BOREAS EXAMINATION PROCESS

REPORT FROM PROFESSOR TONY BARNETT

ON BEHALF OF CORPUSTY AND SAXTHORPE PARISH COUNCIL[1]

AND

AS A RESIDENT OF CORPUSTY AND SAXTHORPE[2]

FROM THE POSITION OF PROFESSORIAL RESEARCH FELLOW, LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE; PROFESSORIAL RESEARCH FELLOW, THE ROYAL VETERINARY COLLEGE, LONDON; HONORARY PROFESSOR IN THE HUMANITARIAN AND CONFLICT RESPONSE INSTITUTE, VICTORIA UNIVERSITY OF MANCHESTER

CONTACT [redacted]

This document has three sections and an appendix.

SECTION 1: METHODOLOGICAL PREAMBLE TO THIS REPORT

SECTION 2: BOREAS' EVIDENCE ABOUT HUMAN HEALTH AND WELFARE

SECTION 3: POINT BY POINT DISCUSSION OF ENVIRONMENTAL STATEMENT, CHAPTER 27 AND ITS APPENDIX

[1] IP ID 20022891
[2] IP ID 20022879

SECTION 1

METHODOLOGICAL PREAMBLE TO THIS REPORT

PREAMBLE 1

I[3] do not object to use of wind powered energy generation. I wish to draw to the Examiners' attention several issues to do with the public health effects of the construction process for Boreas (and associated schemes) as it impacts upon people and communities living along the route of the B1149 and the B1145. I also wish to draw to the Examiners' attention some important technical issues associated with project costing methods deployed uncritically in the project documentation. These should be taken very seriously in any assessment of the viability and true social costs of the project.

I approach the Examiners in the spirit of exploring and ensuring proper consideration of public health risks and costs to wellbeing generated by this national infrastructure project as currently conceived.

I begin with some preliminary framing comments which indicate in broad outline why and how individuals and Parish Councils appear before the Examiners at a marked disadvantage, a disadvantage which might suggest that the process was biased against citizens and communities were it not that we have considerable confidence in the Examiners' ability to compensate for such disadvantage in the course of their deliberations.

It is vital that the Examiners perceive and treat this as a *regional problem* and resist the temptation of seeing this particular proposal on its own – it is one of many affecting the entire region.

The disadvantaging biases are as follows:

1. The proposed windfarm developments as they appear in the lives off individuals and localities involve huge institutions, national and regional politics and complex negotiations between actors such as the Crown Estate, Ofgem, the National Grid, and no doubt others of which we are either unaware or only vaguely aware.
2. In addition, they engage the budgets of major companies, subsidy systems provided by governments for corporations bidding to provide electricity, bidding processes by companies for access to the sea bed and offshore areas.
3. Such processes are remote from the day to lives of the people of this region and the specialist and technical documentation presented by intending developers can sometimes seem designed to baffle rather than inform.
4. In such circumstances, an East African (rather than East Anglian) proverb seems peculiarly apt. It is worth quoting here to remind the Examiners of our faith in them to take serious account of what follows in relation to the lives, livelihoods and wellbeing of the people of Norfolk, and in particular North Norfolk. It says as follows:

WHEN ELEPHANTS FIGHT, IT IS THE GRASS THAT SUFFERS

[3] Note the first-person singular pronoun is used throughout, however opinions expressed in this document are endorsed by Corpusty and Saxthorpe Parish Council.

Costs

All projects, national or local, have costs. I begin by outlining some technical economic issues concerning calculations and consideration of cost as a general background to the work of an enquiry such as this. These fall into three broad groups:

a. Costs which are clearly money costs: an example is the cost of land acquisition for a project on an open and fair market.
b. Costs which are not directly financial but may *be more or less satisfactorily* translated into money costs; an example might be a farmer's loss of the use of her or his land while the project uses it for a project-related purpose over a number of agricultural seasons.
c. *Costs which are not at all easily translatable to money terms*; this is particularly germane to the present examination and examples might include health effects, reduction in life expectancy, epigenetic effects, late developing illness associated with medium or long term exposure to particulate matter generated by project-related additional traffic. Such effects may be very long term in their consequences. These types of costs are all too easily ignored although they are often very serious given their long-term effects on human health and welfare. In addition, such medium to long term effects on morbidity and/or mortality including reduced length and/or quality of life, are all too easily dismissed by intending developers because (as with tobacco related morbidity or mortality) the causal chain is long and there are likely to be confounding factors.

   Because these costs are difficult to quantify. If they are considered they are often represented by inadequate or inappropriate proxy indicators, the choice and construction of which may involve biases in favour of the applicant. They may also be ignored entirely.

   Project costing processes often ignore the externalisation of project costs onto populations outside the project's immediate spatial area and outside its immediate time duration.

   It is for this reason that the Examiners are invited to bear in mind the following question: **How far – if at all - has costing of this national infrastructure project taken account of direct and indirect health, welfare and road safety costs to local communities and the individuals (revealingly only appearing as "receptors" in the project documentation) over the medium and long term?**

PREAMBLE 2

To turn to other health and welfare costs related to the project, Examiners are encouraged to explore the following specific issues:

(a) the medium- and long-term effects of **particulate emissions** (particularly but not exclusively of fine particulate matter [$PM_{2.5}$]) associated with additional traffic moving along or waiting in holding areas before moving along the B1145 and/or B1149 and other roads from vehicle waiting areas in Oulton and / or Cawston.

The costs to health are broader than $PM_{2.5}$ alone and the Examiners may want to take account *inter alia* of the report prepared for DEFRA by Ricardo Energy & Environment in 2018 and submitted in February 2019[4].

In addition, the Examiners will want to take account of the considerable evidence available from Public Health England (PHE) and other sources concerning the health and welfare impacts of particulate emissions and other traffic related pollutants.

