



APPLICANT'S RESPONSE TO ISSUES RAISED AT DEADLINE 3

Drax Bioenergy with Carbon Capture and Storage

Infrastructure Planning (Examination Procedure) Rules 2010

Document Reference Number: 8.10.3

Applicant: Drax Power Limited

PINS Reference: EN010120



REVISION: 01

DATE: March 2023

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PUBLIC

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1. INTRODUCTION

1.1. PURPOSE OF THIS DOCUMENT

- 1.1.1. On 23 May 2022, Drax Power Limited ("the Applicant") made an application ("the Application") for a Development Consent Order (DCO) to the Secretary of State for Business, Energy and Industrial Strategy ("the SoS"). The Application relates to the Drax Bioenergy with Carbon Capture and Storage (BECCS) Project ("the Proposed Scheme") which is described in detail in Chapter 2 (Site and Project Description) of the Environmental Statement (ES) (APP-038). The Application was accepted for Examination on 20 June 2022.
- 1.1.2. This document, submitted at Deadline 4 of the Examination, contains the Applicant's responses to the Written Representations submitted by the various Interested Parties at Deadline 3.
- 1.1.3. In this document, the Applicant has focussed on responding to points that have not already been made by Interested Parties and responded to by the Applicant.
- 1.1.4. In particular, further to its Response to Relevant Representations and submissions at the Hearings, the Applicant has not provided a further response to points raised in relation to the continued operation of biomass at Drax Power Station or the sustainability credentials of these operations. The Applicant's response to these previous points can be found in its Response to Relevant Representations, its Summary of Oral Submissions at ISH1 and OFH1 and ISH2, its response to First Written Questions and its Response to Issues Raised at Deadline 1.
- 1.1.5. The MMO has also submitted a standard response letter that does not raise any points specific to the Proposed Scheme; the Proposed Scheme does not affect the MMO's jurisdiction. Therefore, it is considered that the submission does not require a response from the Applicant.
- 1.1.6. The submission from National Highways was responded to and addressed in an updated SoCG between the Applicant and National Highways that is submitted alongside this document at Deadline 4. The SoCG confirms the agreed position between the parties in advance of the March Hearings.
- 1.1.7. The Applicant notes that National Highways have submitted a representation at Deadline 3 in relation to DCO Requirements matters. However, as recorded in the SoCG, National Highways are content with the DCO Requirements as they currently stand and that the proposals in its Deadline 3 submission therefore fall away. The Deadline 3 submission should therefore be read in that context, and no response to the National Highways submission is provided in this document.

2. NYCC / SDC

Table 2.1 - NYCC / SDC

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
Comments on responses to the Examining Authority's written questions (ExQ1)		
2.1 (S1, P1-2)	<p>The Authorities have the following comments on the Applicant's responses to the Examining Authority's written questions (ExQ1):</p> <ul style="list-style-type: none"> NV.1.6 reference is made to a meeting with SDC on 4 February 2022 to discuss the noise and vibration assessment methodology where an alleged agreement was made to enabling operational noise impacts of between +5dB and +10dB at sensitive receptors, subject to satisfactory contextual factors. These parameters are an indication of adverse noise impacts (BS4142:2014+A1:2019) and it is our recollection that good acoustic design was a key part of the contextual factors discussion, which is yet to be scrutinised when putting into context adverse noise impacts at receptors R6 (2 Forest Grove, Barlow) and R14 (Low Farm). 	<p>As indicated the Applicant's response to NV1.6 at Deadline 2 (REP2-060), the type of contextual considerations that would be developed and presented in the ES chapter were agreed during the meeting on 4 February 2022. Agenda and Meeting notes were issued to all attendees after the meeting on 4 February covering our discussion on contextual considerations in Item 5 – S42 Responses.</p> <p>A meeting was held with the Senior Environmental Health Officer at SDC on 23 March 2023, after ISH3, and the good acoustic design process followed during the ES was discussed. This discussion focused on paragraph 7.5.3 of the ES Chapter 7 (Noise and Vibration) (APP-043) and Appendix 7.2 (Operational Noise Assumptions) (APP-131). It is our understanding that SDC welcomed and agreed with our description of the good acoustic design process and that this does therefore not need further scrutiny.</p> <p>Rating noise limits stipulated in Table 1 of Requirement 17 will be achieved by following a good acoustic design and this will be captured in the Noise Mitigation Scheme to be submitted to the Local Planning Authority for approval prior to commencement of operations.</p>
2.2 (S1, P3)	<ul style="list-style-type: none"> NV.1.7 it is stated that the core construction hours for the project are set out in the Register of Environmental Actions and Commitments, Commitment G5 which are: Monday to Friday 09:00 – 17:00 and 07:00 – 14:30 on Saturdays. By contrast, commitment G5 identifies core construction hours of Monday to Friday 07:00 – 19:00 and 07:00 – 14:30 on Saturdays. Our position is that core construction hours should be Monday to Friday 08:00 – 18:00 and 08:00 – 13:00 on Saturday which reflect those considered to safeguard residential amenity in the early mornings and into the evening. This applies only to core construction hours and is a separate issue to construction works identified as necessary outside of these hours. 	<p>The construction hours for Monday to Friday should read 07:00 – 19:00. The Ref ID G5 of the Register of Environmental Actions and Commitments (REP3-007) is correct.</p> <p>The Applicant would like to refer to its response set out at Deadline 2 (REP2-060), see Table 12.1, ExA ref NV1.7. It is also important to note that the working hours for the Drax Repower DCO, which was consented, were also 07:00 to 19:00 on Monday to Friday.</p> <p>This point was also discussed and addressed by the Applicant at ISH3 and recorded in the Applicant's written summary of oral submissions from ISH3, submitted at Deadline 4 – Agenda Item 6.</p>
Comments on the Applicant's updated draft Development Consent Order		
2.3 (S2, P1-2)	<p>The Authorities have the following comments on the updated draft Development Consent Order:</p> <ul style="list-style-type: none"> Requirement 14(1) – concerns that the temporary compound strategy constitutes permitted preliminary works considering the association with noise complaints if not properly considered. 	<p>This point was discussed at ISH3 and recorded in the Applicant's written summary of oral submissions from ISH3, submitted at Deadline 4 – Agenda Item 6.</p>

