the Blackdog area[3]. The weather station was located at Gordon Lennox Crescent approximately 1.8 miles from the Development.

Slight precipitation was recorded intermittently during survey period and snowfall was recorded on the 1st February at 6, 8 and 9 am.

Periods of precipitation and wind speeds above 5 m/s that elevated the noise levels have been excluded from analysis in this report.

[3] https://www.wunderground.com/personal-weather-station/dashboard?ID=IBRIDGEO6#history/s20180126/e20180202/mcustom

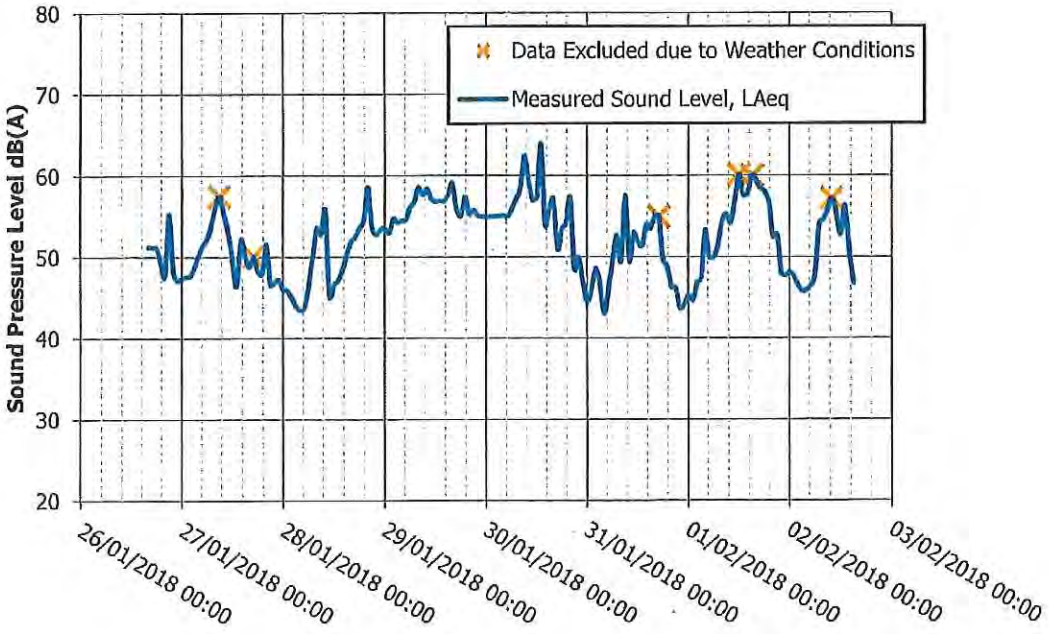
5 SURVEY RESULTS

5.1 Results for Overall Assessment Periods

5.1.1 Willow Grove

Chart 1 below shows the noise monitoring results undertaken at the perimeter of Willow Grove residential property.

Chart 1: Noise Level vs Time History – Willow Grove



As can be seen, the noise levels follow a typical diurnal pattern over the 1 week monitoring period. Elevated noise levels are observed from 29th to 30th January, significantly during night time periods.

A summary of day, evening, weekend and night time average L_{Aeq} are calculated for the 7 days of monitoring period. These are shown in Table 2 below. Values in **bold** indicate an exceedance of the relevant criteria.

