Proposed BOC CO_2 Plant Teesside

Screening Noise Assessment for Effects on Birds on the Dorman's Pool and Reclamation Pond from the Construction and Operation of the Proposed Plant

1.0 Introduction

1.1 BOC is proposing to develop a carbon dioxide (CO_2) capture plant adjacent to its existing hydrogen (H_2) plant located at its North Tees works which is located in the North Tees industrial area. H_2 is extracted from natural gas, but this produces CO_2 as a significant waste stream. Currently the CO_2 is released to atmosphere via a flue stack. BOC is now proposing to capture and liquify the CO_2 and supply it to its customers, reducing these waste emissions.

1.2 In order to facilitate this, a new plant is required adjacent to the existing H_2 plant where the CO_2 will be concentrated, purified and liquified using energy recovered from the H_2 plant using existing equipment. The liquified CO_2 will then be held in storage vessels at the site before distribution by road tanker (12 loads per day). The new plant will not require any buildings with all items (pipework, process equipment etc) located in the open air.

1.3 The plant site is located within an area along the River Tees where land uses are solely industrial both currently and historically. This reflects the designation in the Stockton-on-Tees Local Plan 2019 in relation to Policy EG4 which identifies the North Tees area as a whole (46 ha) as a location for specialist uses such as those related to process industries. The site appears to have active industry to the east and derelict industrial areas to the west including the significant failed Air Products TV1 and TV2 Gasification Plant located to the south/south west. The nearest human receptors (residential dwellings) appear to be located in Port Clarence some 2.8 km to the south west.

1.4 Stockton-on-Tees Borough Council (SoTBC) was consulted on the project and whilst the view of the developers planning consultant (Savills) was that this development would not result in significant environmental effects and hence no formal Environmental Impact Assessment was required, SoTBC suggested that the project should be subject to formal EIA screening due to the proximity of the RAMSAR/SSSI designation which is for a water body located some 865 m to the west (edge of BOC site to nearest edge of water body). This water body, Dorman's Pool, is important for waterfowl as identified in the ecological assessment.

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1.5 SoTBC consulted Natural England (NE) who confirmed that an EIA would not be required but that, given the proximity to the remaining section of the Reclamation Pond, they would expect to see some assessment of potential impacts from construction and operation on the birds that continue to use the water body which effectively makes it a functional of the SPA and RAMSAR site. Particular concerns were raised regarding impacts from piling and traffic noise. It is believed that the Reclamation Pond referred to is also to the west of the site but much closer than Dorman's Pool at a distance of some 160 m from the western boundary of the site to the nearest part of the waterbody.

1.6 However, contemporary information indicates that, since 2017, this pool was depleted/drained and now doesn't exist although there is a small steep sided balancing pond remaining which was always separate to Reclamation Pond. So, on this basis, this area should no longer be of concern to SoTBC or NE.

1.7 This screening noise assessment therefore considers whether significant effects on the avian species using Dorman's Pond are likely from the construction and subsequent use of the proposed plant. However, should there still be any concern over the Reclamation Pond, this is also briefly considered.

2.0 Noise Data and Information

2.1 BOC's project engineers have provided indicative data and information for the construction and operation of the proposed CO_2 plant. This data includes mitigation normally required by for protection of workers and the general amenity of areas proximate to sites. No additional mitigation has been incorporated in respect of habitats.

Construction and Commissioning

2.2 Civil demolition is scheduled for July to mid-August 2021. This will involve breaking out the existing top surface and removal off site. The significant noise generator will be the concrete breaker. This will be intermittent during working hours (07:30 through to 18:00 hours). Typical noise level for concrete breaking would be 105 dB(A) at source. Concrete movements would be ~95 dB(A) at source but intermittent during work hours as vehicles are loaded.

2.3 Civil construction is scheduled for September start. Piling is scheduled to occur over the first half of the month. The prevalent method for piling for Teesport and the general Teesside area is CFA piling (screw type) and this will generate no more noise than general machines (90 dB(A) at source). In the unlikely event that percussive piling is required, this will generate a noise at source of around 120 dB(A).