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2.4 (S2, P3)	<ul style="list-style-type: none"> Requirement 14(1) – ‘The provision of temporary means of enclosure and site security for construction should be included in the list of permitted preliminary works which are excluded from taking place prior to the Construction Environmental Management Plan being agreed. 	This point was discussed at ISH3 and recorded in the Applicant's written summary of oral submissions from ISH3, submitted at Deadline 4 – Agenda Item 6.
2.5 (S2, P4)	<ul style="list-style-type: none"> Requirement 17 (Table 1) – Rating level for Receptors R6 (2 Forest Grove, Barlow) and R14 (Low Farm) have not been amended as per comments in the Local Impact Report. There would be adverse operation noise impacts at Receptors R6 (2 Forest Grove, Barlow) and R14 (Low Farm) without proper scrutiny of good acoustic design. 	A meeting was held with the Senior Environmental Health Officer at SDC on 23 March 2023, after ISH3, and the good acoustic design process followed during the ES was discussed. This discussion focused on paragraph 7.5.3 of the ES Chapter 7 (Noise and Vibration) (APP-043) and Appendix 7.2 (Operational Noise Assumptions) (APP-131). It is the Applicant's understanding that SDC welcomed and agreed with the description of the good acoustic design process and that this does not need further scrutiny. Therefore, values in Table 1 of Requirement 17 do not need to be amended.
2.7 (S2, P6)	<ul style="list-style-type: none"> Schedule 11 – paragraph 3(2) and 3 (3) – the Authorities would ask that the time period for requesting further information is increased from 10 and 15 days respectively, to 21 days for both. 	As recorded at ISH4, the Applicant has agreed this and the amendment is made at Deadline 4.
2.8 (S2, P7)	<ul style="list-style-type: none"> With regard to Schedule 2 Article 7, the Authorities note the Applicants position set out at paragraph 2.34 of Applicants response to Issues raised at deadline 1 [REP2-067]. However, the Authorities position remains as set out in the Local Impact Report. 	This point in relation to Requirement 7 and the Landscape and Biodiversity Strategy being submitted in phases or parts was discussed at ISH4 and recorded in the Applicant's written summary of oral submissions from ISH4, submitted at Deadline 4 – Agenda Item 5.
Comments on any other responses received by Deadline 2		
2.9 (S3, P1-2)	<p>The Authorities have the following responses to the Applicant's Responses to issues raised at Deadline 1 [REP2-067].</p> <ul style="list-style-type: none"> Table 2.1 (2.1) permitted preliminary construction works to take place prior to the CEMP being agreed. In reference to earlier comments, the CEMP is the mechanism to agree finer details such as temporary compound location(s) which are a notorious source of noise complaints due to them (often) being sited close to highway infrastructure thus residential receptors. The revised DCO Requirement 14(1) identifies ‘above ground site preparation for temporary facilities for the use of contractors’ as permitted preliminary works and I would suggest that this is reconsidered so that the temporary compound strategy does not constitute such works. Furthermore, permitted preliminary construction works carried out outside of recommended core construction hours creates a potential for noise impacts and reinforces the need to agree core construction hours in advance at this stage. 	This point was discussed at ISH3 and recorded in the Applicant's written summary of oral submissions from ISH3, submitted at Deadline 4 – Agenda Item 6.
2.10	<ul style="list-style-type: none"> Table 2.1 (2.2) operational noise impacts and good acoustic design. It is not disputed that the relevant authority has an opportunity to ensure 	A meeting was held with the Senior Environmental Health Officer at SDC on 23 March, after ISH3, and the good acoustic design process followed during the ES was discussed. This

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(S3, P3)	that a good acoustic design is achieved during the detailed design stage. Our position is that good acoustic design was a key part of the contextual factors discussion which is yet to be scrutinised when putting into context adverse noise impacts at receptors R6 (2 Forest Grove, Barlow) and R14 (Low Farm), which is enabled through DCO Requirement 17.	discussion focused on paragraph 7.5.3 of the ES Chapter 7 (Noise and Vibration) (APP-043) and Appendix 7.2 (Operational Noise Assumptions) (APP-131). It is the Applicant's understanding that SDC welcomed and agreed with the description of this process and that this does not need further scrutiny.
The Authorities' response to the issues raised by the Applicant on the Landscape Chapter of the Authorities' Local Impact Report		
2.11 (S1, P1-2)	<p><u>Environmental Impact Assessment Regulations</u></p> <p>As per the draft Statement of Common Ground between the Authorities and the Applicant [REP-018], the Authorities agree that in EIA terms there are no significant adverse landscape and visual effects (during the operational period of the Proposed Scheme - moderate or greater level of effect). However, there are a notable number of minor adverse landscape and visual effects as listed in the ES Volume 3 – Appendix 9.5 (APP-152). The Authorities would wish to reiterate the need for an appropriate landscape strategy to comply with local plan policy and to reduce other less significant adverse effects, where reasonable and possible.</p> <p>The Authorities argue that in other cases, where an application that does not meet the threshold for an EIA, a landscape strategy for such a development would be expected as part of the application to comply with local plan policy. In EIA cases such as this DCO application, it would be perverse to only develop a strategy mitigating significant adverse effects, leaving lesser effects to go unchecked, effectively circumventing local plan policy on good design</p>	<p>The approach to the landscape and visual assessment has been undertaken in line with the methodology agreed with the Authorities as recorded in the SoCG (REP3-012) submitted at Deadline 3. This identified a limited number of construction effects considered to be significant as identified within Table 9.7 of Chapter 9 (Landscape and Visual Amenity) (APP-045). Those landscape and visual effects considered not significant are set out in ES Volume 3 Appendix 9.5 (Table of Effects that have been determined to be Not Significant) (APP-153) and range from negligible to slight adverse.</p> <p>Mitigation measures, including those embedded within the Proposed Scheme design (such as locating the Proposed Scheme to the northern end of the Drax Power Station) have focused on trying to avoid, reduce or limit significant effects. Given the scale of the Proposed Scheme, its size and massing, this approach is appropriate and proportionate, as it is not possible to mitigate all non-significant effects, particularly where the Proposed Scheme is visible within broader views and in the context of the existing Drax Power Station. However, some of the mitigation that we have proposed also mitigates not-significant effects.</p> <p>The Applicant has submitted a landscape strategy for the Proposed Scheme which is shown on Figure 1 (Landscape and Biodiversity Mitigation Plan) of the Outline Landscape and Biodiversity Strategy - Volume 2 (APP-181). This is shown at a scale that reflects the large-scale nature of the Proposed Scheme and indicates where existing landscape features are to be reinforced and/or existing vegetation is to be retained.</p> <p>As stated above, the Applicant believes it has incorporated mitigation measures that are proportionate to the effects arising from the Proposed Scheme and its context within the landscape, and how this is perceived from publicly accessible locations.</p> <p>The Applicant is committed to ensuring that consultation is carried out with regard to the detailed design, this is secured within Requirement 7 with reference to the Work No.s 1, 2 and 3, the details of which are to be approved by the LPA.</p> <p>The Applicant believes the proposal includes sufficient measures to ensure compliance with local plan policy, as outlined in the Design Framework– see 5.4 (Local Planning Policy).</p> <p>These points were discussed at ISH3 and the Applicant's position is also recorded in the Applicant's written summary of oral submissions from ISH3, submitted at Deadline 4 – Agenda Item 4.</p>

