6th International Meeting
on
Wind Turbine Noise
Glasgow 20-23 April 2015

The use of cumulative wind turbine noise related planning conditions

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Summary

The use of cumulative wind farm noise conditions is discussed in good practice guidance issued by the Institute of Acoustics. Despite an increase in the number of assessments which require consideration of cumulative noise, the use of cumulative conditions is still relatively rare. The use of such conditions has the potential to unlock 'noise budget' which has been allocated to wind farm schemes which do not need it. There are however a number of concerns relating to the practicality of such conditions and their ability to meet the key acoustic and planning requirements of a condition, whilst also being workable in practice.

This paper discusses some of the strengths and weaknesses of cumulative noise conditions and provides an example of how a cumulative noise condition might work. Ultimately, operators seeking to comply with a cumulative noise condition may need to be able to react first to noise complaints and will need to ensure that they have the flexibility to be able to react to changes in noise the output from other nearby turbines, should this occur. The complexity and inherent risks associated with cumulative conditions will mean that such conditions are only viable on certain wind farm schemes where a new operator is confident that there is noise budget available. Given the disadvantages of cumulative conditions it may be prudent for applicant to seek other ways to derive suitable noise limits if more straightforward options are available.

The use of cumulative noise conditions may still be desirable, in certain circumstances, to enable the maximisation of electricity generation whilst still ensuring the protection of residents and other wind farm operators. With relatively few examples of cumulative noise conditions in England, Scotland and Wales there is no widespread agreement on how such a condition should be constructed. As with all wind farm noise conditions, the exact wording of any cumulative noise conditions will need to be very carefully considered to ensure that they are robust and enforceable.

1. Introduction

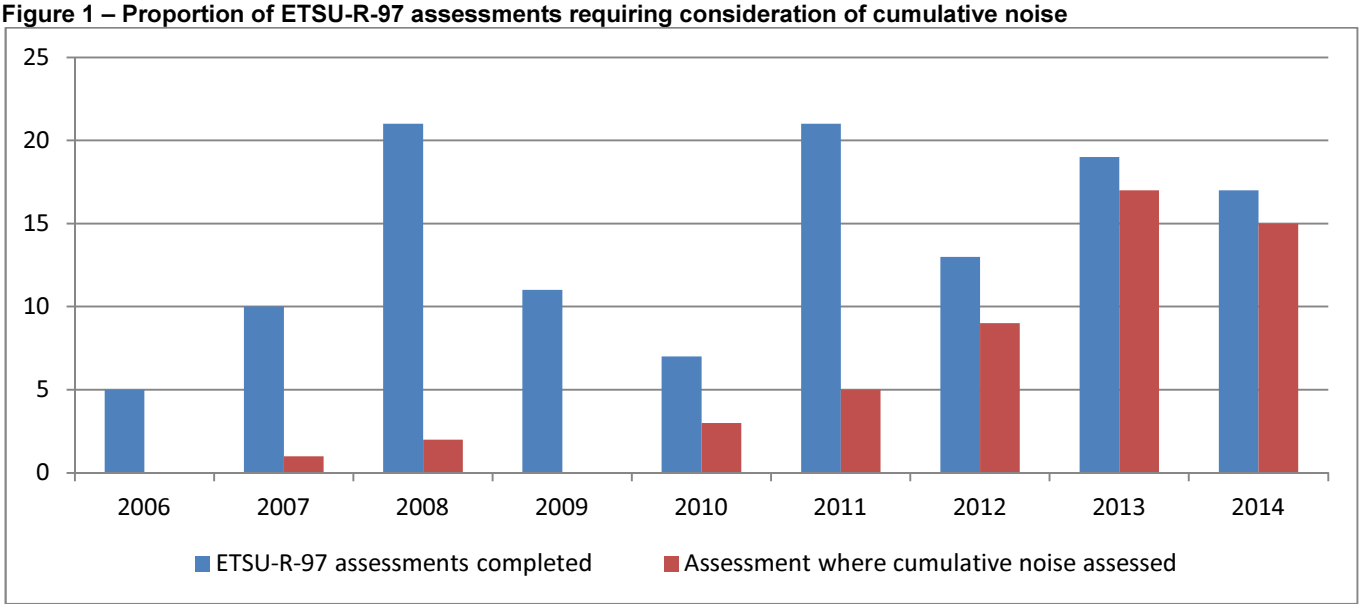
In England, Scotland and Wales an increasing number of wind farm noise assessments involve consideration of cumulative noise impact. The relevant guidance for wind farm noise assessments in the UK, ETSU-R-97 *'The assessment and rating of noise from wind farms'*[i] provides some guidance on cumulative issues. Notably, ETSU-R-97 states that the noise limits that it suggests should relate to total wind turbine from all developments in an area.

The brief discussion of cumulative noise assessment in ETSU-R-97 was perhaps appropriate given the scale of the wind energy industry at the time of writing and may also have reflected most people's views on the likely number of wind farm developments that would be proposed in the future.

Notwithstanding the scale of the industry in the mid 1990's cumulative wind farm noise started to become more important as the number of wind farm developments increased and the proximity to neighbouring wind farms assumed increasing importance. To put this rising relevance of into some context Figure 1 shows, for each year since 2006, the proportion of

ETSU-R-97 assessments undertaken by TNEI Services which required consideration of cumulative noise.

