Independent Noise Working Group

ETSU-Gate

Three Decades of Deception

Bad science and the counter - campaign to replace the ETSU-R-97 wind turbine noise guidance in order to protect public health and wellbeing

June 2025

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The battle against the wind power industry and government to ensure proper control of wind turbine noise

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Notes: Text quoted from reference documents; *"is shown in brown italics"*

Hyperlinks are included to access the referenced documents and websites. Best endeavours have been taken to ensure third party hyperlinks are active but cannot be guaranteed.

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Acknowledgements

The current INWG team would like to acknowledge the contributions made by others during this campaign. Some of these contributors have now 'retired' from active participation, some are still semi-active, and unfortunately some have passed away. These highly valued contributors listed in alphabetical order are.

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This report is dedicated to the memory of:

Susan Crosthwaite (1952 to 2025)
Mike Hulme (1949 to 2021)

Introduction

This is the account of the campaign against wind turbine noise. Although ETSU-Gate is focused on the UK, we see similar situations in other countries, notably Australia, Ireland and the USA. ETSU-Gate is the story of the fight for justice by a mostly rural minority against big business, money, politics and the establishment.

This report records the sequence of events over the three decades and provides an analysis of the science and politics. A record of events in chronological order showing how the campaign has unfolded is included at '**Appendix B - Campaign Time Line'**. The analysis of the science and politics is provided in the form of the '**Campaign Story'** where the main issues are examined. The '**Discussion**' and '**Conclusion**' highlight the key messages from the campaign.

The report title, '**ETSU-Gate**' is taken partly from the official noise guidance for wind turbines known as 'ETSU-R-97' and partly from the infamous Watergate scandal in the USA that led to the resignation of President Nixon in 1974. Watergate became infamous not so much as for the break-in itself as for the subsequent denials, establishment cover up and obstruction of justice.

In many respects, the ETSU-Gate scandal also invites comparison with the Post Office (also known as the Horizon) scandal that is still being unravelled. Similarities with the Post Office scandal include deception, complicit contractors, the cover up by officials, the shifting of blame and government ministers ignoring the evidence presented to them. However, the shifting of blame is the most shocking similarity where wind industry acousticians operating well outside their area of competence, are citing a whole range of non-acoustical factors as being the source of noise complainant annoyance and health problems.

By coincidence, the Post Office minister from May 2010 to February 2012 that ignored the plight of the Sub-postmasters is the same Ed Davey MP who as Secretary of State, Energy and Climate Change ignored evidence relating to the failings of ETSU presented to him by campaigners on 9 October 2013. Davey has since claimed he was lied to by officials regarding the Post Office scandal. Will he claim he was lied to again by officials about ETSU in 2013?

ETSU-Gate also highlights blatant 'Bad Science' by wind industry acousticians driven by financial, political and ideological motives. Corruption of science is also the theme of the book by Paul Goddard and Angus Dalgleish titled, '**The Death of Science**' published in 2023. Goddard and Dalgleish show that bad science is not unique to the wind power industry, in fact it is widespread and affecting many areas of science and especially medicine.

This report shows how 'ETSU-Gate' repeats the human failings from the Watergate and Post Office scandals where it is characterised by an extraordinary array of malpractice, manipulation of the science, abuse of freedom of information laws and attempts to exclude dissenting evidence. Within this report we expose the deception that has been facilitated by

the 'well-meaning', by those motivated by saving the planet, by governments of the left and right, supported and facilitated by the 'establishment', and now all justified on the altar of Net Zero.

This facilitation of corrupt science has included the Institute of Acoustics becoming a vassal of the wind power industry and is a focus of attention throughout this report. The Institute of Acoustics continues to endorse the bad science that has perpetuated ETSU-R-97 as the official government noise guidance for wind turbine noise assessment for three decades. As a result, ETSU-R-97 remains in use despite credible health and scientific evidence that it fails to protect host communities and is unfit for use. ETSU is responsible for untold suffering by a significant rural minority who have had wind turbines imposed on them. While this may not occur in respect of every wind farm or host community, it has affected a sufficient number to show that the methods for determining noise impacts from wind turbines is not working except for the benefit of the wind power industry.

Campaigners including the INWG have been recommending that ETSU be replaced by BS4142 since 2015. BS4142 is the noise standard for all other similar industries and has been shown as being suitable and appropriate for use with wind turbine noise. This recommendation has been repeatedly ignored by government and by the wind industry including the Institute of Acoustics.

The failure to consider BS4142 as a replacement for ETSU by government despite the technical evidence as to its suitability leads to the conclusion that its exclusion could only persist through government policy. This policy, whether official or unofficial condones consigning a rural minority as 'collateral damage' in the deployment of wind power.

This three decades long campaign in the UK has involved four main parties;

- The UK government of the day including ministers from all the main UK political parties.
- Government civil servants who remain anonymous in the background but have been advising ministers and implementing government policy for the deployment of renewables throughout.
- The wind industry including its trade association, its acousticians and lobbyists. This party includes the Institute of Acoustics.
- Independent groups and individuals representing local communities. These include 'The Independent Noise Working Group' (INWG), independent noise consultants and others fighting to protect public health and wellbeing.

Despite there being four main parties involved in the campaign, it has been a decidedly two-sided affair with the wind industry, the government and government officials generally lined up on one side, with independent groups and organisations, often derogatorily referred to as 'objectors' on the other side.

The Campaign Story

This campaign story has been developed from the Chronological time line of events at Appendix B and the reference documents. Each of the main topics arising during the campaign is examined providing references with hyperlinks for further reading.

Chapter 1: In the beginning ETSU was created

This three-decade campaign to control wind turbine noise in order to protect wind farm neighbours all started in 1996 with the release of the official UK wind turbine noise guidance. This guidance document titled, '**The assessment & rating of noise from wind farms'**, and known as ETSU-R-97, Ref 1 - ETSU is commonly referred to as ETSU. The ETSU document framework wording included; "*thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development*". This indicates the prioritisation of wind power development over the protection of affected communities. As has been demonstrated since, the word '**reasonable**' from the perspective of the wind industry or government clearly has a very different interpretation to that of wind farm neighbours suffering the effects of wind turbine noise and in some cases being forced to vacate from homes.

Despite the claimed temporary nature of the ETSU guidance at that time and the recommendation that it should be reviewed after two years, we find that it is still being used as the official UK guidance 29 years later and without any substantial revision.

Not only was the new emerging wind power industry of the 1990s to be allowed to submit local communities to higher noise levels than permitted by other comparable industries in rural areas, the control of wind turbine noise guidance would be handed to the same government department responsible for the deployment of wind power, akin to setting the fox to guard the hen house.

Whereas environmental protection including noise enforcement for most other industries comes under the Department of Environment, Food & Rural Affairs (DEFRA) and its Environment Agency, in the case of wind power, both its deployment and control of its environmental impact including noise comes under what was the Department of Trade, is now the Department for Energy Security & Net Zero (DESNZ).

This conflict of interest within a single government department with its prioritisation of business and political interests over the health and wellbeing of local communities lies at the heart of the ETSU-Gate campaign and is arguable its root cause.

Additionally, whereas many similar industries located in rural areas such as waste management and quarries are subject to licencing and ongoing monitoring, wind power is totally unregulated. Any complaints including noise complaints come under the remit of the local planning authority (LPA) where the wind farm is located.

As we have seen over the last three decades LPAs are either unable or unwilling to resolve these noise complaints and unwilling to take on wind power developers and operators. As a result, most complainants have been left to suffer in silence as the cost and legal barriers preclude most individuals from taking legal action.

This failure of government dating back to the 1990s has been perpetuated by all the subsequent governments, of all the main political parties. This failure has been responsible for an unprecedented level of suffering, ill health and financial loss for a significant number of mostly rural wind farm neighbours.

Chapter 2: The start of noise complaints and industry denials

As we read through the campaign timeline, we find there was minimal activity during the first decade. Very few people outside of the wind power industry would have even been aware of the ETSU guidance and there were relatively few wind farms in operation. However, a report during July 2005 by the acoustician Dick Bowdler titled '**ETSU-R-97 Why it is wrong**', Ref 2 - Bowdler 2005 provided a highly critical appraisal of ETSU.

Unfortunately, this acoustician has since changed 'sides' and has now become a supporter of ETSU, a prominent IOA member and an outspoken supporter of the wind industry and its acousticians. If we refer to his later article in the IOA Acoustic Bulletin, November 2017, Acoustics Bulletin Nov 2017 at page 38. It is difficult to believe that the same person authored to 2005 article. The 2017 Bowdler article is highly disparaging of the seminar speakers and totally unprofessional, a testament to the financial influence of the wind industry. **This article by Bowdler should never have been approved for publication by the IOA and reflects on the professional descent of a supposedly scientific institution into a mouthpiece for the wind industry.**

Wind turbines that were operating during the early 2000's were relatively small in size; however, some were starting to cause noise complaints. As a result of these complaints a study was commissioned by the government and released during 2006 titled '**The measurement of low frequency noise at three UK wind farms**', Ref 5 - HMP 2006. The study conducted by the consultant HMP claimed *"Infrasound associated with modern wind turbines is not a source which will result in noise levels which may be injurious to the health of a wind farm neighbour"* and *"The common cause of complaint was not associated with LFN, but with occasional audible modulation of aerodynamic noise especially at night."*

However, a draft version of the report, '**The measurement of low frequency noise at three UK wind farms – 3rd draft Redacted**', Ref 6 - HMP 3rd draft 2006/9 obtained in December 2009 following a FOI request revealed how the original report had been revised by government officials to **downplay the significance of amplitude modulation and to remove the recommendation to revise the night time noise limits.**

By a remarkable coincidence of timing, while the HMP study was underway, the wind industry trade body, the BWEA (now RenewableUK) released a Briefing Sheet in February 2005 titled, '**Low Frequency Noise and Wind Turbines**' Ref 3 - BWEA 2005 to deny any harmful effects from low frequency noise (See Glossary for description of LFN and infrasound) from wind turbines claiming; *"...that the levels of infrasonic noise and vibration radiated from modern, upwind configuration wind turbines are at a very low level; so low that they lie below the threshold of perception..."*.

This claim along with '**what you can't hear can't hurt you**' continues to the present day as the industry continues the denial of any harmful effects of wind turbine noise.

In what appears to be a response to the HMP report and the BWEA Briefing Sheet, a paper was released in February 2007 to challenge these claims by Dr Amanda Harry titled, '**Wind turbines, noise and health'**, Ref 7 - Harry 2007.

Harry concluded, *"I think it is clearly evident from these cases that there are people living near turbines who are genuinely suffering from health effects from the noise produced by wind turbines. These neighbours of turbines clearly state that at times the noise from turbines is unbearable. The developers are usually heard to say that noise is not a problem. Clearly this cannot be the case."*

Following the HMP report from 2006, the government DTI commissioned Salford University to conduct a study into amplitude modulation (AM), where AM is the beating or thumping noise created by wind turbines. The '**Salford report**' as it became known titled, '**Research into Aerodynamic Modulation of Wind Turbine Noise'**, Ref 8 - Salford 2007 and released in August 2007 downplayed the significance of AM or the need for further research.

Fortunately, the Renewable Energy Foundation (REF) initiated a FOI request for information withheld from the Salford report. This FOI request was initially refused but was provided January 2009 following an appeal. The information obtained by REF under this FOI request indicates that as early as 2007 when the UK wind industry was still at an early stage of development, that there were already a significant number of complaints from wind farms across the country regarding noise. Navigating through the REF report hyperlinks, at, REF FOI for Salford Report Feb 2009 provides details of the noise complaints at each wind farm.

The Salford report survey FOI information release shows details of complaints arising from 27 wind farms. It also demonstrated that the report authors were complicit in withholding and then resisting the release of critical information relating to the extent of these noise complaints.

Chapter 3: The Article (or Bulletin) Method

In response to some early criticisms of ETSU, a group of acousticians closely connected to the wind industry published an article in the IOA journal, Acoustic Bulletin, March 2009 edition titled, '**Prediction and assessment of wind turbine noise**'. Ref 9 - Bulletin 2009. Subsequently known as the '**Article Method**' or '**Bulletin Method**' it recommended a methodology for the treatment of wind shear, and also claimed to address the prediction of noise and the significance of low frequency noise. Not only were these acousticians authoring the Article Method known to be financially involved with wind farm developers, they included some of the original ETSU authors.

The first to successfully challenge the bad science underlying the IOA 'Article Method' was Mike Stigwood of MAS Environmental, followed by Constable and Moroney of REF. The September 2011 Stigwood paper titled, '**The effect of a common wind shear adjustment methodology on the assessment of wind farms when applying ETSU-R-97**' Ref 10 - MAS Article Method 2011 & Ref 10 - MAS Article Summary 2011 tested the Article Method as proposed by the IOA acousticians.

Stigwood states, *"The study concluded that the desired benefit using the article method at all wind speeds, and especially at 5-7m/s where the article method was expected to perform best, is not realised. Where standardised wind shear conditions as implemented by the article, which do not relate to those conditions causing complaint, were substituted for the actual wind shear conditions likely to cause complaint more turbine noise was allowed."*

What the MAS study revealed was a clever and opaque methodology involving a manipulation of the wind shear exponent, developed by wind industry acousticians to allow higher levels of wind turbine noise, and to make any subsequent noise enforcement actions much more difficult. Remarkably, despite the criticisms, this 'Article Method' methodology was subsequently adopted as part of the IOA Good Practice Guide, by the same group of acousticians as discussed later.

REF followed with a paper in April 2012 by Lee Moroney and John Constable titled, '**A critique of the IOA treatment of background noise for wind farm noise assessment**' Ref 12 - REF 2012 where they examined the revised '**Article Method**' methodology for deriving noise limits for wind farm planning conditions. The REF paper confirmed the MAS findings and states;

- *"The Acoustics Bulletin revision increases the uncertainty of the background noise curves and reduces confidence in the reliability of noise conditions based on them.*

- *We also show how the wind speed data accumulated from an on-site anemometer can be used to predict the likelihood and frequency of noise complaints from neighbours for a hypothetical site layout, taking into account the bearing and proximity of the turbines to dwellings. The results demonstrate that separation distances that could be*

judged acceptable under the new methodology, would nevertheless be likely to trigger significant numbers of noise complaints from neighbouring dwellings."

Their conclusion is that the 'Article Method' is less protective of wind farm neighbours than the ETSU methodology and as a result, allows developers to site turbines closer to homes.

Then in July 2012 a group of Northamptonshire campaigners, Cox, Sherman & Unwin with professional assistance, released a comprehensive critique detailing the shortcomings of ETSU. The report Ref 13 - Cox WEIS 2012 (subsequently known as '**Where ETSU is silent**') identified the key deficiencies of ETSU including:

- *"A failure to use suitable microphone wind screens and as a consequence background noise levels will be measured artificially high due to wind noise contamination resulting in an overestimation of masking background noise;*
- *A failure to adequately consider the effects of wind shear in noise assessments so underestimating turbine noise levels;*
- *A failure to correctly analyse background noise data when deriving average noise curves so overestimating background masking noise;*
- *A failure to correctly use the ISO 9613-2 noise propagation model resulting in an under prediction of turbine noise;*
- *A failure to allow for measurement tolerances (or uncertainties) that can easily amount to +/- 10dB resulting in a doubling or halving of the WTN;*
- *A failure to consider AM and LFN."*

'**Where ETSU is Silent**' examines wind shear, its importance in the assessment process and the implications of the Article Method in detail. **The findings in this report clearly demonstrated that ETSU fails to protect and is simply not fit for purpose.**

Chapter 4: The Good Practice Guide

The next phase of the ETSU campaign was triggered by the release of '**A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise**' Ref 16 - IOA GPG 2013 by the Institute of Acoustics during May 2013. Referred to as the '**Good Practice Guide**' or GPG, the IOA noise working group claimed that the GPG was produced; *"In response to a request from the Department of Energy and Climate Change (DECC). The Institute of Acoustics (IOA) set up a noise working group (IOA-NWG) to take forward (where possible) the recommendations of the Hayes McKenzie Partnership Report on 'Analysis of How Noise Impacts are considered in the Determination of Wind Farm Planning Applications' Ref HM: 2293/R1 dated 6th April 2011."*

Release of the GPG was soon followed by critiques by independent groups. A preliminary review of the GPG titled; 'A Review of '**A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise**' REF 17 Ref 17 Cox GPG review 2013 was released shortly afterwards by Cox and others. A meaningful review of the GPG was not possible at this time as the IOA did not initially release the all important GPG Supplementary Guidance Notes that were claimed would provide the detail behind the new guidance. This preliminary review of the IOA GPG concluded:

- *"The Noise Working Group is almost entirely made up of representatives from the wind industry supply chain.*
- *No representatives from groups or consultants having an interest in protecting wind farm neighbours from turbine noise were included. Neither were any statisticians, meteorologists, health professional or academics included. By no stretch of the imagination can this new guidance be considered impartial or independently peer reviewed.*
- *The new guidelines make no significant changes to current practice so allow the wind industry to continue 'business as usual':"*

A paper presented at the 5th International Conference on Wind Turbine Noise at Denver during August 2013 by Mike Stigwood of MAS titled, '**Audible amplitude modulation - results of field measurements and investigations compared to psychoacoustical assessment and theoretical research'**, Ref 19 - MAS Paper Denver 2013 and Ref 19 - MAS Presentation Denver 2013 was a 'game changer' with respect to the recognition of amplitude modulation (AM).

The MAS paper fully refuted the long-held denial by wind industry acousticians that AM affects only a very few wind turbines, that its occurrence is infrequent and that it is difficult to predict. The paper summary includes;

"AM is generated by all wind turbines including single turbines. Propagation conditions, mostly affected by meteorology and the occurrence of localised heightened noise zones determine locations that will be affected. Measurements from eleven wind farms have been presented

and discussed in relation to current research and theory. Findings confirm that AM occurrence is frequent and can readily be identified in the field by measuring under suitable conditions and using appropriate equipment and settings."

MAS had by this time identified over 75 wind farms that were causing noise complaints.

Following further independent analysis of the IOA GPG, a meeting was held between independent campaigners and the Secretary of State Ed Davey MP along with DECC officials at Westminster on 9 October 2013. Two presentations were made. The first presentation by Unwin and Cox titled, '**A Summary of the 'Bad Science' behind the Wind Turbine Noise Guidelines**' Ref 20 - Unwin Bad Science 2013 focused on the bad science employed by the IOA NWG in the Good Practice Guide.

This presentation demonstrated the failure of the GPG to adequately allow for wind shear in the assessment process. Wind shear is a complex topic, and difficult for the layperson to understand, however, the treatment of wind shear is where we find the most serious consequences of the bad science on the assessment process and the most blatant attempt to mislead.

By manipulation of the methodology for assessing the wind shear effect, the Good Practice Guide mandates a sophisticated and deceptive averaging process for wind shear that fails to consider the periods when wind shear is higher than average. This methodology permits much higher noise levels to the advantage of the wind farm developer.

Additionally, the IOA NWG failed to demonstrate that a 'grown-up conversation' had taken place with the wider scientific community and that the outcome is demonstrably based on sound science. The second presentation by Stigwood of MAS Environmental titled, '**Evidence of failure of wind farm guidance to protect well being**' Ref 21 - Stigwood 2013 demonstrated the extent of the noise nuisance problem and included the statements:

- *"A large number of wind farms are causing noise complaints and obvious evidence of harm to well-being such as sleep disturbance (more than 75 we know of and likely to double) = ETSU-R-97 fails to protect.*
- *ETSU-R-97 is incapable of controlling / preventing adverse effects or being modified to achieve that purpose.*
- *Well-being of a significant minority of communities are being jeopardised for the policies.* ***Potentially between 80-160 wind farms causing problems and 1000's homes affected.***
- *Research shows Excess Amplitude Modulation (EAM) = main problem and caused by all large wind farms. It is common and not rare as suggested by UK Government policy."*

It is significant that all the wind farms causing noise complaints that MAS has investigated at this time were considered to be ETSU compliant. This alone provides evidence that ETSU is failing to protect wind farm neighbours.