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2.12 (S3, P2-3)	<p><u>Design Principles</u></p> <p>The Authorities' overarching concern is that, since the original landscape design (also referenced in the Design Framework), the site has been subject to general erosion of the landscape features. It is important that no further erosion of the landscape features take place and where possible good landscape and design principles are applied as any and all applications come forward on the site.</p> <p>The Authorities need to see that the landscape principles set out in the Design Framework are correctly applied to this application and that some comfort is offered now, that detailed design will incorporate the principles set out and where possible where and how those principles will be incorporated.</p>	<p>The Applicant is committed to implementing those elements of the Design Framework that are applicable to the proposed Scheme and this is detailed in the REAC and dDCO.</p> <p>In addition, the Applicant has also committed at ISH3 to reviewing the measures within the Design Framework to ensure all of those that apply are secured via the dDCO and these will be included in the updated REAC submitted at Deadline 5.</p> <p>Whilst the Design Framework (APP-195) describes the wider strategy for Drax Power Station, the Applicant considers that the Proposed Scheme does not result in further erosion of the landscape features of the original design. Indeed, the Landscape Strategy shown on Figure 1 (Landscape and Biodiversity Mitigation Plan) of the Outline Landscape and Biodiversity Strategy - Volume 2 (APP-181), indicates where existing landscape features are to be reinforced and/or existing vegetation is to be retained, and is shown at a scale that reflects the large-scale nature of the Proposed Scheme.</p> <p>It is also important to note that the original Weddle Strategy is from the 1960s – it therefore didn't consider design parameters that exist today such as stand-off distances, overhead lines and other modern safety requirements (sight-lines etc) which constrain the retrofitting of any subsequent designs in the context of Drax Power Station.</p> <p>The Applicant considers that the principles set out in the Design Framework are suitably secured through the following Requirements.</p> <p>Requirement 6 specifically references D1 within the REAC (REP3-007) which sets out the principles of good design as referenced from the Design Framework in relation to Work No. 1, 2 and 3 and requires details to be submitted to and approved by the LPA.</p> <p>Work No. 1 comprises the Carbon Capture Plan itself, Work No. 2 the Carbon Dioxide Transport Infrastructure and Work No. 3 the Supporting Works for Work Nos 1 and 2. Requirement 7 requires detailed landscape and biodiversity strategies to be submitted that substantially accord with the OLBS, in consultation with and approved by the LPA. This includes planting measures, cultivation of materials, hard surfacing, a programme and annual landscape and biodiversity management and maintenance. This will specifically cover Work No. 6 which is the Habitat Provision Area and hedgerow reinforcement and replacement.</p> <p>These points were discussed at ISH3 and the Applicant's position is also recorded in the Applicant's written summary of oral submissions from ISH3, submitted at Deadline 4 – Agenda Item 4.</p>
2.13 (S4, P1-P2)	<p><u>Proposals</u></p> <p>The Authorities would wish to see the following:</p> <p>1. The Plan titled Outline Landscape and Biodiversity Strategy Vol 2 Figure 3 Existing Retained Vegetation [APP-183] includes an area coloured light green indicated as '<i>area to accommodate carbon dioxide construction compound (detailed design will avoid the unnecessary removal of existing vegetation).</i>'</p>	<p>The area identified by the Authorities forms the perimeter planting to the northern end of Drax Power Station and is proposed for temporary use as a construction compound. As identified on Figure 3 Existing Retained Vegetation (APP-183) of the Outline Landscape and Biodiversity Strategy - Volume 2 the planting in question will not be removed where this is avoidable. This is secured through reference to work no. 2 within Requirement 7 of the DCO, which requires a written strategy for that part, which is substantially in accordance with the outline landscape and biodiversity strategy, has been submitted to and, after consultation with NYCC. In this</p>

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	This should be amended to either say that existing vegetation will not be removed (the Authorities preference) or that any vegetation that is required to be removed will be reinstated. If existing vegetation is to be removed and reinstated, it should be made clear why this is necessary and what alternative options have been considered and discounted which would not result in vegetation removal. This principle should be applied to any aspects where existing vegetation is threatened.	<p>way, any requirement to impact this area of planting will be discussed and agreed with NYCC prior to works commencing.</p> <p>This is agreed to with respect to this Proposed Scheme however, as part of the Humber Low Carbon Pipelines application the location of the National Grid AGI has not yet been confirmed and may subsequently impact this planting and will be the subject of a further planning application. The Applicant is therefore unable to confirm the permanent safeguarding of the planting in question.</p> <p>This relates to the light green area shown on OLBS Figure 3 (Existing Retained Vegetation) (APP-183) which could be affected by Humber Low Carbon Pipeline, and therefore, until the location and component infrastructure of the carbon dioxide receiving compound is confirmed, the area needs to remain as 'light green' because the Applicant does not yet know where the infrastructure will be placed. However, this will be refined as the detailed design for both schemes progress and, furthermore, the final design will be included in the LBS.</p> <p>The approach generally to how any removal and replanting of vegetation would be justified and approved via the process set out in Requirement 7 was explained by the Applicant at ISH3 and recorded in the Applicant's written summary of oral submissions from ISH3, submitted at Deadline 4 – Agenda Item 4.</p>
2.14 (S4, P3)	2. A plan setting out where and how the principles set out in the Design Framework will be applied to the Proposed Scheme.	<p>The Design Framework (APP-195) currently sets out design principles in relation to siting, massing and colour in Section 4.1, and these are secured through Requirement 6 of the DCO.</p> <p>Issues of landscape and biodiversity are set out in section 4.2 (Landscape and Biodiversity) and include the approach taken in relation to green infrastructure, which are expanded upon in the Outline Landscape and Biodiversity Strategy and secured through reference to Requirement 7.</p> <p>The detailed design of the site is not currently at a stage by which specific landscape design elements can be referenced on a plan. Nevertheless, when the design has been sufficiently progressed NYCC will have an opportunity to comment on and approve the detailed design, this is secured in Requirement 6 and specific numbered works. The Applicant will by virtue of this requirement within the DCO be obliged to make reference to the relevant design principles that have been extracted from the Design Framework and included in the REAC, and which are referenced in the Requirement. As part of approval under Requirement 6, NYCC would need to be satisfied that the detailed design adheres to the principles of good design outlined within the relevant REAC commitments secured by Requirement 6.</p>
2.15 (S4, P4)	3. The Design Framework to be specifically secured to the DCO document itself. This would most likely be as an addition to requirement 7. The DCO needs to make it clear that any landscape scheme that comes forward to the Authorities for approval must incorporate the principles set out in the Design Framework for it to be considered for approval, including a detailed narrative as to how these principles have been considered.	<p>The Applicant considers that the principles set out in the Design Framework (APP-195) are suitably secured through the following Requirements.</p> <p>Requirement 6 specifically references [D1] within the REAC (REP3-007) which sets out the principles of good design as referenced from the Design Framework in relation to Work No. 1, 2 and 3 and requires details to be submitted to and approved by the LPA. Furthermore, and as reported in Issue Specific Hearing 3 for Environment, additional elements from the Design</p>