Figure 1 – Proportion of ETSU-R-97 assessments requiring consideration of cumulative noise



At the Institute of Acoustics third meeting dedicated to wind farm noise, held in 2007, Jiggins and Mckenzie[ii] discussed how cumulative noise could be predicted, taking account of directivity and presented some solutions on how noise related planning conditions could take account of cumulative impacts.

In May 2013 the Institute of Acoustics (IOA) published *'A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise'*[iii] (GPG). The GPG presents guidance on the application of ETSU-R-97 and has been endorsed by the IOA Council and Government[iv]. Section 5 of the GPG provides detail on how cumulative noise impacts should be assessed and also provides several potential ways of resolving cumulative noise issues and approaches to deriving noise related planning conditions.

The GPG reiterates that the noise limits established using ETSU-R-97 during the development process relate to total wind farm noise for *all* the wind turbines in an area. This total noise limit can be considered to represent the 'noise budget'.

In certain instances the entire noise limit is effectively allocated to a single development, regardless of whether that development is likely to use it all, and this process can mean that there is no noise budget available for subsequent developments in the area. The GPG suggests several approaches which can be used to derive noise limits which ensure that the total noise limit is not exceeded.

One approach to setting noise limits presented in the GPG is the concept of cumulative conditioning. The use of such conditions effectively places responsibility for cumulative noise impacts on the operator of the new development (i.e. the new wind farm operator would need to ensure that total wind turbine noise levels, including the contribution of any existing turbines, will meet the limits). The GPG states (in paragraph 5.7.5):

'...it has been suggested that a planning condition could be constructed that places cumulative impacts responsibilities on any subsequent wind farm developers, i.e. if noise levels from the existing wind farm increase (but are maintained within the existing wind farm's noise conditions) then noise levels from the second wind farm will have to reduce in compensation to ensure that cumulative noise limits are not breached.'

The GPG acknowledges that drafting of such conditions may be complex and that it may be difficult for such conditions to meet the legal requirements[v] of planning conditions in England, Scotland and Wales.

Since the GPG was published, cumulative conditions have been suggested for a number of wind turbine developments and the response of decision makers and key consultees has been mixed. This paper will examine some of the concerns that have been raised and look put these into the context of an outline cumulative condition.

Whilst this paper is written with cognisance of the acoustic and planning guidance in England, Scotland and Wales it may be relevant in other countries where guidance is based on similar principles.

2. When might a cumulative condition be desirable

The GPG presents a number of approaches which can be used to resolve cumulative issues, some of which are more complicated than others. The best approach can vary depending on the wording of any existing conditions and the stage at which the proposed scheme(s) are at in the planning process. With 'standard' noise related planning conditions (like the example condition included in Annex B of the GPG) now spanning several pages there is often an appetite to choose the most straightforward approach available. In some instances however a simple, GPG compliant approach is not available or would constrain the size / operation of a proposed wind farm.

There can be situations where a developer of a new scheme (wind farm B) is confident that an existing operational development (wind farm A) is operating well within its own noise limits, for example predictions or compliance monitoring might suggest it is using 36dB of a 40dB limit (all references in this paper relate to 10 minute L_{A90} values unless otherwise stated). Predicted noise for wind farm B suggests noise from the new turbines will be 32dB. Accordingly, predictions of the likely cumulative level (calculated as part of the planning application) suggest that total cumulative noise will be 37.5dB (assuming that the receptor can be downwind of both schemes simultaneously).

In this example, predictions of the likely cumulative noise are below the noise limit, however any noise limits will need to accord with the one of the key objectives set out in the GPG (as expressed in summary box 21):

'Whenever a cumulative situation is encountered, the noise limits for an individual wind farm should be determined in such a way that no cumulative excess of the total ETSU-R-97 noise limit would occur'.

