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Attn: Drew Ratter

Chair, Investment Committee
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Dear

Viking Energy Shetland LLP
Report by NHS Shetland on the Health Impacts of Wind Farms

Thank you for your letter of 30th July 2013 regarding the report done by Dr Sarah Taylor on the health impacts of wind farms.

We, and our project partners SSE, have had time to review the report and I am pleased to offer some observations.

Dr Taylor is very clear that her report is "not a Health Impact Assessment of the Shetland Wind Farm proposal." This response does not attempt to critique either the work done or the report and our intention here instead has been to consider the issues arising in direct relation to the proposed Viking Wind Farm. As your letter requested we have also commented on how Viking Energy might mitigate the types of issue raised.

Summary:

The report by Dr Taylor identifies five aspects of wind farm development that have relevance to public health.

1. Construction and operational Safety
2. Shadow flicker
3. Electromagnetic radiation
4. Noise including low frequency sound
5. Socio-economic benefits

These aspects have already been considered by Viking Energy in respect of the proposed Viking Wind Farm as part of the formal consenting process.

Indeed each of these aspects has been thoroughly considered in the design of the project and has been addressed as appropriate in Environmental Impact Assessments, with any potential negative impacts mitigated as far as possible. The design and mitigations have been scrutinised during public and stakeholder consultation (informal and formal), and will be controlled by legally binding consent conditions where applicable, should the project proceed.

As a project and as an organisation we are satisfied that the risk of negative health effects arising from the Viking Wind Farm development has been minimised to acceptable levels in all cases.

Commentary:

1. *Construction and Operational Safety*

- 1.1. Dr Taylor's report discusses traditional construction safety issues, blade failure and icing.
- 1.2. As is normal for major projects, final construction safety measures will be confirmed prior to undertaking any actual works. The project is subject to the *Health and Safety at Work etc. Act 1974* and the *Construction (Design and Management) Regulations (CDM) 2007*. These CDM regulations aim to ensure that safety is taken into account and then co-ordinated and managed effectively throughout all stages of a project from conception, design and planning through to the construction works and subsequent maintenance. In accordance with the CDM process, the Viking Wind Farm design takes full account of relevant health and safety requirements and engineering standards.
- 1.3. During the operational phase, the operation and maintenance of the site would be managed in accordance with general legislation and Viking Energy's Safety Rules. These are developed with the input of SSE's own established safety rules, which have been successfully used for many years at SSE's existing operational wind farms.
- 1.4. The public health risks associated with catastrophic blade or turbine failure are minimal and reasonably considered to be confined to the immediate proximity of the turbines. e.g. within a few hundred metres. The nearest residence to the wind farm is more than 1,000m away. As the report notes, lightning strikes are quoted as being the commonest source of breakage. The risks from blade or turbine failure should be considered in the context of the relative risk associated with any public presence in Shetland's hills during lightning storms and extreme weather events.
- 1.5. There are several parts to the consideration of icing risk from wind turbines.
 - 1.5.1. Similar to the risk from blade or turbine failure, the risk from ice throw is limited, proximate and relative to the general risks of being in Shetland's hills during snow, frost and extreme weather conditions. It is a useful context that the references within Dr Taylor's report include a summary that a 100m² property at 300m from a turbine has an ice-throw expectation of 1 strike in 62,500 years. The nearest residence to the wind farm is more than 1,000m away. Shetland's temperate maritime climate means frosts are rarely severe or prolonged in comparison with other regions reducing the risk in this circumstance further.

- 1.5.2. The studies referenced in the report discuss smaller turbines with considerably higher rotational speeds than those proposed for the Viking Wind Farm. The Canadian turbines repeatedly mentioned have a rotational speed of 27rpm comparable to an expected 5-13rpm for the proposed Viking Wind Farm turbines. This difference reduces the risk of ice throw significantly.
- 1.5.3. The risk of ice shed from stationary turbines is correctly considered within Dr Taylor's report to be focused on turbine operational staff. Standard Operating Procedures are designed to minimise the already small risk to staff. For example, the workforce is instructed to approach wind turbines perpendicular to the blades. Furthermore, under standard risk assessment procedures, general maintenance would not be undertaken if there was any risk to staff from icing on blades.
- 1.5.4. There are several mitigations for icing which the report does not consider that are applicable to the proposed Viking Wind Farm. The vibration monitors prevalent on modern large wind turbines ensure any ice build-up or consequential aerodynamic imbalance would be detected and managed. If it was considered that Shetland held a particular ice risk then most turbine manufacturers (and certainly any likely to be considered by Viking Energy) offer anti-icing options for their turbines. These options usually incorporate specific ice detection sensors and some form of blade heating triggered by external air temperature.
- 1.6. In conclusion, the construction and operational risks to public health have been considered, are minimal and will be managed.