Chapter 5: Industry recognition of amplitude modulation

It will have been likely that the wind industry had concluded for some time that they were losing the argument concerning amplitude modulation and that they needed to become more proactive. The industry response came during December 2013 when the UK wind industry trade body, RenewableUK (ReUK), released their research report (six documents) titled, '**Wind Turbine Amplitude Modulation**' Ref 22 - ReUK AM doc 1 2013, Ref 22 - ReUK AM doc 2 2013, Ref 22 - ReUK AM doc 3 2013, Ref 22 - ReUK AM doc 4 2013, Ref 22 - ReUK AM doc 5 2013, Ref 22 - ReUK AM doc 6 2013. This report being a clear response to evidence proving the prevalence and significance of AM provided by independent parties.

Now after years of denial of the significance of AM or even of its existence by the wind industry, continued denial was not feasible anymore. The ReUK report was accompanied by the introduction, *"The wind energy industry today publishes detailed scientific research into the identification, occurrence and resolution of an acoustic characteristic known as Other Amplitude Modulation (OAM). This work, led by RenewableUK is the largest study of its kind to date".*

The ReUK report was soon being analysed by independent parties. The first analysis appeared in the report by Moroney and Constable of REF and released March 2014. This report titled, '**The Efficacy of the RenewableUK (ReUK) Condition in controlling wind farm amplitude modulation (AM) noise**', Ref 24 - REF 2014 is highly critical of the ReUK template planning condition that was claimed would control AM and so protect wind farm neighbours.

The REF report compared the ReUK methodology with the Den Brook AM condition. The Den Brook AM planning condition was included with the planning permission for the Den Brook wind farm in Devon. Den Brook is discussed later and in detail at INWG WP4 where Mike Hulme documents the enormous efforts the wind farm developer, Renewable Energy Systems (RES) made first to have the planning condition not applied, then to have the applied planning condition removed. The REF report conclusions included:

- *" The proposed RUK AM condition would not be breached by recorded wind farm noise data with high levels of AM measured at Askam, a site widely recognised to be producing severe AM problems, and at Swaffham, from data where the AM is clear and significant in magnitude. By comparison, data from both the Askam and Swaffham sites would be in breach of the Den Brook AM condition.*
- *The authors conclude from these facts that the RUK AM condition is manifestly inferior to the Den Brook condition and does not offer to wind farm neighbours any realistic or significant protection against AM disturbance.*
- *The RUK AM condition is too complex and computationally intensive to provide a reasonably accessible and transparent methodology for assessing excessive AM noise.*

Even acoustic professionals will struggle with this method, and Local Authority Environmental Health Officers are extremely unlikely to have either the resources or the training to undertake such compliance tests. This is unacceptable, particularly when more effective alternatives, such as the Den Brook method, suffer no such defects.

- *The RUK condition method results in an understated value of the true peak-to trough levels of the AM noise. This is obviously unacceptable"*

This analysis by REF of the ReUK report highlights the attempt by the wind industry to introduce an opaque and dishonest methodology in the guise of 'controlling' AM.

The next critique of the ReUK report into AM was a presentation by campaigners at the IOA meeting at Newport on 20 March 2014. The presentation titled, **'A Critique of the RenewableUK report on wind turbine amplitude modulation'** Ref 25 - Cox Newport 2014 by Cox, Hulme, Sherman & Unwin included a detailed technical critique including the following comments:

- *"The ReUK report has highlighted aspects of turbine noise previously denied by the wind industry and includes an admission that the AM problem is 'too large to ignore'.*
- *The claims that AM is rare and infrequent have not been substantiated since no survey was carried out; however, evidence elsewhere shows it to be widespread.*
- *The report claims are not supported by the evidence from the study and indicates a disconnect between ReUK who commissioned the study and the authors who carried it out.*
- *The claimed root cause of OAM being blade stall is unproven and admitted to as such by the report authors. As a result, the proposed mitigation strategy, even if it was available would fail to work."*

Much of the ReUK report appeared to be a smoke screen to justify the replacement of the Den Brook AM planning condition, a planning condition that had already been shown to work.

The proposed ReUK planning condition would obfuscate and fail to trigger even with the most intrusive AM. This presentation at the IOA seminar fully rebutted the ReUK report arguments on the cause and solutions to AM.

Chapter 6: Formation of the Independent Noise Working Group

The damming criticism by independent parties to the IOA GPG and the ReUK AM report had a significant impact on the wind industry and policy makers. The IOA responded by forming a new AM working group and launching a new study into wind turbine amplitude modulation under the auspices of the IOA, with an announcement on the IOA website on 1 August 2014. This was accompanied by a Scope of Work document, Ref 26 IOA AM SoW 2014 providing details of the NWG members and affiliations. This new AM study was also announced by the President of the IOA to Ed Davey MP at DECC in a letter, Ref 27 - IOA Egan-Davey 2014 dated 7 August 2014. The letter also included the statement;

"The incidence of AM is reported to be increasing the number of complaints from onshore wind farms and a number of nuisance cases are understood to be currently being progresses through the courts. Without a Government steer on the matter of AM, it is likely that Judges may accept a lower threshold of acceptance than current Government support for onshore may suggest, which could restrict the roll-out of onshore wind in the UK".

This letter was seen by many as a clear case of the Institute of Acoustics lobbying government on behalf of the wind industry for a more permissive assessment regime for wind turbine noise.

The launch of this IOA AM study raised immediate concerns among independent campaigners around the country who were fighting the wind turbine noise problem. Over a period of just a few days these independent parties, experts and non-experts who had previously been loosely collaborating came together during August 2014 and formed the Independent Noise Working Group (INWG). All the INWG members were and still are volunteers, giving their time and expertise and meeting their own expenses. There being no external funding or sponsorship or a formal budget. The history of the INWG is available here, https://inwg.org.uk/history-of-the-group-and-founding-members/

The primary objective of the INWG at that time was to conduct an independent study into wind turbine noise AM that would be able to credibly challenge the methodologies and recommendations of the Institute of Acoustics sponsored AM study.

Chapter 7: Ethics and the Engineering Council

In a coordinated nationwide campaign, letters of complaint against the Institute of Acoustics and its Noise Working Group were sent to the Engineering Council during September 2014. The INWG are aware of at least 10 letters from organisation and individuals having been sent.

These letters questioned the IOA NWG's professional independence, its credibility, and compliance with the Engineering Council Codes of Conduct and Ethical Principles. It also questioned compliance with the IOA's own Code of Conduct and Ethical Principles. It was requested that the Engineering Council urgently investigate these allegations of bias in favour of the commercial interests of the wind industry, and of its consultants for prioritising commercial interests ahead of protecting the public from wind turbine noise and its associated effects on health.

Professional institutions including the Institute of Acoustics are regulated by the Engineering Council and are required to comply with the Engineering Council Codes of Conduct and its Ethical Principles. A template response letter, Ref 29 - Engineering-Council 2014 received by each of the complainants from the Engineering Council dated 17 October 2014 informed that the complaints against the IOA should be taken up directly with the IOA itself. This being a most unhelpful response given the circumstances.

Although the complaint letters to the Engineering Council failed to have any immediate effect on the unethical behaviour of the IOA NWG, it did highlight the way the 'Establishment' had closed ranks in support of wind power development. It became clearer now that establishment support extends to the retention of ETSU and its overly permissive noise limits. This was being given a higher priority than protecting public health and wellbeing.

However, the complaints did appear to have had some effect. On 19 December 2014 the IOA released a most extraordinary statement on their web site, Ref 32 - IOA statement 2014 and clearly in response to the criticism regarding the ethics of the IOA noise working group and connection with the wind industry. This highly defensive statement attempted to clarify their position and especially the criticism of the IOA Bulletin Method and the IOA GPG.

The IOA statement even implied that since their methodologies have been debated at planning inquiries and accepted by Planning Inspectors, they must therefore be correct. **The implications of this are an apparent abandonment of the 'Scientific Method' and a reliance on the politically directed Planning Inspectorate to be adjudicating the science.**

Chapter 8: Cotton Farm community noise monitoring

The Cotton Farm wind farm located in Cambridgeshire operates eight Senvion MM92 wind turbines, each rated at 2MW with a turbine rotor diameter of 92.5m and tip height of 126m. The wind farm commenced operation in January 2013 and very soon after started to generate noise complaints from the neighbouring villages. As a result, the local community decided to fund and install a long-term noise monitor.

Details of the community monitor project from a local community perspective are available at INWG Work Package 9 dated August 2015, titled, '**The Cotton Farm Monitor Experience**' Ref 53 - INWG WP9 Gray 2015 by Bev Gray. The objective of the community noise monitor was to obtain evidence of the noise that was affecting the community. It is also believed that this is the first time a long-term noise monitor has been established by a local community to monitor wind turbine noise.

WP9 abstract states, *"Existing wind turbines, as has been proven by the Cotton Farm monitor experience, should be constantly monitored and the data recorded. There has to be a clear understanding of the problems caused by noise and a clear directive for immediate action by the authorities and operators when unacceptable noise conditions do occur. The experience pioneered by the local community around the Cotton Farm wind farm proves this is not only practical but essential for legal and health reasons."*

The monitoring equipment was installed during 2013 and managed by MAS Environmental. MAS provided details of the noise monitor in two papers. The first paper titled, '**Initial findings of the Cotton Farm wind farm long term community noise monitoring project**' Ref 30 - Stigwood Cotton Farm 2014 by Stigwood, Stigwood & Large was presented November 2014 at Internoise, Melbourne. The paper abstract stated;

- *"This paper provides early results of a long-term study of community impact from wind farm noise and uses of the data obtained. A continuously recorded database of noise collected under different meteorological conditions has allowed detailed analysis of particular characteristics such as amplitude modulation and also the reliability of assessment methodologies for predicting and quantifying impact.*

- *Surprising outcomes are explored including upwind impact. In 2013 MAS Environmental established a permanent monitoring station to record and publish data online located 600m from the nearest turbine to correlate the impact upon the community and provide an extensive database. This paper maps the evolution of the project. Online data enables a wider study of the effect of meteorological change on noise immission in a flat eastern area of the UK."*

The second paper titled, '**Cotton Farm Wind Farm – Long term community noise monitoring project – 2 years on**' Ref 36 - Stigwood Glasgow 2015 by Stigwood, Large & Stigwood was presented at the 6th International Conference on Wind Turbine Noise, Glasgow April 2015.

This paper includes further evaluation of the now extensive database collected over nearly 2 years and how noise features correlate with community response and complaints. This includes analysis of some of the prominent characteristics recognized as a feature of the noise as created by this wind farm and how they impact. This part of the long-term study focuses on the parameters and procedures used to identify AM noise. Analysis of the inability of noise controls to reflect true impact in relation to Cotton Farm wind Farm data is also explored.

The paper Summary Findings following analysis of the Cotton Farm data show;

- "The quickest and most effective means of analysing the special characteristic AM within WTN is firstly through manual assessor checks. This provides a quick method of excluding unusable data that is not subject to the flaws in automated algorithms.

- Algorithms and procedures designed to automatically filter WTN datasets to exclude periods affected by extraneous noise but not exclude AM and based on FFT analysis of the BPF, have a high failure rate.

- FFT procedures are yet to be shown to provide efficient algorithms for this type of highly variable sound energy and can miss periods of impact, be falsely triggered by extraneous noise or simply fail to reflect impact. The main procedure developed by ReUK was found to permit highly intrusive, erratic and unreasonable noise.

- FFT derived procedures in a modified form to those currently presented by RES can be used as an extra evaluation tool to assist analysis of noise but only after initially filtering periods excessively corrupted by extraneous or absent AM.

- FFT procedures are unhelpful when dealing with sound data containing erratically varying AM and erratically varying extraneous noise sources. There are also problems identifying AM where there are other character features such as tonality or lower frequency noise.

- Impact from WTN containing special characteristics can best be assessed applying context procedures comparing against actual levels of background masking noise which are present during the periods of impact. This is best evaluated by comparing the periods before, during and after turbine switch off tests.

- Application of special character penalties to threshold limits such as contained in ETSU-R-97 does not reflect impact and fails to reduce excess levels of adverse noise.

- The revised standard BS4142 2014 has addressed concerns which led to its exclusion when ETSU-R-97 was written and now includes extended analysis of special characteristics in noise. This renders it suitable to WTN containing AM. Comparative tests show it is better suited at determining impact than ETSU-R-97 derived methods which are formulated on the absence of any significant character content.

- Many commonly held views over frequency and duration of AM, when it occurs and how it should be rated, require revisiting. In particular the cumulative effect of AM and other characteristics of the wind turbine noise need to be considered and not just modulation depth."

Wind turbine noise recordings from the Cotton Farm turbines and from other sites are available at the MAS website; https://www.masenv.co.uk/listening_room

Chapter 9: The Northern Ireland Assembly report

The report titled '**Report on the committee's inquiry into wind energy**' Ref 85 contained in seven volumes was produced for the Northern Ireland Assembly (NIA) and released March 2015. This full inquiry into wind energy conducted by the NIA Committee for the Environment provides what is probably the most comprehensive and credible review of the impacts of wind turbines carried out at that time.

The report stated that the issue of wind turbine noise was the most contentious aspect of the inquiry. The key recommendations from the report regarding wind turbine noise included:

"The Department should review the use of the ETSU-97 guidelines on an urgent basis, with a view to adopting more modern and robust guidance for measurement of wind turbine noise, with particular reference to current guidelines from the World Health Organisation. The Department should bear responsibility for ensuring that arrangements be put in place for on-going long-term monitoring of wind turbine noise"

ETSU was heavily criticised in the NIA report, which suggests that the current BS4142 revision (BS4141:2014) be considered when determining if ETSU should be updated. **While the Northern Ireland Assembly report was highly significant and credible with its damming appraisal of ETSU, it appears to have been totally ignored by the UK establishment including the IOA.**

Chapter 10: The INWG amplitude modulation study

After almost a year of intensive work, the INWG study into wind turbine noise and amplitude modulation was nearing completion by early summer 2015. In order to present the preliminary INWG findings and recommendations to government, a meeting was held at Westminster with government ministers on 7 July 2015 facilitated by Chris Heaton-Harris MP. During this Westminster visit separate meetings were held with James Wharton MP (DCLG), Liz Truss MP (DEFRA) and Jane Ellison MP (Dept of Health). At these meetings INWG presented the document, '**Discussion document for meetings with Government Ministers'** Ref 40 - INWG Discussion doc July 2015. The study findings:

- *"EAM occurs frequently, often for extended periods and can affect all wind turbines.*
- *Confirmed there are ill health effects at the noise levels and separation distances permitted by ETSU.*
- *Without an AM planning condition there is no effective legal remedy against AM noise. Local authorities are unable to deal effectively with AM*
- *LFN is relevant to AM and an integral component of WT noise.*
- *ETSU is not 'fit-for-purpose' (Northern Ireland Assembly report, Jan 2015 recommends that ETSU be reviewed on an urgent basis)."*

The study recommendations:

- *"ETSU noise guidance to be replaced with a code of practice based on BS4142:2014*
- *Independent research required into the health effects of wind turbine noise including AM, LFN and infrasound.*
- *An effective AM planning condition is required for every wind turbine planning approval.*
- *Continuous noise monitoring should be required for every wind turbine planning approval.*
- *Effective remedy required for retrospectively dealing with noise nuisance including AM from existing wind turbines"*

Mike Stigwood of MAS also presented their discussion document '**Amplitude Modulation Discussion Document**' Ref 41 MAS AM Discussion doc July 2015 This included their recent findings regarding AM and the extent of the noise problem with several wind farms.

The INWG study work packages were released during October 2015 and became an important milestone in the campaign to replace ETSU. It was a huge achievement and demonstrated what a dedicated team of volunteers working remotely from each other, without a formal organisation or budget could achieve when suitably motivated.

The scope of the INWG study was considerably wider than that adopted by the IOA for their study, and it was completed in only one year, achieving all its original objectives. Importantly, the INWG AM study proved to be highly credible, enabling it to successfully challenge the findings of the IOA study and is still relevant today. The INWG study consisted of multiple work packages summarised as follows:

WP 1; The Fundamentals of Amplitude Modulation of Wind turbine Noise

By Dr John Yelland, Ref 42 - INWG WP1 Yelland 2015 who investigates the science behind wind turbine noise and amplitude modulation. **Yelland provides what is arguably the most comprehensive discussion to date on the science behind wind turbine noise.**

Yelland is highly critical of current industry practice to exclude the measurement of low frequency noise below 100Hz based on the assumption that '**what you can't hear can't hurt you**'. WP1 also includes a critical analysis of the of the ReUK AM report from December 2013.

WP 2.1; Review of Reference Literature

By Richard Cox, Ref 43 - INWG WP2.1 Cox 2015 who presents the results of a review of the available literature on wind turbine noise (WTN). Over 160 documents are included in the review and of these at least 85 documents are technical in content. This contrasts with the IOA AMWG literature review, which lists a total of just 35 documents. WP2.1 executive summary states,

"Throughout the period reviewed, aided by its acoustic, political and legal consultants, the UK wind industry has sought to hide the true science behind WTN and its effects on people through a concerted strategy of obfuscation and political lobbying. Studies under the auspices of the Institute of Acoustics (IOA), by the wind industry and government into AM and its excess (EAM) are shown to be a diversion to avoid answering the scientific questions that really matter. This has been aided by compliant government officials who have been focused on removing barriers to the deployment of wind power generating capacity and by the wind industry effectively taking control of the IOA's successive 'Noise Working Groups'."

WP 2.2; AM Evidence Review

By Sarah Large of MAS Environmental, Ref 44 - INWG MAS WP2.2 Large 2015 who looks primarily for evidence of audible amplitude modulation noise in support of its existence and prevalence. **Amplitude modulation (AM) can be defined as the regular (cyclic) variation in noise level, usually at blade passing frequency, which exhibits a change in the noise character of the wind farm noise as the decibel level rises and falls**.

The executive summary states; *"The data described below is conclusive that AM exists and it shows AM is being generated by the majority of wind energy developments. It also shows that AM can be generated by all turbines regardless of size, model or type. AM is not rare but is*

prevalent and whilst meteorology may not be the sole determinant, under certain meteorological conditions adverse AM can occur for long periods of time."

WP 3.1; Study of Noise and Amplitude Modulation Complaints Received by Local Planning Authorities in England

By Trevor Sherman, Ref 45 - INWG WP3.1 Sherman 2015 who analyses responses from a survey of local planning authorities (LPAs) to determine the extent of the wind turbine noise problem across England.

The executive summary, at para 1.3 'Extent of the problem' states: *"In England, of the 203 responses to the survey 54 LPAs have received complaints about noise from industrial wind turbines. This should not be interpreted as 27% of wind farms giving rise to noise complaints; many of the LPAs which reported no complaints may well have no operating wind farms in close proximity to housing. Of the 54 LPAs, 17 have also investigated complaints about EAM. Over 600 individual complaints had been received with the majority being in the five year period 2010-14."*

at para 1.4 'Awareness of Mitigations' states; *"…Some LPAs show strong confidence in ETSU-R-97 ('ETSU') and its companion Good Practice Guide (GPG). Others challenge its validity and are seeking a more robust way to deal with EAM at all stages in the application and development process. They are calling for objective science-based guidance on measuring and testing for EAM as well as nationally agreed standards that are consistently applied and proven mitigations for EAM. There are many frustrations with the current arrangements."*

WP 3.2; Excessive Amplitude Modulation, Wind Turbine Noise, Sleep and Health

By Dr Christoper Hanning, Ref 46 - INWG WP3.2 Hanning 2015 with contributions by Prof Alun Evans, Carmen Krogh and Dr Sarah Laurie who summarizes the effects of Excessive Amplitude Modulation (EAM) on people living close to wind turbines. This includes annoyance, sleep disturbance and health effects through a review of the available health related literature. His report discusses ETSU's inability to protect noise sensitive receptors from sleep disruption and therefore harm to their health and in this context to consider the contribution of EAM.