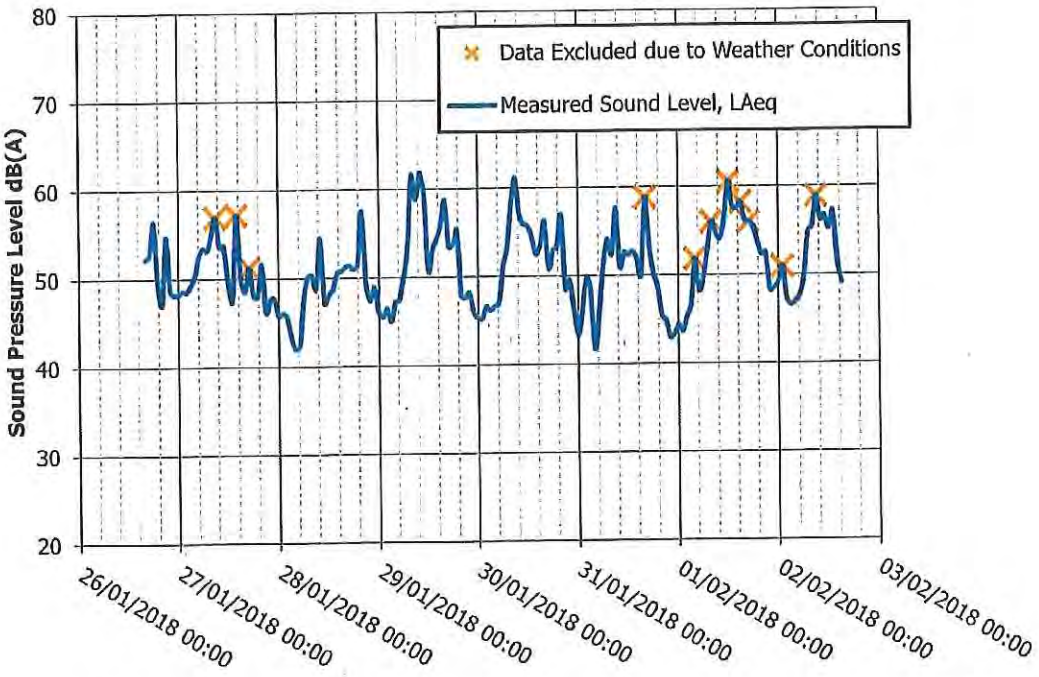
Table 2: Summary of Noise Levels L_{Aeq}

Date	Day	Day-time L_{Aeq}, dB	Evening & Weekend L_{Aeq}, dB	Night-time L_{Aeq}, dB
26/01/2018	Friday	51	51	50
27/01/2018	Saturday	54	49	45
28/01/2018	Sunday	-	53	**54**
29/01/2018	Monday	57	56	**55**
30/01/2018	Tuesday	59	54	47
31/01/2018	Wednesday	53	47	49
01/02/2018	Thursday	57	54	47

5.1.2 Hareburn House

Chart 2 below shows the noise monitoring results undertaken at the perimeter of Tarbothill residence.

Chart 2: Noise Levels vs Time History – Hareburn Terrace



As can be seen, the noise levels follow a diurnal pattern throughout the monitoring period similar to Willow Grove receptor. It can be observed that the day time noise levels were also elevated during 29th and 30th January, however only a slight increase is observed at night time during these two days.

A summary of day, evening, weekend and night time average L_{Aeq} are calculated for the 7 days of monitoring period. These are shown in Table 2 below.

Table 3: Summary of Noise Levels L_{Aeq}

Date	Day	Day-time L_{Aeq}, dB	Evening & Weekend L_{Aeq}, dB	Night-time L_{Aeq}, dB
26/01/2018	Friday	54	51	50
27/01/2018	Saturday	53	49	46
28/01/2018	Sunday	-	52	48
29/01/2018	Monday	58	51	47
30/01/2018	Tuesday	56	53	48
31/01/2018	Wednesday	53	46	47
01/02/2018	Thursday	56	52	48

6 ASSESSMENT OF RESULTS

As can be seen from Tables 2 and 3, the daily averaged LAeq levels show some periods where the limit is exceeded. The exceedances occurred at Willow Grove at Night-time on 28th and 29th January, where the night time $L_{Aeq, 8hours}$ are 54 and 55 dB(A) respectively, exceeding the 50 dB(A) noise limit.

A more detailed comparison of noise levels is presented in the next section.

6.1 Assessment of 1 hour L_{Aeq} Periods

A detailed assessment is undertaken in this section, where the hourly L_{Aeq} values are assessed against the noise limits and any exceedances are highlighted during the monitoring period.

6.1.1 Willow Grove

The exceedance events for respective period of day, night, evening & weekend are presented in Table 5 below for Willow Grove.

Table 5: Hourly Exceedances – Willow Grove

Measurement Period	Number of Hours exceeding limit	Date & Time of Exceedances
Day Time	0	--
Evening & Weekends	0	--
Night-time	20	27/01/18 – 04:00 to 07:00
		28/01/18 – 23:00 to 29/01/18 07:00
		29/01/18 – 23:00 to 30/01/18 07:00
		01/02/18 – 04:00

It can be seen that the noise levels only exceed during the night time period at Willow Grove. The levels of exceedances are shown in more detail in Section 6.2 in Table 7.