As an example of this plethora of evidence, PHE states in relation to particulate matter and other traffic related pollutants that there is:

> "a strong case for investing in prevention and early intervention at local and national levels, as well as allowing the necessary resources for the cases that cannot be prevented. " [5]

Furthermore, PHE states as a general guide to engaging with these issues that:

> "Taking effective local action to reduce air pollution and improve public health requires an inclusive, multi-disciplinary approach across local authority functions involving spatial and transport planners, environmental and public health teams, local political and community leaders and the public. Coordination between local areas is also vital to align approaches and avoid displacement of pollution from one populated area to another."[6]

This document has been prepared in the spirit of this advice; the project documentation shows no evidence of having been prepared in that spirit.

[4] Air Quality damage cost update 2019, ED 59323 | Issue Number 2.0 | Date 27/02/2019, contact Sally Whiting Ricardo Energy & Environment, Gemini Building, Harwell, Didcot, OX11 0QR, United Kingdom
[5] https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution - accessed 25 March 2019;
[6] Ibid.

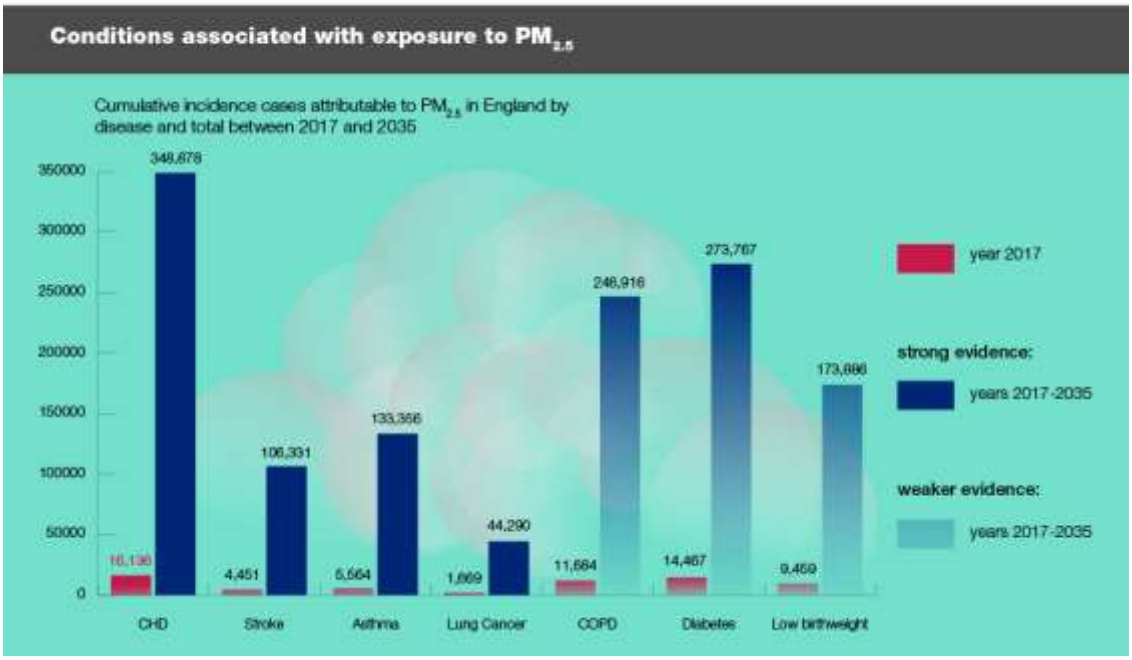
It was argued by a solicitor[7] appearing for Ørsted at the Open Floor Session for that application dated 25 March 2019, and stated verbally and on record that the Applicant considered that the "impacts would be negligible at best (*sic*)"[8].

Such a claim is contrary to the publicised opinion of PHE and indeed to a plethora of both long standing and recent expert opinion[9]. The medium and long term impacts of exposure to $PM_{2.5}$ considered alone is illustrated in the following projections published by PHE[10] in which it is stated that there is strong evidence that these emissions alone (not taking into consideration other noxious emissions which will be associated with increased traffic movements associated with the project) could be expected to increase rates of coronary heart disease (CHD), stroke, asthma and lung cancer, together with other evidence of Chronic Obstructive Pulmonary Disease, diabetes &c – all of which impose costs on individuals, families, communities, the economy and the public purse arising from additional demands on the resources of the NHS.

Other significant objective evidence of the effects arising from increased traffic associated with the project are cited below.[11]

Examiners are invited to note evidence of very long-term epigenetic[12] changes (changes in the human genome) associated with environmental pollution arising from vehicle emissions.[13]

[7] Ms Claire Brodrick from Pinsent Masons LLP
[8] Presumably she meant "at worst".
[9] https://www.nice.org.uk/guidance/ng70 - NICE is the The National Institute for Health and Care Excellence;
[10] https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution - accessed 25 March 2019;
[11] https://uk-air.defra.gov.uk/assets/documents/reports/cat11/1212141150_AQEG_Fine_Particulate_Matter_in_the_UK.pdf
https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/New-solutions-to-air-pollution-challenges-in-the-UK-LFSP-BP.pdf
https://www.imperial.ac.uk/news/184333/ways-imperial-researchers-tackling-pollution-crisis/
[12] For introductory information about epigenetics, see: Nessa Carey *The Epigenetic Revolution* Icon Books, London 2011.
[13] Professor Paul Vineis, Professor of Environmental Epidemiology at Imperial College, London suggests on a precautionary basis that: "We have found epigenetic marks of exposure to air pollution – that is, features not due to structural change in the sequence of the DNA, but due to gene regulation.."
https://www.imperial.ac.uk/news/184333/ways-imperial-researchers-tackling-pollution-crisis/



(b) the effects of this project on **ambulance response times** for people living in this area and in the catchment area more generally in North Norfolk; recent data suggests that this area has some of the poorest response times in England and Wales. The Examiners will know that response times can be measured in several ways, notably from receipt of call to arrival of ambulance crew on site and from receipt of call to arrival of patient at an appropriate hospital, in most cases this means the Norfolk and Norwich Hospital.

(c) Current *median*[14] time for arrival of crew at the patient in the NR11 and NR10 postcode areas is 18.37 minutes[15]. This is of course not the time from receipt of call until arrival of ambulance at the N&N Hospital. Neither is it the mean time.