2.4 General construction is scheduled for mid-November to mid-February. There is not expected to be any significant noise generation as most equipment fabrication will occur offsite. Machine tools such as grinders and drills will be expected (<95 dB(A) at source). However, generally from former projects, average construction noise levels at the site boundary do not exceed 65 dB L_{Aeq} but with occasional peak noise levels at the site boundary expected to be ~ 85 dB(A) L_{Aeq}.

2.5 Based upon the above, and in relation to key periods for pertinent birds, other of elements of construction will run into early winter but these are low noise generating, e.g. concrete base pouring and vehicle movements.

2.6 With regard to commissioning, the main activity of significance with regard to noise is steam blowing where the lines are cleared of debris from construction with swarf and scale etc. This is a one-off process generally carried out over one day. The noise level at any one nozzle is generally ~100 dB(A).

2.7 With regard to vibration from construction, as there is unlikely to be any percussive piling, perceptible levels beyond ~50 m from the site boundary would not be expected. If percussive piling was required, perceptible levels would not be expected beyond ~ 100 m from the site boundary. In either case, not perceptible levels would occur at Dorman's Pool.

2.8 The following mitigation for construction noise and vibration is proposed as a matter of course (see para 2.1):

- use of CFA piling over percussive piling;
- construction during daytime hours (as defined);
- careful maintenance and operation of machinery and tools of use;
- minimisation of on-site construction activities by off-site fabrication where necessary and possible;
- minimisation of drop heights when loading rubble; and
- use of temporary noise screening where any significant noise emissions could occur.

2.9 Based upon the above, for the consideration of worst-case construction or commissioning noise effects on Dorman's Pool which would be from concrete breaking, a source term level at 1 m of 105 dB(A) or 113 dB(A) SWL has been assumed. Assuming propagation over hard ground, this would result in a noise level of ~45 dB at the nearest edge of Dorman's Pond or ~61 dB at the nearest part of the Reclamation Pond if it existed.

<u>Operation</u>

2.10 General noise levels, taking account of normal standard mitigation adopted as referred to in para 2.1, are expected to be at or below the noise level generated by the existing H_2 plant. Further details are provided as follows:

- Turbine and compressor machine house. Noise mitigated by acoustic screening down to 95 dB(A) at the machine house boundary.
- Evaporative cooling tower. Specific noise sources are the air inlet and outlet plenums and the fans. Modern cooling towers design to <100 dB(A) at source by methods such as good fan speed and impeller design, suitable air inlet and outlet open area.

- Steam and gas venting - through designed vents, steam traps, safety relief valve operation, line purges, valve solenoid and actuator operation and road tankers pressuring down and purging. This will be intermittent during operation and through design will generate noise at source of no higher than 85 dB(A).
- Small rotating machinery e.g. pumps starting and stopping. Design and operational basis 80 dB(A) at 1 metre.
- Audible warnings would be as per Teesside H_2 plant.

2.11 For illustrative purposes, the noise assessments for the sister plant to BOC North Tees CO_2 capture plant (i.e. Trafford Park) identify noise levels at the boundary of between 65 and 72 dB(A) for a similar plant size and distance from plant boundary.

2.12 With regard to the duration and frequency of intermittent, startling events, as detailed above, would occur from steam and gas venting, small rotating machinery and audible warnings. Steam and gas venting would be expected to occur several times a day; other events are expected to be rare (<1/week).

2.13 With regard to vibration from operation, none would be perceptible beyond the site boundary and it is most unlikely that any of the process plant would generate any vibration as this would be detrimental to the plant and precluded by design.

2.14 The following mitigation for operational noise, adopted for workforce and amenity protection (not for habitat protection) is proposed:

- effective design and maintenance of plant to <85 dB(A);
- vents fitted with silencers;
- acoustic screening for turbines; and
- noise monitoring during commissioning.

2.15 Based upon the above, for the consideration of worst-case operational noise effects on Dorman's Pool which would be from worst case cooling towers, a source term level at 1 m of 100 dB has been assumed. However, this is obviously for just one plant item and hence in order to provide a worst case of a cumulative noise level from multiple plant items, a total noise level of 110 dB(A) or 118 dB(A) SWL has been assumed. Assuming propagation over hard ground, this would result in a noise level of ~50 dB(A) at the nearest edge of Dorman's Pool or 66 dB(A) at the nearest part of the Reclamation Pond if it existed.