6.1.2 Hareburn House

The exceedance events for respective period of day, night, evening & weekend are presented in Table 6 below for Hareburn House.

Table 6: Hourly Exceedances – Hareburn House

Measurement Period	Number of Hours exceeding limit	Date & Time of Exceedances
Day Time	0	--
Evening & Weekends	0	--
Night-time	11	27/01/18 – 04:00 to 07:00
		29/01/18 – 06:00
		30/01/18 – 06:00
		31/02/18 – 06:00
		01/02/18 – 04:00
		02/02/18 – 01:00

It can be seen that the noise levels only exceed during the night time period at Hareburn House. The levels of exceedances are shown in more detail in Section 6.2 Table 8.

6.2 Assessment

The detailed hourly analysis shows that there were multiple exceedances throughout the monitoring period although these only occurred during night time. These have been compared with activity logs (DPRs) provided by Vattenfall, as shown in Table 7 and 8:

Table 7: Level of Exceedances – Willow Grove

Date	Time of Exceedance hh:mm	Noise Level $L_{Aeq,1h}$ dB(A)	Activity/ Comments
27/01/18	04:00	50.0	No Site Activities – Exceedance at this time is found at both locations, with higher levels at Hareburn House (unlikely to be from site)
	05:00	51.5	
	06:00	52.2	
28/01/18	23:00	53.4	Pay out winch wire to CLV and commence pull in of export cable.
	00:00	53.6	
	01:00	53.0	
	02:00	54.7	
	03:00	54.3	
	04:00	54.5	
	05:00	54.6	
	06:00	56.1	
29/01/18	23:00	55.0	Nearshore trenching by Trench former. VBMS crew leaving site, no activities from 6:25.
	00:00	54.9	
	01:00	55.0	
	02:00	55.0	
	03:00	55.0	
	04:00	55.1	
	05:00	55.0	
	06:00	55.9	
01/02/18	04:00	53.3	No Site Activities

Table 8: Levels of Exceedances – Hareburn House

Date	Time of Exceedance hh:mm	Noise Level $L_{Aeq,1h}$ dB(A)	Activity/ Comments
27/01/18	04:00	50.4	No Site Activities – Exceedance at this time is found at both locations, with higher levels at Hareburn House (unlikely to be from site)
	05:00	52.7	
	06:00	53.4	
29/01/18	06:00	50.2	Pay out winch wire to CLV.
30/01/18	06:00	51.1	VBMS crew leaving site.
31/01/18	06:00	51.6	No Site Activities
01/02/18	04:00	51.8	No Site Activities
02/02/18	01:00	50.9	No Site Activities

Single instance exceedances where there were no site activities are likely to be from external interferences such as traffic, aircraft or public passing the location.

Willow Grove is at a distance of 20 to 25 meters from the site perimeter (e.g. car park, light generators etc.) whereas Hareburn House is at a distance of above 100m and situated on a hill above site height level. As such a reduction in noise level of up to 6dB is to be expected at Hareburn House property due to it altitude and distance from site.

This can be seen from comparison of levels in Table 6 and 8. , where noise levels from site activities on 28/01/18 were around 55 dB at Willow Grove but were just under 50 dB at Hareburn house and only exceeded at Hareburn house on 06:00 at 50.2 dB (when noise level at Willow Grove was 56.1 dB).

Single hour exceedance during periods of no site activity are likely to be from external factors, such as car or traffic passing by equipment on site, helicopter/ plane passing overhead or interference at Hareburn House location from public or dog walkers (Equipment was situated adjacent to the common walking path next to the access road).

The results therefore indicate that whilst 1-hour exceedances of the night-time criteria levels occurred during times of both activity and non-activity at the site, the exceedances identified at Willow Grove during the whole night periods on the 28 and 29th of January appear to coincide with significant night-time activity.

7 GLOSSARY OF TERMS

Ambient Sound: Sound which comprising all sources, including the source under investigation.

Background Sound: The background sound level is the underlying level of noise present at a particular location for the majority (usually 90%) of a period of time.