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		<p>Framework will be included in the updated REAC submitted at Deadline 5 if appropriate following a review of the Design Framework. Work No. 1 comprises the Carbon Capture Plan itself, Work No. 2 the Carbon Dioxide Transport Infrastructure and Work No. 3 the Supporting Works for Work Nos 1 and 2.</p> <p>Requirement 7 requires detailed landscape and biodiversity strategies to be submitted that substantially accord with the OLBS, in consultation with and approved by the LPA. This includes planting measures, cultivation of materials, hard surfacing, a programme and annual landscape and biodiversity management and maintenance. This will specifically cover Work No. 6 which is the Habitat Provision Area and hedgerow reinforcement and replacement.</p> <p>These points were discussed at ISH3 and the Applicant's position is also recorded in the Applicant's written summary of oral submissions from ISH3, submitted at Deadline 4 – Agenda Item 4.</p>

3. ROBERT PALGRAVE

Table 3.1 – Robert Palgrave

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CARBON CAPTURE RATE		
3.1 (S1, P12)	In summary, the Applicant's response provides no evidence from comparable power-CCUS installations that the target carbon capture rate of 95% for Drax BECCS has ever been achieved. It is highly likely therefore that no such evidence exists. Consequently there can be little confidence in the level of carbon capture claimed by the Applicant. Their projections for the amount of carbon they would capture, and the size of the 'negative emissions ' they would provide in support of Net Zero are optimistic and should be re-worked.	<p>A number of IPs have queried the use of the 95% capture rate and have suggested or implied that this is a figure that the Applicant cannot achieve.</p> <p>The reference to the 95% capture rate can be found in the guidance document titled 'Post combustion carbon dioxide capture: best available techniques' (BAT), published in July 2021, almost a year prior to the applicant's DCO application being accepted for examination. The guidance states at section 3.1:</p> <p><i>'You should aim to achieve a design CO2 capture rate of at least 95%, although operationally this can vary, up or down.'</i></p> <p>Section 3.6 further confirms that: <i>'Capturing at least 95% of the CO2 in the flue gas is considered BAT. You can base this on average performance over an extended period (for example, a year). To achieve this, you should make sure the design capture level for flue gas passing through the absorber equates to at least 95% of the CO2 in the total flue gas from the power plant. If you process less than the full flue gas flow, your capture rate will have to be correspondingly higher. Over the averaging period, your capture level may vary up or down.'</i></p> <p>The Carbon Capture rate of the technology used for the Proposed Scheme has been designed to capture approximately 95% of all CO₂ from two biomass units. This figure is considered to be achievable based on the use of Best Available Techniques.</p> <p>The Applicant is currently pursuing an Environmental Permit that will be issued by the Environment Agency. Under the terms of any permit that is granted, Drax will be required to use Best Available Techniques in order to prevent or minimise emissions and impacts on the environment.</p> <p>It is expected that an Environmental Permit granted will establish the figure of 95% (and when and how it should be tested).</p> <p>Ultimately the achievement of the 95% figure is a matter not for this DCO Application but is rather a matter that the Environment Agency will control under the terms of the Environmental Permit. Nevertheless the Applicant considers that the figure of 95% is achievable.</p>
AIR POLLUTION		
3.2 (S2, P7)	At 5.3 in the same table (page 41) of Document Reference Number: 8.10.1, the Applicant responds to comments from Biofuelwatch about the uncertainties in predicting the air pollutants from the Drax BECCS, saying that: <i>"The modelling of amine degradation products is based on the biomass plume characteristics and uses the ADMS v5.2 software package. The theory behind the degradation of amines is well established, the model software has been validated by the developers and the reaction rates used for the amine</i>	<p>The air dispersion modelling has been undertaken using data provided by the technology supplier rather than on generic amines or indeed proxy compounds. Air dispersion models are inherently conservative in nature and hence will generate a worst-case scenario.</p> <p>The Applicant does not accept that there is not sufficient information on which to assess the impacts of the Application.. In their Responses to the Examining Authority's written questions</p>

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	<p><i>degradation are specific to the technology (provided by the technology suppliers from literature values).</i></p> <p><i>Any model, or indeed monitoring, has associated uncertainties. This is taken into account in the assessment through the employment of highly conservative assumptions that ensure that impacts are not underestimated. Specifically, in the case of the modelling of amines and their degradation, it has been assumed that all degradation products (nitrosamines and nitramines) have the same toxicity as NDMA and act in combination, and the photolytic degradation of products has been neglected as has the time delay between the release of amines and the onset of degradation. “</i></p> <p>The Applicants assurances presented here are not supported by comments in the BAT Review, which at page 32 reported on experience at Boundary Dam 3:</p> <p>“More recently (CCSKC, 2020a), based on experience at BD3, it was stated that:</p> <p><i>‘..... the research currently available on post-combustion amine-based carbon capture is insufficient for adequately understanding interactions between amines and flue gases.</i></p> <p><i>“Long-term testing of amines was quite often limited in duration around the time that BD3 was built. The data we have on the behaviour of the amine used on this particular facility does not reflect the accelerated degradation that occurred closer to 3,000 or 4,000 hours of run time.” In the presence of the common components and undesirable particulates present in a flue gas stream, amines degrade and must be replaced with fresh amine solution for the capture process to continue optimally. Degradation products and operational challenges are unique to each of the different amines in combination with various flue gas streams. As such, piloting must adequately emulate the conditions of the final, full-scale process. “</i></p> <p>The author refers to accelerated degradation of the amine used at around 3000-4000 hours. The question for the examination is this – has the Applicant's testing on a Drax BECCS pilot been extensive enough to reliably report the results of amine degradation on flue gas composition and hence atmospheric pollution? Why have no reports been published showing the results of testing if it has been done?</p>	<p>(ExQ1) (REP2-076), the Environment Agency confirms at AQ 1.2 confirm that: <i>‘the Environment Agency does know the make up of the solvent.’</i></p> <p>The UK Health Security Agency also confirmed in their Responses to the Examining Authority's written questions (Document Reference REP2-097) that: <i>‘UKHSA is satisfied that the applicant's risk assessment for amine emissions from the proposed post-combustion carbon capture plant is appropriately conservative and in-line with the current knowledge base relating to nitrosamines and nitramines.’</i></p> <p>The need to maintain commercial confidentiality is an acknowledged part of the Environmental Permitting process. Chapter 6 (Air Quality) of the ES (APP-042) sets out that additional model sensitivity testing has been carried out based on published data in the public domain; and in line with methodology and work undertaken on this topic by the Environment Agency. The Applicant's approach has been considered acceptable by the Environment Agency, with further consideration to be undertaken in the permit process.</p>
3.3 – 3.4 (S2, P8)	<p>Secondly in the above extract from the BAT review, the point is made that <i>“degradation products and operational challenges are unique to each of the different amines etc”</i> and that therefore <i>“piloting must adequately emulate the conditions of the final full scale process”</i>. Again we know very little about the pilot testing done by the Applicant. Were trials run for long enough and at</p>	<p>The composition of the solvent will be covered by an Environmental Permit that will be issued by the Environment Agency and the relevant information has been provided to them. The Environment Agency as the competent authority is currently determining this application and has stated in its Statement of Common Ground that the Applicant's approach is acceptable with further consideration to be undertaken in the permit process.</p>