3.0 Noise Criteria for Avian Species

3.1 Various reports and studies have been conducted on noise effects on avian species as reported below, as extracted from an RPS report on Review of Effects of Construction Noise on Birds in SSSI near Springs Road Exploratory Wellsite, 2018.

IECS 2009 Report

3.2 The IECS 2009 report (Cutts et al., 2009) defines disturbance in the general context as discrete events that disrupt ecosystem, community or population structures or in some way alter resource levels i.e. food and space. It may also influence the survival of individual birds and reduce the function of the site either for roosting or feeding. The report states that disturbance varies in its magnitude, frequency, predictability, spatial distribution and duration, and species vary greatly in their susceptibility to disturbance and this susceptibility is likely to vary with age, season, weather, and the degree of previous exposure. The links between visual and audible stimuli are evident throughout the report and it is clear that noise by itself is not necessarily a cause for disturbance if not accompanied by a perceived visual threat.

3.3 In its literature review the IECS report cites a Dutch study (Smit and Visser, 1993) that found that reactions to noise from shooting ranges are stronger if sounds are combined with visual disturbance.

3.4 The importance of visual stimuli to aircraft noise disturbance is also cited in a report by Brown (1990). The IECS report cites its author's personal observation of a remote-controlled model aircraft in the vicinity of wildfowl having the greatest disturbance effect once the engine had cut, with the remote-controlled aircraft becoming silent whilst still in the air. This immediately led to vigorous alarm calling and movement of individuals into cover, with presumably the loss of noise causing the aircraft to be perceived as a raptor.

3.5 The IECS report reviews a 1999 study (Cutts and Allen 1999) into the disturbance of birds in response to flood defence works at Saltend on the Humber estuary.

3.6 In a separate series of reports by IECS to the Saltend Cogeneration Company into the effects of piling noise on estuarine birds, the monitoring of noise related disturbance was carried out. Noise levels were predicted across the site and ranged between 55 and 84 dBA (no indication is given initially in the report of the noise index used but, in subsequent paragraphs, use is made of the L_{Amax} parameter, with the time response factor not identified – but it is presumed that the Fast time response is inferred).

3.7 Effects on the bird population were observed via observations of flight responses and or behavioural changes. With respect to specific noise levels the following response descriptors are given:

- Noise below 50 dB – low
- Regular noise 50 – 70 dB – low to moderate
- Irregular noise 50 – 70 dB – moderate
- Regular piling noise below 70 dB – moderate
- Irregular piling noise above 70 dB – moderate to high

3.8 No indication is given of the response designation of regular piling noise above 70 dB, or indeed what is meant by regular piling noise. Noise levels of around 70 dB L_{Amax} were considered to be above the level that would initiate a behavioural response and below the level that initiates flight responses in most cases.

3.9 The 2009 IECS reports refer to observations made during the construction of the South Humber Power Station. The report states that despite consistent periods of piling activity on the pump house construction site on the landward side of the seawall, birds appeared indifferent to the noise of piling and during visits in February and March, the numbers and distribution of birds on the mudflats at low tide were similar during periods of piling and periods without piling. The report considered that the screening of the mudflats by the seawall was effective in minimising disturbance effects and that any disturbance caused by piling activity could have been attributed to the increased presence of people associated with such activities.

3.10 The 2009 IECS report gives an illustrative overview of the effects of disturbance to waterbirds from different activities that may arise as a result of a construction project. Five levels of disturbance impact are defined for feeding and roosting, as set out in Table 1 below:

Table 1 IECS noise impact criteria

Level	**Impact**	**Effect Level**	**dB(A)**	**Type of Noise**
1	No impact	Low	Below 50	Regular construction noise
2	Behavioural changes (alarm calls, heads up, change in feeding/roosting activity)	Moderate	Equal to or below 70	Piling noise
3	Movement within zone	Moderate to high	Above 70	Piling noise
4	Movement out of zone but remaining on site	High	Above 85	Piling noise
5	Movement off site	High	Not defined	

3.11 The noise unit in Table 1 is not defined in the 2009 IECS report but is probably meant to refer to the L_{Amax} index, as this has already been referenced in the IECS report in connection with the Saltend study.