Decibel (dB): The decibel is the basic unit of noise measurement. It relates to the cyclical changes in pressure created by the sound and operates on a logarithmic scale, ranging upwards from 0 dB. 0 dB is equivalent to the normal threshold of hearing at a frequency of 1000 Hertz (Hz). Each increase of 3 dB on the scale represents a doubling of the Sound Pressure, and is typically the minimum noticeable change in sound level under typical listening conditions.

dB(A): Environmental noise levels are usually discussed in terms of dB(A). This is known as the A-weighted sound pressure level, and indicates that a correction factor has been applied, which corresponds to the human ear's response to sound across the range of audible frequencies. The ear is most sensitive in the middle range of frequencies (around 1000-3000 Hz), and less sensitive at lower and higher frequencies. The A weighted noise level is derived by analysing the level of a sound at a range of frequencies and applying a specific correction factor for each frequency before calculating the overall level. In practice this is carried out automatically within noise measuring equipment by the use of electronic filters, which adjust the frequency response of the instrument to mimic that of the ear.

Frequency: The frequency of a sound is equivalent to its pitch in musical terms. The units of frequency are Hertz (Hz), which represents the number of cycles (vibrations) per second.

$L_{A90,t}$: This term is used to represent the A-weighted sound pressure level that is exceeded for 90% of a period of time, t. This is used as a measure of the background noise level.

$L_{Aeq,t}$: This term is known as the A-weighted equivalent continuous sound pressure level for a period of time, t. It is similar to an average, and represents the sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound in question.

L_{AFmax}: The maximum A-weighted sound pressure level measured over a given period, with a fast time weighting.

Noise: Unwanted sound that may refer to both natural (e.g. wind, birdsong etc.) and artificial sounds (traffic, industrial noise, aircraft etc.).

Rating Level: Sound level which has been corrected for acoustic features as outlined under BS4142 methodology.

Sound pressure (P): The fluctuations in pressure relative to atmospheric pressure, measured in Pascals (Pa).

Sound pressure level (L_p): Sound pressure measured on the decibel scale, relative to a sound pressure of 2 x 10-5 Pa.

Specific Level: In terms of BS4142 methodology, the specific level is the sound level produced by a source, without corrections for acoustic features.

Time Weighting: Time weightings determine how quickly the sound level meter responds to changes in noise level, and is generally set to 'Fast' or 'Slow'. A fast time weighting resulting in in the sound level meter sampling every 1/8th second: a slow time weighting results in a sample measurement being taken by the sound level meter every 1 second.

APPENDIX A – SURVEY RECORD SHEETS

ARCUS

Noise Survey Record Sheet – Page 1: Location and Equipment Details

Project No.	2963	**Project Name:**	Aberdeen Offshore wind farm
Location (x of y)	1	**Installed By:**	BA
Lat/Long	57.21726, -2.06196	**Location Name**	Willow Grove
Start Date	26/01/2018	**Start Time**	1600

Equipment Details	**Make/Model**	**Serial No.**
Sound Level Meter:	Rion NL-52	976222
Calibrator:	Rion NC-74	34372738
Source of Equipment:		ANV
Meter Timestamp (Start/End, GMT/BST):		Start GMT

Description of Sound Source:	At fence of nearest residential property. Between identified noise sources and the residence.
Distance from façade::	>10m
Noise sources observed:	Works on site, occasional traffic on access road and noise from vessel on water near shore
Weather conditions	Low wind and no precipitation
Additional notes:	SLM placed at site ground at fence of nearest sensitive receptor. In direct line with identified noise sources.

ARCUS

Noise Survey Record Sheet – Page 2: Visit Record

Project No.	2963	Location (x of y)	1

Installation (Visit 1)

Date:	26/01/2018	Time:	1600
Filename:	Auto_101	Calibration level:	94
Range setting:	0	Meas. period:	1hr LAeq for 7 day period
Freq weighting:	A	Weather station?	No
Lp Logging	No	Audio/ 8ve bands?	No
Notes:	SLM placed at site ground at fence of nearest sensitive receptor. In direct line with identified noise sources.		

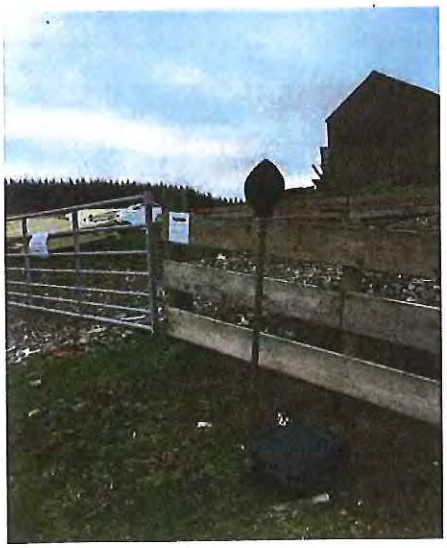
Visit 2

Date:	02/02/2018	Time:	1430
Visited by:	BA	Calibration level:	94
Level pre-calibration	93.8	Batts replaced?	N/A
Equipment Removed?			Yes
Notes:	SIM removed from site.		