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	<p>sufficiently large scale using the proprietary amine mixture to give an adequate level of certainty to its air quality impact assessment?</p> <p>The Applicant has declined to disclose the composition of the Amine mixture is it proposing for the PCC, citing commercial confidentiality. Consequently, it is difficult if not impossible to interrogate the Applicant's assessment of air quality impacts.</p>	
3.5 (S2, P15)	<p>The Applicant wrote in the Environmental Statement at 6.5.22: <i>"Given that the specified reactivity data for the proprietary amine and nitrosamine compounds remain confidential, additional model sensitivity testing has been completed based on applying amine reaction rate coefficients equivalent to proxy amine and nitrosamine compounds, for which published data in the public domain are available"</i>.</p> <p>Then at 6.5.58 in the ES, the Applicant wrote admitting that the assessment has a further limitation: <i>"Due to the confidentiality of the proprietary amine solvent, it is not possible to present the equivalent toxicity data relating to the assessed amine and nitrosamine compounds, thus representing a limitation to the assessment. However, further sensitivity testing of the amine chemistry modelling has been undertaken to address and reduce uncertainty, as detailed in Appendix 6.3 and outlined in paragraphs 6.5.21 to 6.5.25 and below."</i></p> <p>Overall the Applicant's approach is very concerning: modelling is inherently prone to uncertainties as the Applicant has admitted, and the use of proxies and the failure to disclose results of testing increases the likely margin of error. If it is not known which reactions are occurring within the flue gases or what substances and breakdown products may be present in the flue gases, the air quality impact assessment is deeply flawed.</p>	<p>Dispersion modelling has inherent uncertainties. However this does not imply that the air quality impact assessment is flawed. The modelling undertaken takes appropriate account of uncertainty and is robust. Please also see response to Biofuelwatch's Deadline 2 submissions also submitted at Deadline 4.</p> <p>It is important to note that proxy compounds are not used in the main assessment. This is based on process-specific compounds and reaction rates. Sensitivity testing was guided by the range of reaction rates seen in literature.</p> <p>Model results for amine degradation products are provided in Appendix 6.4 (Operational Phase Air Quality Results Tables: Human Receptors) (REP2-032) for both directly emitted nitrosamines, i.e. those formed within the process prior to emission to air, and for the sum of direct emitted and formed in air degradation products. Ground level impacts from nitrosamines and nitramines are dominated by the products formed in ambient air.</p> <p>As has been stated within the air quality assessment, the Applicant's treatment of uncertainty in the modelling has been:</p> <ul style="list-style-type: none"> • to use a well validated dispersion model (ADMS); • to ensure that model inputs parameters are set at their worst case e.g. emission rates, where there is potential variability; • to undertake sensitivity testing including for meteorological conditions; and • to assess the Proposed Scheme against the maximum modelled concentrations over all model scenarios.
3.6 (S2, P16)	<p>This all stems from the fact that the proposal is novel and unproven at this scale.</p>	<p>The post combustion capture process removes the carbon from the flue gas stream and does not differentiate between the fuel type used in the process.</p> <p>The use of carbon capture technology is not new and has been developed over the past 45 years and used in relation to various generation types. The solvent technology that drives the process has been evolving over that time frame. With the choice of the MHI KS21 solvent, the Applicant will be using the very latest version of that solvent technology. The KS21 solvent has been shown to outperform its predecessor in numerous trials including within the Drax Power Station CCS incubation facility, will provide a scalable solution, and is now the primary product being offered by MHI in this market.</p>

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
		<p>The UK Government quite clearly sees the need for BECCS at scale and this need is reflected in the Government's Biomass Policy Statement published in November 2021 as well as the Net-Zero Strategy – Build Back Greener published October 2021, and the recent consultation on business models for power BECCS. Para 42 of the Net-Zero Strategy provides the following information regarding how the Government assesses the technological development of BECCS:</p> <p><i>'Bioenergy has already played a significant role in decarbonising the electricity system, accounting for 12.6% of total renewables generation in 2019.15 Technological changes mean that biomass usage can now go beyond carbon-neutral and deliver negative emissions by combining it with carbon capture and storage (BECCS).'</i></p>
3.7 (S2, P16)	<p>To introduce it without further extended and realistic pilot trials poses a serious risk to human health. The BAT paper put forward by the Applicant (at page 77) made it clear that the operational experience of PCC is so limited that reliable assessments of air quality impacts are not so far available.</p> <p><i>"Given the complex nature of the processes involved and the emerging nature of PCC technology, as already discussed, pilot studies under thoroughly realistic conditions are required for reliable indications of the dispersion, reaction and deposition modelling inputs, and these inputs will still need to be verified by monitoring of the full-scale plant for an extended period after construction, [...]"</i></p> <p>It is not precautionary to proceed with a process and substances that are untested or lacking in information: these issues mean that any modelling that has been done has a limited value.</p>	<p>The Applicant is confident that the PCC technology can be operated within the parameters modelled within the ES, and this will be secured within the Environmental Permit. The amine compounds are not untested. Information on their toxicology is available and was used in specifying the updated Environmental Assessment Levels (EALs) provided in Air Quality Technical Note 1 (AS-019)</p> <p>The assessment of impacts, including information on the excess cancer risk provided in Table 16.1 Response Ref. 16.1, 16.4 and 16,5 of the Applicant's Responses to Relevant Representations (AS-038) demonstrates that there will be no significant risk to health resulting from the operation of the Proposed Scheme.</p>
3.8 (S2, P19)	<p>For clarification the ExA might explore these questions.</p> <p>First. Were the Applicant's assessment of air quality impacts reported in the Environment Statement based on the specific atmospheric chemistry of the two amines (Ethylamine (EA) and 2-(Ethylamine) ethanol (EAE) and the Nitrosamine (ENEN) that would be emitted to air by the PCC?</p>	<p>The Applicant has undertaken the Environmental Statement in line with the compounds provided by the technology supplier, which have been agreed with the Environment Agency. Please see the Applicant's response within this document to Response Ref. 3.5 (paragraph 2).</p>
3.9 (S2, P20)	<p>Second. Was the assessment of impacts informed by realistic-scale PCC trials on woody biomass? Will the reports of such trials be made available for scrutiny?</p>	<p>The Applicant considers that the point about the modelling undertaken and the details associated has already been answered in response AQ 1.2 of Table 2.1 ('Air Quality and Emissions) of the Applicant's Responses to Examining Authority's First Written Questions (REP2-060).</p>