(d) In a response dated 6 March 2019 to an enquiry about project related traffic Ms Emily Woolfenden of Orsted stated as follows:

> "In respect to both links 60 and 76 (the B1149 to B1354 junction; and the B1149 from Saxthorpe roundabout to Heydon Junction), the traffic flows for Hornsea Three are expected to peak at 232 two-way movements of light vehicles and 162 two-way movements of HGVs on a daily basis (please note that the two-way movements figures stated allows for both the outward and return journey and therefore reflects the total number of daily movements).

[14] Note this is neither the mean nor the modal time. it is merely the central value of the distribution. The median time is a bad representation of the way that delays affect people's lives, pain and deaths.
[15] http://www.ambulanceresponsetimes.co.uk/, accessed 25 March 2019.

These maximum vehicles flows are associated with particular construction activities occurring within the onshore cable corridor in this area (i.e. laying of the haul road). Traffic during other activities are anticipated to be lower than this maximum."

I make that a total of 788 additional single movements over an unspecified "peak" and allowing for an eight-hour working day that suggests 1.625 additional movements associated with this project per minute.

It is against this background that I pose my second question:

2. **What effects will additional project traffic movements along the B1149 and B1145 have on the 100 metre particulate emission plumes along both sides of the B1149 and B1145 during the project's life and over the following 30 years taking account of:**
    a. **the particular susceptibility of the ageing population characteristic of the area;**
    b. **the child population in the area;**
    c. **the concerning model outputs provided in the 2018 Ricardo Energy & Environment report cited above;**
    d. **the effects of this additional traffic on ambulance response times in North Norfolk during the construction period once again taking into consideration the ageing population in this area and its special needs in relation to emergency responses;**
    e. **what impact will additional traffic generated by the extensive housing developments planned over the next several years at Corpusty and Saxthorpe have on project related and other traffic movements[16] including that generated from the many additional homes recently constructed in Holt, some for people who commute to Norwich daily and whose movements have already increased the burden of traffic on a narrow country road?**

[16] Ørsted was approached for its comments on the Corpusty and Saxthorpe Neighbourhood Plan but did not respond to this invitation.

PREAMBLE 3

Modelling of project impacts usually involve specification of variables assumed by modellers to be "significant".

Choice of "significant" variables may exclude factors which are significant to local communities. This class of exclusion is likely to engage bias in favour of the applicant.

Furthermore. such bias is deeply disguised in the interstices of the model and often contained within model variables which are represented by proxy indicators. Finally, technical models can be constructed with both conscious and unconscious bias and/or to support an applicant's case, such bias being hidden by a mathematical language inaccessible to all but a few experts[17].

Later in this report, I shall indicated several places where such bias is likely to exist in disguised form, notably in relation to both the structure and content of arguments presented in Norfolk Boreas Offshore Wind Farm, Chapter 27, Human Health and in Norfolk Boreas Offshore Wind Farm, Appendix 27.1, Human Health Supporting Information.

It is against this background that I pose the third question:

3. **Will the Examiners obtain and consider complete lists of all models used in planning this project, lists of all variables considered in these models, lists of all proxy indicators the detailed formulae deployed, and will they critically appraise these models and comment on them in their adjudication? Will they share this information with the potentially affected communities so that they in turn may provide suggestions for variables which are of concern to them, but which are likely to have been omitted by modellers in planning this project?**

PREAMBLE 4:

In relation to consideration of health impacts of the proposed projects, in this case the Boreas project, Examiners should be aware that applicants for the Vattenfall and Ørsted schemes have already been found to have taken very tightly circumscribed responses from Public Health England stating that they do not have concerns about certain very detailed and specific technical issues such as Electro Magnetic Fields and *misrepresented* these as Public Health England's opinion about much wider public health concerns such as those raised in this document.

Examiners are referred to the Hornsea Project Three May 2018 document Environmental Statement: Annex 3.3 – Electro-Magnetic Fields (EMF) Compliance Statement PINS Document Reference: A6.4.3.3 sAPFP Regulation 5(2)(a) p. 5 which refers explicitly to EMF issues alone and to the letter from Dr Haymond Lam of Public Health England dated 13 September 2017, a copy of appears below:

[17] M.R. Banaji & A.G. Greenwald, *Blind Spot: Hidden biases of good people,* New Yok, Delacorte Press, 2013.

Public Health England

Mr Stuart Livesey
Project Development Manager
Hornsea Project Three Offshore Wind Farm
DONG Energy, 5 Howick Place,
London
SW1P 1WG

13 September 2017

Dear Stuart,

Nationally Significant Infrastructure Project
Hornsea Project Three Offshore Windfarm
Section 42 Consultation

Thank you for your consultation regarding the above development. Public Health England (PHE) welcomes the opportunity to comment on your proposals and Preliminary Environmental Information Report (PEIR) at this stage of the project.

PHE notes that we have replied to earlier consultations as listed below and this response should be read in conjunction with that earlier correspondence.

Request for Scoping Opinion responded on 25th November 2016

We have considered the submitted documentation and can confirm that we are satisfied with the approach taken in preparing the PEIR and the conclusions drawn.

We have assessed the submitted documentation and wish to make the following comments:

We note that whilst the submitted reports do not identify any significant risk to public health, traffic movements associated with the overall development and the onshore construction activities may generate some localised issues, particularly noise, which will need careful management during the development phase.

PHE has reviewed the Preliminary Environmental Information Report: Annex 3.3 - Electro-Magnetic Fields (EMF) Compliance Statement and consider the assessment it contains to be satisfactory. There are a couple of factual points in the text of the Annex that should be checked and revised, although that does not reflect on the sufficiency of the assessment. These are:

1) Para 1.2.2.14. Check the latest IARC lists of classifications. Coffee has moved from Class 2B to Class 3.

2) Para 1.3.1.2. Revise first sentence. HPA RPD recommended adopting the ICNIRP guidelines in its 2004 advice. The government responded to that advice by adopting the guidelines in the terms of the 1999 EU Recommendation.