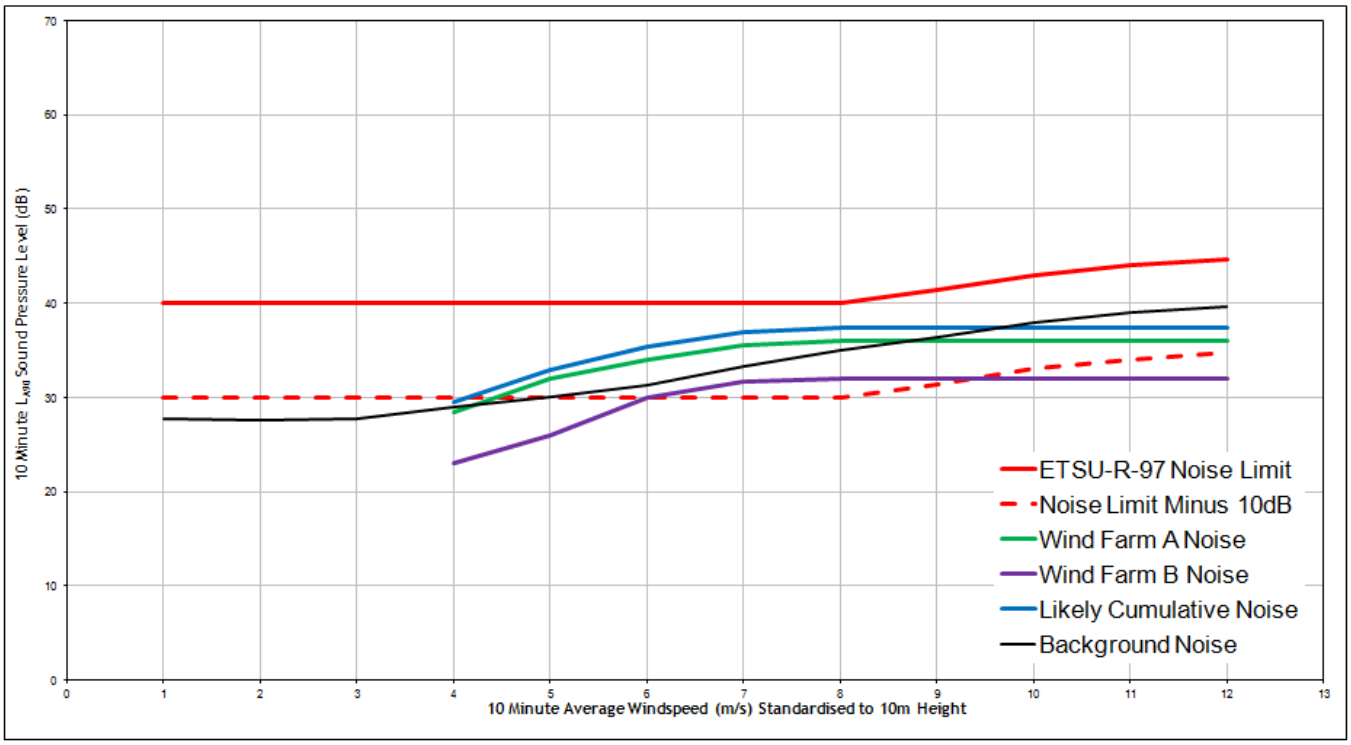
One way to achieve this aim would be to set noise limits at least 10dB below the limit given to wind farm A. This would mean that even if wind farm A were to use its full noise limit wind farm B would have a negligible impact[1] on the ability of wind farm A to meet it's own limits; cumulative noise levels would also still be within the total 'noise budget'. Some would argue that there might be difficulties in demonstrating compliance with a limit which is potentially set below the existing background noise levels, this is discussed further in Section 3. Adoption of the minus 10dB approach may also prevent full usage of the ETSU-R-97 limit so it is not necessarily the best approach to maximise power generation.

Figure 2 illustrates the scenario described above and it can be seen predicted noise for wind farm B exceeds the Noise Limit Minus 10dB. To mitigate the exceedance it would be necessary

[1] On the basis that 40dB + 30dB = 40.4dB and that the increase of 0.4dB is unlikely to be perceptible or measureable in the field.

to reduce noise from Wind Farm B (potentially reducing the number of turbines or meaning that the turbines would need to operate in a low noise mode for a proportion of the time), this despite the fact that both wind farms could operate concurrently and meet the ETSU-R-97 limit.

Figure 2 – Cumulative Noise Scenario



In this scenario, a cumulative condition could be considered as it would maximise the generation of energy whilst also protecting noise sensitive receptors by ensuring that the appropriate noise limit is met.

All the examples presented in this paper assume, for simplicity, that the property being considered is simultaneously downwind of both wind farm A and wind farm B; but for some properties this will not be the case. Where a property is it between two wind farms it can further reduce the proportion of the noise limit that the operational wind farm A can use for a given wind direction, potentially making more of the noise budget available for wind farm B. Whilst a series of 'upwind' and 'downwind' noise limits have sometimes been used to account for this fact, the use of a cumulative condition would provide maximum flexibility for operators to make the most of any directivity attenuation which is occurring at key properties.

3. Key considerations

Whilst the principle behind cumulative conditions has merit, concerns have been expressed regarding the enforceability of conditions. For such a condition to be usable it would need to satisfy both the relevant planning and acoustic requirements and also be workable in practice. The three requirements are very much interlinked and are discussed in turn below.

3.1 Planning requirements In England and Wales planning conditions must meet the tests set out in the National Planning Policy Statement[vi], whilst in Scotland they must satisfy the same tests which are set out in Circular 4/1998 *'The use conditions in planning permissions'*[vii]. Conditions should be:

- Necessary;
- Relevant to planning;
- Relevant to the development to be permitted;

- Enforceable;
- Precise; and
- Reasonable in all other respects.

Whilst the tests contained within the NPPF and Circular 4/1998 are the same, the later provides significantly more detail on their meaning so has been referenced, where appropriate, below.

Circular 4/98 explains that *'Sometimes a condition will be unenforceable because it is in practice impossible to detect an infringement'*, this is a concern which is sometimes raised regarding cumulative conditions and this will be discussed further in Section 3.2.

The circular also notes that *'It is unreasonable to impose a condition worded in a positive form which developers would be unable to comply with themselves, or which they could comply with only with the consent or authorisation of a third party'*. Clearly, this could be a significant limitation of a cumulative condition given that total wind turbine noise levels will be influenced by turbines operated by one or more third parties. One potential way to alleviate this limitation is to have a 'backstop position' which, if satisfied, would demonstrate that the proposed development was not contributing to the exceedance of the ETSU-R-97 noise limits. This could be achieved by adopting a backstop position requiring the development to operate 10dB below the ETSU-R-97 limits.