4. BIOFUELWATCH

Table 4.1 – Biofuelwatch

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
Biofuelwatch Deadline 3 comments on any other responses received by Deadline 2 (REP3-025)		
4.1 (S1, P1-3)	<p>BFW raised concerns about impacts raised in the HRA</p>	<p>Biofuelwatch have correctly quoted from and identified the impact pathways that the Applicant considered could lead to likely significant effects ('LSE') on European Sites. The ExA will be aware that LSE is tested against a 'high bar' and with no consideration of targeted mitigation measures, i.e. if there is an objective possibility of harm prior to detailed assessment, there is potential for LSE. Following identification of LSE by the Applicant, these have been subject to more detailed assessment by way of Section 4 of the HRA Report (REP2-101).</p> <p>As set out in Section 5 of the HRA Report, following detailed analysis by the Applicant and with additional updates following advice from and consultation with Natural England, no adverse effects on the integrity of any European Site are predicted to arise.</p>
4.2 (S3, P1)	<p><u>Comments other consents and licenses REP2-020</u></p> <p>We note that in document REP2-020 'other consents and licenses' Drax is applying for a Greenhouse Gas Permit. We request that the ExA asks Drax why it needs to apply for a Greenhouse Gas Permit, given this scheme is supposed to reduce Greenhouse Gas Emissions."</p>	<p>A Greenhouse Gas (GHG) Permit is required by an installation regardless of whether some or all of its units are fuelled on 100% biomass.</p>
Biofuelwatch Deadline 3 comments on Written Representations on responses to questions from the ExA to the Applicant (REP3-023)		
4.3 (P1 – P2)	<p>AQ 1.7 of REP2-060, Drax asserts: 'Local authorities undertake widespread monitoring of pollution concentrations in the study area and, where these are elevated above background pollution levels eg, Selby AQMA, they have been explicitly included in the Predicted Environmental Concentrations,' We would ask the ExA to request that Drax provides evidence of its assertion that 'Local authorities undertake widespread monitoring of pollution concentrations in the study area.'</p>	<p>The monitoring undertaken by local authorities is publicly available within their Air Quality Annual Status Reports that are published on an annual basis. For example: for Selby, the reports are published on Selby District Council's Local Air Quality Management website¹ for years from 2012 to 2022. Pollutant concentrations are monitored at 36 locations within the district. For East Riding of Yorkshire, the reports are published on East Riding of Yorkshire's Air quality monitoring website² for years from 2012 to 2022. Pollutant concentrations are monitored at over 90 locations within the district.</p>
4.4 (P3 – P4)	<p>AQ 1.8 of REP2-060 Sulphur emissions - we understand emissions of sulphur from wood are less than those from coal, and therefore do not require Flue Gas Desulphurisation to remain within EALs. However, the applicant's response to the ExA's question states that it intends to reduce sulphur emissions post carbon capture. This does not address the concerns we raise in our written submission REP2-073, page 32 regarding the additional challenges regarding CCS when applied to</p>	<p>Electrostatic Precipitators are already operating across all units at Drax and are designated as BAT. The precipitators will continue to function once BECCS is installed on both units 1 and 2.</p> <p>The quench column will remove a proportion of Sulphur Dioxide emissions prior to the flue gas entering the absorber, this is achieved with pH control in order to enhance Sulphur Dioxide removal. The flue gas will also pass through electrostatic precipitators prior to entering the absorber column.</p>

¹ <https://www.selby.gov.uk/local-air-quality-management>

² <https://www.eastriding.gov.uk/environment/pollution/air-pollution/air-quality-monitoring/>

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
	biomass retrofits and new build due to the impact of flue gas impurities, including sulphur, on the carbon capture process, and the associated uncertainties regarding the emissions of the plant especially with regard to nitrosamines."	

5. JUST TRANSITION WAKEFIELD

Table 5.1 - Just Transition Wakefield

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
1. Particulates		
5.1 (Section 1)	<p>Particulates – there is no provision in the design for Electrostatic Precipitation Scrubbing (EPS) to remove fly ash and other particulates, yet the BAT guidance clearly states that this is a potential issue. Section 3.3.1 of the BAT guidance says:</p> <p>Aerosols</p> <p>Sulphur trioxide (SO3) droplets and fine particulates* should not be present in the flue gas. If they arise in the PCC process they can cause significant amine emissions.</p> <p>The level of emissions (mainly solvent amines) are not directly related to aerosol measurements. Monitoring aerosols is difficult and aerosol quantities may also vary significantly over time.</p> <p>Aerosols might be present, for example, because of significant SOx in the flue gas. Where this is the case, you should carry out long-term testing on a pilot plant or the actual plant, with all planned countermeasures in place, to show satisfactory operation. You should also carry out regular isokinetic sampling in the operational plant to assess total vapour and droplet emission levels.</p> <p>Other flue gas impurities</p> <p>You may need to remove materials in the flue gas that would accumulate as impurities in the solvent (such as metals, chlorine and fly ash) to lower concentrations than is required under the LCP BREF.* This is to ensure satisfactory PCC plant operation. Whether you need to do this will depend on the specific solvent properties and the effectiveness of the solvent management equipment (such as filtering and reclaiming).</p> <p>You should assess the effects of flue gas impurities through realistic, long term pilot testing. In general, your PCC plant must abate these types of flue gas impurities before the residual flue gases are finally released to atmosphere.</p> <p>*My emphasis</p> <p>Because of the claimed commercial confidentiality surrounding the proprietary solvent, we cannot know if there is a risk of fly ash and other materials building up in the solvent, and seek an explanation of this aspect of the proposed operation. It is reasonable to assume that there will be fly ash present in the flue gas stream, and we question why there appears to be no EPS designed in.</p>	<p>Electrostatic Precipitators are currently used to control particulate matter. These are already operating across all units at Drax and are designated as BAT. The precipitators will continue to function once BECCS is installed on both units 1 and 2 and will continue to be a requirement of the Environmental Permit..</p>

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
	We know that the applicant received wood pellets from a number of sources, and that the supply includes both hard and soft woods – presumably with different chemical composition that can influence chemical contamination of the flue gases as well as the amount of fly ash.	
2. Amines		
5.2 (Section 2, Paragraph 1)	Transport – how will the initial bulk import of solvent to the solvent store and to charge the CCS system be achieved? Is there a risk assessment for this? How will the operational import of new solvent to replace losses be achieved? How frequently will this be required? Is there a risk assessment for this, particularly the initial bulk import?	Solvent will be delivered to the power station by road tanker and discharged into bulk storage in compliance with the relevant protocols to be developed based on the nature of the solvent. The Applicant currently imports substances under the Control of Substances Hazardous to Health (COSHH) Regulations. These Regulations will continue to be in force for the import of solvent into the site. Drax is an experienced operator having managed and dealt with bulk deliveries of various chemicals to site for over 40 years. Drax estimates one tanker required per week to replenish spent solvent.
5.3 (Section 2, Paragraph 2)	Emissions Monitoring – what plans are in place for emissions monitoring of the solvent and any degradation products? Is this part of the planning consent as well as the environmental permitting?	Emissions monitoring requirements will be dealt with as part of the Environmental Permit and with consideration of BAT.
3. Carbon Dioxide		
5.4 - 6 (Section 3, Paragraph 3)	<p>We have questions about the capture rate.</p> <p>During Issue Specific Hearing 1, and in their response to it, the Applicant made confident claims of an average capture rate of 95%. We seek clarity on this. In everyday language, “average” and “mean” are synonymous. We would like explicit confirmation that this “average 95% capture rate” does indeed require the mean capture rate to be 95%, not the median or mode, which are sometimes also referred to as averages. This is important for operational monitoring and public confidence.</p> <p>In our responses at Submission Deadline 2, we questioned the applicant's confidence in achieving the 95% capture rate and the lack of evidence for this. We ask the ExA to push the applicant to provide evidence for this confidence, bearing in mind that the academic literature on existing CCS plants, including point source/power station Post Combustion Capture (PCC) indicates that a 60-70% capture rate over time would be ambitious.</p> <p>In response to our questions on this, the applicant (in document 8.10.1 Applicant's Responses to Issues Raised at Deadline 1) repeated the assertion that the process is designed to capture 95% of the CO₂ in the flue gas stream, but provided no further</p>	See the Applicant's response to item 3.1 above.