The executing summary states; *"A large body of evidence, presented below, demonstrates that human sleep and health are adversely affected at wind turbine noise levels permitted by ETSU. There is particular concern for the health of children exposed to excessive wind turbine noise. The inadequate consideration of excessive amplitude modulation (EAM) is a major factor in the failure of ETSU to protect the human population."*

WP 4; Den Brook

By Michael Hulme, Ref 47 - INWG WP4 Hulme 2015 who documents the legal, planning and technical issues surrounding the Den Brook AM planning condition (2009). This work package details the enormous effort Renewable Energy Systems (RES), the wind farm developer, has gone to over the previous 8 years to ensure first that an AM planning condition is not applied, then to have the applied planning condition removed, and finally to have it sufficiently weakened, presumably to ensure it prioritises operation of the wind farm rather than provide the intended protection against EAM.

The Den Brook wind farm and Michael Hulme gained national fame with the four-part BBC documentary titled '**Wind Farm Wars**' screened during 2011. This documentary is still available on YouTube at; Wind Farm Wars BBC 2011

WP 5; Towards a draft AM Condition

By Sarah Large, Ref 48 - INWG MAS WP5 Large 2015 who investigates options for the control of AM. Four main methods for assessing or limiting EAM have been critically examined in this work package. The executive summary at para 1.8 states;

"The 2014 version of BS4142 was also used to assess impact at two of the six sites. BS4142 has previously been dismissed, both in ETSU-R-97 and by others, as an appropriate means of control for wind farm noise. The issues raised to support these arguments have been examined below and found inapplicable to the new version of the standard. BS4142:2014 was found to work very well for assessment and control of cumulative wind farm noise and character impact."

WP 6.1 & WP 6.1A; Legal Issues: The Control of Excessive Amplitude Modulation from Wind Turbines

By Richard Cowen, Ref 49 - INWG WP6.1 Cowen 2015 who considers the legal issues surrounding wind turbine noise nuisance. The scope of WP6.1 includes:

- To assess the legality of the Den Brook Condition relating to EAM following the judgement of the Court of Appeal;
- To assess the legal appropriateness of other remedies such as Statutory and Private Nuisance that have been recommended since that judgement or may be available to persons affected by EAM;
- To recommend the most appropriate course of action that will provide legal protection to residents hosting wind farms should EAM occur.

In the Supplementary Paper 6.1A, Ref 50 - INWG WP6.1A Supp Cowen 2015 Cowen considers the legal issues for claimants relating to shell companies.

WP 6.2; Control of AM noise without an AM planning condition using Statutory Nuisance

By Bev Gray, Ref 51 - INWG WP6.2 Gray 2015 who reviews from a community perspective the practical experiences and causal effects of Statutory Nuisance laws when used as a means of protection from Excessive Amplitude Modulation (EAM). The scope of WP6.2 includes:

- Review EAM noise nuisance complaints procedures and the difficulties of applying Statutory Nuisance by local authority officers.
- Proposals to ensure a more effective method of EAM control than the existing statutory nuisance.

WP 8; Review of Institute of Acoustics Amplitude Modulation Study and Methodology

By Richard Cox, Ref 52 - INWG WP8 Cox 2015 with contributions by Richard Cowen, Bev Gray, Melvin Grosvenor, Chris Hanning, Mike Hulme, Les Huson, Trevor Sherman, Mike Stigwood & John Yelland.

WP8 reviews the activities of the Institute of Acoustics and its Noise Working Groups with respect to wind turbine noise amplitude modulation. WP8 takes a highly critical look at the IOA noise working group's AM study and their methodologies. It should be noted that the IOA AM study final report was not released until August 2016. As a consequence, the INWG review, designated as WP8.1, of the IOA report and the WSP / Parsons Brinckerhoff report, was delayed and subsequently released January 2017.

WP8 executive summary concludes with: *"The recent decision by DECC to award the contract for an 'independent study into AM' to WSP / Parsons Brinckerhoff ensures that Richard Perkins as Technical Director of the Acoustics, Noise & Vibration Team at WSP / Parsons Brinckerhoff and also as Chairman of the IOA NWG and a senior member of the IOA Council is now able to influence both AM studies. The conclusion to be drawn is from all of the above is that the long term wind industry strategy of obfuscation, whilst capitalising on the IOA's trusted and respected position as a scientific institution is set to continue."*

Following complaints by the INWG regarding the undue influence of Richard Perkins, he was subsequently withdrawn from the IOA NWG and was replaced by Gavin Irvine of Ion Acoustics.

WP 9; The Cotton Farm Monitor Experience

By Bev Gray with contributions by Jeff Tossell, Ref 53 - INWG WP9 Gray 2015. WP9 provides a review of a rural community's experience in setting up and carrying out long term continuous noise monitoring and recording of wind farm noise. The long-term noise monitor experience pioneered by the local community around the Cotton Farm wind farm proves this is not only

practical and cost effective but essential for contesting noise nuisance.

Wind turbine noise recordings from the Cotton Farm turbines and from other sites are available at the MAS website; https://www.masenv.co.uk/listening_room

WP10; Two Decades of Deception

By Cox, Cowen, Gray, Hanning, Hulme, Sherman & Yelland of INWG and Large of MAS Environmental, Ref 54 - INWG WP10 Cox 2015. WP10 summarises all the Work Packages and brings forward the INWG's key finding and recommendations. The number one recommendation to government being:

As recommended by the Northern Ireland report of January 2015, ETSU should be replaced with a procedure based on the principles of BS4142: 2014. This will bring wind turbine noise assessment into line with other industrial noise controls. New guidance of this type should be formulated in a Code of Practice that sets out a BS4142: 2014 type methodology that reflects noise character and relates impact to the actual background noise level and not an artificial average.

Chapter 11: The INWG AM study launch

The completed INWG amplitude modulation study was launched at Westminster on 13 October 2015 at a meeting with Andrea Leadsom MP, Minister of State and Department of Energy and Climate Change and DECC officials.

The meeting was facilitated by Chris Heaton-Harris MP where INWG presented their '**Discussion document for DECC meeting**' Ref 55 - DECC Meeting INWG Oct 2015 including the findings and recommendation of the AM study to the Minister and DECC officials. The INWG AM study recommendations include:

- *"ETSU noise guidance to be replaced with a code of practice based on BS4142:2014*
- *Independent research is required into the health effects of wind turbine noise including EAM and LFN*
- *An effective AM planning condition required for every wind turbine planning approval*
- *Continuous noise monitoring (with data transparency) should be required for every medium & large wind turbine planning approval*
- *Effective remedy required for retrospectively dealing with noise nuisance including EAM from existing wind turbines*
- *Government should disassociate itself from the IOA until the conflict of interest and ethics issues are resolved and full transparency restored."*

MAS presented their '**AM Discussion Document**' Ref 56 - DECC Meeting Large MAS Oct 2015 including their 'experience of AM from multiple wind farms and how it is affecting people living near to the turbines. The character and features of the noise were discussed along with the extent of the problem and the effects it is having.

Two days later the INWG also presented the AM study at the IOA conference at Harrogate October 2015. The INWG paper titled, '**Wind Turbine Amplitude Modulation & Planning Control Study**' Ref 57 - INWG AM Study paper Harrogate 2015 by Cox, Cowen, Gray, Hanning, Hulme, Sherman, Yelland & Large was published in the Proceedings of the Institute of Acoustics conference, October 2015; (Vol.37. Pt.2 2015). The presentation with the same title Ref 58 - INWG AM Presentation Harrogate 2015 was delivered at the conference on 15 October 2015.

The INWG then followed up the presentation of the AM study with a press release via the INWG political sponsor Chris Heaton Harris. The **'INWG Press Release'** Ref 59 - INWG Press release DECC 13102015 based on WP10 included, quote;

"The wind industry and its acousticians have for many years been denying there are noise related problems associated with industrial wind turbines. A report released this week, and presented to the Department of Energy and Climate Change by the Independent Noise Working Group (INWG), shows how a small group of wind industry funded acousticians have

taken control of the Institute of Acoustics (IoA) noise working groups. This façade of respectability afforded by the Institute of Acoustics has enabled the wind industry to dominate government noise assessment policy and planning guidance by providing inaccurate and misleading scientific advice. The parallels with the Volkswagen emission scandal are quite remarkable."

Chapter 12: The wind industry fights back

The IOA NWG finally released their amplitude modulation study report on 9 August 2016. The study titled, '**Final Report - A Method for Rating Amplitude Modulation in Wind Turbine Noise**' Ref 60 - AMWG Final Report-09-08-2016 was authored by Bass, Cand, Coles, Davis, Irvine (Chair), Leventhall, Levet, Miller, Sexton and Shelton. It was subsequently presented at the Internoise conference in Glasgow on 23 August 2016.

At the same Internoise conference, WSP / Parsons Brinckerhoff (WSP/PB) presented the results of their research into AM, commissioned by the government DECC. The paper titled, '**A review of research into the human response to amplitude-modulated wind turbine noise and development of a planning control method**' Ref 61 - WSP AM paper Inter.noise 2016 was authored by Perkins, Lotinga, Berry, Grimwood & Stansfield.

Although the WSP/PB report was presented at the Internoise conference, the full report was withheld for reasons unknown. Following a Freedom of Information (FOI) request, an undated and redacted version of '**WSP/PB wind turbine AM report**' Ref 62 - WSP PB-AM-Proposalv5redacted-April2015 was eventually released on 25 October 2016.

On 7 December 2016 the IOA held a Workshop at Birmingham titled, '**ETSU-R-97 - Time to move on**'. A presentation was given by McKenzie & Bullmore titled, '**What might an Alternative to ETSU-R-97 Look Like?'** Ref 63 - IoA WT Noise 2016 McKenzie and Bullmore.

McKenzie and Bullmore are leading wind industry acousticians with Bullmore being one of the original authors of ETSU. In their Birmingham presentation they advocated two variations on the existing ETSU methodology, plus a third option to simply continuing with ETSU as it is.

It appeared incredible that BS4142 as the UK noise guidance standard that applies to virtually all other similar industries was not even considered.

The MeKenzie, Bullmore paper showed a realisation that after years of criticism of ETSU, it would eventually be replaced with something. **The problem for the wind industry is how to replace ETSU with something equally or more permissive that will permit a continuation of 'business as usual' and in addition facilitate the deployment of the new generation of larger and noisier wind turbines?**

It is also clear why the wind industry has avoided any consideration or even any mention of the industry standard, namely BS4142 for wind turbine noise assessment in their studies and reports. Adopting BS4142 would constrain turbine deployment at some locations as it would require greater separation from housing and schools as is necessary to protect residential amenity against the adverse noise impact. This is seen as an economic threat to the wind industry and a policy threat to government driven by Net Zero targets.

Following the release of the IOA NWG AM study and the WSP/PB research into AM for the government, the INWG conducted a detailed review of both reports and published the results as a belated AM study work package designated WP 8.1**.** **WP8.1** titled, '**Review of WSP/Parsons Brinckerhoff and Institute of Acoustics Amplitude Modulation Studies**', Ref 64 - INWG WP8.1 Cox 2017 and '**WP8.1 Appendices**', Ref 64 - INWG WP8.1 Appendices Cox 2017 by Cox, Cowen, Gray, Grosvenor, Hanning, Hulme, Huson, Sherman, Stigwood & Yelland was released on 12 January 2017.

WP8.1 highlights the coordination between the IOA NWG and the WSP/PB acousticians, all who are closely connected with the wind industry. Then when tested, their recommendations for controlling AM were shown to fail.

Les Huson of L Huson Associates tested the IOA NWG report hybrid AM methodology using real turbine noise data and this is shown at **WP8.1 Appendices F and G**. The conclusion from this preliminary testing, is that the AMWG measurement metric under records the actual level of AM at best and will completely miss recording intermittent AM and situations where there are multiple turbines operating at different rotational speeds.

WP 8.1 revealed that these latest IOA NWG and WSP/PB AM proposals are basically reworked versions of the heavily criticised 2013 ReUK AM study proposed methodology, with some of the same authors involved. However, the following important admissions are made within these latest two reports after many years of denial:

- *"That modulating WTN-like sounds are more annoying than similar noise levels without significant modulation.*
- *The threshold of perception of AM is around 2dB and increasing modulation depth is associated with increased annoyance. That where there are high levels of AM, the adverse effects could be significant and on this basis a control for AM is required.*
- *That wind turbine related noise annoyance is associated with increased risk of sleep disturbance and stress. Additionally, the annoyance increases during normal resting periods during the late evening, night-time and early morning. However, the potential impacts on health are still not accepted by WSP/PB, and other reports which do suggest a causal link are heavily criticised.*
- *That AM cannot be predicted at the planning stage so the likely default position for a planning decision maker should be to apply an AM planning condition unless there is good reason not to."*

The WSP / PB report, Ref 62, WSP PB Phase 2 report WT AM at para 3.3.87 makes unsubstantiated claims regarding non-acoustic factors (such as general attitudes to wind energy) as contributing to annoyance to noise from wind farms. This being a continuation of the not-so-subtle wind industry attempts to shift the blame for noise complaints from the source of the noise to the attitude of the complainant. This approach by wind industry acousticians acting well outside their areas of competence is rebutted in WP8.1 Ref 64 Appendix C, page 4.

A meeting to present the INWG analysis of the IOA NWG AM study and the WSP/PB AM research was held at Westminter with the Energy Minister Jessie Norman MP and DECC officials on 1 March 2017. INWG were represented by Cox, Cowen, Gray, Grosvenor & Yelland with MAS represented by Stigwood & Large. The meeting was facilitated by Chris Heaton-Harris MP and supported by constituency MPs, Heidi Allen MP, Victoria Atkins MP and Natascha Engle MP.

The '**Discussion Document**' Ref 65 - INWG discussion doc DBEIS meeting Mar 2017 was presented and the key messages conveyed to the minister were:

- **That the WSP/PB report is not only 'unfit for purpose' but is downright misleading and should be rejected by Government.**
- **That there is a clear attempt in this report to bury the health effects of WTN despite overwhelming evidence to the contrary.**
- **What the combined Parsons Brinckerhoff and Institute of Acoustics reports propose is virtually the same AM control scheme as proposed by RenewableUK in their 2013 report. This report by the wind industry trade association was heavily criticised at the time and was shown not to control AM.**

INWG repeated the recommendation that ETSU be replaced by BS4142 and referred to a FOI response dated 3 Feb 2017 that released government internal emails showing:

- **Confirmation that if ETSU is withdrawn, BS4142 could be used to fill the gap.**
- **Context aspect and noise limits would need to be applied**
- **BS4142 could result in some planning applications being rejected that would be granted under ETSU**

Although INWG WP 8.1 was delayed while awaiting the IOA and WSP/PB reports, it became arguably the most important INWG work package as it exposed the extent of the deception by wind industry acousticians, facilitated by complicit government officials.

There is no doubt that the forensic examination and exposure of the IOA NWG AM study and the WSP/PB research into AM report by the INWG through WP8.1, became a serious embarrassment and setback to the wind industry and government.

Chapter 13: WSP review of noise guidance

Following the release of INWG WP8.1 and its communication to government in 2017 there was no visible progress for several years. It was only during the summer of 2021 that campaigners discovered a government DBEIS contract had been awarded to WSP to review the noise guidance (ETSU) for onshore wind.

The first stage of this contract was a stakeholder engagement survey with a closing date of September 2021. This consultation was by invitation only and the INWG were clearly not invited. It was only following a request directly to DBEIS that the INWG was allowed to participate, and by then at a very late stage in the proceedings. However, an INWG consultation response was submitted to WSP on 24 September 2021, see, INWG response DBEIS Sept 2021.

There was no further communication with DBEIS or WSP following the September 2021 consultation until the final WSP report was released on 10 February 2023. The report titled, '**A review of noise guidance for onshore wind turbines**' Ref 79 - WSP Lotinga Linkedin Feb 2023 by Michael Lotinga and Toby Lewis of WSP was released on the WSP website. However, the report to government is dated October 2022, so had been withheld for over three months for reasons unknown.

This 400-page WSP report was subsequently analysed by the INWG. The INWG report titled '**Analysis of WSP Report titled: A review of noise guidance for onshore wind turbines**' Ref 81 - INWG Analysis of WSP report April 2023 by Cox, Crosthwaite, Gray & Grosvenor was released and submitted to the government DESNZ on 15 April 2023.

The INWG analysis of the WSP report, concluded that this review of ETSU by WSP is heavily biased with obvious conflict of interest, also;

- *"In the evidence review, WSP admit to examining a restricted evidence base and utilising an inferior review methodology.*
- *The stakeholder survey was by invitation only and judged to be highly deficient and unbalanced. Unsolicited consultation responses however relevant were ignored by the authors and were not considered in the WSP review.*
- *The LPA consultation response rate of just 9% is highly questionable. This compares poorly against the 77% response rate achieved by the INWG to a similar survey during 2014, documented at WP 3.1.*
- *Despite the deficient study methodology and stakeholder consultation, the limited evidence reviewed within the report clearly shows that ETSU is unfit for use and should be replaced."*

Given the strength of the evidence revealed within the WSP report, there is a clear and obvious disconnect between this evidence, and the report's conclusions and

recommendations. **This leads to the conclusion that the WSP report recommendations were predetermined.** The INWG recommendations communicated to government DESNZ included:

- *"Reject the recommendations made by WSP in their review for ETSU-R-97 to be retained albeit with some revisions.*
- *Replace ETSU-R-97 with BS4142:2014+A1:2019 as the official guidance for wind turbine noise assessment.* **(Table 1 at page 26 of the INWG report provides a comparison of the key features of BS4142 with ETSU).**
- *Reject the WSP suggested proposal for a government 'position statement' on low frequency noise. This proposal is unsupported by the evidence and would conflict with the World Health Organisation (WHO) position.*
- *Conduct independent research into the effects on health and well-being of wind turbine neighbours including impacts from long term exposure, low frequency noise, infrasound, amplitude modulation and tonal noise as recommended by the WHO.*
- *Introduce licencing and regulation of wind power generation by a national agency such as the Environment Agency. This to include continuous monitoring and recording of noise and turbine data (SCADA) with the data available for compliance and complaint purposes."*

The WSP review of ETSU took over 2 years to complete. Based on experience with previous government reports, it is highly likely that draft versions were reviewed and amended by government officials until the desired conclusions and recommendation were achieved.

As a result of the INWG analysis, it is considered by campaigners that this review of ETSU by WSP has been a whitewash and the report recommendations were predetermined. Additionally, there is the suspicion that the WSP review of ETSU is being used as the basis of justifying a replacement for ETSU that will permit even higher levels of noise, both audible and infrasonic. A more permissive guidance will be essential on order to permit the planned deployment of the new generation of much larger onshore wind turbines being justified by Net Zero targets.

In what appears to be a response by the WSP authors to the INWG analysis of their ETSU review, a two-part article was published in the IOA Acoustic Bulletin. The articles titled, '**Onshore wind turbine noise: A review of the current guidance framework for the UK Government – Part 1**', Ref 83 - Acoustics-bulletin-Sept 2023 appeared in the Sept/Oct 2023 edition at page 26, and the 2nd article titled, '**Onshore wind turbine noise: A review of the current guidance framework for the UK Government – Part 2**', Ref 84 - Acoustics-bulletin Nov 2023 appeared in the Nov/Dec 2023 edition at page 26.