3.2 Acoustic requirements Determining the specific noise from a wind farm development can be difficult, particularly when noise from the wind turbines is low at a location where background noise levels are high or where the site specific noise limits are set below the average background noise level. This is recognised in the IOA GPG Supplementary Guidance Note 5 which notes:

'...where the shut-down noise approaches the operational noise, the level of shut-down noise has an increasing effect on the calculated turbine noise such than when the difference between the two is 3 dB or less, it may no longer be appropriate to use this correction [subtracting noise measured with the turbines off from noise with the turbines on to determine the specific noise] *with any degree of accuracy and some other method of determining turbine noise in the presence of high levels of background noise may need to be agreed with the planning authority.'*

As more planning conditions are set based on limits which are set below the total ETSU-R-97 noise limits, the issue of being able to accurately determine the specific noise will become increasingly important. This is not however an issue specific to cumulative conditions, for example, ETSU-R-97 suggested that where turbine noise was below 35dB at the nearest properties (at wind speeds up to 10m/s at 10m height) a flat limit of 35dB could be applied at all wind speeds regardless of background noise levels. Compliance with this flat 35dB limit this can be difficult to verify in areas where background noise is high. The SGN does go on to suggest one solution to this issue:

'*In such cases where noise limits are less than ETSU-R-97 limits (e.g. apportionment of noise impacts due to cumulative impacts) compliance measurements may need to be undertaken in closer proximity to the wind farm to ensure background noise levels do not unduly influence the readings.'*

It is however not clear how this would fit in with most modern conditions, some of which specifically request compliance monitoring at the complainants property. Furthermore, even if the specific noise levels at an agreed proxy location could be determined, most modern conditions do not specify how those levels would be extrapolated to the nearest properties to enable comparison with the noise limits. This is an area which may benefit from further discussion but again, it is not specific to cumulative conditions.

SGN5 also notes that:

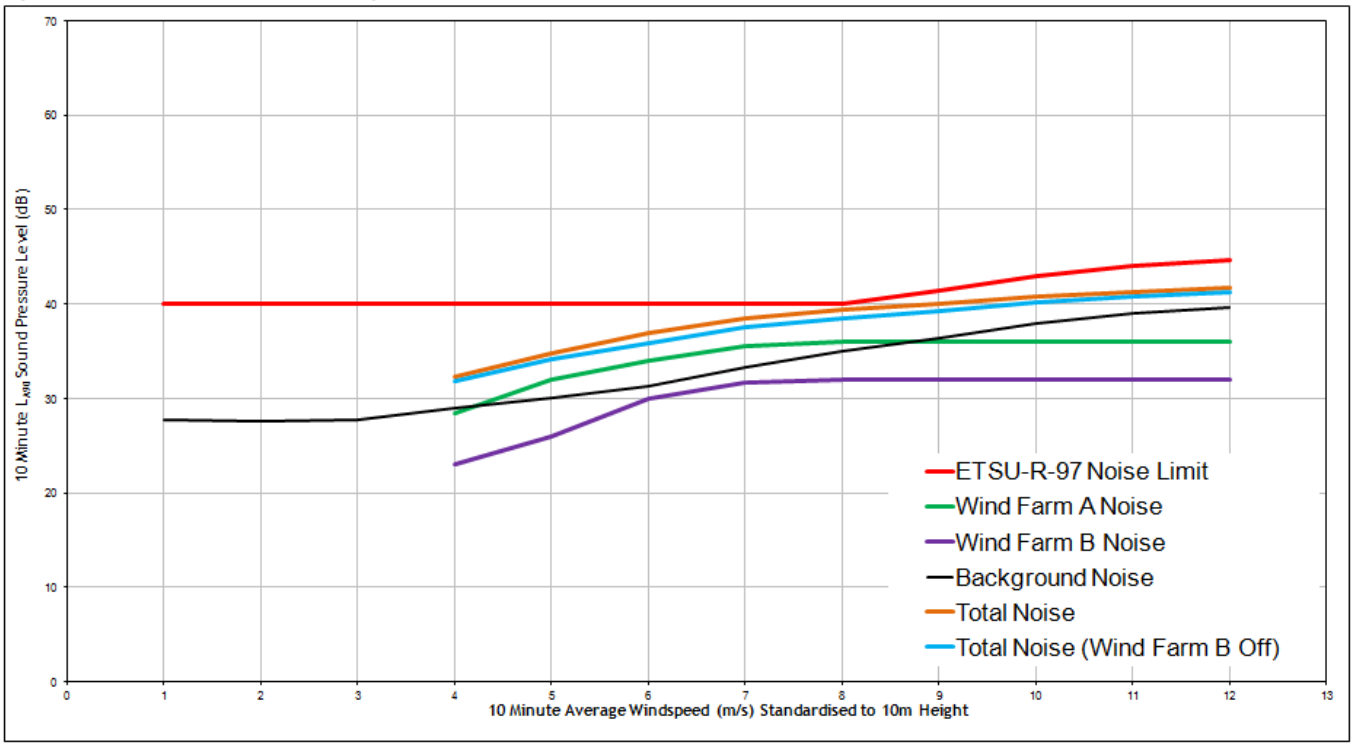
'In the event that the typical background noise is greater than the turbine noise limit, and if the additional contribution of the turbine noise to the prevailing background is difficult to discern with confidence from the data, then it is likely that compliance with the ETSU-R-97 limits would be demonstrated.'

In a situation where there is no difference between measurements made with and without the turbines operating it may therefore be reasonable to assume that the contribution of those turbines is 10dB below the total measured noise level (it is however worth noting that, depending on the levels of background noise this is not necessarily the same as being 10dB below the ETSU-R-97 noise limit).

The question has been raised as to whether it is necessary for an operator to be able to determine the specific noise from other developments in the area. Whilst this might be useful information to have, it may not be readily available as other operators are unlikely to be willing to turn their turbines off to enable the calculation of the specific noise. Assuming that is it not possible to determine the specific contribution of the other turbines in the area consultants may need to make the cautious (and potentially unrealistic) assumption that all noise measured during compliance monitoring is turbine noise.