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
	evidence to cover the gap between the design assumptions and historic operation of PCC in power stations. We have read and understood the BAT documentation, as quoted in this document, and still believe that there is a gap between design and operation. This gap will be pursued at the Environment Agency consultation because it is clear that where the reality gap is predictable, it must be considered.	
5.7 (Section 3, Paragraph 10)	<p>Operational considerations</p> <p>During ISH1, the applicant appeared to make contradictory statements, implying at one point that the two abated (retrofitted) units would be running continuously. At another point, the applicant suggested that the two abated units, like the two unabated units were likely to be deployed flexibly to meet demand due to the intermittency of supply to the grid from renewable generation (from wind and solar). This second model is clearly the expectation from section 3.6 of the BAT guidance.</p> <p><i>3.6 Capture level, including during flexible operation</i></p> <p><i>Capturing at least 95% of the CO2 in the flue gas is considered BAT. You can base this on average performance over an extended period (for example, a year). To achieve this, you should make sure the design capture level for flue gas passing through the absorber equates to at least 95% of the CO2 in the total flue gas from the power plant. If you process less than the full flue gas flow, your capture rate will have to be correspondingly higher. Over the averaging period, your capture level may vary up or down.</i></p> <p><i>As the fraction of intermittent renewable generation in the UK rises, CCS power plants will need to start and stop more often, and possibly also operate at variable loads. It is therefore important that CO2 can also be captured at high levels during these periods, including during start-up and shutdown, to maintain high average capture levels.</i></p> <p><i>A method to maintain capture at normal rates or higher at all times using solvent storage has been identified in the BAT review. This, or alternatives that can achieve equivalent results, is considered BAT. If your PCC plant is not initially constructed with this capability, your permit application should show how you may retrofit it.</i></p> <p><i>Therefore we would like clarification about whether the applicant is planning for one or both operational models, and whether they have confidence in meeting the 95% average capture rate in both scenarios.</i></p> <p>Section 3.6 of the BAT guidance is clear that capture rates need to average 95% during start-up and shutdown. The guidance says that the use of solvent storage has been identified in the BAT review as a method of improving capture rates, and that if the PCC plant is NOT designed with this facility, it must be possible to retrofit it. It is not clear to the lay person whether the current application includes this, either in the current DCO</p>	<p>The applicant draws the IP's attention to the Government's Power BECCS consultation document titled: 'Business model for power bioenergy with carbon capture and storage ('Power BECCS') A consultation seeking views on potential business models for power bioenergy carbon capture and storage' published October 2022, which includes the following text on the subject of dispatch profile:</p> <p><i>'We have considered the optimum dispatch profile for power BECCS and the impacts of running power BECCS as baseload or flexibly. Baseload running means to generate constantly, whereas flexibly implies a level of responsive generation. Given the critical importance and scale of the negative emissions meeting our economy-wide carbon removal ambitions, the policy objective for the power BECCS business model is to design a mechanism that will incentivise dispatch as often as possible to maximise negative emissions. Alongside this objective, consideration of the impact on the electricity system and how to carefully incentivise the best use of biomass is also required. Baseload generation would enable a greater potential rate of negative emissions. Dispatchable, flexible generation, likely lowers the costs to the power sector, but with a lower rate of negative emissions. However, we are also considering how the dispatch profile could impact investability. Considering the benefit of negative emissions for Carbon Budgets across the whole economy relative to the additional cost of generation, it could be more beneficial overall to incentivise a power BECCS plant to run as baseload.'</i></p> <p>This demonstrates that the Government is considering the position it wishes to take in funding the relevant scenario it wishes BECCS to take forward.</p> <p>The Applicant has confidence in meeting the required capture rate in either scenario and is working with the Environment Agency on how this will be defined through the permitting process.</p>

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	or as a potential further addition requiring planning permission. Clarity on this would be appreciated as well as whether the BAT suggested solvent storage process is designed in.	
4. BAT Review		
5.8 (Section 4, Paragraph 7)	<p>The Bat guidance directs readers to the BAT Review site [REDACTED] which references specific documents to further inform the BAT Guidance, including Gibbins, J., Lucquiaud, M. (2022) BAT Review for New-Build and Retrofit Post-Combustion Carbon Dioxide Capture Using Amine-Based Technologies for Power and CHP Plants Fuelled by Gas and Biomass and for Post-Combustion Capture Using Amine-Based and Hot Potassium Carbonate Technologies on EfW Plants as Emerging Technologies under the IED for the UK, Ver.2.0, December 2022. This document is available from [REDACTED]</p> <p>From p29-30 of this document:</p> <p>There are many amines, with an infinite scope for variety in the range of amine-containing blends initially fed into the plant. Further complexity is introduced as amine inventories degrade and accumulate possible additives and impurities as they approach long-term equilibrium compositions, with the additional modifying effects of reclaiming and other solvent maintenance during commercial service. Reclaiming and solvent management are often omitted from pilot tests undertaken for solvent development or comparison, but are obviously absolutely essential if pilot tests results are to represent those on an actual commercial plant, where some form of reclaiming and other solvent management techniques can be expected to be deployed.</p> <p><u>It cannot be too strongly emphasised that it is this long-term, equilibrium composition and solvent behaviour that will determine the solvent-related environmental performance of the plant, not the behaviour observed in tests starting with relatively fresh solvent and with little or no reclaiming or other solvent maintenance to remove impurities, as would be required in commercial operation.*</u> It is self-evident that the average long-term concentration of any given impurity in the solvent will be the value at which, for that specific impurity, average removal rate matches average formation rate (for degradation products) or average addition rate (for flue gas impurities or corrosion products). Thus, tests that do not include the use of the impurity removal procedures that will be used in full-scale applications can never match the solvent composition (and therefore behaviour) that will be observed in practical commercial applications.</p> <p>* Authors' emphasis</p>	<p>The need to maintain commercial confidentiality is an acknowledged part of the Environmental Permitting process. Chapter 6 (Air Quality) of the ES (APP-042) sets out that additional model sensitivity has been carried out based on published data in the public domain; and in line with methodology and work undertaken on this topic by the Environment Agency (EA).</p> <p>Drax are working closely with the EA to provide required information to gain the Environmental Permit and will be monitored against that permit, including in relation to amines. Drax will comply with those requirements as they develop as it has done since construction of the power station and as other successful applications have noted e.g. Keadby 3. This is ultimately a matter for the Environment Agency to consider in determining the permit.</p> <p>Please refer to previous Response Reference 16.1 of the Applicant's Relevant Representations Response Document (PDA-002) and previous answers (5.3 and 5.4) in relation to uncertainty around impacts of nitrosamines, and its response to Biofuelwatch in its Response to Deadline 2 submissions, updated and re-submitted at Deadline 4.</p>