We understand that the promoter will wish to avoid unnecessary duplication and that many issues including air quality, emissions to water, waste, contaminated land etc. will be covered elsewhere in the ES, but we believe that the summation of relevant issues into a specific section of the report provides a focus which ensures that public health is given adequate consideration and due weight in the planning process. The section should summarise key information, risk assessments, outline any proposed mitigation, and identify any residual impacts or uncertainties. Compliance with the requirements of National Policy Statements and relevant guidance and standards should also be highlighted.

Should you have any questions or concerns please do not hesitate to contact us.

Yours sincerely

[redacted]

Environmental Public Health Scientist
[redacted]

Please mark any correspondence for the attention of National Infrastructure Planning Administration.

The level of *misrepresentation* of PHE's position by Vattenfall and Ørsted is evident in a response from Public Health England dated 1 May 2019 regarding the correspondence from Dr Haymond Lam dated 13 September 2017. Ms Richards from the Health and Safety Executive's NSIP which states as follows:

'Dear Prof Barnett

Thank you for your letter, in light of the timescales for a response, it is useful to note that our section 42 scoping consultation response highlighted that it should be read in conjunction with previous correspondence such as our response to the scoping opinion on the 25th November 2016, where the need to consider issues such as air quality were highlighted.

Our section 42 response also highlighted "that whilst the submitted reports do not identify any significant risk to public health, traffic movements associated with the overall development and the onshore construction activities may generate some localised issues, particularly noise, which will need careful management during the development phase. In particular we note the need for a comprehensive Construction and Environmental Management Plan."

<u>Our understanding from the submitted documentation was that these aspects would be addressed through detailed consultation with the district and county councils.</u>

I hope this helps and happy to discuss this further.

Kind regards

Carol Richards

NSIP Admin Team'

There is no evidence that:

a. **either the PHE's scoping consultation opinion dated the 25th November 2016, or**
b. **the section 42 scoping response dated 13 September 2017;**

considers or comments in any serious manner upon the wide range of public health and welfare issues which I described in my original evidence submitted to the Examiners at the Open Floor Hearing at Dereham on Wednesday 24 April 2019. The Examiners will note that there I cite *inter alia* PHE's own research as partial support to my argument together with other sources.

In addition to the above, while Ms Richards from PHE states that 'these aspects would be addressed through detailed consultation with the district and county councils." I draw to the attention of the Examiners that "these issues" – those that I raised in my original evidence – have not been examined through any detailed consultation with the district and local councils.

Furthermore, I should add that what she describes (using the wording of Dr Lam's letter of 13 September 2017, as "some localised issues", are in fact extremely significant and long-term issues for the health and welfare of a substantial population in the communities around the B1145 and B1149.

I also note again that the people of these communities are described throughout the Vattenfall documentation as "receptors". I leave it to the Examiners to decide whether this linguistic oddity reveals anything about how the local people with their "localised issues" are seen by Vattenfall, Ørsted or – as in the present case - Boreas.

PREAMBLE 4

The Examiners might wish to note that in their approach to preparation of their submission, despite the numerous volumes they have submitted, the applicants seem to have entirely ignored the provisions of the UK Government's Green Book: Central Government Guidance on Appraisal and Evaluation (2018)[18] which provides a guide to considerably more sophisticated methods of appraisal and evaluation than those deployed in the applicant's documentation.

PREAMBLE 5

There is every good national planning reason for all of the current applications for windpower development in Norfolk to be considered together as a *regional* development issue. To consider them piecemeal is irrational in planning, economic and financial terms and in the medium and long

18 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

term are very likely to be seen to have generated costs considerably beyond any calculation of benefits accruing.

SECTION 2

BOREAS' EVIDENCE ABOUT HUMAN HEALTH AND WELFARE

I now turn to consideration of the extensive documentation provided on the USB device labelled nb dco appl. This contains 4.36 GB of data and is entitled "Norfolk Boreas: offshore windfarm". It consists of 61 files dated between 10 May 2019 and 4 June 2019.

1. **Death by data and implicit bias:** I have noted the weight of documentation because I think it underlines the improbability of any local community without specialist knowledge and support and considerable resources of time being able to engage with this weight of documentation. The implications of this observation could be considered as indicative of the challenges and inequalities of the consultative process itself. It is even possible to speculate that it is in the interests of a powerful and well financed applicant to inflate the content of their evidence with so much data (rather than information, the distinction is important[19]) presented in many documents and appendices as to increase the challenge to local communities. In this case, there is considerable confirmation bias[20] implicitly contained within the data and the way it has been framed within the Boreas documentation. This technique is widely used and is often associated in comedy with the approach adopted by the fictional Sir Humphrey Appleby in the television series *Yes Minister* and *Yes Prime Minister*.

   Here the technique is not a matter for humour. Rather it engenders serious concern for how the welfare, health and other concerns of local communities should receive serious consideration in the context of a review of a proposed NSIP.

2. **The Legislative Framework of the Boreas Evidence:**

In the Boreas document Environmental Statement Chapter 27 Human Health, Section 27.2.1 deals with Legislation and Guidance. It very helpfully presents the legal framework as follows:

> **"27.2.1 Legislation**
> 10. The following legislative context has informed the assessment.
>
> 11. The Health and Safety at Work Act 1974 (HM Government of Great Britain, 1974) places duties on employers to ensure, so far as is reasonably practicable: the health, safety and welfare at work of all their employees; and that persons not in their employment are not exposed to risks to their health or safety as a result of the activities undertaken. In both cases, the requirement for risks to be reduced to As Low As Reasonably Practicable (ALARP) is fundamental and applies to all activities within the scope of the Health and Safety at Work Act 1974.
>
> 12. The Control of Major Accident Hazards Regulations 1999 relate to the management of threshold quantities of dangerous substances identified in the regulations (HM Government of Great Britain, 1999).
>
> 13. The Health Protection Regulations 2010 came into force to complete the modernised legal framework for health protection in England. Three sets of regulations complement

[19] Data are simply facts or figures — bits of information, but not information itself. When data are processed, interpreted, organized, structured or presented in a way which makes them meaningful or useful, they are called information. Information provides context for data.