Other Studies

3.12 An investigation was undertaken by researchers from the University of Leeds (Wright et al., 2013). The experimental study deliberately disturbed birds at a high tide roost site, in an agricultural field adjacent to a sea wall on the south bank of the Humber. Use was made of an air horn which was reported as providing a noise level of 114 dBA at 2 m from the source. No indication of the frequency characteristics of the air horn were provided. Noise measurements were made at two different locations and the noise level at the roosting site estimated from these two measurements through a sound propagation model. The air horn was sounded for three seconds at a time and the noise level recorded at each of the two locations. It is not clear from the paper what the actual noise parameter used for the measurements was, and whether the term L_{bird} should be taken as L_{Aeq} value or some form of maximum level. A classification system for disturbance included Level 1 (behavioural change but not flight), Level 2 (flew but soon returned to the site) and Level 3 (flew and abandoned the site). Level 0 represented no behavioural changes observed. For curlew, the study found a mean Level 1 disturbance at about 72 dB L_{bird} and a mean Level 2 disturbance at about 76 dB L_{bird}. Golden plover and common gulls were slightly more sensitive to noise and Lapwings were found to be significantly more sensitive. Visual disturbance from the experimenter was taken into consideration in the methods used, but their effects could not be statistically separated from the overall results.

3.13 An investigation into disturbances to winter birds was commissioned by BP in the mid 1980's during the development of the Dorset Oilfield. The study was centred on Brand's Bay during a period of drilling for hydrocarbons. Besides investigating the disturbance by drilling operation stimuli, the study sought to put this into perspective by observing all disturbances caused by external stimuli such as fishing boats, aircraft, wildfowlers and natural predators. It was concluded that when the impact of the drilling rig was put into perspective against disturbances from other stimuli, the level of impact from the drilling rig was low. More disturbances were caused by natural predators, or large slow flying birds, low-flying aircraft and helicopters and by wildfowlers. In addition, there was evidence that habituation plays an important part in reducing the sensitivity of the species to disturbance. The initial site activity, before drilling commenced, caused most disturbances, but evidence suggests that birds became more accustomed to traffic noise during the next eight-week period. Reaction to the Kelly Spinner (a particular noisy operation) was similar, in that disturbance was caused when it was first used, but that its use on eight subsequent occasions produced no response.

3.14 Another relevant historical report is a study which describes the effects of anthropogenic disturbances on Brent Geese wintering on the Essex coast near the site of the then proposed London Airport at Maplin Sands (Owens, 1977). The report concluded that Brent Geese quickly became habituated to most sounds, but unexpected sounds, such as nearby gunshots from wildfowlers, usually put the geese to flight. Similarly, the first shots of the day at nearby army gunnery ranges caused the birds to leave the area, but they quickly returned and ignored all subsequent firings for that day. Extremely loud but regular bangs made during nearby weapon testing caused little reaction after the first few weeks.

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3.15 Further historical information from the Wilson Report (Wilson 1963) – states that to scare birds, a noise level of approximately 85 dB sound pressure level at the bird's ear was required. Also in 1974, the Noise Advisory Council in its leaflet "Noise in public places" stated that birds are not disturbed by continuous loud noise and a "bang" of less than 80 dBA would probably be ineffective as a bird scaring device.