2. *Flicker*

- 2.1. Dr Taylor's report has a conclusion that: "Shadows caused by wind turbine blade rotation can cause flickering that contributes to the annoyance perceived by some people. Shadow flicker can cause epileptic fits in some people with epilepsy, though this is unlikely at the normal rotational speed of wind turbines. Operational guidelines ideally include mitigations to reduce the risk of photosensitive epilepsy and annoyance from flicker."
- 2.2. The Viking Energy Environmental Statement includes a shadow flicker assessment that concludes: "Shadow Flicker effects have been modelled and are not considered to be significant". No challenge was made to this assessment during the formal consent process or consultations.
- 2.3. Larger commercial wind turbines such as those considered by Viking Energy have rotation speed limits even further under the possible epilepsy hertz range than those discussed in the report references.
- 2.4. In the unexpected event that shadow flicker is unreasonably evident at any household then it is possible to utilise standard or optional control systems to switch off particular turbines during potential impact periods. This has been specified within the Viking Energy Environmental Statement since 2009 and remains a commitment.

3. *Electromagnetic radiation*

- 3.1. Dr Taylor's report finds that "The range of reviews in the mainstream scientific literature conclude that there is no evidence of any link between health effects and the EMR generated around wind turbines, and that the theories that various effects can be attributed to EMR are conjecture and unproven."
- 3.2. This accords with Viking Energy's own position and that of the wider renewable energy industry; no public health issues relating to electromagnetic radiation are likely to arise from the Viking Wind Farm. This expectation is reinforced by the separation distances from properties.

4. *Noise*

- 4.1. The well-documented concerns regarding noise and wind farms have led to agreed industry standards. These standards are enforced by Government through the Environmental Impact Assessment process and by the conditions attached to consents. The consent conditions provide the confidence that even where design and assessment anticipate no problems, any unexpected problems can be objectively remedied.
- 4.2. The generation of electricity from wind farms is similar to other industrial, commercial and recreational activities in that it can create noise. There are no scientifically unique elements to the noise arising from wind farms but there can be multiple and simultaneous types of noise arising across different levels, frequencies and variability. There is agreement that noise received at sufficient level, from any source, has the potential to cause annoyance, and as a result could lead to sleep disturbance or health effects.
- 4.3. Noise is one of the most important potential environmental effects of wind turbine development and so it is considered at the earliest concept design stages. Wind farm developers accept that the turbines do emit broadband and tonal sounds with aerodynamic variables but also that received sound levels (and consequently any potential effect) depend on several factors including the distance between the sound source and the place of measurement, known as the receptor. In relation to the Viking Wind Farm the design objective was not to avoid emissions of noise altogether, although modern turbines are consistently quieter than older turbines regardless of size. The design objective was to avoid emissions of noise that exceed agreed levels at source and at agreed receptors. It is not an issue of whether there is noise. It is an issue of limits and controls.
- 4.4. Dr Taylor's report discusses noise generally but also low frequency noise and infrasound as well as amplitude modulation effects. The report, Viking Energy, the wider renewable energy industry and the Institute of Acoustics all agree that there is no reliable evidence to say that low frequency sound (including infrasound) from wind farms has adverse effects on wind farm neighbours. Dr Taylor's report does caveat that "more recent theories of the potential perception of infrasound might lend support to reports of effects not previously measured or understood." In the absence of a means of measuring or even understanding a perceived effect, developers like Viking Energy can only proceed with objective assessments based on scientifically robust measurements.
- 4.5. Both the report and Viking Energy's Environmental Statement consider that natural sources of infrasound (such as from ocean waves) have equal or greater levels of

output than any levels of infrasound measured at wind farms. This has relevance for a project set in an island never more than 3 miles from the sea.