[20] Confirmation bias is the tendency to frame and or interpret evidence as confirmation of an existing belief, theory or institutional position.

the updated Public Health (Control of Disease) Act 1984, which was substantially amended by the Health and Social Care Act 2008. These are:

- The Health Protection (Notification) Regulations 2010 (SI 2010/659);
- The Health Protection (Local Authority Powers) Regulations 2010 (SI 2010/657); and
- The Health Protection (Part 2A Orders) Regulations 2010 (SI 2010/658).

14. The Clean Air Act (1993) aims to reduce pollution from smoke, grit and dust and gives local authorities powers to designate smoke control areas (HM Government of Great Britain & Northern Ireland, 1993). The Air Quality Standards Regulations 2010 transpose into English law the requirements of Directives 2008/50/EC and 2004/107/EC on ambient air quality.

15. Part III of the Environmental Protection Act 1990 discusses control of emissions (including dust, noise and light) that may be prejudicial to health or a nuisance (HM Government of Great Britain & Northern Ireland, 1990).

16. The International Convention for the Prevention of Pollution from Ships (MARPOL) includes regulations aimed at preventing and minimising, both accidental and operational, pollution from ships (International Maritime Organisation, 1973).

17. The revised Bathing Water Directive 2006/7/EC safeguards public health and clean bathing waters (European Parliament and Council of the European Union, 2006). Bathing waters are also protected under the Water Framework Directive 2000/60/EC (European Parliament and Council of the European Union, 2000)."

Furthermore, the next section, 27.2.2 **Guidance**, states that:

"18. Planning Practice Guidance on Environmental Impact Assessment (EIA) explains the requirements of the Town and Country Planning (EIA) Regulations 2017. The guidance does not provide any additional information in relation to defining, scoping or assessing 'population and human health'. Regard has therefore been given to the advice provided in the Institute of Environmental Management and Assessment, 2017: Health in Environmental Assessment, a primer for a proportionate approach (Cave et al., 2017a). Public Health England has also issued a briefing note on health in EIA for local public health teams (Cave et al., 2017b).

19. The approach to assessing health in EIA has also been informed by relevant UK guidance on Health Impact Assessment (HIA). In England there is no overarching guidance for HIA. However, generic principles are evident in specialist guidance such as that by the Department of Health in relation to HIA of government policy (Department of Health, 2010), or that by the London Healthy Urban Development Unit in relation to urban planning (NHS Healthy Urban Development Unit, 2015). In Wales there is good quality project level guidance on HIA by the Wales Health Impact Assessment Support Unit (WHIASU, 2012). Similarly in Northern Ireland overarching project level HIA guidance is provided by the Institute of Public Health in Ireland (Metcalfe et al, 2009). HIA guidance from Scotland includes discussion of issues relevant to rural contexts (Higgins et al., 2015). The HIA guidance is used as useful contextual guidance in the production of this ES chapter which is intended to provide reasoned conclusions for the

identification and assessment of any likely significant effects of the project on human health in compliance with the EIA Regulations 2017.

20. Guidance published by the World Bank Group (World Bank Group, 2015) advises that community health and safety hazards specific to wind energy include blade or ice throw, aviation impacts, marine navigation, electromagnetic fields, public access, and abnormal load transportation. Due to the project being located 72km from the coast (see Chapter 5 Project Description), blade or ice throw and aviation issues are unlikely to be a concern for local populations to the onshore cable route. Marine navigation is considered in Chapter 15 Shipping and Navigation.

21. Public Health England (PHE) released guidance in 2013 regarding the health effects of exposure to electric and magnetic fields; this guidance has been used to consider the effects of electromagnetic fields (EMF) in section 27.6 (PHE, 2013).

22. In March 2004, the National Radiological Protection Board (NRPB) (now part of PHE), published advice on limiting public exposure to electromagnetic fields. The advice was based on an extensive review of the science and a public consultation on its website and recommended the adoption in the UK of the EMF exposure guidelines published by the International Commission on Non-ionizing Radiation Protection (ICNIRP). The ICNIRP guidelines are based on the avoidance of known adverse effects of exposure to EMF at frequencies up to 300 GHz (gigahertz), which includes static magnetic fields and 50 Hz electric and magnetic fields associated with electricity transmission (McKinlay et al., 2004).

23. This human health chapter has had regard to the precautionary findings of the UK Stakeholder Advisory Group on Extremely Low Frequency Electric and Magnetic Fields (SAGE). SAGE was initiated by National Grid and was adopted by the Department of Health in order to provide advice to the Government (Stakeholder Advisory Group on Extremely Low Frequency (ELF) EMFs, 2010)."

3. Extensive reproduction of the above text is necessary because the Examiners should note:

    a. That the legislative framework for this health impact assessment is very dated and does not take any account of either the methodological concerns outlined in Section 1 of the present document, nor does it take account of health and *welfare* aspects as outlined in Section 1.

    b. In particular, while both the framework and the guidance make mention of, *inter alia,* Health and Safety at Work (1974), Control of Major Accident Hazards 1999, Clean Air 1999, Environmental Protection Act 1990, International Convention for the Prevention of Pollution from Ships, 1973, the revised Bathing Water Directive 2006/7/EC safeguards public health and clean bathing waters (European Parliament and Council of the European Union, 2006), and much more, it it also notes that:

        > "In England there is no overarching guidance for HIA (Health Impact Assessment)." But that " generic principles are evident in specialist guidance such as that by the Department of Health in relation to HIA of government policy (Department of Health, 2010), or that by the London Healthy Urban Development Unit in relation to urban planning (NHS Healthy Urban

Development Unit, 2015)." In other words, there is no agreed method for assessing the impact of a project as that proposed on human health and welfare, only a complex bricolage of legal usage and custom much of which is rooted in very dated legislation.

c. In short, the method used for assessment of health and welfare impact of the Boreas proposal is not fit for purposes of protecting the health and welfare of rural communities in Norfolk; it is – however – it may be elegantly used to protect the interests of Boreas, Vattenfall and Ørsted[21].

d. Most concerning from the perspective of the local communities potentially adversely impacted by the proposed developments is that while the Guidance section(cited para 20 above) refers to "Guidance published by the World Bank Group (World Bank Group, 2015)", a section which deals with "community health and safety hazards specific to wind energy include blade or ice throw, aviation impacts, marine navigation, electromagnetic fields, public access, and abnormal load transportation", Boreas (and for that matter Vattenfall and Ørsted) singularly fails to take account either in its method or in its analysis of the tradition of health and welfare economics which has influenced the impact assessment methods of the World Bank for the last forty years, that associated with the work of Professor Amartya Sen who has been professor of economics, *inter alia,* at both Harvard and Cambridge[22]. He is also a winner of the Nobel Prize for economics.