Part 1 describes the project background, aims and methodologies employed. As such it generally summarises content from the main report and was not controversial. Part 2 was expected to continue with a summary of the evidence, conclusions and recommendations from the main report. However, instead it focused on what appears to be a response to

criticisms including the INWG critique of the WSP report. **Importantly, there are now also some highly significant U-turns by WSP in the article compared to the original WSP report to government.** These are discussed below in the INWG Briefing paper released March 2024.

The INWG requested the IOA to be allowed to publish an article in the Acoustics Bulletin in order to respond to the two WSP articles published in the September and November 2023 editions. The IOA initially agreed to the INWG request but rejected the proposed INWG article, listing several objections. A revised article addressing all the IOA objections was subsequently submitted. This second version was also rejected but no reasons were given for the rejection this time.

However, the INWG were invited to submit a '**Letter to the Editor**'. The IOA did finally agree to the submitted INWG letter titled, '**Onshore wind turbine noise guidance**'. However, publication was delayed to the May 2024 edition, available here; **Ref 90**, IOA Acoustics Bulletin May 2024 at page 60.

The attempt by the INWG to have the IOA publish a response to the WSP articles in the Acoustics Bulletin was met with strong resistance and delaying tactics. There can be no doubt that the IOA were acting to stifle independent scrutiny of their acousticians.

The INWG released a Briefing Paper titled, '**Onshore wind turbine noise guidance**', Ref 89 - INWG Briefing Paper March 2024 on 28 March 2024. The paper authored by Cox, Cowen, Crosthwaite, Gray & Grosvenor was written to provide an update on the INWG report titled, '**INWG Analysis of WSP Report**' dated April 2023 and to incorporate an assessment of the two-part article by WSP published in the IOA Acoustics Bulletin promoting their review of ETSU to government. There is no doubt that the WSP authors had read the INWG critique from April 2024 of their report on ETSU, as the subsequent articles in the Acoustics Bulletin were in effect a response to that INWG critique. Additionally, in their Acoustics Bulletin articles, the WSP authors appeared to make some significant U-turns from their original report:

- The WSP authors discuss noise limits at length, pointing out that the ETSU pass/fail outcome is inconsistent with the wider policy frameworks in England and Northern Ireland. These frameworks require noise impacts to be addressed in a more nuanced way.
- The WSP authors discuss and now appear to recommend the use of LA_{eq} for noise measurement, instead of LA_{90} as is currently mandated by ETSU. This is a significant change from the main WSP report.

It should be noted that adopting BS4142 would address both these issues. **In what seems to be a most significant U-turn, the WSP authors now recognise, if only indirectly that there may be some merit in the BS4142 type assessment methodology and use of LA_{eq} in place of LA_{90}.**

Chapter 14: Legal judgements

The difficulties in successfully taking legal action against a wind farm operator for noise nuisance has been discussed within the INWG AM study at WP6.1 and WP6.2. At WP6.1 Richard Cowen considers the legal issues surrounding wind turbine noise nuisance. At WP6.2 Bev Gray reviews from a community perspective the use of Statutory Nuisance laws as a means of protection from wind turbine noise.

In the event of noise complaints, the ETSU noise guidance is generally followed by local authorities (LPAs). ETSU permits the wind farm operator to conduct lengthy noise surveys that will generally allow them to claim the noise complies with the guidance, the noise limits and planning conditions. LPAs have been found to be extremely reluctant to pursue noise nuisance cases by taking on wind farm operators. As a result, claimants are effectively abandoned by their LPA at this point, usually after a lengthy investigation process. The legal and cost barriers to taking legal action are such that it is an extremely difficult route for wind farm neighbours to take. However, a few cases have proceeded with varying degrees of success.

The first high profile wind turbine noise nuisance legal case dating from 2011 known as, '**Davis v Tinsley, Watts, Fenland Windfarms Ltd, EDF Energy PLC & Fenland Green Power Co-operative Ltd**', also known as the '**Jane Davis case**' gained the attention of the national press. The article dated November 2011 by Jacqueline Cook of Shepard and Wedderburn LLP titled, '**Wind farms and noise nuisance – another chink in the armour**', Ref 11- Davis v Tinsley Shepherd Weddersburn Nov 2011 describes the landmark nuisance legal case, brought by Jane Davis against the operator of the Deeping St Nicholas wind farm.

The Davis family had been forced to vacate their home due to the unbearable turbine noise and became the first high profile legal case where they managed to successfully bring a nuisance case against the wind farm developer. Fortunately for Jane Davis, but unfortunately for others suffering in similar circumstances, the Jane Davis case was settled out of court before a judgment could be made and a legal precedent established. This meant that details of the case and the financial settlement were subject to a confidentiality agreement. **In doing so, the wind industry avoided the creation of a legal precedent that could have had widespread implications for other noise complaints.**

The Cook article makes clear the very high burden of proof that any claimant must overcome in order to succeed with a noise nuisance case. For many affected individuals they are forced to suffer in silence as the legal costs alone prevent them from taking nuisance action.

The '**Coventry and Laurence**' judgement from February 2014 may have significant implications for nuisance cases in the future. This Supreme Court judgement, '**Coventry and others (Respondents) v Lawrence and another (Appellants)**', Ref 23 - Coventry v Lawrence 2014 although not a wind farm case it does deal with noise as a nuisance and is relevant for wind

turbine noise nuisance cases. This judgment deals with issues such as the ability to acquire a right to commit a noise nuisance and 'coming to the nuisance' that may need new approaches.

An important implication of the Coventry and Lawrence judgement is that a planning condition does not authorise a person to commit a nuisance. Compliance with a planning condition does not mean that a nuisance has not been committed.

The next successful legal judgement was at the Sheriff Court of Grampian, Highlands and Islands at Aberdeen for the noise nuisance case of '**Milne against Stuartfield Windpower Limited'**, Ref 74 - Milnes v Stuartfield Judgment May 2019. This May 2019 judgement was unusual in two respects:

- The case was not settled out of court and a judgement was reached. It therefore created a legal precedent in Scotland, but not in England.
- The judgement was based on the evidence from the lay witnesses, and not the acoustic experts.

An article covering the Milne case written by Laura Tainsh at law firm Davidson Chalmers Stewart, Ref 76 Tainsh Milne v Stuartfield 2019 states that, *"compliance with specific noise provisions in a planning condition does not prevent claims for statutory nuisance".*

Additionally, a Press article in the independent '**Noise Bulletin'** titled **'Turbine nuisance action succeeds'**, Ref 75 - Turbine Nuisance Case NB March 2019 stated; *"As this case will no doubt be used as a precedent for future actions, and the order itself used as a template for future injunctions".*

This judgement under Scottish law would not create a legal precedent in England, but should be taken into account in any future cases in England. **This judgement confirms that compliance with specific noise provisions in a planning condition does not prevent claims for statutory nuisance.**

The '**Noel Uren and John Zakula v Bald Hills Wind Farm PTY LTD**' judgement, Ref 78 - Bald Hills judgement March 2022 at the Supreme Court of Victoria in March 2022 created a legal precedent in Australia. Although not creating a legal precedent in the UK, the '**Bald Hills**' judgment it is still relevant as the noise standards and legal system are both similar to the UK. In this judgement quote; *"Noise found to be substantial and unreasonable interference with plaintiffs enjoyment of land."*

The '**Meenacloghspar (Wind) Limited Judgement'**, Ref 88 - Meenacloghspar-judgement-March-2024 delivered by The High Court, Ireland during March 2024 created a legal precedent in Ireland. Although not creating a legal precedent in the UK, it is relevant to the UK due to the similar legal system and common use of the ETSU noise guidance. The case between Margaret Webster and Keith Rollo & Ross Shorten and Joan Carty as Co-Plaintiffs and Meenacloghspar (Wind) Limited as Defendants concerned noise nuisance.

This judgement is also important in that it highlights the extreme suffering experienced by these wind farm neighbours due to wind turbine noise. Justice Emily Egan, found in favour of the plaintiffs despite potential compliance of noise levels because, according to plaintiff testimony:

- *Even with the windows closed, and despite wearing professional noise cancelling headphones, the noise and vibrations caused by the turbines still disturbed sleep.*

- *Sleep patterns remained extremely disrupted, and on many nights, plaintiffs would not get more than two hours sleep. This meant feeling frequently exhausted and stressed.*

- *Noise and vibrations would pass through the walls and could be "felt in the bones," with reverberations felt inside and outside the home.*

Although there was an acknowledgement that Amplitude Modulation was a factor, the case was largely judged on the evidence of the plaintiffs and not that presented by the expert witnesses. **Whether the operational noise levels were compliant with the ensuant planning conditions, was deemed to be of little relevance as with the Coventry & Lawrence judgement.**

These limited judicial successes in Scotland, Ireland and Australia have not been replicated in England, with just the Jane Davis case from 2011 coming close with an out of Court settlement. As a result, no legal precedent has been set in England.

The difficulty in succeeding with a Statutory Nuisance prosecution in England was demonstrated in 2021 with the Cotton Farm case, **Mr Keith Holl v Greencoat UK Wind UK**, [Ref 92]; Holl-v-Greencoat-noise-complaint-Cotton-Farm-2020

The Cotton Farm wind farm Statutory Nuisance case against the operator of the wind farm was brought by a local resident Keith Holl. This was after more than eight years of almost daily noise nuisance and thousands of complaints from the local community to the local authorities. The local community had effectively been abandoned by their LPAs leaving them to suffer in silence.

Following formal submission of the complaint to the Court on 21 January 2020, the defendant embarked on a text book case of obfuscation and delaying tactics to frustrate the legal process by exploiting a legal loophole. This included Greencoat plc the owner, and the operator, BayWa r.e. UK Ltd and BayWa r.e. Operations Services Ltd, frustrating attempts to identify the 'person responsible'. This was described in Court papers as;

"The repeated use of the corporate veil to shroud the identity of the operator is sufficient to raise a question in the mind of a layman as to whether information is being deliberately concealed.".

The case finally came to Court on 26 January 2021 and lasted two days. At the point when Mr Holl's acoustic expert was about to give evidence, the Greencoat team claimed this Statutory Nuisance complaint was a Criminal proceeding and as such the acousticians evidence was not admissible as it was now more than 6 months old.

As a result, the acousticians' evidence could not be given to the Court and the case was dismissed on a technicality.

What the Cottom Farm case demonstrates is the virtual impossibility for the victims of wind turbine noise to obtain justice under English law. This leaves wind farm operators effectively immune to prosecution for noise nuisance.

From a legal perspective, the issues that can be drawn from this case are;

1) The case was brought by an individual who claimed to be affected by a statutory nuisance under Section 82 of the Environment Protection Act 1990. This section enables members of the public to take proceedings if the local planning authority fails to act.

2) The proceedings are in the Magistrates Court and are "summary proceedings", i.e. they can only proceed in the Magistrates Court and not in the Crown Court. (Cases which must proceed in the Crown Court, such as murder, or may proceed there, such as theft, are not subject to this 6-month rule.)

3) Under Section 127 of the Magistrates Courts Act 1980, Summary Proceedings can only deal with **events that occurred within 6 months of the proceedings being started (i.e. when the Complaint or Information was received by the Magistrates Court). Anything that happened before the 6 months period is inadmissible as evidence** (although it MAY support evidence within the 6-month period)

4) Although proceedings under section 82 above are started by a "Complaint" (which relates to Civil as opposed to Criminal proceedings), if the Magistrates do find a nuisance has been committed, they can in England (but not in Scotland) impose a fine as well as make an order.

5) As a result of this, it is now settled law that proceedings for Statutory Nuisance in England are Criminal, not Civil, whatever Section 82 may say about "Complaint".

6) The Standard of Proof in Criminal Proceedings is 'Beyond Reasonable Doubt' whereas in Civil Proceedings it is 'On the Balance of Probabilities'. It is therefore much harder to prove a criminal case than a civil one.

7) In addition, in Criminal Proceedings the Criminal Procedure and Investigations Act 1996 applies and the prosecutor (i.e. the individual in 1 above) has to serve on the defence (i.e. the wind farm company) details of all the material that he has considered but not used which may

assist the defence or undermine his (the individual's) case. Many professional prosecutors, including the Crown Prosecution Service, have fallen foul of these requirements but in this case, an individual is expected to do it and get it right.

8) Statutory Nuisance when taken by an individual, as in the Cotton Farm case, therefore places a huge burden on the individual. **He must comply with all the above rules and if he does not, his case will fail as a result. This is precisely what happened in the Cotton Farm case and the wind farm company exploited all the above rules to their advantage**.

Chapter 15: Advances with low frequency noise

Some of the earliest research into low frequency noise from wind turbines was conducted by Kelly and others in the 1980s. INWG WP 2.1 titled '**Review of Reference Literature**', Ref 43 - INWG WP2.1 Cox 2015 dated July 2015 provides further details. Evidence from the 1980s confirmed that:

- People do indeed react to a low frequency noise environment; and
- A-weighted measurements are not an adequate indicator of annoyance when low frequencies are dominant

Concerns regarding low frequency noise were raised in the paper titled, '**Inadequate standards currently applied by local authorities to determine statutory nuisance from LF and infrasound**', Ref 2 - H Guest 2003 Inadequate standards by Hazel Guest published by the UK Noise Association in March 2003.

Although not specifically related to wind turbine noise, this paper examines the barriers experienced by those who complain to their local authorities about low frequency noise (LFN). However, the issues discussed relate to wind turbine LFN. The paper concludes that:

- *"The results of research in LFN and infrasound are not being communicated adequately to EHOs.*
- *The government's guidelines on levels for annoyance and nuisance are inadequate because they take into account neither individual differences nor the actual experiences of those who have been exposed to LFN for some time."*

The release of '**A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin**' report, Ref 14 - Wisconsin report Dec 2012 known as the '**Wisconsin report**' during December 2012 in the USA was a highly significant advance in the recognition of noise nuisance relating to low frequency noise including inaudible noise. Commissioned for the Wisconsin Public Service Commission, this paper consists of separate reports by four different consultants who between them represent both developers and resident groups. **Testing was carried out at several homes that the residents had been forced to abandon due to the wind turbine noise from the Shirley wind farm**. The overall report conclusions agreed by all four consultants included:

- *"Residents report being intensely affected despite inaudibility and to be aware of turbine operation even when the turbines are not visible",* also;

- *"the study also showed that a wind turbine is indeed a unique source with ultra-low frequency energy. In general, enough was learned by these investigators, all with quite different past experiences, that it can be mutually agreed that infrasound from wind turbines is an important issue that needs to be resolved".*

The Wisconsin report was followed by the paper '**The results of an acoustic testing program, Cape Bridgewater wind farm**', Ref 31 - Cape Bridgwater report 2014 Cooper in November 2014 by Steven Cooper. This appears to be a first of its kind in Australia or elsewhere, in that it was a joint exercise between a wind farm operator and residents. Additionally, this paper provided a significant advance in the recognition and understanding of low frequency effects.

Resident's observations identified 'sensation' as the major form of disturbance from the Cape Bridgwater wind farm.

By including narrowband analysis in the description of the acoustic environment, the study confirms that the infrasound obtained in a wind farm effected environment is different to that in a natural acoustic environment.

The Cape Bridgwater paper was highly praised by independent experts including Steve Ambrose from the USA who in a '**Letter to S Cooper**', Ref 33 - Ambrose Letter Cape Bridgewater to Cooper Jan 2015 dated 22 January 2015 stated, *"Congratulations, I commend you for pursuing scientific truth by investigating the human response to large wind-turbines in the acoustic environment. Your correlation of human response journal entries with scientific waveform analysis clearly shows hearing is not limited to audible sounds. Research continues to reveal that the ear has multiple functions and capabilities. This study merits recognition by acoustic and public health professionals for more research."*

The letter continued with, *"Your study goes far beyond the 1980s Neil Kelley et al. studies that identified operating wind-turbines can produce airborne transmissions that humans detect as "sensations". Bray/James research showed that one-third octave band filters could not measure the low-frequency peaks produced wind-turbines. Neighbors' complaints were ignored by the majority. Acoustic experts failed to understand the limitations of their instruments and analysis methods".*

The Ambrose letter highlights the concerns and issues with low frequency noise in the USA and Australia are exactly the same as in the UK. Also, that there are fortunately still a small minority of honest professional acousticians that are prepared to challenge the bad science that perpetrates throughout the wind industry.

An important reason for the lack of wider recognition of low frequency noise from wind turbines is the limitation of the sound meters used for noise measurement. The paper titled, '**Constraints imposed by and limitations of IEC 61672 for the measurement of wind farm sound emissions'**, Ref 38 - Huson constraints of IEC-61672 WTN Apr2015 presented by Les Huson at the 6th International Conference on Wind Turbine Noise, Glasgow in April 2015 discusses these constraints.

Huson provides evidence that available sound meters compliant with IEC 61672 are unsuitable for measurements where infrasound is present as typically found in WTN emission at

frequencies below 6 Hz or where there are low background noise levels. In his conclusions Huson states;

"The author is aware of numerous wind farm assessments, made in accordance with the ETSU-R-97 methodology, where data has been used in preparing trend lines from background and post-construction operating conditions that is outside the range of measurement for which the sound level monitoring equipment is compliant with IEC 61672. Such charts are presented as examples of good practice in the IoA Good Practice Guide. The author knows of no ETSU-R-97 type assessment where account has been made for such non-compliant data that is outside the measurement range of the instruments."

INWG WP1 titled, '**The Fundamental of Amplitude Modulation of Wind Turbine Noise'**, Ref 42 - INWG WP1 Yelland 2015 by John Yelland dated November 2015 elaborates on the measurement of low frequency sound. At Section 5 – Measurements, Dr Yelland a professional physicist states;

"The use of A-weighting reduces the sound level measurement – but not of course the sound level – by 50db at 20 Hz. At these low frequencies G-weighting is equally inappropriate as it too reduces measurements, by 50 to 100 dB at blade pass frequencies. Any weighting is inappropriate. As even the straightforward unweighted measurement of sound power level is referred to as "Z-weighting" the concept of weighting is obviously well entrenched in the acoustic mind set; inaudible pulsing pressure waves around 1 Hz however are far better understood in terms of physics rather than acoustics,"

Dr Yelland is also critical of current industry practice to exclude the measurement of low frequency noise below 100Hz based on the assumption that '**what you can't hear can't hurt you**'.

More recent research by the **International Acoustics Research Organisation** (IARO) provides a significant advance in our understanding of wind turbine low frequency noise and infrasound, how it should be measured and how the data should be analysed. This research also provides evidence of the direct link between low frequency noise and health effects**. In doing so it challenges the wind industry denials surrounding the health effects from LFN and infrasound.**

The IARO is an international group of researchers with a mission to investigate acoustical environments, especially with respect to features that affect humans and animals, and to publish the results. IARO holds the ethics approval for the CSI-ACHE, the Citizen Science Initiative into Acoustical Characterisation of Human Environments, the results of which are publicly disseminated.

The report titled, '**Report on the High-Resolution Infrasonic and Low-Frequency Sound Recordings Conducted Within a Rural Farm in Scotland in 2022 and 2023'**, Ref 85 - IARO Rural Farm Report 2024 discusses noise measurements carried out at a rural sheep farm in

Scotland following complaints of severe health deterioration that only began following the commissioning of a nearby wind farm. The goal of the investigation was to provide high-resolution analyses of the soundscape in and around the rural sheep farm, on behalf of all residents and farm workers (10 adults and 4 minors).