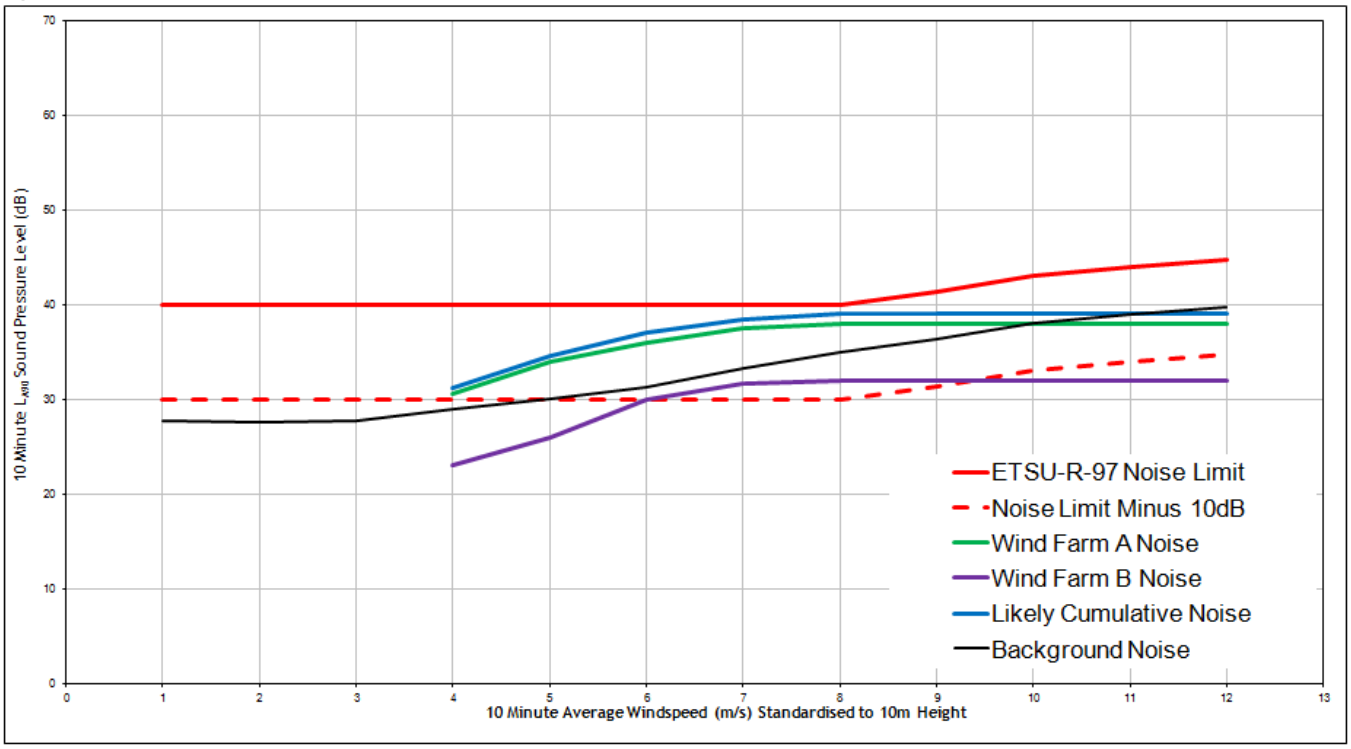
Figure 3 illustrates potential results of compliance monitoring using the example numbers presented in Figure 2. The graphs shows that total noise (background noise plus noise from all the turbines) meets the noise limit and compliance monitoring, should it be required, may not need to include a correction for background noise.

Figure 3 – Compliance Monitoring Scenario



The first scenario is based on a location where likely cumulative noise levels are well below the noise limits (there was a minimum margin between predicted levels and the noise limit of 2.7dB in Figure 2). It is worth exploring a situation where the margin is much smaller. Figure 4 shows another Cumulative Noise Scenario where noise from Wind Farm A is 2dB higher.