Grimsby River Terminal Construction Pile Noise Monitoring and Bird Behaviour Observations

3.16 A detailed measurement exercise was undertaken by Xodus Group (Postlethwaite and Stephenson, 2012) of noise levels at the Pyewipe mudflats during piling for the new Grimsby River Terminal. The noise measurements were complemented by observations from a professional Ornithological Consultant. The study had the following objectives:

i. to record the day-to-day variation in received sound pressure levels at two locations representative of the Pyewipe mudflats throughout the monitoring period and to review the effect of weather conditions (particularly wind direction) on received noise levels when percussive piling is taking place;
ii. to determine the typical sound power levels of the piling rigs when driving piles into the riverbed;
iii. to use the measured sound pressure level data at the two monitoring locations together with knowledge of the location of the rig, the sound power levels and the weather conditions pertaining at the time of piling, to predict the received sound pressure levels on other parts of the mudflats;
iv. to review the assemblages of birds on the mudflats and at the roost areas for different states of the tide and to catalogue changes to bird behaviour caused by external stimuli, and where possible, to identify each stimulus to changed behaviour; and
v. to bring together the evidence from the study to see whether any trends become apparent with respect to received noise levels and changes to bird behaviour and as a secondary, albeit important issue, to see whether any habituation effects could be detected.

3.17 Two noise monitors were established to provide a measure of the noise gradient across the mudflats during piling. Observations of the numbers and species of birds on the Pyewipe mudflats were made over 13 separate occasions during the piling activity in May and July 2012. The observations included maps on an hourly basis of the bird assemblages across the mudflats (to about 1,500 m from the observation points). In addition a record was kept of:

i. all the observed disturbances together with the timing of the disturbance;
ii. the cause of the disturbance if this could be identified;
iii. the number, species and location of the birds disturbed; and
iv. the severity of the disturbance.

3.18 With respect to the latter, this was classified into four disturbance categories:

Disturbance Level 1: Birds looking up or heads raised alert and temporarily stopping feeding, or roosting;

Disturbance Level 2: Birds moving away from the cause of the disturbance by walking or swimming before resuming feeding;

Disturbance Level 3: Birds taking flight and landing somewhere in the same feeding area or mudflat;

Disturbance Level 4: Birds taking flight and leaving the survey area completely.

3.19 This is a similar classification as used by IECS (2009) although the latter used the notation from Level 1 – "no effect" to Level 5 – "maximum response".

3.21 Following the noise measurements and observations at Grimsby, a computer-based noise model was then developed and refined to give best fit to the measured noise data based on the location of the driven pile, and this allowed the noise levels across the mudflats to be determined as a series of contours. The observations of disturbances, together with observations of noise events when no disturbances were seen, were analysed in conjunction with the measured and computed noise level data and several conclusions made. Of note is that widespread disturbances to birds feeding on the mudflats were caused by natural predators (mainly peregrines), aircraft and helicopters, and that noise from the work site was, generally, the cause of a very small percentage of the disturbances observed. The general conclusions from the Xodus Group report included the following:

- Noise from the construction site as a whole (not just piling) caused about 1% of the total disturbances observed during construction activities, when measured as the number of birds disturbed.
- Disturbances to large number of birds at any one time were caused by raptors (mainly peregrine), aircraft and helicopters.
- Noise levels up to 81 dB $L_{Amax\ F}$, in some cases, caused no disturbance during percussive piling.
- Level 1 disturbances (heads up alert) were observed to occur in the noise level range of 66 to 83 dB $L_{Amax\ F}$ for percussive piling.
- Level 2 disturbances (short walk or swim from the source of noise) were observed to occur in the range 68 – 81 dB $L_{Amax\ F}$ for percussive piling.
- As no Level 3 (short flight) or Level 4 (flight out of area) noise related disturbances were observed, a percussive piling noise level greater than 83 dB $L_{Amax\ F}$ would be expected to be required to instigate a flight response.
- A percussive piling noise level less than 66 dB $L_{Amax\ F}$ gave rise to no noise disturbance.
- Whilst it was not possible to provide evidence of habituation to percussive piling noise from this study, the Level 1 disturbances generally indicated that where noise is not perceived as a threat, the disturbance is temporary.

- A noise level of 70 dB $L_{Amax\ F}$ has previously been proposed as an indicator of moderate disturbance to waterbirds due to piling noise (IECS 2009). The Exodus study concluded that this would be very precautionary if applied to the proposed development site, and a level 10 dB higher would still be precautionary level indicator of moderate adverse significance in relation to percussive piling noise.

4.0 Screening Noise Assessment

4.1 From the above, the following worst-case levels are reported:

Construction

- a noise level of ~45 dB at the nearest edge of Dorman's Pool
- or ~61 dB at the nearest part of the Reclamation Pond if it existed.