ARCUS

Noise Survey Record Sheet – Page 3: Photographs

Project No.	2963	Location (x of y)	1



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Registered in England & Wales No. 5644976

ARCUS

Noise Survey Record Sheet – Page 1: Location and Equipment Details

Project No.	2963	**Project Name:**	Aberdeen offshore wind farm
Location (x of y)	2	**Installed By:**	BA
Lat/Long	57.21686, -2.06286	**Location Name**	Hareburn House
Start Date	26/01/2018	**Start Time**	1600

Equipment Details	**Make/Model**	**Serial No.**
Sound Level Meter:	Rion NL-52	231668
Calibrator:	Rion NC-74	34372738
Source of Equipment:		ANV
Meter Timestamp (Start/End, GMT/BST):		Start GMT

Description of Sound Source:	At bend in fence to the southern west residential property closest to working site.
Distance from façade::	>10m
Noise sources observed:	Construction works noise from secondary site and noise from vessel on water near works site.
Weather conditions	Low wind 1.1m/s no precipitation
Additional notes:	Contact on site couldnt get access to residential properties. Cannot encroach on their properties as very sensitive case ongoing. SLM placed at property perimeter 1.5m from wooden half fence.

ARCUS

Noise Survey Record Sheet – Page 2: Visit Record

Project No.	2963	**Location (x of y)**	2

Installation (Visit 1)

Date:	26/01/2018	**Time:**	1600
Filename:	Auto_201	**Calibration level:**	94
Range setting:	0	**Meas. period:**	1 hour LAeq for 7 day period
Freq weighting:	A	**Weather station?**	No
Lp Logging	No	**Audio/ 8ve bands?**	No
Notes:	Contact on site couldnt get access to residential properties. Cannot encroach on their properties as very sensitive case ongoing. SLM placed at property perimeter 1.5m from wooden half fence.		

Visit 2

Date:	02/02/2018	**Time:**	1430
Visited by:	BA	**Calibration level:**	94
Level pre-calibration	93.7	**Batts replaced?**	N/A
Equipment Removed?			Yes
Notes:	SLM removed from site		

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ARCUS

Noise Survey Record Sheet – Page 3: Photographs

Project No.	2963	Location (x of y)	2

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Registered in England & Wales No. 5644976

[Redacted]

From: [Redacted]
Sent: 19 February 2018 15:06
To: [Redacted]
Cc: [Redacted]
Subject: EOWDC - TPC - Evaluation Report - Queries

Hi [Redacted]

Many thanks for providing the Evaluation Report for the substructure and foundation with suction bucket jackets. We have reviewed internally and have a few further queries.

1. Could you please provide MS-LOT with the Evaluation Report for the wind turbines referred to in the Component Certificate (Document Reference: FER-CC-DNVGL-SE-0074-00111-3 – Final Evaluation Report dated 15/03/2016)?
2. The Design Lifetime is for 25 years, does this include additional capacity for TPC to cover the construction phase and also the decommissioning phases? Additionally, if you seek to extend the marine licence and section 36 to 25 years, you will need to recommission the TPC for the additional year(s).
3. Section 4 (page 3) and A13 (page A-11) – Conditions – Transport & Installation – are these conditions carried through into the CMS? Not complying with these conditions would invalidate the TPC. Additionally, the ECoW report during the installation of these substructures should detail how the construction method complies with all conditions listed at A13.
4. Section 4 (page 4) – Conditions - O&M Phase – an ongoing reporting mechanism regarding these conditions should be included in the OMP, can you please confirm if you intend to take this approach?
5. Will separate TPC be conducted to cover the secondary structures (J-tubes, boat landing, access platforms) – these aspects are listed as scoped out at section 6 (page 4) – Conclusions.

If you have any further queries please do not hesitate to contact MS-LOT.