4. In other words, the methods which have been used by the applicant, Boreas, are biased, inappropriate and should not be taken as in any way sufficient for understanding or assessing the impact of the proposed scheme. In the next section, Section 3, detailed discussion of the inadequacies of the Boreas documentation is provided on a point by point basis.

[21] At a most simple level, the Examiners should note that the report does not make any calculations of impact in relation to DALYS (disability adjusted life years – see Appendix 1), although this method is only one among many that the inadequate health impact assessment has failed to deploy.

[22] Among his many publications over the last fifty years, most of which are relevant to the *methodological* points at issue in the current matter, the following are of note: Sen, Amartya (1983). Choice, Welfare, and Measurement. Oxford: Basil Blackwell; Sen, Amartya; Suzumura, Kōtarō; Arrow, Kenneth J. (2002). Handbook of social choice and welfare. Amsterdam Boston: Elsevier; Sen, Amartya; Stiglitz, Joseph E.; Fitoussi, Jean-Paul (2010). Mismeasuring our lives: why GDP doesn't add up: the report. New York: New Press Distributed by Perseus Distribution. The examiners will note that two Nobel prize winners appear among these authors.

SECTION 3:

POINT BY POINT DISCUSSION OF ENVIRONMENTAL STATEMENT, CHAPTER 27 AND ITS APPENDIX 27.1

1. **Particulate matter**

Appendix 27.1 mentions "particulate matter" five times (two of which are in footnotes) and the health problems of $PM_{2.5.}$ receive scant consideration overall. In Appendix 27.1, at section 2.2 Air Quality, the general problem of $PM_{2.5.}$ is mentioned *en passant* but its effects on actual "receptors" is nowhere discussed as a long-term problem or takes account of the following literature[23]:

1. Atkinson RW, Anderson HR, Sunyer J, et al. Acute effects of particulate air pollution on respiratory admissions: results from APHEA 2 project. Air Pollution and Health: a European Approach. Am J Respir Crit Care Med. 2001;164(10 Pt 1):1860–1866. [PubMed] [Google Scholar]
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3. Le Tertre A, Medina S, Samoli E, et al. Short-term effects of particulate air pollution on cardiovascular diseases in eight European cities. J Epidemiol Community Health. 2002;56:773–779. [PMC free article] [PubMed] [Google Scholar]
4. Salvi S, Blomberg A, Rudell B, et al. Acute inflammatory responses in the airways and peripheral blood after short-term exposure to diesel exhaust in healthy human volunteers. Am J Respir Crit Care Med. 1999;159:702–709. [PubMed] [Google Scholar]
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7. Lin S, Munsie JP, Hwang SA, Fitzgerald E, Cayo MR. Childhood asthma hospitalization and residential exposure to state route traffic. Environ Res. 2002;88:73–81. [PubMed] [Google Scholar]
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13. Baccarelli A. Breathe deeply into your genes!: genetic variants and air pollution effects. Am J Respir Crit Care Med. 2009;179:431–432. [PubMed] [Google Scholar]
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15. Dominici F, Peng RD, Bell ML, et al. Fine particulate air pollution and hospital admission for cardiovascular and respiratory diseases. JAMA. 2006;295:1127–1134. [PMC free article] [PubMed] [Google Scholar]
16. Sunyer J, Basagaña X. Particles, and not gases, are associated with the risk of death in patients with chronic obstructive pulmonary disease. Int J Epidemiol. 2001;30:1138–1140. [PubMed] [Google Scholar]
17. Schwartz J. Air pollution and hospital admissions for respiratory disease. Epidemiology. 1996;7:20–28. [PubMed] [Google Scholar]
18. Dockery D, Pope C, Xu X, et al. An association between air pollution and mortality in six US cities. N Engl J Med. 1993;329:1753–1759. [PubMed] [Google Scholar]
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[23] This is a very partial bibliography.

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2. **In the light of this omission, it is odd to read in the introduction to appendix 27.1, at 1.1 that:**

   "An evidence base of publicly available information has been used to support the scoping and assessment conclusions of Chapter 27 Human Health. Evidence statements have been extracted from a review of abstracts and full articles published in English on PubMed1 from the past five years. The review is not exhaustive and aims to provide a summary only of the key issues relevant to the scope of Chapter 27 Human Health."

   In view of the above, this claim is unsustainable and evidence of the flimsy and biased approach which the Boreas report has taken to questions of human health and welfare. The scoping and assessment is improperly described as "evidence based"; it omits vital sources.

3. **Chapter 27, Human Health**: this report does not seem to engage seriously with the question of $PM_{2.5}$ and long-term health and welfare effects in general. its method for assessing levels of vulnerability should be questioned as it is strange that they demonstrate very negligible impacts - but in effect does this by looking at effects on very large population fractions and therefore commits an ecological fallacy by attributing to the smaller constituent populations (those around the B1145 and B1149) the characteristics of the larger population. This elementary error of statistical interpretation is a formal fallacy in the interpretation of statistical data that occurs when inferences about the nature of individuals are deduced from inferences about the group to which those individuals belong[24]. An example of this error is use of the following table:

[24] Pearce, N. The ecological fallacy strikes back. Journal of Epidemiology & Community Health 2000; 54:326-327.