Operation

- in a noise level of ~50 dB(A) at the nearest edge of Dorman's Pool
- or 66 dB(A) at the nearest part of the Reclamation Pond if it existed.

4.2 From the section on criteria, whilst there is some uncertainty and other factors also cause startle reactions and displacement etc, it would appear that noise levels in the region 60 to 70 dB(A) are the range above which some adverse effects could occur. Based upon the worst case levels above, there would be no disturbance to avian species in the Dorman's Pool area but potentially some very limited disturbance if in the area of the Reclamation Pond if it is existed. As it does not appear to, and just a balancing pond remains, neither SoTBC nor Natural England should be concerned that the BOC CO_2 plant proposal would result in significant effects on avian species in the SPA and RAMSAR site nor any closer.

5.0 Context

5.1 Following current guidance for industrial type noise sources although in relation to human receptors, it is accepted that it is necessary to not only consider the noise levels affecting the receptors but also to consider the context of the project and the surroundings, as affecting receptors. The area is industrial and is allocated as such in the local plan. The only sensitive receptors in the area are avian species that occupy the waterbodies. Historically, the whole of the area around the proposed plant had industrial processes on it and this is clear from the extent of the brownfield sites. As mentioned above, the largish area of newish looking industrial development to the south west of the BOC site is the failed Air Products (AP) TV1 and TV2 gasification plant. This was a significant development.

5.2 The planning application for TV1and TV2 was made in 2011 (11/0359/EIS). The noise studies used in the EIA and HRA were carried out in 2010. The HRA indicates that the noise effects were satisfactory.

5.3 From the HRA, it seems NE at the time was concerned about SPA species using the Reclamation Pond, located immediately west of the BOC site and north of the AP site. Since 2011, however, Reclamation Pond has been reclaimed. This appears to have occurred further to a 2001 planning permission (01/2203/P) and there hence isn't any more up to date HRA noise info relating to the development. Therefore it is now only Dorman's Pool itself which is part of the SPA that needs to be taken account of.

5.4 After the failure of AP's TV1 and TV2 project a company called Cogen submitted an application for another gasifier project on part of the same site. This application (16/1998/EIS) was not determined and was withdrawn in December 2020. However Cogen did an ES and this includes noise measurements at Dorman's Pool dated 2016. These measurements were taken over just one night-time period and showed the ambient level varying from ~42 dB L_{Aeq} late evening to ~50 dB L_{Aeq} at 10:00 hrs.

5.5 It is relevant that based on the info AP submitted for its far larger project located much closer to the SPA (and at the time adjacent a now defunct body of water that NE considered hosted some of the SPA flock), the Appropriate Assessment concluded no harm and hence the project was granted planning permission and subsequently an EA Permit. The EA also had to consider the HRA as it was the competent authority for the permit.

6.0 Summary and Conclusions

6.1 SoTBC and NE raised concerns over the noise effects from the proposed BOC CO_2 plant on the RAMSAR/SSSI designation which is for a water body located some 865 m to the west (edge of BOC site to nearest edge of water body). This water body, Dorman's Pool, is important for waterfowl as identified in the ecological assessment. SoTBC and NE agreed that no formal EIA was necessary, but that consideration should be given to birds using the Reclamation Pond referred which is much closer to the site but effectively acting as an extension Dorman's Pool SPA/RAMSAR site.

6.2 Following investigation, it appears that the Pond was present in 2017 but has been drained since and is no longer a waterbody except for what appears to be a small remaining balancing pond. On this basis, it should no longer be of concern to SoTBC or NE.

6.3 Notwithstanding this, an assessment has been provided for the effects on avian species using Dorman's Pool. This has indicated that worst case noise levels from construction and operation should not result in any adverse effects on the avian species present. In addition to this, the area is fundamentally industrial in nature and by allocation in the Local Plan. Other planning applications for significant industrial processes closer to Dorman's Pool have also been allowed.

6.4 Overall from the above, SoTBC and NE should have no further concerns regarding noise effects on the SPA/RAMSAR site regarding the proposed new BOC CO_2 plant.

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