The report Appendix A titled, '**Technical Background for Laypersons**', Ref 86 - IARO Annex A Rural Farm report 2024 provides a more detailed description of the measurement and analysis methodology. The IARO methodology compared to ETSU allows for the identification of a wind turbine acoustic signature (WTAS) due to:

- Increased time resolution
- Increased frequency resolution
- Use of unweighted sound pressure level (SPL) measurement

Chapter 16: Health & wellbeing

The connection between wind turbine noise and health effect was highlighted in February 2007 by the paper,' titled,' **Wind turbines, noise and health**', Ref 7 - WT noise and health A Harry 2007 by Dr Amanda Harry. The paper examines the health effects caused by a wind farm in Cornwall, UK and concludes with:

"I think it is clearly evident from these cases that there are people living near turbines who are genuinely suffering from health effects from the noise produced by wind turbines. These neighbours of turbines clearly state that at times the noise from turbines is unbearable. The developers are usually heard to say that noise is not a problem. Clearly this cannot be the case."

The Amanda Harry paper highlights how wind industry acousticians are making claims regarding health effects that are outside their area of expertise and without any supporting evidence. This practice continues to the present day.

In the **Wisconsin report** from December 2012 titled, '**A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin**', Ref 14 - Wisconsin report Dec 2012 the overall conclusion states;

"Residents report being intensely affected despite inaudibility and to be aware of turbine operation even when the turbines are not visible"

and Appendix C states; *"Nauseogenicity is a factor at Shirley. Acceleration of the inner ear is suggested due to extremely low-frequency pulsations at the rotation and blade pass rates that occur in or near the frequencies of highest potential for nauseogenicity and, are coupled strongly into the homes now abandoned."*

The health effects of wind turbine noise are also explored by Chris Hanning at **INWG WP3.2** dated March 2015. Dr Hanning's report titled, '**Excessive Amplitude Modulation, Wind Turbine Noise, Sleep and Health**', Ref 46 - INWG WP3.2 Hanning 2015 examines the effects of Excessive Amplitude Modulation (EAM) on people living close to wind turbines including annoyance, sleep disturbance and health effects through a review of the available health related literature. His report discusses ETSU's inability to protect noise sensitive receptors from sleep disruption and therefore harm to their health. Hanning's executive summary states,

"A large body of evidence, presented below, demonstrates that human sleep and health are adversely affected at wind turbine noise levels permitted by ETSU. There is particular concern for the health of children exposed to excessive wind turbine noise. The inadequate consideration of excessive amplitude modulation (EAM) is a major factor in the failure of ETSU to protect the human population."

The paper titled, '**Environmental Noise Pollution: Has Public Health Become too Utilitarian?**', Ref 66 - Environmental Noise Pollution Evans 2017 by Prof Alun Evans questions the acceptance of the Collateral Damage caused by wind farms. In the paper published May 2017 by the Centre for Public Health, Queens University, Belfast, the abstract states;

- *"Wind turbines produce a range of sound but it is the Infrasound and low frequency noise which deserves special attention. Infrasound is considered to be below the range of human hearing so it is not measured in routine noise assessments in the wind farm planning process. There is, however, evidence that many can register it and a sizeable minority is sensitive, or becomes sensitised to it. The actual route of transmission still requires elucidation.*

- *The net effect of the entire range of noise produced is interference with sleep and sleep deprivation. Sleep, far from being a luxury is vitally important to health and insufficient sleep, in the long term, is associated with a spectrum of diseases, particularly Cardiovascular. The physiological benefits of sleep are reviewed, as is the range of diseases which the sleep-deprived are predisposed to.*

- *Governments, anxious to meet Green targets and often receiving most of their advice on health matters from the wind industry, must commission independent studies so that the Health and Human Rights of their rural citizens is not infringed. Public Health, in particular, must remember its roots in Utilitarianism which condoned the acceptance of some **Collateral Damage** provided that the greatest happiness of the greatest number was ensured. The degree of **Collateral Damage** caused by wind farms should be totally unacceptable to Public Health which must, like good government, fully exercise the **Precautionary Principle**."*

The IARO paper titled, '**Health Report on a Rural Sheep Farm in Scotland**', Ref 91 - IARO Rural Farm Health Report 2014 by Alves-Pereira, Bakker, Summers & Crosthwaite released June 2024 follows on from their earlier research and report regarding low frequency noise recordings at this sheep farm. This investigation was carried out following a request by the residents and workers at the farm.

These farm residents began suffering severe health deterioration following the commissioning of the most recent wind farm in their area. The investigation was led by the International Acoustic Research Organisation (IARO) of New Zealand supported by Citizens Initiative, Scotland. Analysis of acoustic recordings show a practically continuous exposure of the farm residents to a strong wind turbine acoustic signature (WTAS) and low frequency tones. These WTASs are not detectable with the methodologies imposed by current UK noise guidance, namely ETSU.

Since the installation of the wind farm, Mr Z, 76, has been hospitalized twice, in March 2023 and in June 2023 (airlifting required); Ms. Z1 (53, daughter) was hospitalized from June 2023

to January 2024; and Ms. Z2-4 (14, granddaughter), diagnosed with high spectrum autism at age 2, has seen her behaviour greatly and seriously aggravated, causing a devastating impact on the entire family.

In November 2023, the family Z received a letter from a Consultant in Public Health (Health Protection) [name redacted] representing NHS Highland (Inverness), where it was suggested that the symptoms developed by the rural sheep farm residents were due to psychosocial factors (I.e., a psychosomatic aetiology). Meditation, mindfulness and cognitive behavioural therapy were the recommended therapeutic courses of action.

NHS-Highland attribute a psychosomatic aetiology to the disorders developed by the farm residents, while proffering no clinical or scientific evidence to support their position. This is contrary to the rules of evidence-based Medicine. This report demonstrates that medical representatives of NHS Highland irresponsibly ignored the foundational principles of the Scientific Method by:

- *"Disregarding the dose-response relationship, as defined in Medical Sciences, which quantifies and associates objective medical endpoints to specific quantities (doses) of a physical agent of disease.*
- *Using methodologically flawed studies to substantiate their scientifically indefensible position.*
- *Establishing a diagnosis without proffering any clinical or scientific evidence.*
- *Recommending a therapeutic course of action that borders on clinical negligence."*

Chapter 17: Guidance and Regulation

As discussed elsewhere, ETSU was written and released in the 1990s. In this section we review the other guidance and regulation, relating to onshore wind turbine noise.

During January 2019 the **World Health Organisation** (WHO) released its '**Environmental noise guidelines for the European Region'**, Ref 72 - WHO Environmental noise guidelines - 2019. The updated WHO noise guidance included wind turbines for the first time in this 2019 revision. Unfortunately, the UK government has not acted on this guidance or its recommendations.

During April 2019 Professor David Unwin released his paper titled, '**Wind Turbine Noise & Shale Gas Extraction; Towards a Robust Regulatory Roadmap?**' Ref 73 - Unwin Regulatory Roadmap 2019 . In his paper Unwin compares and contrasts the regulatory framework in place for onshore wind turbines with those for shale gas extraction and minerals working.

A central feature of the current roadmap for building and operating onshore wind farms in England is the absence of an effective regulatory roadmap of the type that is commonly imposed on other large industrial developments in essentially rural areas.

Unwin's paper concludes that;
"The current regulatory regime for onshore wind is too light, unable to inspire the confidence of communities close to operating wind farms that is essential to any further developments."

A key recommendation being the replacement of the discredited ETSU-R-97 with a noise assessment based on the principals of BS4142 as the basis for the noise assessment.

During June 2019 the British Standard for industrial noise assessment, BS4142 was revised by British Standards (BSI). This latest version being known as **BS4142:2014+A1:2019** is titled, '**Methods for rating and assessing industrial and commercial sound**'. BS4142 was first published in 1967. It received major revisions in 1990 and 2014 with minor revisions in 1975, 1980, and 1982.

In 2014 the substantially revised standard known as BS4142: 2014 addressed concerns which led to its exclusion for use with wind turbines when ETSU-R-97 was written in the 1990s. BS4142:2014 included extended analysis of special characteristics in noise rendering it suitable for wind turbine noise containing AM.

The updates from BS4142:2014 to BS4142:2014+A1:2019 included some technical changes including the introduction of '**uncertainty**' into the assessment. (Note that uncertainty is also known as measurement or calculation errors and tolerances.) This latest revised standard BS4142:2014+A1:2019 with the introduction of uncertainty into the assessment strengthens the argument for its use with wind turbine noise.

ETSU has long been criticised for not including uncertainty, making wind turbine noise assessment possibly the only field of science or engineering that assumes zero errors or tolerances, clearly a practical impossible situation. A comparison table of ETSU v BS4142 is provided at Appendix B.

Chapter 18: Politics and Westminster

Wind turbine noise campaigners have been fortunate to have been given the opportunity to meet with government ministers on several occasions to present evidence, findings and recommendations. For this the INWG is grateful for the facilitation of these meetings by its political sponsor Chris Heaton-Harris MP. In this section we review these meetings and the evolving national politics at Westminster over the period of the ETSU-Gate campaign.

A review of the '**Campaign Time Line**' at Appendix A identifies the tenure of each Prime Minister and each Secretary of State responsible for Energy including wind power. The political parties in power are highlighted in their political party colours.

At the time ETSU was written and released we had a Conservative government but this all changed in May 1997 when the Labour party led by **Tony Blair MP** were elected to government, with Blair serving as Prime Minister until June 2007. **Gordon Brown MP** assumed the Labour leadership from June 2007 and served until the election in May 2010. It was during the premiership of Gordon Brown that **Ed Milliband MP** was appointed Secretary of State, Energy and Climate Change from October 2008.

One of Miliband's earliest actions was to introduce the **Climate Change Act**, with it receiving royal assent on 26 November 2008. The Climate Change Act introduced a legal requirement on the government to reduce UK greenhouse gas emissions by 80% by year 2050. The growing enthusiasm within Whitehall at that time for renewables, especially wind power was given a strong boost by the Climate Change Act.

The election of a Conservative led Coalition government during May 2010 led **by David Cameron MP** as Prime Minister, resulted in a Liberal Democrat, **Chris Huhne MP** being appointed Secretary of State, Energy and Climate Change. As a result, the deployment of renewables remained as a high priority for government. Over the following years there was a surge in planning applications for onshore wind farms across the UK driven by the highly lucrative subsidies.

Most of these planning applications were opposed by local communities and subsequently refused by the local planning committees. However, most of these refusals went to Appeal and were subsequently approved by government appointed Planning Inspectors.

Remarkably, over this period none of those wind farm planning applications that were actually refused, were refused solely or mainly for reasons of noise. Of those planning applications that were approved, all were claimed to be ETSU compliant, and were accepted as such by planning Inspectors. As we were already discovering, being ETSU compliant did not mean there would be no noise complaints.

Chris Huhne MP served as Secretary of State until February 2012 when he was forced out of office and was jailed for perverting the course of justice relating to a speeding offence. Huhne was succeeded by another Liberal Democrat **Ed Davey MP** who continued the same enthusiasm for renewables including wind power. Davey served as Secretary of State until May 2015.

On 9 October 2013 a meeting was held at Westminster where a group of campaigners and a professional acoustician met **Ed Davey** MP and DECC officials. The meeting was facilitated by constituency MP **Chris Heaton-Harris**. Two presentations were made. The first titled, '**A Summary of the 'Bad Science' behind the Wind Turbine Noise Guidelines**' Ref 20 - Unwin - Bad Science 2013 challenged the IOA Good Practice Guide. Evidence was presented showing the failure to adequately allow for wind shear in the assessment process. This failure with wind shear having the most serious consequences for the assessment process and being the most blatant attempt to mislead.

A second presentation was made by the acoustician Mike Stigwood of MAS Environmental titled, '**Evidence of failure of wind farm guidance to protect well being**' Ref 21 - Stigwood DECC Oct-2013 provided evidence to demonstrate the extent of the noise nuisance problem. It being highly significant that all the wind farms causing noise complaints that MAS has investigated at this time were considered to be ETSU compliant. This alone provides strong evidence that ETSU is failing to protect wind farm neighbours.

During this meeting with Ed Davey, it was evident that he was only entertaining the meeting as a demonstration of 'Coalition unity' and showed little interest in the evidence being presented. As far as could be determined the evidence presented was later ignored.

Following the general election in May 2015, the Conservatives formed a majority government and Ed Davey was replaced by the Conservative **Amber Rudd MP** who served as Secretary of State until July 2016. Shortly afterwards, on 18 June 2015 the new Energy Minister **Greg Clark MP** released his '**House of Commons Written Statement (HCWS42)'**, Ref 39 - Greg Clark HCWS42 2015 , an action that effectively halted further development of onshore wind power in England. Statement HCWS42 only applied to onshore wind allowing the Conservative government to continue to focus on Offshore wind power development.

Although HCWS42 was welcomed by many rural communities and halted development in England, it did not apply to Scotland where the Scottish government continued moving at pace with the deployment of onshore wind. Statement HCWS42 also had no effect on the resolution of existing noise complaints across the country.

It was during August 2014 that the Independent Noise Working Group was formed with the primary objective at that time to conduct an independent study into wind turbine noise amplitude modulation (AM) that would be able to credibly challenge the methodologies and recommendations of the Institute of Acoustics sponsored AM study. The INWG was jointly

sponsored by Chris Heaton-Harris MP (Conservative, Daventry) and the National Alliance of Wind Action Groups (NAWAG).

As work on the INWG study was approaching completion meetings were arranged with government ministers to present the initial findings. Representatives of the INWG supported by Mike Stigwood of MAS Environmental met with government ministers at Westminster on 7 July 2015. The meetings were facilitated by Chris Heaton-Harris MP.

Separate meetings were held with **James Wharton MP** (DCLG), **Liz Truss MP** (DEFRA) and **Jane Ellison MP** (Dept of Health). Preliminary study findings and recommendations from the INWG Amplitude Modulation Study were presented using two discussion documents, '**INWG Discussion document'**, Ref 40 - INWG Discussion Westminster 7 July 2015 and '**MAS AM Discussion document**', Ref 41 - MAS Discussion Westminster July 2015.

Following completion of the INWG AM study during the summer of 2015, a separate meeting was held at Westminster with the then Energy minister **Andrea Leadsom** MP, Minister of State at the Department of Energy and Climate Change and DECC officials. This launch of the AM study on 13 October 2015 was again jointly presented by INWG and MAS Environmental. The '**INWG Discussion document for DECC meeting'**, Ref 55 - DECC Meeting Cox INWG Oct 2015 and the '**MAS Discussion document for DECC meeting**' Ref 56 - DECC Meeting Large MAS Oct 2015 presented the recommendations of the study including;

- *"ETSU noise guidance to be replaced with a code of practice based on BS4142:2014*
- *Independent research is required into the health effects of wind turbine noise including EAM and LFN*
- *An effective AM planning condition required for every wind turbine planning approval*
- *Continuous noise monitoring (with data transparency) should be required for every medium & large wind turbine planning approval*
- *Effective remedy required for retrospectively dealing with noise nuisance including EAM from existing wind turbines*
- *Government should disassociate itself from the IOA until the conflict of interest and ethics issues are resolved and full transparency restored."*

MAS presented their experience of AM from investigations at multiple wind farms and how it is affecting people living near to the turbines. The character and features of the noise were discussed along with the extent of the problem and the effects it is having.

July 2016 saw **Theresa May MP** become Prime Minister of the Conservative government, taking over from David Cameron. Also, **Greg Clark MP** was appointed Secretary of State, Business, Energy and Industrial Strategy (DBEIS).

The next meeting for campaigners at Westminster was on 1 March 2017 when the INWG and MAS presented the findings and recommendations following their reviews of the WSP and

IOA amplitude modulation studies. This meeting again facilitated by Chris Heaton-Harris MP was with **Jessie Norman MP,** the Energy Minister and DBEIS officials. Support was also provided by constituency MPs **Heidi Allen MP** (Conservative), **Victoria Atkins MP** (Conservative) and **Natascha Engle MP** (Labour). The discussion document titled, '**Review of WSP/PB and IOA AM Reports**' presented to **Jessie Norman MP**, Ref 64 - INWG discussion document DBEIS meeting 2017 included the following:

- *"That the WSP/PB report is not only unfit for purpose but is downright misleading and should be rejected by Government.*
- *That there is a clear attempt in this report to bury the health effects of WTN despite overwhelming evidence to the contrary.*
- *What the combined Parsons Brinckerhoff and Institute of Acoustics reports propose is virtually the same AM control scheme as proposed by RenewableUK in their 2013 report. This report by the wind industry trade association was heavily criticised and shown not able to control AM."*

This was a particularly disappointing meeting as the Energy Minister appeared uninformed on the subject of wind turbine noise and appeared unable to grasp the significance of the issues. In fact, this meeting highlighted a fundamental weakness of government in that Government Ministers without a scientific or engineering background are unlikely to comprehend the often-complex technical issues and consequences arising, especially relevant with wind turbine noise. As a result, they are not able to sensibly challenge government officials or their advisors on these matters. Such scientifically illiterate government ministers are entirely at the mercy of their officials.

June 2019 saw the **Climate Change Act Amendment** by the **Theresa May** Conservative government with a mandate requiring an increase from 80% to 100% reduction in greenhouse gas emissions by 2050. This is referred to as the **Net Zero** target and is a legally binding target for the UK government. This Amendment was passed by a large majority of MPs, without any detailed parliamentary scrutiny or national debate. The introduction of Net Zero as government policy will have further strengthened government resolve with the deployment of renewables and will have strengthened the hand of the wind industry and its supporters.

What in hindsight had been a period of relative political stability up to this point, changed when in July 2019 saw **Boris Johnson MP** become Prime Minister, replacing Theresa May as leader of the Conservative government leading to a high turnover of government ministers.

Initially **Andrea Leadsom MP** was appointed as the new Secretary of State, Business, energy and industrial strategy (DBEIS). However, this appointment was short lived with **Alok Sharma MP** replacing Leadsom in February 2020, and then **Kwasi Kwarteng MP** replacing Sharma in January 2021.

Then on 6 September 2022 **Liz Truss MP** replaced Boris Johnson as Prime Minister **and Jacob Rees-Mogg MP** was appointed Secretary of State, Business, Energy and Industrial Strategy.

Then just seven weeks later on 24 October 2022 Rishi **Sunak MP** replaced Liz Truss as Prime Minister and leader of the Conservative government. On 25 October 2022, **Grant Shapps MP** was appointed Secretary of State for the now Department of Energy Security and Net Zero (DESNZ). Less than a year later in August 2023 **Claire Coutinho MP** replaced Shapps as Secretary of State for Energy Security and Net Zero.

The general election in July 2024 resulted in Labour winning a large parliamentary majority and **Keir Starmer MP** became Prime Minister on 4 July 2024. On 5 July 2024, Starmer appointed **Ed Miliband MP** as Secretary of State for Energy Security and Net Zero.

One of the first actions by **Ed Miliband MP** was the release of a **Policy Statement** regarding onshore wind on 8 July 2024, available at: UK Government Policy Statement Onshore Wind July 2024

This policy statement removes the effective ban on further onshore wind turbine development in place since June 2015. Footnotes 57 and 58 to paragraph 163 of the NPPF no longer apply. This policy statement has effectively reopened England to onshore wind power development.

Chapter 19: The argument for BS4142

The campaign story has taken us from the creation of ETSU in 1996 through the various chapters where we discuss the start of noise complaints, the denials by the industry regarding noise impacts including amplitude modulation, low frequency noise and the health effects of the noise. This was followed by industry attempts to muddy the waters with deceptive assessment methodologies including the Article Method, the Good Practice Guide and studies into amplitude modulation. All the documented acts of deception, bad science and obfuscation were countered by independent campaigners who were able to expose the failings of every one of these industry reports, and then present the evidence to government ministers.

During March 2015 the Northern Ireland Assembly released their report, Ref 35 titled, '**Report on the committee's inquiry into wind energy'.** ETSU was heavily criticised in the NIA report, which suggested that the current BS4142 revision (BS4141:2014) be considered when determining if ETSU should be updated.