Table 3.3 PHE Wider Determinants of Health

		North Norfolk District		Broadland District		Breckland		Norfolk County		England
Indicator	Period	Count	Value	Count	Value	Count	Value	Count	Value	Value
Rate of complaints about noise[2]	2014/15	412	4.0	443	3.5	71	0.5	4,865	5.5	7.1
Number of premises licensed to sell alcohol per square kilometre	2015/16	494	0.5	291	0.5	408	0.3	-	-	1.3
Density of fast food outlets	2014	95	92.4	47	37.3	69	51.5	676	77.0	88.2
Killed and seriously injured (KSI) casualties on the roads[3]	2014 - 16	124	40.0	167	44.0	195	48.0	1,170	44.1	39.7
Air pollution: fine particulate matter[4]	2015	-	8.2	-	8.7	-	8.4	-	8.9	8.3
Access to Healthy Assets & Hazards Index[5]	2016	30,298	29.3%	18,599	14.7%	35,227	26.0%	281,123	31.8%	21.2%
Overcrowded households	2011	883	1.9%	668	1.3%	1,452	2.7%	8,917	2.4%	4.8%
Affordability of home ownership	2016	220,000	9.4	220,000	8.1	195,000	8.1	195,000	7.4	7.7
Fuel poverty	2015	5,357	11.3%	3,619	6.6%	5,367	9.5%	36,389	9.5%	11.0%
Injuries due to falls in people aged 65 and over	2016/17	556	1,594	518	1,556	633	1,880	3,852	1,769	2114
Excess winter deaths index[6]	Aug 2015 - Jul 2016	75	16.8	41	8.4	103	21.1	417	13.4	15.1

[2] Number of complaints per year per local authority about noise per thousand population (according to statistics collected by the Chartered Institute of Environmental Health).
[3] Rate of people KSI on the roads, all ages, per 100,000 resident population.
[4] Annual concentration of human-made fine particulate matter at an area level, adjusted to account for population exposure. Fine particulate matter is also known as $PM_{2.5}$ and has a metric of micrograms per cubic metre ($\mu g/m^3$).
[5] Percentage of the population who live in LSOAs which score in the poorest performing 20% on the Access to Healthy Assets & Hazards (AHAH) index. The AHAH index is comprised of three domains: access to retail services, access to health services, and physical environment. The AHAH index provides information on how conducive to good health an area is relative to other areas.
[6] Excess Winter Deaths Index is the excess winter deaths measured as the ratio of extra deaths from all causes that occur in the winter months compared with the expected number of deaths, based on the average of the number of non-winter deaths.

4. **Running tracks**: Given the health and welfare impacts of working on public roads, it would be sensible to have an alternate scheme which extends the running track provision by considerably more than the currently envisaged 20%. If the bottom line is the main consideration, we once again encounter the failure to balance long term health and welfare costs against short term financial costs and therefore evaluation of the true cost of this scheme.

5. **Lack of surveys to estimate health and welfare impacts**

   The way the problem of estimating human health and welfare effects of the proposed project is presented throughout Chapter 27 and its appendices ignores the fact that saving money costs imposes the costs of human welfare and health on a local population without even

bothering to do a survey of health effects. See Appendix 9.21 Norfolk Boreas Health Outgoing Documents:

> "1.2.4 Survey Programme" where it is stated that:
>
> "Currently there is no intention to carry out any specific surveys in respect of the consideration of health impact. Other surveys have been carried out in other sections, for example noise, that may be referred to in this chapter."
>
> And this omission is repeated in another form at document 9.07 where they state:
>
> "There is no intention to carry out specific primary surveys in relation to the health baseline, except where these are being carried out with respect to other chapters being examined, notably Noise, Air Quality, Land Quality, Water Quality, and Waste."
>
> To underline the point, Chapter 27 and its Appendix 27.1 are based on clear decisions **not** to explore the question of human health and welfare impact of the proposed project in any detail.

6. Construction related traffic and its effects

The following tables take no account of ambulance movements along these stretches of road and also indicate extensive interference with other traffic movement along road, and takes no account of seasonality in an area where in August-December there is considerable large scale harvest associated slow heavy vehicle movement at this and other times of the year.

Royal HaskoningDHV

VATTENFALL

Table 4.1 Proposed mobile traffic management routes

			Scenario 1				Scenario 2			
Link ID	Route	AADT Base Flows	Stage 1 HGV movements (two-way)		Stage 2 HGV movements (two-way)		Stage 2 HGV movements (two-way)		Stage 3 HGV movemen (two-way)	
			Max. Daily	Hourly peak*	Max. Daily	Hourly peak*	Max. Daily	Hourly peak*	Max. Daily	Hourly peak*
42	B1145: Reepham Road	2,265	n/a	n/a	40	4	72**	8	40	4
67	Happisburgh Road	1,000	n/a	n/a	33	~4	80	8	33	~4
68	Heydon Lane	1,000	n/a	n/a	37	~4	80	8	37	~4
69	Little London Road	500	n/a	n/a	30	~4	48**	5	30	~4
70	Plantation Road (230m south of North Walsham Road junction)	1,000	n/a	n/a	31	~4	72**	8	31	~4
71	Vicarage Road / Whimpwell Street	2,000	34	~4	31	~4	30	~4	31	~4
72	Dereham Road / Longham Road - Dillington	1,000	n/a	n/a	34	~4	136	14	34	~4
73	Hoe Road South	500	n/a	n/a	29	~3	96	10	29	~3
74	Mill Street, Elsing Road – Swanton Morley	500	n/a	n/a	30	~4	72	7	30	~4
75	B1354 - Blickling	2,000	n/a	n/a	37	~4	72	7	37	~4
76	High Noon Road / Church Road	500	n/a	n/a	31	~4	72	7	31	~4
77	Hall Lane – North Walsham	500	n/a	n/a	30	~4	72**	7	30	~4
78	Bylaugh	500	n/a	n/a	30	~4	72	7	30	~4
79	B1145 / Suffield Road***	2,000	n/a	n/a	31	~4	72	7	31	~4
A to V	Local Access routes	Varies	n/a	n/a	29 - 37	~4	n/a	n/a	29 - 37	~4
Notes:										
*	Daily HGV flows divided by 10									
**	Proposed mitigation flows identified in the ES									
***	Localised widening may be required at the junction between the A140/B1145 to accommodate the largest HGVs.									