Kind regards

[Redacted]

[Redacted]
[Redacted]

marinescotland
Marine Scotland Licensing Operations Team
Scottish Government
Marine Laboratory, 375 Victoria Road, Aberdeen, AB11 9DB
[Redacted]
[Redacted] / MS.MarineRenewables@gov.scot
http://www.gov.scot/Topics/marine/Licensing/marine

[Redacted]

From: [Redacted]
[Redacted]
Sent: 19 February 2018 15:44
To: [Redacted]
Cc: [Redacted]
Subject: RE: EOWDC - TPC - Evaluation Report - Queries

Thanks Sophie for sending these comments. I will discuss them with the Project Team and come back to you asap.

Regards,
Esther

From: [Redacted]
Sent: Monday, February 19, 2018 3:06 PM
To: [Redacted]

Cc: [Redacted]
Subject: EOWDC - TPC - Evaluation Report - Queries

Hi [Redacted]

Many thanks for providing the Evaluation Report for the substructure and foundation with suction bucket jackets. We have reviewed internally and have a few further queries.

1. Could you please provide MS-LOT with the Evaluation Report for the wind turbines referred to in the Component Certificate (Document Reference: FER-CC-DNVGL-SE-0074-00111-3 – Final Evaluation Report dated 15/03/2016)?

2. The Design Lifetime is for 25 years, does this include additional capacity for TPC to cover the construction phase and also the decommissioning phases? Additionally, if you seek to extend the marine licence and section 36 to 25 years, you will need to recommission the TPC for the additional year(s).

3. Section 4 (page 3) and A13 (page A-11) – Conditions – Transport & Installation – are these conditions carried through into the CMS? Not complying with these conditions would invalidate the TPC. Additionally, the ECoW report during the installation of these substructures should detail how the construction method complies with all conditions listed at A13.

4. Section 4 (page 4) – Conditions - O&M Phase – an ongoing reporting mechanism regarding these conditions should be included in the OMP, can you please confirm if you intend to take this approach?

5. Will separate TPC be conducted to cover the secondary structures (J-tubes, boat landing, access platforms) – these aspects are listed as scoped out at section 6 (page 4) – Conclusions.

If you have any further queries please do not hesitate to contact MS-LOT.

Kind regards

[Redacted]

[Redacted]

[Redacted]

marinescotland
Marine Scotland Licensing Operations Team

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[Redacted] / MS.MarineRenewables@gov.scot
http://www.gov.scot/Topics/marine/Licensing/marine

[Redacted]

From: [Redacted]
Sent: 19 February 2018 11:14
To: [Redacted]
Cc: [Redacted]
Subject: EOWDC - Weekly Call Action Tracker - Monday 12 February 2018

Hi [Redacted]

Many thanks for submitting. Look forward to speaking later, can't see anything missing off the list, although you did mention that you would be enquiring about the format of wind speed direction and data to be submitted to MS-LOT during operation.

Best

[Redacted]

From: [Redacted]
Sent: 18 February 2018 21:47
To: [Redacted]
Cc: [Redacted]
Subject: RE: EOWDC - Weekly Call Action Tracker - Monday 12 February 2018

Hi [Redacted]

Attached you can find the updated action tracker. I will provide more detail tomorrow about the new points added. Please let me know if I have missed anything.

Regards,
[Redacted]

From: [Redacted]
Sent: Thursday, February 15, 2018 4:30 PM
To: [Redacted]

Cc: [Redacted]
Subject: EOWDC - Weekly Call Action Tracker - Monday 12 February 2018

Hi [Redacted]

Can you please send me an updated version of the action tracker following our weekly call on Monday 12th February? Many thanks.

[Redacted]

[Redacted]

From: [Redacted]
Sent: 19 February 2018 12:22
To: [Redacted]

Cc: [Redacted]
Subject: EOWDC - WNoO_011 - Acknowledgement of receipt

Dear [Redacted]

Many thanks, MS-LOT acknowledge receipt.

Kind regards

[Redacted]

From: [Redacted]
Sent: 19 February 2018 11:43
To: [Redacted]
Cc: [Redacted]
Subject: WNoO_011

Hi [Redacted]

Attached you can find the Weekly Notice of Operations 011. Apologies for the delay I was just waiting to receive the latest updates.

Regards,
[Redacted]

[Redacted]
[Redacted]
Aberdeen Offshore Wind Farm

3rd Floor, The Tun Building
4 Jackson's Entry
Holyrood Road
Edinburgh
EH8 8PJ

[Redacted]
[Redacted]