- 4.6. The report also considers Vibroacoustic Disease and Wind Turbine Syndrome. Again, there is agreement between the report, Viking Energy and others that there is no recognised scientific evidence presented to support either the risk of VAD arising from wind turbines or the Wind Turbine Syndrome hypothesis.
- 4.7. The Viking Energy Environmental Statement contains entire chapters dedicated to considering noise. Assessments model the warranted noise outputs of proposed turbines to thereafter calculate immission (inward) decibel values at the nearest identified residencies for both construction and operational noise and for both day and night circumstances. These are then compared to the results of surveys of existing background noise levels. Limits are set based on relevant standards (e.g. BS5228 for construction) and an assessment is made as to whether or not the targets will be met.
- 4.8. The Viking Energy Environmental Statement concluded that “no receptors would be exposed to noise levels above the modified ETSU-R-97 criteria across the range of assessed wind speeds during night-time or quiet day-time periods.” ETSU-R-97 is an agreed method of assessing and rating noise from wind farms. The methodology was updated in 2009. The Environmental Statement also concludes that design changes “removed the possibility of receptors being exposed to noise from the concurrent or consecutive use of multiple borrow pits.” and that “levels can be reduced to below the target noise level by ensuring the mitigating measures detailed within BS5228 are implemented” for construction activities. These assessments were scrutinised by the public and stakeholders during the consent process without contest. These assessments and conclusions were based on a proposal for 127 turbines. Consent was only actually granted for 103 turbines. While already considered not significant, the reduction reduces the concern for noise effects further.
- 4.9. To ensure the Viking Wind Farm does not exceed these assessments there are six legally-binding consent conditions addressing noise:
 - 4.9.1. Condition 42 is an obligation on Viking Energy to keep permanent ongoing records of environmental conditions such as wind speed and direction. These must be provided to the planning authority to assist with noise monitoring and the protection of residential amenity.
 - 4.9.2. Condition 43 sets the limits of overall sound level outputs for the Viking Wind Farm turbines and requires a warranty from the developer and turbine manufacturer that the turbines will not exceed those limits. It also imposes requirements for individual turbine controls including the ability to automatically cut out at specified wind speeds or directions if it is required to ensure compliance with the set limits.
 - 4.9.3. Condition 44 formally sets decibel limits for noise measured at any dwelling near to the Viking wind Farm at both day and night. This sets an objective basis for the evaluation of any complaints.
 - 4.9.4. Condition 45 is an obligation on Viking Energy to commission specified measurements of noise emissions and immissions to the satisfaction of the planning authority if requested. This places the burden of cost of complaint investigation onto Viking Energy yet maintaining control with the planning authority.

- 4.9.5. Condition 46 is an obligation on Viking Energy to measure for tonal noise (different from straightforward decibels). If specified amounts are found then the straightforward permitted decibel levels are adjusted to compensate. This reflects any complicated noise types found. Conditions 45 and 46 both specify that any measuring work must be done by a corporate member of the Institute of Acoustics or an appropriately qualified employee of a company that is a member of the Association of Noise Consultants.
- 4.9.6. Condition 47 imposes reaction by Viking Energy should the set noise limits at any residence be exceeded. Viking Energy must take all reasonable steps to ensure noise from the wind farm is reduced to prescribed levels including turning off individual or multiple turbines until noise emissions are reduced or an acceptable solution is put in place.

5. *Socio-economic benefits*

- 5.1. Dr Taylor's report mentions but excludes the indirect impacts on public health associated with the potential socio-economic impacts arising from wind energy development.
- 5.2. Many of the references to the report and other studies do consider this issue and establish a positive indirect connection between socio-economic and environmental benefits and improved public health.
- 5.3. The Viking Energy Environmental Statement presents conclusions in regard to socio-economic benefits. When simply adjusted to reflect the reduced number of turbines consented, the wider economic benefit to the Shetland community of the operation of the wind farm including income from land rental, community levy and local profits is likely to result in a direct annual income to Shetland of £31m and the creation and sustaining of around 348 gross jobs (direct and indirect mostly from investment of returns but including 35 working on the project and 19 in support services) per annum over the 23 year life of the project. There would also be £8.8m direct income to local suppliers each year and 231 gross jobs during construction. The wider economic benefits arise from effects not picked up by conventional impact analysis, and include the investment made possible from the profits and income generated. It is estimated this could result in around 300 jobs being sustained over the life of the wind farm, with the potential for more from investment in new development projects. The eventual total could be even higher due to the cautious assumptions used regarding the level of local investment from resources available.
- 5.4. As Trustees will be aware, the UK electricity market is being reformed and within that process the Department of Energy and Climate Change, in conjunction with the Scottish Government, is examining specific mechanisms to ensure island renewable energy projects come forward. An income uplift for island projects designed to support credible levels of return on investment is due to be consulted upon in September or October 2013. This is with a view to setting defined income levels for all low carbon sources of electricity, including recognition of those located in islands, in December 2013. These reforms will change, and should effectively underpin on a long-term basis, the business model of the project. A revised economic summary will be considered before the project proceeds to Final Investment Decision.
- 5.5. The Viking Wind Farm will reduce carbon emissions resulting in health and environmental benefits. The project's habitat and heritage strategies incorporate positive educational objectives linked to public welfare. The project will have an access

strategy promoting healthy outdoor activity, particularly walking and cycling. These commitments are secured by legally-binding consent conditions.

As we said at the time of its publication, Viking Energy welcomes Dr Taylor's desk-top study of existing literature and we are reassured from our reading of the report that because of the appropriate mitigations and distances being applied, the Viking Wind Farm will have no negative impact on public health. Thorough assessments have been done for all of the credible causes of public health concern and legally-binding consent conditions both enforce any proposed mitigations and protect against any unexpected occurrences at this particular project.

I trust this reassures you regarding the points discussed in Dr Taylor's report when specifically considered in the context of the proposed Viking Wind Farm.

If you have any questions after reading this letter or if you require any further information, please don't hesitate to get back in touch.

Yours sincerely,

David Thomson