It is also noteworthy that proposed use of mobile signalling system takes no account of fluid dynamic effects[25] of transmitted delay and therefore does not model delay in relation to real time delays arising which are likely to be the result of "abnormal" traffic associated with the long running construction phase of this project.

This observation also applies to the following sections of the Traffic Management Plan 4.1 General Principles - Managing HGV Demand:

> "106. To reduce the requirement for hard engineering, mobile traffic management is proposed to control low HGV demand on lightly trafficked narrow roads. The use of mobile traffic management would avoid the need for temporary road closures or road widening which could introduce delays and, in many areas, would require a full road closure to implement.
> 107. It is envisaged that mobile traffic management would comprise of a suitably marked pilot vehicle (with flashing ambers) with two-way radio communication with the HGV driver. The pilot vehicle would exit the access and travel to a designated layby/passing place. The pilot vehicle would then temporarily stop oncoming traffic and radio to the HGV driver to exit the site and traverse to the designated passing place. Appendix 4 visually depicts this traffic measure.
> 108. The desirable distance a HGV would be allowed to travel under pilot vehicle control would be 1km, this is based on a HGV travelling at 20km per hour for a period of three minutes (deemed an acceptable duration for other road users to be held up). To keep the pilot vehicle control distance to a minimum it may be necessary to construct temporary passing bays in the highway verge to 'hold' HGVs prior to being called."

At no point in the Traffic Management Plan does the issue of current thinking on fluid dynamics of traffic appear to have been taken into consideration.

7. Health care providers

In the Environmental Statement Appendix 27.1 the applicants state that:

> "When patients cannot get to their health care provider, they miss the opportunity for evaluation and treatment of chronic disease states, changes to treatment regimens, escalation or de-escalation of care and, as a result, delay interventions that may reduce or prevent complications (Syed et al., 2013).
> 27. Lack of access to transport can mean the difference between care delivered in a timely manner that has a greater chance of improved health outcomes and an inefficient utilisation of health care services. This may be late, or non-, presentation at primary health care and a higher level of treatment in accident and emergency departments (Syed et al., 2013).
> 28. Shortages of sufficient health care in rural areas relate to staff shortages, uneven distribution of resources, quality deficiencies, access limitations and the inefficient utilisation of health care services. The reasons for such shortages include physical/infrastructural, professional, educational, social-cultural, economic and political issues (Weinhold and Gurtner, 2014)."

[25] See for example: Day to Day Dynamic Traffic Assignment with Imperfect Information, Bounded Rationality and Information Sharing, Yang Yu Ke Han, Centre for Transport Studies, Department of Civil and Environmental Engineering, Imperial College London, United Kingdom, 2018.

None of the above appears to recognise the implication of these data for the effects that project related traffic will have on this aspect of human health and welfare in the areas around the B1149 and B1145 and in the wider area of North Norfolk served by the Norfolk and Norwich Hospital in Norwich. It certainly does not take into account the absence of the fluid dynamic processes associated with traffic referred to above.

8. **Poor quality data:**

Throughout Chapter 27 and Appendix 27.1, the Boreas documentation in relation to human health and welfare impacts fails to utilise the most up to date and useful data. In particular (ths is but one example) it fails to triangulate its superficial assertions and analysis in relation to other sources.

In particular it does not utilise CDRC (Consumer Centre Research Data) data for the most up to date information despite citing that source in its own documentation at Appendix 27.1.

The Examiners will doubtless wish to consult the CDRC database to learn just how much detailed data has not been used by the applicants in their assessment activities. The database as it applies to Norfolk may be consulted at:

https://maps.cdrc.ac.uk/#/indicators/ahah2_airquality/default/BTFTFPT/12/1.1772/52.7682/

Appendix 1: GLOSSARY OF TECHNICAL TERMS

Metrics: Disability-Adjusted Life Year (DALY)

Quantifying the Burden of Disease from mortality and morbidity

Definition

One DALY can be thought of as one lost year of "healthy" life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability.

DALYs for a disease or health condition are calculated as the sum of the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for people living with the health condition or its consequences:

Calculation

DALY = YLL + YLD

The YLL basically correspond to the number of deaths multiplied by the standard life expectancy at the age at which death occurs. The basic formula for YLL (without yet including other social preferences discussed below), is the following for a given cause, age and sex:

YLL = N x L

where:

N = number of deaths

L = standard life expectancy at age of death in years

Because YLL measure the incident stream of lost years of life due to deaths, an incidence perspective has also been taken for the calculation of YLD in the original Global Burden of Disease Study for year 1990 and in subsequent WHO updates for years 2000 to 2004.

To estimate YLD for a particular cause in a particular time period, the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead). The basic formula for YLD is the following (again, without applying social preferences):

YLD = I x DW x L

where:

I = number of incident cases

DW = disability weight

L = average duration of the case until remission or death (years)

Prevalence YLD

The recent GBD 2010 study published by IHME in December 2012 used an updated life expectancy standard for the calculation of YLL and based the YLD calculation on prevalence rather than incidence:

YLD = P x DW

where:

P = number of prevalent cases

DW = disability weight

Social value weights (age-weighting and discounting)

The original Global Burden of Disease Study and WHO updates for years 2000-2004 also applied several social value weights in the calculation of DALYs for diseases and injuries. Apart from the disability weights, these also included time discounting and age weights.

Appendix 2: MAP SHOWING THE EXTENT OF THE TRANSPORT LINKS AND COMMUNITIES IN NORFOLK WHICH WILL BE IMPACTED OVER A LONG PERIOD AS THIS AND OTHER PROJECTS ARE BROUGHT ON STREAM