During the summer of 2015 the INWG released its study into amplitude modulation. The key recommendation to government arising from this study was the replacement of ETSU with BS4142. INWG WP5, titled; '**Towards a draft AM Condition**' Ref 48; INWG WP5 Large 2015 investigates the options for the control of AM. The executive summary at para 1.8 states;
"The 2014 version of BS4142 was also used to assess impact at two of the six sites. BS4142 has previously been dismissed, both in ETSU-R-97 and by others, as an appropriate means of control for wind farm noise. The issues raised to support these arguments have been examined below and found inapplicable to the new version of the standard. BS4142:2014 was found to work very well for assessment and control of cumulative wind farm noise and character impact."

Government internal emails released on 3 Feb 2017 following a FOI request revealed the following:

- **Confirmation that if ETSU is withdrawn, BS4142 could be used to fill the gap.**
- **Context aspect and noise limits would need to be applied**
- **BS4142 could result in some planning applications being rejected that would be granted under ETSU**

The INWG report titled '**Analysis of WSP Report titled: A review of noise guidance for onshore wind turbines**' Ref 81 - INWG Analysis of WSP report April 2023 was released and submitted to the government DESNZ on 15 April 2023. This report included from page 23, an updated argument for the use of BS4142.

The INWG Briefing Paper, Ref 89; INWG Briefing Paper March 2024 updated and reiterated the argument for adopting BS4142 as the replacement for ETSU.

An updated comparison chart based on the Ref 81 and Ref 89 INWG documents is included at **Appendix A**.

Unfortunately, these recommendations to adopt BS4142, first by the Northern Ireland Assembly, followed by the INWG has to date been ignored by government and the wind industry. Not only have these recommendations been ignored but government and the wind industry have gone to great lengths to not even mention the existence BS4142 in reports on this topic. All this seems especially remarkable as Toby Lewis, one of the WSP authors of the 2023 report to government, **Ref 79**, is also a member of the Association of Noise Consultants Good Practice Working Group for BS4142:2014+A1:2019, ANC BS 4142 Technical Note v1.0.

BS4142 is probably the most frequently used standard for industrial noise assessment in the UK, and every professional acoustician and every LPA environmental health officer should be familiar with its use.

Therefore, the omission of any consideration of BS4142 by government or industry leads to the conclusion that this situation could only exist as a result of government policy, official or unofficial, to impose levels of noise from wind turbines that are higher than is permissible from other forms of industrial activity.

Adopting BS4142 as the official noise guidance would provide a viable, cost-effective solution to wind turbine noise assessment that is in line with similar industries. A comparison of ETSU v BS4142 features and benefits is provided at Appendix A.

Adopting BS4142 would force wind farm operators to adopt a more responsible attitude while the impact on renewable generation nationally would likely be minimal

Chapter 20: Where next for ETSU-Gate?

Following the critique of the WSP review by the INWG released 15 April 2023, there has been no further communication with the Government. However, it is understood that after considering the recommendations of the WSP report, a government steering group was convened *"comprising policy officials and technical experts from across government and the devolved administrations".* It is also understood the steering group agreed to proceed with undertaking specific, targeted updates to the ETSU guidance in the short term, although no details have been released. Also, that DESNZ would be seeking an organisation to undertake an update to the ETSU guidance.

The closing date for the government contract tender was 29 May 2024 and the tender details are available on the government website at, PS24055 - Update to ETSU-R-97 Onshore Wind Noise Guidance - ITQ - Contracts Finder. A statement on the government contract website states; *"Due to the sensitivity of this work, the full specification will only be provided to potential Bidders upon completion of the PS24055 Non-Disclosure Contract"*

INWG discovered in November 2024 that the contract has since been awarded to 'Noise Consultants Ltd'. Information on Noise Consultants Ltd is available here: Noise Consultants - Environmental Noise & Vibration Experts

During November 2024 the INWG submitted a Freedom of Information request, asking for the details of this government contract since this environmental information is clearly in the public interest. On 25 November 2024 the government responded declining to provide the requested environmental information.

The INWG has since obtained a copy of a letter dated 14 May 2025 from Michael Shanks MP, Minister for Energy at DESNZ to Alistair Carmichael MP. **The letter in response to Shetland constituent's questions regarding wind turbine noise provides for the first time by a government minister, confirmation that wind power development is being prioritised over the protection from noise.** The letter includes the statements;

- *"The Government is committed to ensuring that decision makers have access to the best guidance, enabling onshore wind to be built whilst also balancing potential impacts.*
- *The Government has carefully considered the recommendations from the WSP report and Noise Consultants Ltd have been contracted to undertake updates to ETSU guidance.*
- *Whilst we are unable to disclose the exact nature of the update due to ongoing policy and commercial sensitivities, it is fair to say that updates will be based on recommendations by the WSP in their 2023 report."*

Discussion

The driver behind the ETSU-Gate campaign is wind turbine noise and the impact it is having on rural communities, plus the inability to obtain a resolution to these complaints. While not all wind farms are causing noise complaints and not all rural communities are affected, a significant minority are impacted. This noise impact can result in a range of effects ranging from annoyance, through loss of sleep, to more serious health issues. In some cases, families are being forced to vacate their homes. Details of the suffering by some of these rural communities is evidenced in reference documents, Ref 11; Davis v Tinsley Shepherd Weddersburn Nov 2011, and Ref 14; Wisconsin report Shirley wind farm Dec 2012, and Ref 74; SCT-Milnes-v-Stuartfield-Windpower-Judgment.pdf, and Ref 78; Bald Hills judgement March 2022, and Ref 88; Meenacloghspar-judgement-March-2024.pdf, and Ref 91: Rural Farm Health Report - Final.

The health effects of wind turbine noise are discussed at Chapter 16 and evidence relating to low frequency sound is examined at Chapter 15. The following message received from a wind farm neighbour in Scotland during April 2025 illustrates the desperate situation being imposed on a rural minority by the unconstrained development of wind power, quote;

*"There is absolutely no abatement in our suffering as a consequence of [**Redacted**] wind farm. It has been particularly bad with predominantly wind blowing between South and East over the last 3-4weeks. Our health and that of all the residents at [**Redacted**] is steadily deteriorating with the passage of time. Personally my sleep pattern is such that I now only have two hours of proper sleep (when I first go to bed) - the rest of the night very difficult to get back to sleep. This is seven days/week..... I don't know how much longer we can bear the situation we are in before the consequences are much more serious than just constant exhaustion."*

The barriers to successfully taking legal action against a wind farm operator over noise nuisance are discussed at Chapter 14. Although there has been some limited success, notably in Ireland, Australia and Scotland, as yet no legal precedent has been established in England where the law differs from Scotland.

The Cotton Farm case Ref 92 discussed at Chapter 14 demonstrates that it is virtually impossibility for the victims of wind turbine noise to obtain justice under English Statutory Nuisance law. As a result, wind farm operators are effectively immune to prosecution for noise nuisance.

The campaign story begins at Chapter 1 with the creation of the ETSU noise guidance in 1996 by a wind industry and government working group with the stated intention from day one to prioritise wind farm development above the protection of host communities from noise.

Additionally, control of wind turbine noise guidance would be the assigned the responsibility of the same government department responsible for wind power deployment. Whereas regulation and environmental protection including noise enforcement for other industries comes under the Department of Environment, Food & Rural Affairs (DEFRA) and its Environment Agency, in the case of wind power, both its deployment and control over its environmental impact including noise comes under what was then the Department of Trade, now the Department for Energy Security & Net Zero (DESNZ). Additionally, there is no regulation or licencing of wind power as with other polluting industries such as quarries and waste processing.

This conflict of interest dating from 1996 within a single government department with its prioritisation of business and political interests over the health and wellbeing of wind farm host communities, plus the lack of regulation lies at the heart of ETSU-Gate and is arguably its root cause.

At Chapter 2 we find the start of noise complaints, and denials by the wind industry starting with the BWEA briefing sheet in 2005 titled, **Low Frequency Noise and Wind Turbines**, **Ref 3**. This was followed by the Salford report titled, **Research into Aerodynamic Modulation of Wind Turbine Noise,** **Ref 8**, marking the start of an elaborate disinformation campaign by the wind industry aided by government. Or was it by the government aided by the wind industry?

A FOI request by REF for data withheld from the Salford report, REF FOI for Salford Report Feb 2009 revealed that as early as 2007 there were already a significant number of noise complaints arising from 27 wind farms across the country, (Navigate the REF report hyperlinks for details of each of these noise complaints).

Prior to 2010 there was little in the way of scrutiny of ETSU or investigation into the effects of wind turbine noise. However, the surge in planning applications that started from around 2010, the subsequent construction of onshore wind farms, and then the noise complaints, energised local communities. This led to the formation of wind farm opposition groups across the country. It was out of these opposition groups and the scrutiny of wind farm planning application Environmental Impact Assessments that highlighted the failings with ETSU.

The disinformation promulgated by the wind industry at that time is discussed at Chapters 3 and 4. This started with the **Article (or Bulletin) Method**, **Ref 9** at Chapter 3, followed by the **Good Practice Guide**, **Ref 16**. at Chapter 4. These were successfully challenged by independent experts at **Ref 10**, **Ref 11** and **Ref 12**. Local campaigners countered in 2012 with a report titled, **Wind Turbine Noise Impact Assessment - Where ETSU is Silent.** This report, Ref 13 - Cox WEIS 2012 authored by a group of Northamptonshire campaigners discussed at Chapter 3 was one of the first reports to quantify the deficiencies of ETSU.

The wind industry finally realised it could not continue to deny the existence or relevance of Amplitude Modulation (AM) so expanded their campaign by attempting to introduce a methodology for its control (AM being the beating or thumping sound heard by people living

near to wind turbines and the cause of most complaints). The next industry response in the form of a study into AM titled **Wind Turbine Amplitude Modulation,** Ref 22 was released in 2013. This report by RenewableUK is discussed at Chapter 5 where campaigners subsequently exposed the bad science by wind industry acousticians and their failed attempt to introduce an opaque and dishonest methodology in the guise of 'controlling' AM.

It was also at this time that the wind industry ramped up their campaign to counter the noise complaints and criticism of ETSU. This included denial of the health effects of wind turbine noise, a claim that amplitude modulation (AM) was an extremely rare phenomenon and a denial that low frequency sound could have any ill health effects claiming '***what you can't hear, can't hurt you***'.

Campaigners and independent experts countered, thoroughly rebutting these industry reports and papers including, Ref 10 - MAS Article Method 2011, Ref 12 - REF 2012, Ref 17 Cox GPG review 2013, Ref 19 - MAS Paper Denver 2013 and Ref 20 - Unwin Bad Science 2013. The Stigwood paper titled '**Evidence of failure of wind farm guidance to protect well being**' Ref 21 - Stigwood 2013 demonstrated **that AM is generated by all wind turbines, that its occurrence is frequent and that it can be readily identified in the field by measuring under suitable conditions and using appropriate equipment**.

Independent analysis and critique included, **'A Critique of the RenewableUK report on wind turbine amplitude modulation**' Ref 25 - Cox Newport 2014, presented at the IOA Newport seminar in March 2014. This demonstrated that the proposed ReUK planning condition would obfuscate and fail to trigger even with the most intrusive AM. This presentation also fully rebutted the ReUK claim as to the cause of and mitigation solutions to AM.

With the wind industry attempts at damage limitation regarding AM having been thoroughly rebutted by independent campaigners, the industry and government responded, with the IOA announcing during early August 2014, the formation of a new AM working group and the launch of a new study into AM. This news was met with concern amongst independent campaigners and led to the creation of the Independent Noise Working Group (INWG), discussed at Chapter 6.

The INWG was formed by a group of experts and non-experts in late August 2014 with political sponsorship by Chris Heaton-Harris MP (Conservative, Daventry), the constituency MP for several of the INWG members. The primary objective of the INWG was to conduct an independent study into wind turbine noise and amplitude modulation that would be able to credibly challenge the methodologies and recommendations of the anticipated Institute of Acoustics sponsored AM study.

These two competing studies into AM, were conducted simultaneously with the INWG study taking one year to complete. The INWG individual work packages completed during the summer of 2015 and are discussed at Chapter 10.

The launch of the INWG study is discussed at Chapter 11 where the findings and recommendations were presented to Government at Westminster on 13 October 2015. **The main recommendation from the INWG study was that ETSU should be replaced by the use of BS4142**. BS4142 being the noise Standard applied for all other similar industrial noise sources, the exception being wind turbines.

The presentation was made to Andrea Leadsom MP, Minister of State at the Department of Energy and Climate Change and DECC officials and included two discussion documents, Ref 55 - DECC Meeting INWG Oct 2015 and Ref 56 - DECC Meeting Large MAS Oct 2015 .

This was followed by a presentation to the Institute of Acoustic at their annual conference at Harrogate on 15 October 2015, titled, '**Wind Turbine Amplitude Modulation & Planning Control Study' Control Study**', Ref 57 - INWG AM Study paper Harrogate 2015 and, Ref 58 - INWG AM Presentation Harrogate 2015. There can be no doubt that the release of the INWG study had a major impact on the IOA AM study, as it was delayed and not released until a year later.

The IOA finally released their AM study during August 2016 titled, '**Final Report - A Method for Rating Amplitude Modulation in Wind Turbine Noise**' Ref 60 - AMWG Final Report-09-08-2016, and simultaneously WSP / Parsons Brinckerhoff (WSP/PB) presented the results of their government commissioned research into AM. This is discussed at Chapter 12. The paper titled, '**A review of research into the human response to amplitude-modulated wind turbine noise and development of a planning control method**' Ref 61 - WSP AM paper Inter.noise 2016 was also presented alongside the IOA study at the Glasgow Inter.noise conference. However, the full WSP/PB report was withheld and only obtained some months later following a FOI request by campaigners, Ref 62 - WSP PB-AM-Proposalv5redacted-April2015 .

Following a detailed analysis of these two reports the INWG published the results as the final AM study **Work Package 8.1** titled, '**Review of WSP/Parsons Brinckerhoff and Institute of Acoustics Amplitude Modulation Studies**', Ref 64 - INWG WP8.1 Cox 2017 and '**WP8.1 Appendices**', Ref 64 - INWG WP8.1 Appendices Cox 2017. This INWG analysis was presented at Westminster to the Energy Minister Jessie Norman MP and DECC officials on 1 March 2017, see the '**Discussion Document**' Ref 65 - INWG discussion doc DBEIS meeting Mar 2017.

INWG repeated the recommendation that ETSU be replaced by BS4142 and referred to a FOI response dated 3 Feb 2017 that released government internal emails. These emails provide confirmation from within government that if ETSU is withdrawn, BS4142 could be used as its replacement.

There is no doubt that rebuttals of both the IOA NWG AM study and the WSP/PB research into AM report by the INWG through WP8.1, became an embarrassment and setback to the wind industry and government.

Following the March 2017 Westminster meeting there was no further communication with government or the wind industry until August 2021. It was then that the INWG discovered that DBEIS had awarded a contract to WSP to review the ETSU noise guidance. The first stage of the review was for a stakeholder survey, by invitation only with a closing date in September 2021, and INWG were not invited.

Following an appeal to DBEIS, the INWG was allowed to participate and a survey response was submitted in time. However, it was not until February 2023 that the 400 page WSP report titled, '**A review of noise guidance for onshore wind turbines**' Ref 79 - WSP Lotinga Linkedin Feb 2023 was released. The WSP report was subsequently analysed by the INWG and a report produced titled '**Analysis of WSP Report titled: A review of noise guidance for onshore wind turbines**' Ref 81 - INWG Analysis of WSP report April 2023. This highly critical report was submitted to the government, DBEIS now renamed DESNZ on 15 April 2023.

As a result of the INWG analysis, it is the considered view by campaigners that the review of ETSU by WSP has been a whitewash and the report recommendations were predetermined. Additionally, there is the suspicion that the WSP review of ETSU is being used as the basis for justifying a replacement for ETSU that will permit even higher levels of noise, both audible and infrasonic**. A more permissive guidance will be essential on order to permit the planned deployment of the new generation of much larger onshore wind turbines, all being justified by Net Zero targets.**

By late 2015, the evidence against ETSU was overwhelming and had been clearly communicated to government ministers by campaigners. However, the simple fact that 10 years later and with ETSU still the official guidance, it tells us that the evidence has been ignored. Despite the visits to Westminster by campaigners to present evidence to ministers and government officials, plus the submission of reports and consultation responses, there has been no reciprocal attempts for any form of engagement by government ministers or officials with campaigners. **Seemingly all the evidence relating to the science and the impacts on wind farm neighbours has been ignored**.

Experience to date of dealing with government confirms beyond reasonable doubt that scientific proof and evidence relating to the suffering imposed by rural communities hosting wind farms is not enough to obtain the change required to the noise guidance. There would appear to be barriers, either political or ideological, blocking any open discussion or change.

Examination of the political landscape over the period of the ETSU-Gate campaign shows that each of the three main political parties have been in power for some of this time, albeit the Liberal Democrats in power with the Conservatives in the Coalition government.

During the last 15 years when the ETSU-Gate campaign has been most active there have been six Prime Ministers and eleven Secretaries of State responsible for energy. Of these Secretaries of State, the longest serving was Ed Davey MP (LD) from February 2012 to May 2015 and Greg Clark MP (C) from July 2016 to July 2019. The shortest serving was Jacob Rees

Mogg MP (C) from September to October 2022 and Kwasi Kwarteng MP (C) from January 2021 to September 2022. This was accompanied by a similar high turnover of junior Energy ministers. These short tenures would have precluded most of these government ministers getting to grips with the issues of the day and following them through. The exceptions to this would be Ed Davey and Greg Clark.

A copy of the letter obtained by the INWG dated 14 May 2025 from Michael Shanks MP, Minister for Energy at DESNZ to Alistair Carmichael MP finally exposes government policy. **This letter in response to Shetland constituent's questions regarding wind turbine noise provides for the first time written confirmation by a government minister, that wind power deployment is being prioritised over the protection of communities from noise.**

Conclusion

When we consider government policy and actions regarding wind turbine noise guidance, we see little difference in outcome between any of the governing political parties. The Conservatives have shown less enthusiasm for onshore wind, having introduced an effective ban from June 2015, (removed by the Labour government in July 2024) but took no action regarding ETSU or wind turbine noise and ignored the evidence presented to them.

With the high turnover of government ministers, the only thread of continuity within government has been with the civil servants who have from behind the scenes and anonymously, 'guided' ministers and implemented government policy. Additionally, these civil servants have been aided by wind industry consultants with some even seconded to government. The fictional character Sir Humphrey Appleby from 'Yes Minister' (BBC 1980s) manipulating government ministers and policy appears to be very real and present in Whitehall today.

Since 2015 the scientific and empirical evidence has clearly shown ETSU to be unfit for use and that it should be replaced with BS4142. The argument for BS4142 is discussed at Chapter 19. BS4142 was first recommended by the Northern Irland Assembly report, titled, '**Report on the committee's inquiry into wind energy'** Ref 35, and shortly afterwards by INWG on release of the AM study discussed at Chapters 10 and 11. The argument for BS4142 was further developed in the INWG report titled '**Analysis of WSP Report titled: A review of noise guidance for onshore wind turbines**' Ref 81 - INWG Analysis of WSP report April 2023. Additionally, government internal emails released on 3 Feb 2017 following a FOI request revealed, "*that if ETSU is withdrawn, BS4142 could be used to fill the gap*".

Not only have these recommendations to adopt BS4142 been ignored, but government and the wind industry have gone to great lengths to avoid even mention of the existence BS4142 in relation to any reports on ETSU or wind turbine noise.

The omission of any consideration of BS4142 by government or industry leads to the conclusion that this situation could only exist as a result of government policy, official or unofficial, to impose levels of noise from wind turbines that are higher than is permissible from other forms of industrial activity and then to conceal the truth.

