly higher source levels (and also a different frequency content) than the equipment to be used in this survey
b) the water of the Moray Firth is much deeper than Aberdeen Bay, and as stated above, sound travels further in deeper water, although certain frequencies, particularly mid/high frequencies, can propagate in shallow waters depending on

sea surface and seabed; however, these frequencies are likely to be outside the hearing range of many of the species present (see discussion below)

c) displacement cannot occur 10 km landward due to the coastal location of the survey.

As a consequence, and as described in EPS Risk Assessment: USBL use for operational survey work (document 1197777-1-A), the impact radius has been decreased to 5 km, and an impact area of 78.5 km^2 was used in Table 2.2 (simple calculation of πr^2), and this disturbance radius was also used for the consideration of potential impacts on dolphin species due to the lack of comparative studies. This is considered a conservative proxy for the HT1 flowline survey route.

As this route moves further inshore the disturbance radius is likely to be smaller, with the numbers of induvials potentially disturbed presented here (Table 2.2) as a worst-case, conservative estimate. This equates to very small proportions of the species' reference populations.

Table 2.2: Number of individuals of the four main EPS potentially disturbed during the operation of geophysical survey systems and positioning equipment

Species	No. of individuals within the area of potential impact	% of reference population which has the potential to be affected
Harbour porpoise	47	0.03
Bottlenose dolphin	2	1.05
White-beaked dolphin	19	0.06

Source: SCANS III density estimates used in calculations from Hammond *et al*. (2021) and reference population abundance estimates[1] used in calculations from IAMMWG (2021)

In modelling done for Vattenfall, harbour porpoise were disturbed up to 4.0 km from a 32 kHz system in 35 m water depth (Binnerts *et al*., 2020). It is also not considered likely that the USBL positioning systems will cause significant disturbance or displacement to these cetaceans, due to the low operating frequencies of the acoustic pulses from the USBL positioning systems and transponder beacons. This disturbance is considered unlikely to cause any population level effects.

2.1.3 Conclusions

Increased anthropogenic noise from the USBL positioning equipment has the potential to induce the onset of auditory injury (threshold shifts) at close proximity to the noise source. With mitigation (see Section 3) the potential for the onset of auditory injury to be induced is negligible. The potential for onset of auditory injury is also only likely to affect a very small percentage of the reference populations of EPS in the survey area.

Following the 2020 Marine Scotland and Scottish Natural Heritage (SNH; now NatureScot) guidance (Marine Scotland and SNH, 2020) for inshore waters, there is the potential for disturbance of marine mammals, as defined in Regulations 39 (1) (a) and (b)

[1] Bottlenose dolphin abundance estimate is based on weighted management units recommended by NatureScot (Knott, 2021)

and 39 (2) of the Habitats Regulations, from the operation of USBL positioning equipment during the proposed UXO investigations. As noted above, temporary displacement is the most likely response. Up to 47 harbour porpoises, 2 bottlenose dolphins and 19 white-beaked dolphins have the potential to be disturbed. This disturbance will not be sufficient to cause any population level effects (i.e. it will not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status in their natural range), and thus it is considered that an EPS licence (to disturb) can be issued under Regulation 39 of the Habitats Regulations.

2.2 Increased Noise from Vessels

The survey programme will add an additional vessel into the marine environment of Aberdeen Bay. Therefore, it will potentially increase levels of anthropogenic noise and thus has the potential to affect marine mammals. Increased vessel noise has the potential to cause behavioural responses in marine mammals, as well as auditory injury such as PTS or TTS, and may mask naturally occurring sounds.

Noise varies from vessel to vessel but is a continuous noise source; different vessels will generate different frequency characteristics and sound levels.

The impact prediction in EPS Risk Assessment: Construction Phase Works (document 1148902-1-B4) is still relevant and information within that document is utilised here.

2.2.1 Auditory Injury

The vessel proposed to carry out the survey will be of medium size (see Table 1.1). Medium size vessels are classed as 50-100 m length, with sound intensity levels of 165-180 dB re 1µPa @ 1m rms, and frequencies of a few hundred Hz (Prideaux, 2017 and references therein), therefore there is no potential of auditory injury to cetaceans.