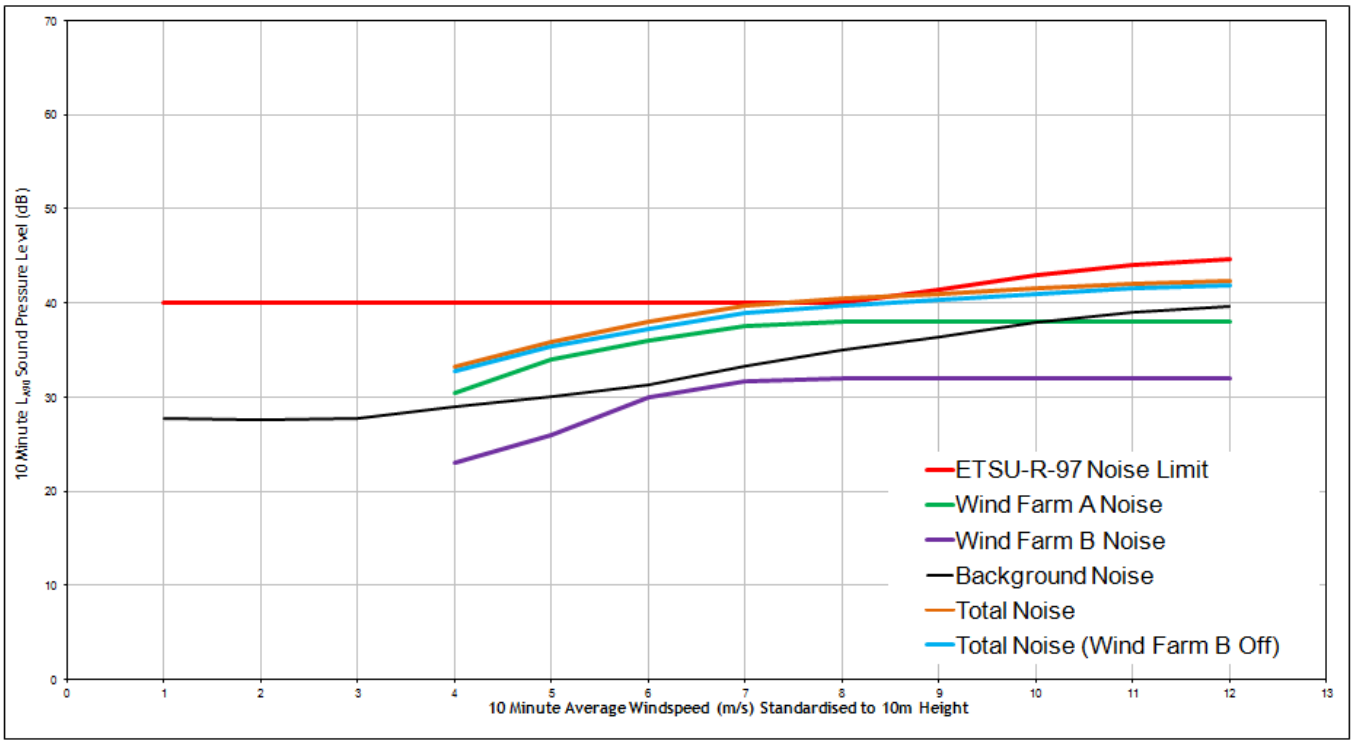
Figure 4 – Cumulative Noise Scenario 2



The Likely Cumulative Noise level is still within the ETSU-R-97 Noise Limit so when it is assessed against the guidance in ETSU-R-97 it would be considered acceptable, but would a cumulative condition be appropriate in this case?

Figure 5 shows results which could be expected during a compliance monitoring assessment

Figure 5 – Cumulative Noise Scenario 2



The graph shows that in this scenario, Total Noise exceeds the noise limit. Typically operators would then repeat the monitoring with the turbines switched off to determine the specific noise but the operator of Wind Farm B may only be able to turn their own turbines off. In this instance that additional monitoring shows that Wind Farm B is having an influence as demonstrated by

the difference between the light blue and the orange lines. The Wind Farm B operator may not however be able to determine the exact contribution of the background noise so it can not apply the background noise correction. In this scenario the operator of Wind Farm B may need to accept that there is an exceedance of the cumulative condition.

To mitigate the exceedance the operator of Wind Farm B would need to reduce the noise emitted by its turbines until total noise drops below the noise limit. In reality this mitigation may not actually be required (as it may be background noise that is causing the exceedance) but this is a potential risks for an operator who accepts a cumulative condition.

It may be that the exceedance is being caused by the operation of Wind Farm A and that, as a result, there is no amount of mitigation that the operator of Wind Farm B can employ that will enable them to meet their cumulative noise limit. This is another potential risk involved with the adoption of cumulative conditions and it would also potentially fail the planning test of reasonableness as the condition would be relying on the actions of a third party over whom the operator has no control.

It has been suggested that the condition could include a 'back stop position' which could be adopted in the event that it is not possible to demonstrate cumulative compliance with the ETSU-R-97 limit. This could involve Wind Farm B seeking to demonstrate that it can comply with the ETSU-R-97 noise limit minus 10dB. If the operator was able to demonstrate that there was no difference between measurements made with and without their turbines on it may be reasonable to assume that they must be operating at least 10dB below the measured noise level and would therefore be having a negligible effect.

3.3 Practical requirements

Aside from the practicality of the acoustic elements of cumulative conditions, planning conditions need to be workable from the operators perspective. Many wind energy projects are financed by third parties and, understandably, most financial bodies are very risk adverse. During due diligence work it is likely that funders will investigate all potential 'what if' scenarios, if there is a cumulative condition with a backstop position a funder will be keen to ensure that the project is still viable should the development need to comply with the backstop position.

The ability of the development to operate at the backstop position is therefore an important consideration for the developer and, once again, there is a potential cross over into the planning requirements. Circular 4/98 states:

'Avoidance of Onerous Requirements
Even where a condition would not be so unreasonably restrictive as to be ultra vires... For example, a condition which ... which would obviously make it difficult to finance the erection of the permitted building by borrowing on mortgage, should be avoided on these grounds.'

Ultimately it is not the role of acousticians to determine whether a proposed development is financially viable but clearly it is something that developers should consider carefully before proposing, or accepting, a cumulative noise condition.

4.0 Review of case recent case law

Since the IOA GPG was published there have been two Public Inquiries where cumulative conditions have been discussed in detail whilst a decision for a third site which is referenced in the IOA GPG has been issued. Each of the three sites is discussed briefly below.

4.1 Rowantree Wind Farm This wind farm was referred in the IOA GPG as an example of where a cumulative condition was proposed but the decision was pending. The decision[viii] was issued in 2013 at which time the appeal was dismissed and planning permission refused.