Adopting BS4142 as the official noise guidance would provide a viable, cost-effective solution to wind turbine noise assessment that is in line with similar industries. A comparison of ETSU v BS4142 features and benefits is provided at **Appendix A**. Adopting BS4142 would force wind farm operators to adopt a more responsible attitude to their neighbour communities while the impact on renewable generation nationally would likely be minimal.

Glossary

Name / Abbreviation	Description / Definition
AM	Amplitude Modulation; of audible wind turbine noise. See also EAM
AMWG	Amplitude Modulation Working Group of the IOA
Acoustics Bulletin	Also known as the 'Bulletin' is a bi-monthly journal published by the Institute of Acoustics.
BS4142	The British Standard titled: 'Method for rating and assessing industrial and commercial sound'. Published by BSI
BSI	British Standards Institute
BWEA	British Wind Energy Association, now known as RenewableUK, also ReUK, is the UK wind power industry trade association.
dB	Decibel, the logarithmic scale used to quantify sound levels.
DBEIS	Government Department for Business, Energy & Industrial Strategy
DECC	Government Department of Energy & Climate Change
DEFRA	Government Department for Environment, Food & Rural Affairs
DESNZ	Government Department for Energy Security & Net Zero
DLUHC	Government Department for Levelling Up, Housing & Communities
DTI	Government Department of Trade and Industry
EAM	Excessive (or Excess) Amplitude Modulation of audible wind turbine noise, also referred to as Other Amplitude Modulation (OAM).
EHO	Environmental Health Officer within a Local Planning Authority
EIR	Environmental Information Request. Is similar to a FOI but relates to requests for environmental information. See also FOI
ETSU	See ETSU-R-97

ETSU-R-97	Also known as ETSU is the official guidance for wind turbine noise assessment. Titled: 'The assessment and rating of noise from wind turbines' it was released by the Energy Technology Support Unit on behalf of the DTI in 1996.
FOI	A Freedom of Information (FOI) request allows anyone to ask any public authority in the UK for information they hold, promoting transparency and accountability, with the authority requested having 20 working days to respond. See also EIR.
GPG	The ETSU Good Practice Guide released by the IOA NWG during 2013.
HMP	Hayes McKenzie Partnership, a UK acoustic consultancy
IARO	The International Acoustics Research Organisation is an international group of researchers based in New Zealand with a mission to investigate acoustical environments, especially with respect to features that affect humans and animals, and to publish the results.
Immission	The sound incident (arriving at) at a given location resulting from the sound emitted by a source
Infrasound	Commonly considered to be sound with frequencies below 20 Hz. There being some overlap with low frequency sound. 20 Hz is often considered to be the lower limit of audible sound although sound below 20Hz may be audible at sufficiently high levels. See also LFN.
INWG	The Independent Noise Working Group
IOA	The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration. It is a nominated body of the Engineering Council.
IOA NWG	Institute of Acoustics Noise Working Group.
LFN	Low frequency noise, generally considered to be sound with frequencies in the range of 10 Hz to 200Hz. There being some overlap with Ultrasound. The threshold of audibility is generally around 20 Hz and varies between individuals. See also Infrasound.
LPA	Local Planning Authority
MAS	MAS Environmental is an independent UK noise and environmental consultancy.
NAWAG	National Alliance of Wind Action Groups

Net Zero	The UK government Net Zero strategy sets out policies and proposals for decarbonising all sectors of the UK economy to meet the net zero target by 2050.
OEM	'Other' Amplitude Modulation of audible wind turbine noise, also referred to a 'Excessive' Amplitude Modulation (EAM) but now generally referred to as simply AM.
REF	The Renewable Energy Foundation is a registered charity promoting sustainable development for the benefit of the public by means of energy conservation and the use of renewable energy.
ReUK	'RenewableUK' is the UK wind power industry trade association, formerly known as the British Wind Energy Association
RES	Renewable Energy Systems, a UK wind farm developer and operator
WHO	World Health Organisation
WSP	WSP is a global engineering and professional services consulting company
WSP / PB	Parsons Brinkerhoff, a UK consulting company was acquired by WSP during 2014 and during 2017 was combined with the parent company WSP Global. The PB brand has since been retired.
WTN	Wind Turbine Noise

Appendix A

BS4142 v ETSU-R-97 Comparison

Feature / Question	BS4142	ETSU-R-97
What is it?	Title: **Methods for rating and assessing industrial and commercial sound**, open here.	Title: **The assessment and rating of noise from wind farms**, open here.
What is it used for?	It is the British Standard for rating and assessing sound of an industrial and/or commercial nature.	For noise assessment of wind turbines only.
Where is it used?	Used for investigating complaints, assessing sound from proposed, new, modified or additional sources of sound of an industrial or commercial nature. For virtually all industrial and commercial applications, except wind turbines. It uses "*outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident*."	For wind turbine sound assessment only. Primarily designed for noise assessments for wind turbine planning applications. Has been adapted for use when investigating complaints and is usually included as a planning condition Not designed for post construction compliance testing but has been used for such assessments.
What is their history?	Originally based on the Wilson Report of 1963, first published in 1967, amended in 1975, 1980 and 1982. Revised in 1990. Revised again in 1997 and 2014. Amended 2019 with the current version designated; BS4142:2014+A1:2019 (BS4142:2019)	Dated September 1996 and produced by a wind industry noise working group facilitated by the government department of trade & Industry (DTI). ETSU-R-97 has not been revised since although the Institute of Acoustics issued a Good Practice Guide in 2013, open here.

Why was the Good Practice Guide (GPG) produced during 2013 and has it improved the situation?		Was instigated in response to many years of criticism of ETSU-R-97. The GPG clarified several areas of the assessment process but still left critical faults inherent with the basic ETSU-R-97 methodology. The method for deriving noise limits and wind speeds is still the root cause of most of the noise complaints. Does not adequately account for wind shear and allows undue latitude with the setting of noise limit curves. Also fails to control AM or LFN.
Why was ETSU-R-97 created?		The emerging wind industry considered BS4142:1990 to be too restrictive and claimed unsuitable for several reasons for wind turbine application. ETSU-R-97 is described as; *"...a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."*
If BS4142:1990 was unsuitable, why is the current version of BS4142:104+A1:2019 now suitable?	Summarised by S. Large @ INWG WP5 page 160 11.5: *"The use of BS4142 has been shown to work with wind farm noise data. Concerns raised previously with low background sound levels and influence of meteorological conditions, namely wind speed, have been addressed in revisions along with advancement of the science and quashed."*	

Is BS4142 in its latest revision ready for use with wind turbine noise assessment	Yes It is recommended though that some additional user guidance be produced specifically for use with wind turbine noise	
What are the main concepts or differences between ETSU-R-97 and BS4142	Utilises the 'Rating' method of assessment. Compares the noise impact at a specific location by assessing noise loudness and character (Rating) compared with the actual background noise level.	Utilises a 'derived limit' method of assessment. Compares either predicted or measured noise with noise limits derived from data from a background noise and wind speed survey data. Relies on the masking effect of wind induced noise to mask the turbine noise.
How does it work?	The basic process being; Make measurements of all noise at the assessment location, including the "problem" noise, in terms of LAeq - termed the "ambient" noise level, then; A measurement is then made of all the noise excluding the "problem" noise in terms of both LAeq and LA90; these measurements are termed the "residual" and "background" noise levels respectively, then; The "residual" LAeq measurement is then subtracted (logarithmically) from the "ambient" LAeq measurement to produce the noise level produced by the "problem" noise alone - termed the "specific" noise Level, then; If the "problem" noise is tonal [containing a noticeable hiss, whine or hum] or if it is impulsive [contains bangs clatters, clicks or thumps] or if it is irregular enough to attract attention, a correction is added to	The basic process being; Conduct a background measurement survey of the wind farm site either before the turbines are built or when not operating. Sound measurement in $LA90_{10}$min, also metrological data including wind speed. Sound measurement at receptor locations where the noise will be experienced, then; Derive noise limits for day and night from the background sound levels plus 5dB except for the lower limit over a range of derived wind speeds, then; Predict turbine noise levels over a range of wind speeds, then; Compare predicted noise levels with the ETSU-R-97 derived limits. If predicted noise exceeds the limit, the result is a fail. If the predicted noise is below the limit the result is a pass.

	the "specific" level to produce the "Rating level ", then; The "background" LA90 measurement is then compared against the "rating" level, then; If the "rating" level exceeds the "background" by around 10 dBA or more this "indicates a significant adverse impact". A difference of around 5 dBA 'indicates an adverse impact'; at a difference below 5 dBA, the lower the adverse impact and below 0dBA – Low adverse impact likely – 'All dependant on the context'.	Noise limits are subject to separate regimes for day and night. For daytime, the minimum is 35 – 40 dB $LA90_{10}$min increasing with increasing wind speed. For night time the minimum is 43dB $LA90_{10}$min increasing with increasing wind speed. For financially involved receptors the minimum limit day and night is 45dB $LA90_{10}$min. Not designed for compliance testing.
What was the purpose of the Good Practice Guide (GPG) for ETSU-R-97?		Defined in the GPG para 1.2.1 by; *"This guide presents current good practice in the application of the ETSU-R-97 assessment methodology for all wind turbine developments above 50 kW, reflecting the original principles within ETSU-R-97, and the results of research carried out and experience gained since ETSU-R-97 was published. The noise limits in ETSU-R-97 have not been examined as these are a matter for Government."* The GPG has been criticised as the fundamental defects with ETSU remain and as witnessed by the September 2012 WSP stakeholder survey.
Does the guidance control for tonal, impulse and amplitude modulation, and if so, how?	Yes Applies graduated corrections for both tonal and impulsive character including AM. Tonal correction of up to 6dB, impulse correction of up to 9dB. Corrections are cumulative.	Tonal only. Does not control impulsive character or AM. The IOA have proposed a separate control method for AM but when tested by the INWG it was found to underestimate AM and

		declared not fit for purpose, see above.
Is low frequency noise controlled	Requires LFN to be assessed using DEFRA NANR45.	No
ETSU-R-97 is criticised for using the $LA90_{10}$min index whereas BS4142 uses the LAeq measurement index. What are the implications?	Uses the LAeq measurement index that effectively averages all the sound energy over the measurement period. A separate frequency analysis using fast time data is used to identify tonal and for impulsive calculations.	Uses the $LA90_{10}$min measurement index effectively recording a sound level exceeded for 90% of the time and averaged over a 10-minute period. As such it fails to identify impulsive or modulating sound including AM.
Does the guidance allow for uncertainty in the process, also known as measurement error or tolerance	Yes - The latest version now allows for uncertainty.	No - Has been criticised as being possibly the only application of science where uncertainty has not been recognised. This assumes zero error in the measurements and calculations. The INWG has estimated that the cumulative uncertainty in a typical noise assessment with noise prediction could be as high as plus/minus 10dB. The guidance should allow for the aggregation of errors representing a reasonable worst case
The ETSU-R-97 derived noise limits have been a topic for criticism for many years. What are the issues?	Does not use fixed limits or require derived noise limit curves.	Heavily criticised for improper statistical modelling of the background noise data when determining the noise limit curves. Many noise assessments found to have poorly fitted curves unsupported by physics and determined mostly by the analytic method employed. They almost always favour the developer with higher noise limits than warranted.

There has been criticism of the fixed noise limits, what are the issues?	There are no fixed noise limits. The Rating assessment method compares the impact of the noise at the receptor location. This eliminates the ambiguity of derived wind speeds, derived noise limits and the effects of wind shear.	Limits are derived via a complex and opaque process to create limit curves based on background noise level, wind speed and minimum limits. This can result in significant adverse noise impact, typically during evenings and night and for extended periods while still remaining 'compliant' with ETSU-R-97. Failing to account correctly for high wind shear conditions, typically occurring during the night is a fundamental fault with ETSU-R-97. Compared to other jurisdictions, ETSU-R-97 has some of the highest minimum noise limits for wind turbines. Is also unique in having night limits higher than day limits.
Is the guidance designed for post construction compliance testing	Yes	No Ambiguity on this allows the operator considerable latitude in the assessment process such that it becomes inevitable that the wind farm is declared 'compliant'. The LPA is therefore unlikely to challenge this finding by the operator's consultants.
Is the guidance designed for compliance testing or complaint resolution?	Yes	Ambiguity on this allows considerable latitude in the assessment process such that the wind farm can be claimed as compliant with ETSU, yet the complaints can continue.
How long does it take to do a compliance test or complaints investigation?	Can be completed in one day	Can take many weeks to assess with recent assessments taking months.

Appendix B

Campaign Time Line

This campaign timeline records the milestones occurring throughout the campaign period. To aid in the interpretation of the timeline, these events are colour coded as shown below. Government and energy minister tenures are also shown, again colour coded in line with their political party colours.

Colour Key

Date	Description
Date	Green to indicate an activity, evidence or event that challenges the validity of the official noise guidance ETSU-R-97 or activities by the wind industry or government.
Date	Orange to indicate an activity, evidence or event that supports the wind industry, the retention of ETSU-R-97 or otherwise supports an overly permissive government noise policy.
Date	Activities or events not directly related to the wind turbine noise campaign but relevant to this discussion are shown without any specific colour code identification.
Date	The Prime Minister and Government Secretary of State (or equivalent) with responsibility for power generation are shown with applicable dates and colour coded by their respective Labour, Conservative and Liberal Democrat (Coalition) governments.
Date	Red for Labour government
Date	Blue for Conservative government
Date	Yellow for Liberal Democrat (Coalition) Secretary of State

Campaign observations are shown in bold green text.

Hyperlinks are provided for convenient access to referenced documents and web sites for further reading. Each of these hyperlinks have been tested and found to be working correctly at the time of writing. However, since some are to third party websites there can be no guarantee that they will continue to work.

Campaign Time Line

Date	Description and Hyperlinks
November 1990	**John Major MP, Conservative** – Prime Minister from 28 November 1990 to 1 May 1997
	During the 1990s it will have become evident to the emerging UK wind industry and its acousticians that noise would become a constraining factor in their ambition to deploy large scale wind onshore power generation across the UK. The existing noise guidance designed to offer protection from excessive industrial noise, primarily BS4142, was seen as a major obstacle to these ambitions. So, a working party was formed in order to develop a more permissive noise guidance that prioritised wind power development above the protection of people living near wind turbines.
	This failure to provide adequate protection from noise for wind farm neighbours occurred despite there being considerable evidence available from the 1980s regarding the effects of wind turbine noise and particularly from low frequency noise. Refer to INWG Work Package 2.1 Review of Literature for details of research during the 1980s, available here; Ref 43, INWG Work Package 2.1 July 2015
	Following the release of ETSU for the UK, it was effectively exported to other countries. ETSU is still being used in Ireland while a similar methodology was adopted in guidance used in Canada, Australia, and New Zealand. Needless to say, all these countries are facing similar wind turbine noise nuisance issues as the UK.
July 1995	**Ian Lang MP, Conservative -** President of the Board of Trade (5 July 1995 to 2 May 1997), the government minister responsible for energy
September 1996	**The assessment and rating of noise from wind farms** Available here, Ref 1: ETSU-R-97
	Known as **ETSU-R-97** or simply **ETSU**, this guidance was released by the Energy Technology Support Unit (ETSU) and the UK Department of Trade and Industry Noise Working Group. The working group comprised of representatives from the wind industry and government. The ETSU guidance Executive Summary states;
	"*This document describes a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of*

protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."

Given the earlier findings from research into amplitude modulation (AM) and low frequency noise (LFN), it was surprising to find that this evidence was ignored when the ETSU noise guidance was produced. We find that this working group replaced the use of BS4142, the standard that was applicable for noise assessment for similar types of industrial noise sources, with a new form of guidance only for wind turbines, and specifically allowing higher permitted noise levels.

It becoming being apparent at this time to the wind industry and government that BS4142 would constrain the ambitions of the wind industry in the deployment of onshore wind power. When we read ETSU we find:

- LFN is not considered despite the evidence that it is a significant component of wind turbine noise;
- Amplitude modulation greater than 3dB (EAM) is not considered despite the evidence from the 1980s research;
- Noise measurement is made using the A weighting despite the evidence that this is unsuitable when low frequency is present;
- Measurements are made only outside (in free field conditions) and not inside homes despite the evidence that LFN can result in higher noise levels and annoyance inside;
- It failed to properly consider wind shear and its effects on noise levels, especially at night;
- Perversely, night time noise limits were set higher than day time limits

The temporary nature of ETSU was acknowledged at the time and at page 2 states, *"The report was drafted in the light of the best information available at the time. However, it is acknowledged that as more experience and information become available and as circumstances develop it may become necessary to revise and improve the contents of this report. The Noise Working Group therefore suggests this report and its recommendations are reviewed in two years time."*

So, despite these claims at the time that ETSU was a temporary measure, it has remained the official noise guidance for wind turbines, and without any substantial revision, since 1996 to the present day.

Not only was this overly permissive noise guidance designated specially for wind turbines, responsibility for the guidance and how it is applied was assigned to the government department responsible for wind power deployment (The then Department of Trade & Industry, now the Department for Energy Security & Net Zero).

So, from day one, there was a conflict of interest within government that has facilitated the continuation of an overly permissive noise guidance, to the detriment of people living near wind turbines, and this has continued to the present day.

It should be noted that for virtually all other types of similar industrial activities, often located in rural locations, environmental protection including noise enforcement comes under the government Department for Environment, Food & Rural Affairs (DEFRA) and its Environment Agency.

May 1997 **Tony Blair MP, Labour** - Prime Minister from 1 May 1997 to 27 June 2007

May 1997 **Margaret Bekett MP, Labour -** President of the Board of Trade (2 May 1997 to 27 July 1998)

July 1998 **Peter Mandelson MP, Labour -** Secretary of State for Trade and Industry (27 July 1998 to 23 December 1998)

December 1998 **Stephen Byers MP, Labour -** Secretary of State for Trade and Industry (23 December 1998 to 8 June 2001)

June 2001 **Patricia Hewitt MP, Labour -** Secretary of State for Trade and Industry (8 June 2001 to 6 May 2005)

March 2003

Inadequate standards currently applied by local authorities to determine statutory nuisance from LF and infrasound

By Hazel Guest, UK Noise Association published in the Journal of low frequency noise, vibration and active control 5 March 2003 and available here, Ref 2: H Guest 2003 Inadequate standards

Although not specifically related to wind turbine noise, this paper examines the barriers experienced by those who complain to their local authorities about low frequency noise (LFN). However, the issues discussed relate to wind turbine LFN. The paper concludes that:

- *"The results of research in LFN and infrasound are not being communicated adequately to EHOs.*
- *The government's guidelines on levels for annoyance and nuisance are inadequate because they take into account neither individual differences nor the actual experiences of those who have been exposed to LFN for some time."*

There would have been little or no recognition of the significance of the ETSU guidance outside of the wind power and acoustics industries in the years immediately following its release and its coming into effect.

However, as more wind farms were being built and the noise complaints started, community groups and independent acousticians became motivated to understand the new guidance. It soon became evident that ETSU was seriously flawed. However, criticisms of ETSU were met with denials and obfuscation by the wind industry, and silence from the government.