2.2.2 Behavioural Response

Predicted 90 dB_{ht} (species) impact ranges for medium vessels (ICOL, 2013) are presented below (Table 2.3). VHF cetaceans, harbour porpoise in the survey area, have the greatest potential to be disturbed by the vessel noise, with an impact range of 11 m.

Table 2.3: 90 dB_{ht} (species) impact ranges predicted for vessel noise from medium and large sized vessels

Species	Medium vessels (<100 m) Impact range (m)
Harbour porpoise	11
Bottlenose dolphin (also used as a proxy for white-beaked dolphin)	4

Source: adapted from ICOL (2013) and Barham *et al*. (2014)

Noise from vessels is unlikely to cause disturbance to individual animals, except when in very close proximity to a vessel. Given that the largest potential impact range predicted for a strong avoidance reaction is 11 m (for harbour porpoise), coupled with existing vessel movements within the area, it is considered that sound from vessel activity

associated with the UXO investigation activities will not significantly add to the background noise levels from vessels already present.

2.2.3 Conclusions

It is highly unlikely that vessel noise will cause auditory injury in any species of cetacean or will elicit a behavioural response over and above that caused by the usual vessel activity within the area.

Following Marine Scotland and NatureScot guidance (Marine Scotland and SNH, 2020) for inshore waters, it is considered that there is no potential for an offence to be committed as defined in Regulations 39 (1) (a), (b) and 39 (2) of the Habitats Regulations 1994 (as amended in Scotland).

2.3 Collision Risk

Vessel strikes are a known cause of mortality in marine mammals and basking sharks (Laist *et al*., 2001; Schoeman *et al*., 2020). Collisions can occur with vessels of all sizes, although the more serious incidents tend to be caused by very large vessels, and those going at speeds of 14 knots or more. Injuries sustained can include fracturing, bruising, nicks or slicing off parts of fins, and the most serious accidents can result in death of the animal, although death may not be immediate (Sea Watch Foundation, 2009).

Large slow-moving whales are considered to be most susceptible to vessel strike as smaller cetaceans are generally sufficiently mobile to avoid vessels either in their path or moving towards them. However, there may be a reporting bias towards larger whales as many vessels may not be aware that they had collided with smaller species (Schoeman *et al*., 2020).

Avoidance behaviour by cetaceans is often associated with fast, unpredictable boats such as speedboats and jet-skis (Bristow & Reeves, 2001; Gregory & Rowden, 2001; Leung Ng & Leung, 2003; Buckstaff, 2004), while neutral or positive reactions have been observed with larger, slower moving vessels such as cargo ships (Leung Ng & Leung, 2003; Sini *et al*., 2005). Harbour porpoise, in particular, generally respond negatively to high-speed planing-hulled vessels (Oakley *et al*., 2017).

One survey vessel will be used for the survey programme (see Section 1.3). The vessel will transit to and from the survey route along predefined corridors. Furthermore, during the surveys themselves, the vessels will follow a predefined survey corridor, and will be travelling at a working speed of approximately less than 4 knots with a transit speed of approximately 10 knots.

The predefined transit corridors to site and pre-defined linear route for the surveys themselves makes it easy for animals to predict and avoid survey vessels, and thus greatly reduces the risk of collision.

2.3.1 Conclusions

Following Marine Scotland and SNH guidance (Marine Scotland and SNH 2020) for inshore waters, there is negligible potential for injury or disturbance to EPS, as defined in Regulations 39 (1) (a) and (b) and 39 (2) of the Habitats Regulations, from collision with vessels associated with the proposed work.

No offence will be committed under Regulation 39 of the Habitats Regulations and therefore an EPS licence will not be required for this potential impact (collision with vessels).

3 MARINE MAMMAL MITIGATION PLAN

Operation of USBL positioning equipment during the survey has the potential to cause auditory injury to EPS (cetaceans) at very close range. Therefore, mitigation in the form of pre-work searches will be undertaken prior to the use of positioning equipment.

These mitigation measures for cetacean EPS (JNCC, 2017) are also deemed to be appropriate for seals and basking shark, as well as otter.

3.1 Pre-work Searches

It is acknowledged that adherence to the measures outlined in the JNCC guidelines (2017) constitutes best practice and minimises the risk of disturbing marine mammals. Principles of this guidance will be applied in order to ensure that auditory injury is not induced in any cetaceans present within the injury zone, from the equipment.