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
	<p>On page 31, the authors quote a 2018 review of the Boundary Dam CCS plant after 4 years of operation which emphasises their point:</p> <p>'The capture facility at Boundary Dam has been operating since 2014, almost four years. During this time, there have been difficulties with the plant being able to supply the contracted CO2 to its off-taker. There were a significant number of design deficiencies and construction quality issues to manage. In addition, the Capture Plant continues to experience significant issues with the amine absorbent chemical that is fundamental to the process.</p> <p>These issues were, and continue to be, tackled in order of priority: 1) safety, 2) reliability, and 3) efficiency and cost-effective operation. As SaskPower implemented projects to correct the issues of which it was aware, the process was further complicated by the emergence of previously undetected issues that required further corrective action. At times, this involved long lead times to procure and install specialized equipment. This, coupled with amine-related issues, has contributed to lengthy outages and underperformance of the plant.</p> <p>The commercial confidentiality surrounding the applicant's proprietary solvent, and the associated lack of (publicly available) data from trials provides little confidence that the actual operation of the retrofitted PCC will over time meet the required 95% capture rate. The reasons to doubt the applicant's confidence are abundantly clear, so we must ask that the evidence for the applicant's confidence be clear and unambiguous and that their pilot project(s) anticipated the above reported issues.</p>	
5.9 (Section 4, Paragraphs 8-9)	<p>Solvent Safety</p> <p>In section 2.3.4 of the Gibbins and Lucquiaud review, the authors rate and rank potential solvents and solvent mixes in terms of safety, effectiveness and other variables. See for example Table 2.1 from page 28 (see Appendix A). We cannot assess the solvent in terms of its effectiveness, or its likelihood to degrade and interact with contaminants such as (so-called) NOx, because we are prevented from knowing the exact make-up of the proprietary solvent.</p> <p>Again, we have to ask that at the very least, the applicant explains this in detail in a closed session with the Examining Authority and later, with the Environment Agency. This commercial confidentiality cannot extend to the statutory bodies charged with consenting, permitting and licencing the BECCS operations.</p> <p>Appendix A</p> <p>Table 2.1 Classes of amines and relevant characteristics for PCC from BAT-for-PCC_v2_EfW-1.pdf, accessed at [REDACTED]</p>	<p>The Applicant has provided the Environment Agency with the information associated with the solvent composition as well as the air dispersion model and associated files. The applicant refers to the response given by the UK HSA, which is content with the Applicant's position.</p> <p>See also the Applicant's response to this point in 16.1 of the Applicants Response to Relevant Representations and Additional Submissions (AS-038).</p>

Response Ref. (Location in Original Submission)	Comment			Applicant's Response
	(summary for amines in aqueous solution, as typically used in PCC applications and pilot tests, based on amine related references cited in this review) Type of amine	Examples in use	Relevant characteristics for PCC	
	Primary	MEA	Widely used for other purposes, rapid kinetics, low CO2 capacity, moderate volatility and can form mists with aerosols, moderate to low stability and resistance to thermal degradation, pure material will not form stable nitrosamines, liquid at all relevant temperatures, easy to reclaim thermally. Proposed for use at increasing concentrations in water (now 35-40% w/w, was 30% w/w) to partially overcome lower CO2 loading capacity and hence higher regeneration energy requirements than secondary and tertiary amines/blends.	
	Secondary/ secondary blends	PZ Piperazine	Rapid kinetics, moderate CO2 capacity, lower volatility compared to MEA but can still form mist with aerosols, good thermal and oxidative stability, as secondary amine the pure material forms nitrosamines, can 'freeze' at lower temperatures so often used as an accelerator in blends with 'slower' amines, reported to be reclaimable thermally (Sexton, 2014) but limited practical evidence available at the time of writing.	
	PZ + AMP blends		AMP is a sterically-hindered amine with higher capacity and PZ an accelerator in this blend. Non-proprietary version known as CESAR1, with public domain information available (e.g.	

Response Ref. (Location in Original Submission)	Comment			Applicant's Response
			Brüder, 2011). More toxic, rapid kinetics, high CO2 capacity, low volatility but can still form mist with aerosols, good thermal and oxidative stability, readily forms nitrosamines, limited published evidence on reclaimability to date, precipitation reported for CESAR1 blend at low flue gas temperatures (30oC vs 40oC) (Languille, 2021).	
	Tertiary/tertiary blends Good capacity but slow kinetics so used in blends	PZ + MDEA blends	PZ is an accelerator for the slower, tertiary amine MDEA in this blend. Rapid kinetics, high CO2 capacity, lower volatility than MEA but can still form mist with aerosols, good thermal and oxidative stability, forms nitrosamines, liquid at all relevant temperatures, may not be easily reclaimable thermally due to the difference between the boiling points of MDEA of 246.1oC and that of PZ of 146oC.	

6. YORKSHIRE WATER

Table 6.1 – Yorkshire Water

Response Ref. (Location in Original Submission)	Comment	Applicant's Response
6.1 (Page 1)	Yorkshire Water raised concerns about the impact of the Proposed Scheme on their assets.	The Applicant notes the concerns raised by Yorkshire Water regarding the impact of the Proposed Scheme on a number of existing clean water assets. As noted in the Schedule of Negotiations and Powers Sought (REP3-005) the Applicant noted that this Party has interests in several plots both within the main Drax Power Station site and in the areas affected by works to existing overhead lines. The Applicant has been in correspondence with this Party since March 2022 regarding proposed protective provisions in the dDCO. The Relevant Representation response published in March 2023 at Deadline 3 provided the Applicant with detailed information on this party's concerns, and the Applicant provided its response below to Yorkshire Water at CAH1 held on 23 March 2023 (as set out in its Summary of Case at that Hearing also submitted at Deadline 4), and will continue to engage with this party to ensure that any outstanding concerns are discussed, and to identify whether bespoke protective provisions would be appropriate to ensure that this party's assets are protected during the implementation and operation of the Proposed Scheme as appropriate.