Notwithstanding the decision, the Reporter had put forward a schedule of planning conditions for the Scottish Ministers to use should they choose to act against his advice and allow the appeal. The conditions included a cumulative noise condition about which the Reporter noted:

'In summary, in the very narrow range of circumstances that apply at Threeburnford, it would be possible to isolate the specific noise from Rowantree or Toddleburn. The proposed noise condition would therefore be reasonably necessary, precise, enforceable and reasonable.'

4.1 Sneddon's Law This consented wind farm is to be located close to the operational Whitlee Wind Farm. The wind farm was originally consented in June 2012 with limits set based on the ETSU-R-97 noise limits (which has already been allocated to Whitlee Wind Farm) minus 10dB.

In March 2013, an application was made to remove several noise conditions and replace them with alternatives which included a cumulative noise condition. In October 2014 the appeal was allowed and the decision notice[ix] contained extensive commentary on several of the planning and acoustics considerations discussed in Section 3. The reporter commented that it might be difficult to demonstrate that a development was operating 10dB below the full ETSU-R-97 noise limits and questioned the robustness of undertaken measurements at a proxy location and using this to determine compliance with limits set at a property further away.

The decision notice also ponders whether the cumulative noise limit should relate to total noise (noise from all the turbines plus background noise or just the noise from the turbines), the validity of the later approach seemingly being dependant on whether it would be possible to arrange a shutdown of all the turbines in the area to determine background noise levels (thus allowing the calculation of noise from the turbines only).

The situation at Sneddons Law is perhaps somewhat unique as owing to the nature of the application the Reporter was not considering the acceptability of the scheme but instead which noise conditions should be used on a scheme which was already consented. Ultimately the Reporter concluded that:

'the revised condition 29, as proposed by the appellant and as imposed by me with some modifications, can operate to ensure that the noise levels from the two wind farms together are no greater than those which could be experienced by neighbouring residents from Whitelee alone.'

4.1 Tullymurdoch Wind Farm This wind farm was granted consent, following an appeal in September 2014 and a cumulative noise condition was adopted. Noise issues were discussed in detail at the Inquiry although the reporter only included a concise summary of the discussion relating to the use of cumulative noise conditions within the appeal decision notice[x]. The format of the condition attached to the Tullymurdoch Wind Farm consent is similar to the example presented in Section 5.

5.0 Structure of planning conditions

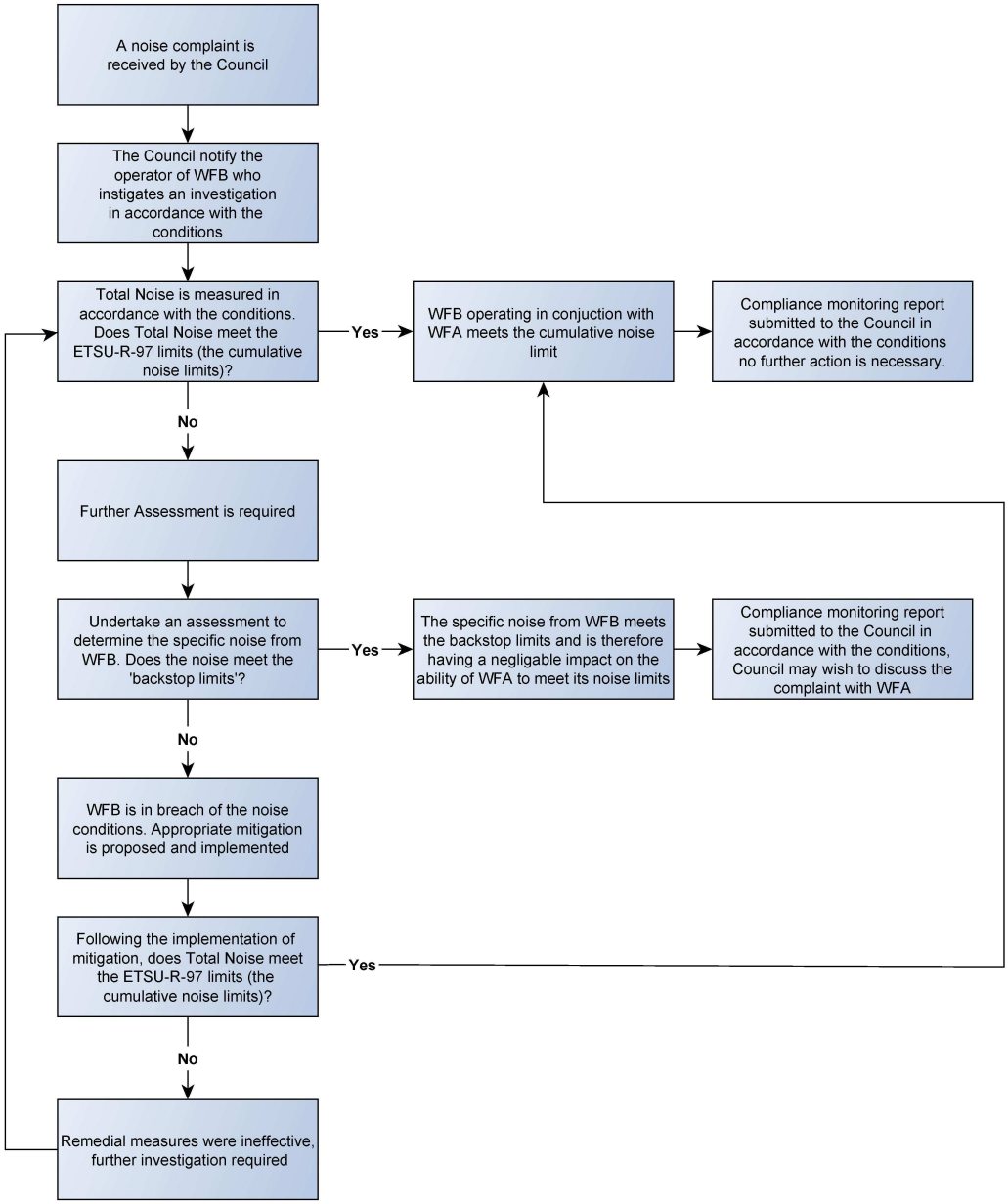
This section sets out one approach which could be used to construct a cumulative noise condition. In essence the development would be given two different noise limits, the first being a cumulative noise limit which would relate to total noise resulting from the development itself operating concurrently with the other consented developments named in the condition and a second 'backstop' limit which would relate solely to the noise from the development itself.