Given the low level of risk to marine mammals from the positioning equipment (low likelihood of encounter and low risk of PTS due to power source level of equipment), it is considered that a suitably briefed member of the vessel's crew can fulfil the role of Marine Mammal Observer (MMO) and will be able to undertake the pre-work searches. The crew member will be dedicated to the role during all required pre-watch periods, and will be positioned at a location on the vessel that allows for sufficient visibility around the entire sound source. Although there is a limited range for auditory injury and/or disturbance from the equipment in use, the recommended mitigation zone is the quoted 500 m, due to the fact the operating frequencies of some of the equipment being within the hearing range of cetaceans and as per recommendation of NatureScot (Knott, 2019, pers. comm.). Reticule binoculars will be utilised, to ensure judgement of the mitigation zone boundaries. As the MMO role can only be undertaken effectively during periods of good visibility (sea state 3 or less) and in daylight, the commencement of pre-work searches will only take place under these conditions. In cases of poor visibility and as works are planned to operate over 24 hours, the MMO dedicated crew member, also trained as a PAM operator, will operate the PAM at night or in poor visibility.

Due to the nature of the positioning equipment and anticipated operational mode, once any subsea equipment (e.g. ROV) is deployed, the USBL positioning system and transponder beacons will be activated and remain operational for the duration of ROV use. It is assumed that as the USBL positioning system and transponder beacons are effectively in continual operational mode while the ROV is in the water, this initial and constant signal would act as an acoustic deterrent thereby preventing susceptible cetaceans from entering the localised area in which they may be predisposed to PTS onset (auditory injury). It is proposed that additional pre-work mammal watches would only be required if there was a significant break in the operation with deactivation of the USBL positioning system, and as per the revised JNCC guidance (2017). JNCC guidance states that if there is an unplanned break in the USBL positioning system 'activation' of longer than 10 minutes, then a 30-minute pre-watch before starting up again is necessary. If the break is planned, then the observer would watch during the 'deactivation' period, and if there are no cetaceans seen then the USBL positioning system and transponder beacons can be started again even if the break is longer than 10 minutes.

3.2 Transit Watches

A nominated competent observer on the bridge of the survey vessels will keep watch for marine mammals during transit between port and the survey corridor. Any sightings will be communicated to the Master of the vessel as soon as is practicable and the following actions, as per the Scottish Marine Wildlife Watching Code (SNH, 2017), implemented:

- The Master of the vessel will ensure that marine mammals are avoided to a safe distance (100 m or more) in all possible circumstances.
- The Master of the vessel will minimise high powered manoeuvres where this does not impair safety.

3.3 Reporting

A log of all MMO (suitably briefed crew member) effort and USBL positioning equipment operations will be kept (using the JNCC Marine Mammal Recording Forms).

Following completion of the survey programme, Vattenfall will submit a report to MS-LOT which will include the following:

- completed Marine Mammal Recording Forms
- dates, locations and details of activity
- details of all MMO operator effort including information about any marine mammals detected
- details of any technical problems encountered and actions taken.

4 CONCLUSIONS

This assessment of the potential for impacts on cetacean EPS from the UXO investigations survey activities along the proposed HT1 flowline route (increased anthropogenic noise from use of the USBL systems, increased vessel noise, collision with vessels) from a worst-case scenario concluded that, post-mitigation:

- the potential for auditory injury is considered to be negligible
- the potential for disturbance is considered to be negligible within the context of the wider populations of EPS.

Following the 2020 Marine Scotland and SNH guidance (Marine Scotland and SNH, 2020) entitled “The protection of Marine European Protected Species from injury and disturbance: Guidance for Scottish Inshore Waters (July 2020 Version)”, there is potential for (auditory) injury to marine EPS, as defined in Regulations 39 (1) (a) and (b) and 39 (2) of the Habitats Regulations 1994 (as amended in Scotland), from increased anthropogenic noise during the survey programme.

Therefore an EPS licence will be required for this potential impact (increased anthropogenic noise from the USBL positioning systems), however, it is considered that the conditions for award of an EPS licence under Section 39 of The Conservation (Natural Habitats, &c) Regulations 1994 (as amended in Scotland) have been met.

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