Compliance monitoring, if required, would look at the two noise limits sequentially, if the development could not demonstrate compliance with either limit it would fail to comply with the conditions and mitigation would be required. Following implementation of the mitigation

compliance monitoring would be undertaken again and this process would be repeated until compliance with one or other limit is demonstrated.

Figure 6 provides an overview of how such a condition would work. In this example there is one existing wind farm (WFA) which has been consented with limits set equal to the ETSU-R-97 limits and one proposed wind farm (WFB), the backstop limits are set 10dB below the ETSU-R-97 noise limits.

Figure 6 – Flowchart representing the stages of a cumulative condition



6.0 Conclusions

At a time where cumulative noise assessments are becoming more common, and more complex, it is important that suitably worded robust and enforceable noise related planning conditions are used to adequately control wind turbine noise. IOA GPG sets out several methods to do this, some of which are now becoming widely used and many of which are now well understood.

The use of cumulative conditions remains controversial and whilst conditions have been adopted by decision makers there is no general agreement on how or whether such conditions should be used and, if so, how they should be worded.

Compliance monitoring of operational wind farms is complex and it can be hard to accurately extract the contribution of a single wind farm, this can be even more difficult to achieve where there are several operational developments in the an area. Most of the challenges involved with compliance monitoring are however not exclusive to sites controlled using cumulative noise conditions.

There are a number of disadvantages to using cumulative conditions and, as a result, they are not suitable for use on all sites and it may be appropriate for them to only be considered where a more straightforward approach is not available. Cumulative conditions are likely to be lengthy and complicated and they need to carefully drafted to ensure they meet the acoustic, planning and practical requirements which are necessary to ensure the condition is workable. In the event that compliance monitoring is required at a site consented with a cumulative noise condition the assessment may be lengthy and expensive. In certain circumstances the approach taken during compliance monitoring may also need to be cautious if it may not be possible to accurately determine the exact contribution of background noise. Developers and operators will also need to ensure that the scheme is still viable if the existing wind farms do use more of the ETSU-R-97 noise limit than expected.

Nevertheless, in certain circumstances, the use of cumulative conditions has the potential to help developers utilise spare 'noise budget', maximising the potential to generate energy whilst also protecting residents and existing operators.

Cumulative noise conditions may be particularly relevant where the following conditions exist:

- There is available 'noise budget' which has been allocated to, but is not being used by, a consented wind farm development; and
- Other forms methods for deriving site specific noise limits as set out in the IOA GPG (such as apportionment, demonstration of the controlling property principle or significant headroom and negotiation) are not applicable.

It seems likely that, in the absence of further guidance on cumulative conditions, that they will continue to be a source of disagreement between experts and that, as a result, they will be used sparingly. Given the increasing importance of cumulative noise impacts and that there is now some case law relevant to cumulative conditions it could be a topic which could benefit from further discussion in the IOA GPG (which notes in its preface that 'The IOA will keep the document under review, and consider updating when significant changes to current good practice have occurred').

References

[i] The Working Group on Noise from Wind Turbines (1996) ETSU-R-97 '*The Assessment and Rating of Noise from Wind Farms'*, ETSU for the DTI (Department of Trade and Industry)

[ii] Dr Andy Mckenzie and Mark Jiggins (2006) '*Wind Farm Noise: Cumulative Impact Assessment'*, IOA Wind Farm Noise 2

[iii] Institute of Acoustics (2012) '*Good Practice Guidance on the application of ETSU-R-97 for wind turbine noise assessment'*

[iv] In Scotland - Letter John Swinney, MSP Cabinet Secretary for Finance, Employment and Sustainable Growth to Prof B Shield, IOA, 29 May 2013 and In England and Wales - Letter Edward Davey, MP Secretary of State to Prof B Shield, IOA, 20 May 2013

[v] As set out in the NPPF in England and Wales and Circular 4/98 in Scotland.

[vi] Department for Communities and Local Government (2012) *' National Planning Policy Framework'*

[vii] The Scottish Government (1998) Circular 4/1998 'The use of conditions in planning permissions'

[viii] Rowantree Wind Farm Decision Notice, dated 22 March 2013, Case Reference: Rowantree Wind Farm

[ix] Sneddons Law Wind Farm Decision Notice, dated 24 October 2014, Planning Appeal Reference PPA-190-2040

[x] Tullymurdoch Wind Farm Decision Notice, dated 3 September 2014, Planning Appeal Reference PPA-340-2073