February 2005

BWEA Briefing Sheet: Low Frequency Noise and Wind Turbines

By: Bass, Bullmore, Hayes. Jiggins, Leventhall, McKenzie, Trinick and available here, Ref 3: BWEA Briefing Sheet Feb 2005

In this document by the wind industry trade body (at this time known as the 'British Wind Energy Association' and now rebranded as 'RenewableUK') continues the industry wide denial of the effects of LF noise and '**what you can't hear can't hurt you**' with claims there are no health effects, quote: *"...that the levels of infrasonic noise and vibration radiated from modern, upwind configuration wind turbines are at a very low level; so low that they lie below the threshold of perception..."*

May 2005

Alan Johnson MP, Labour - President of the Board of Trade (6 May 2005 to 5 May 2006)

July 2005

Report titled; '**ETSU-R-97 Why it is wrong'**

By Dick Bowdler of New Acoustics and available here, Ref 4:
ETSU Why it is wrong Bowdler

This report provides a clearly argued discussion of the deeply flawed assumptions supporting ETSU and points out that the ETSU limits can easily allow turbine noise levels of 20 to 25dB above background noise levels in rural areas. In his introduction Bowdler states;

- *"ETSU-R-97 is used throughout the UK to assess wind farm noise in planning applications. It has been incorporated into PAN45 in Scotland and PPS22 in England. Nevertheless, it is a thoroughly flawed document and does not deserve the prominence it has been given."*
- *"The conclusions of ETSU-R-97 are so badly argued as to be laughable in parts. It is the only standard where the permissible night time level is higher than the permissible day time level".*
- *"ETSU-R-97 bears no resemblance to standards used for other industrial developments. Other renewable energy developments have to meet much stricter standards. Each time the Noise Working Group that drew up the document decide that a particular standard is appropriate, they follow it up by saying (without putting forward any evidence whatsoever) that such a standard would restrict development of wind farms and so find reasons to relax it further."*

Note: Bowdler was highly critical of ETSU at the time of writing this report but has subsequently become supportive of the wind industry and its acousticians.

This has included participation in the Institute of Acoustics noise working group and the production of joint papers on wind turbine noise. However, he continued to represent community groups and local authorities at planning inquires while still claiming to be independent.

The acoustician Dick Bowdler is a good example of how many acousticians have migrated to the wind industry 'money tree' and in doing so have sacrificed their professional integrity.

May 2006

Alistair Darling MP, Labour - Secretary of State for Trade and Industry (5 May 2006 to 27 June 2007)

The denials of low frequency noise or infrasound continued with the report commissioned by the government with HMP, one of the leading wind industry acoustic consultants and authors of ETSU. However, there is an admission that 'occasional' amplitude modulation does occur.

Additionally, the 3rd draft version (redacted) obtained under a FOI request shows that inconvenient findings (the significance of LFN and the higher night time limit) were removed by government officials from the final version.

2006

The measurement of low frequency noise at three UK wind farms

Hayes McKenzie Partnership (HMP) for the Department of Trade & Industry. Report available here, Ref 5: The measurement of LF noise at three UK wind farms DTI 2006

The wind industry denial of LF noise effects continued with this report commissioned by the UK government in response to reports in the national press of health effects of wind turbine noise. The report produced by HMP, acoustic consultants with close wind industry connections claimed:

"Infrasound associated with modern wind turbines is not a source which will result in noise levels which may be injurious to the health of a wind farm neighbour" and;

"The common cause of complaint was not associated with LFN, but with occasional audible modulation of aerodynamic noise especially at night."

However, this admission of '**occasional audible modulation of aerodynamic noise**' (AM), was the start of the gradual recognition by the wind industry that AM was and still is a significant problem with wind turbine noise.

The measurement of low frequency noise at three UK wind farms – 3rd draft Redacted

Available her, Ref 6; HMP-Report-2006-Redacted-3rdDraft-Dec-2009.pdf

Following a FOI request, a redacted 3rd draft version of this HMP report was obtained during December 2009. This redacted draft document reveals comments (presumably by government officials) and study findings removed from the final report.

The government officials' comments on page 35 show why the significance of low frequency noise (LFN) was subsequently downplayed in the final report. However, there is a recognition in this 3rd draft of the existence of amplitude modulation (AM) at page 46, quote, *"the presence of aerodynamic modulation which is greater than that originally foreseen by the authors of ETSUR-97, particularly during the night hours, can result in internal wind farm noise levels which are audible and which may provoke an adverse reaction from a listener"*.

Also, *"To reduce the potential for such situations with future wind turbines, it is recommended that consideration be given to a revision of the night-time absolute noise criterion proposed within ETSU-R-97 and the development of an assessment methodology to take account of periods when high levels of aerodynamic modulation are found at a neighbouring receptor location*".

Unfortunately, the recommendation in the draft report to reduce night time noise limits, was removed from the final report.

February 2007

By Dr Amanda Harry dated February 2007 and available here, Ref 7; WT noise and health A Harry 2007

This paper examines the health effects caused by a wind farm in Cornwall, UK and concludes with:

"I think it is clearly evident from these cases that there are people living near turbines who are genuinely suffering from health effects from the noise produced by wind turbines. These neighbours of turbines clearly state that at times the noise from turbines is unbearable. The developers are usually heard to say that noise is not a problem. Clearly this cannot be the case.

A discussion follows which clearly explains why the characteristic noise from these turbines can be producing the symptoms that are being described

above. On searching through the current literature I can find no papers written showing that turbines are harmless, only statements from acousticians giving their personal thoughts. In addition to this some of these acoustic experts have made statements categorically saying that the low frequency noise from turbines does not have an effect on health. I feel these comments are made outside their area of expertise and should be ignored until proper medical, epidemiological studies are carried out by independent medical researchers."

The Amanda Harry paper highlights how wind industry acousticians are making claims regarding health effects that are outside their area of expertise and without any supporting evidence. This practice has continued to the present day.

June 2007

Gordon Brown MP, Labour – Prime Minister from 27 June 2007 to 6 May 2010

August 2007

Research into Aerodynamic Modulation of Wind Turbine Noise

By Moorhouse, Hayes, von Hunerbein, Piper & Adams; Salford University. Note: Some or all of these authors are considered to be financially connected with the wind industry and Hayes is also one of the ETSU authors. The report is available here, Ref 8: Salford Report Aug 2007

The Salford report was commissioned by the then government DTI following on from the HMP report from 2005/6. The downplaying of the significance of AM continued with the Salford report and concludes with; *"..the causes of AM are not fully understood and that AM cannot be fully predicted at current state of the art."*

Also; "*Considering the need for further research, the incidence of AM and the number of people affected is probably too small at present to make a compelling case for further research funding in preference to other types of noise which affect many more people."*

The Salford report was criticised by Constable and Moroney at the Renewable Energy Foundation (REF) for withholding critical information as it failed to:

- Reveal the names of any wind farms with noise problems
- Reveal the specifics of the noise complaints
- Publish the survey responses from local authorities

REF subsequently initiated a Freedom of Information Request (FOI) for the missing information. This was initially refused but following an appeal the information was provided with redactions on 12 January 2009. The information received by REF and their assessment is available at, REF FOI for

Salford Report Feb 2009 includes details of the many noise complaints already logged being local authorities from the 1990s onwards.

The Salford Report authors were clearly complicit in withholding and resisting release of critical information relating to the extent of noise complaints.

The information obtained by REF under this FOI request indicates that as early as 2007 when the UK wind industry was still at an early stage of development, that there were already a significant number of complaints from wind farms across the country regarding noise. The Salford report survey shows complaints arising from 27 wind farms.

October 2008

Ed Miliband MP, Labour - Secretary of State, Energy and Climate Change (3 Oct 2008 to 11 May 2010)

November 2008

The Climate Change Act

Introduced by Ed Miliband MP, this Act received royal assent on 26 November 2008. The Act mandated for an 80% reduction in UK greenhouse gas emissions by 2050.

The Climate Change Act introduced a legal requirement on the government to reduce UK greenhouse gas emissions and hence an increased government priority for the deployment of renewables, especially wind power.

March 2009

Prediction and assessment of wind turbine noise

An article published in the Institute of Acoustics (IOA) 'Acoustics Bulletin' journal by; Andrew Bullmore, Andy McKenzie, Bob Davis, Dick Bowdler, Geoff Leventhall, Malcolm Hayes & Mark Jiggins, available here, Ref 9:
Acoustics Bulletin March 2009

This article (pages 35-37) with proposed methodologies for implementing ETSU was produced by the IOA in response to criticisms of ETSU. Subsequently known as the '**Article Method**' or the '**Bulletin Method**' it claims to address:

1. The treatment of wind shear during noise assessments.
2. The prediction of turbine noise levels at receptor locations.
3. The significance of vibration and low frequency noise from wind turbines.

These methodologies for the treatment of wind shear and turbine **noise prediction have since been adopted by the IOA in the Good** Practice Guide released May 2013.

Additionally, the IOA continued to deny that LFN has any health effects on wind farm neighbours and to downplay the importance of amplitude modulation. However, these claims and proposed methodologies have subsequently been heavily criticised.

May 2010

David Cameron MP, Conservative leading a Coalition government – Prime Minister from 6 May 2010 to 13 July 2016

May 2010

Chris Huhne MP, Liberal Democrats - Secretary of State, Energy and Climate Change (12 May 2010 to 3 February 2012)

The first to successfully rebut the science underlying the IOA 'Article Method' was Mike Stigwood of MAS Environmental, followed by Constable and Moroney of REF.

September 2011

The effect of a common wind shear adjustment methodology on the assessment of wind farms when applying ETSU-R-97

By Mike Stigwood, MAS Environmental dated 27 September 2011
The main paper and summary are available here, Ref 10:
MAS Study of article method versus ETSU

MAS Study of Article Method v ETSU Summary

Research was carried out by MAS to test the 'Article Method' as proposed by the Institute of Acoustics working group in the March 2009 article. The research found that not only is the Article (or Bulletin) Method unlikely to indicate adverse noise impact at the planning stage, but once the development is operational **the 'Article method' virtually removes the ability for local communities to enforce controls over unreasonable turbine noise impact.**

The Executive Summary includes; *"The study concluded that the desired benefit using the article method at all wind speeds, and especially at 5-7m/s where the article method was expected to perform best, is not realised. Where standardised wind shear conditions as implemented by the article, which do not relate to those conditions causing complaint, were substituted for the actual wind shear conditions likely to cause complaint more turbine noise was allowed.*

Further, the comparison showed that in all cases analysed there was a loss of community protection when adopting the article method."

What the MAS study revealed was a clever and opaque methodology involving a manipulation of the wind shear exponent, developed by wind industry acousticians to allow higher levels of wind turbine noise, and to

make any subsequent noise enforcement actions much more difficult. Despite the criticisms, this methodology was subsequently adopted as part of the IOA Good Practice Guide, see later.

November 2011

Wind farms and noise nuisance – another chink in the armour

By Jacqueline Cook of Shepard and Wedderburn LLP, UK
Available here, Ref 11; Davis v Tinsley Shepherd Weddersburn Nov 2011

This website article documents what became a landmark nuisance legal case at this time brought by Jane Davis against a wind farm operator. The Davis family had been forced to vacate their home due to the turbine noise and became the first high profile legal case where they managed to bring a nuisance case against the wind farm developer. The author commented that;

"The Davis case is expected to resume in Court in November 2011 following an adjournment. The outcome of this landmark case is eagerly awaited. If the claimants are successful, the judgment could impact on future wind farm developments and open the judicial floodgates for other cases on similar grounds".

Unfortunately, the Jane Davis case was subsequently settled out of court and subject to a confidentiality agreement that prevents the detail of the agreement and the financial compensation being made public. In doing so, the wind industry avoided the creation of a legal precedent that could have had widespread implications for onshore wind.

February 2012

Ed Davey, Liberal Democrats - Secretary of State, Energy and Climate Change (3 February 2012 to 8 May 2015)

April 2012

A critique of the IOA treatment of background noise for wind farm noise assessment

Renewable Energy Foundation (REF) by: Lee Moroney, John Constable, available here, Ref 12: https://www.ref.org.uk/publications/255-ioa-critique

This paper by REF examines the revised methodology for deriving noise limits for wind farm planning permissions as proposed in an article in the Acoustics Bulletin by the Institute of Acoustics working group in March 2009.

The REF paper shows that the Acoustics Bulletin revision increases the uncertainty of the background noise curves and reduces confidence in the reliability of noise conditions based on them.

Also, the revised methodology can produce different noise conditions depending on the dates chosen for the baseline background noise survey, thus yielding differences in permitted wind farm noise levels of as much as 5dB for the same site.

The criticism of ETSU continued with the report, 'Where ETSU is Silent'.

July 2012

Wind Turbine Noise Impact Assessment - Where ETSU is Silent

By Cox, Unwin & Sherman dated 10 July 2012.
With contributions by John Temple LLM, Rod Greenough, Mike Hulme, Lee Moroney, John Yelland, Jon Whitehurst, and Chris Heaton Harris MP.
Subsequently submitted to Government by Chris Heaton-Harris MP.
Available here, Ref13; Wind Farm Noise Impact Assessment, Where ETSU is Silent

This comprehensive report provides a detailed critique of ETSU, how it is being implemented by the wind industry, and its acoustic consultants. Key deficiencies include:

- *"A failure to use suitable microphone wind screens and as a consequence background noise levels will be measured artificially high due to wind noise contamination resulting in an overestimation of masking background noise;*
- *A failure adequately to consider the effects of wind shear in noise assessments so underestimating turbine noise levels;*
- *A failure to correctly analyse background noise data when deriving average noise curves so overestimating background masking noise;*
- *A failure to correctly use the ISO 9613-2 noise propagation model resulting in an under prediction of turbine noise;*
- *A failure to allow for measurement tolerances (or uncertainties) that can easily amount to +/- 10dB resulting in a doubling or halving of the WTN;*
- *A failure to consider AM and LFN."*

The findings in this report clearly demonstrated that ETSU is simply not fit for purpose. These findings were communicated to Government.

We also find that the USA is also blighted with wind farm noise and resulting in wind farm neighbours having to leave their homes in order to escape the noise. The Wisconsin report was a highly significant advance in the recognition of noise nuisance and low frequency noise including inaudible noise.

December 2012

A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin

By Walker, Hessler, Hessler, Rand and Schomer for the Public Service Commission, Wisconsin, USA, 24 Dec 2014
Available here, Ref 14; Wisconsin report Shirley wind farm Dec 2012

The 'Wisconsin Report' as it was subsequently known was a highly significant milestone and step forward in our understanding of WTN nuisance and particularly LFN. Commissioned for the Wisconsin Public Service Commission in the USA, this paper consists of separate reports by four different consultants who between them represent both developers and resident groups. Testing was carried out at several homes that the residents had been forced to abandon due to the wind turbine noise.

A unique feature of this paper is that the wind farm operator cooperated by turning on and off the turbines and the consultants jointly agreed the overall report conclusions including:

"Residents report being intensely affected despite inaudibility and to be aware of turbine operation even when the turbines are not visible";

"the study also showed that a wind turbine is indeed a unique source with ultra-low frequency energy. In general, enough was learned by these investigators, all with quite different past experiences, that it can be mutually agreed that infrasound from wind turbines is an important issue that needs to be resolved".

Additionally, Appendix C by Rand Acoustics concluded with;
"Nauseogenicity is a factor at Shirley. Acceleration of the inner ear is suggested due to extremely low-frequency pulsations at the rotation and blade pass rates that occur in or near the frequencies of highest potential for nauseogenicity and, are coupled strongly into the homes now abandoned. More research at Shirley is recommended to understand nauseogenicity from wind turbine operations, to properly design and site large industrial wind turbines (over 1 MW) near residential areas to prevent the severe health effects. More work is needed to establish what infrasonic levels are consistent with relief for the neighbors.

Medical research and measurement is urgently needed to be field coordinated along with infrasonic acoustic and vibration testing. The correlations to nauseogenicity at the 2.5MW power rating and size suggest worsening effects as larger, slower-rotating wind turbines are sited near people."

And Appendix D by Schomer and Associates includes the statements:
Page 2 – *"The measurements support the hypothesis developed in (I) that the primary frequencies are very low, in the range of several tenths of a Hertz up to several Hertz. The coherence analysis shows that only the very low frequencies appear throughout the house and are clearly related to the blade passage frequency of the turbine. As Figure 5 shows, the house is acting like a cavity and indeed at 5 Hz and below, where the wavelength is 200 Feet or greater, the house is small compared to the wavelength."*

Page 3 – *"Currently the wind turbine industry presents only A-weighted octave band data down to 31 Hz. They have stated that the wind turbines do not produce low frequency sound energies. The measurements at Shirley have clearly shown that low frequency infrasound is clearly present and relevant. A-weighting is totally inadequate and inappropriate for description of this infrasound."*

Additional information and comments relating to this report and its significance is available on the Wind Watch site at: Wind Watch Shirley WF report

May 2013

A neglected source of uncertainty in potential wind farm noise assessment using the ETSU-R-97 process

By Rod Greenough and David Unwin published in the Acoustics Bulletin May 2013, available here, Ref 15: Acoustics_Bulletin38_3_36-42.pdf

This article is critical of the data analysis and statistical techniques employed by wind farm applicants during the planning process in determining background noise levels, and hence in deriving the noise limits during the ETSU assessment process.

The next major milestone was the release on the Good Practice Guide (GPG) to the application of ETSU by the Institute of Acoustics. This in turn was followed by critiques by independent groups.

May 2013

A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise

Released by the Institute of Acoustics noise working group; Cand, Davis, Jordan, Hayes & Perkins (Chair), available here, Ref 16: IOA Good Practice Guide 2013

This guide was produced, quote; *"In response to a request from the Department of Energy and Climate Change (DECC). The Institute of Acoustics (IOA) set up a noise working group (IOA-NWG) to take forward (where possible) the recommendations of the Hayes McKenzie Partnership Report on 'Analysis of How Noise Impacts are considered in the Determination of Wind Farm Planning Applications' Ref HM: 2293/R1 dated 6th April 2011."*

See: HMP Report HM 2293/R1 April 2011

This guide claims to present current good practice in the interpretation and application of the ETSU-R-97 assessment methodology for all wind turbine developments above 50 kW, reflecting the original principles within ETSU-R-97, and the results of research carried out and experience gained since ETSU-R-97 was published.

The Good Practice Guide was subsequently widely criticised for the way the consultation was handled and for the science claimed to underpin its findings and recommendations.

May 2013

A Review of 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' Issued by the Institute of Acoustics 20 May 2013

Available here, Ref 17; Comments on IoA Good Practice Guide dated May 2013

This preliminary review by Richard Cox and others dated 24 May 2013 concluded;

- *"The Noise Working Group is almost entirely made up of representatives from the wind industry supply chain.*
- *No representatives from groups or consultants having an interest in protecting wind farm neighbours from turbine noise were included. Neither were any statisticians, meteorologists, health professional or academics included. By no stretch of the imagination can this new guidance be considered impartial or independently peer reviewed.*
- *The new guidelines are completely devoid of any scientific robustness and the IoA are not transparent in providing the evidence to support the NWG's conclusions.*
- *The new guidelines make no significant changes to current practice so allow the wind industry to continue 'business as usual':"*

When reviewing this new guidance document, the referenced Supplementary Guidance Notes had not been released. Since much of the detail supporting the new guidelines should be contained in these supplementary notes, a meaningful review of the new guidance was not possible at this time.

Summer 2013

Wind farm noise assessments: ETSU-R-97 and the three-legged stool

This paper by David Unwin and Richard Cox was published in the Summer 2013 edition of Science in Parliament, available here, Ref 18: SIP SUMMER 2013

The paper provides an explanation of the ETSU noise assessment methodology, identifying the three assessment legs and how it fails to provide adequate protection for people who live near wind turbines. These three assessment legs being:

- The measurement of the background noise under various conditions.
- A prediction of the turbine noise using manufacturer's turbine data and a noise propagation and prediction model.
- A comparison of predicted noise against background noise derived noise limits to determine compliance with noise limits.

The paper discusses some of the important scientific failings of the ETSU-R-97 guidance.

August 2013

Audible amplitude modulation - results of field measurements and investigations compared to psychoacoustical assessment and theoretical research

Paper presented at the 5th International Conference on Wind Turbine Noise; by Stigwood, Large, Stigwood; MAS Environmental. The paper and presentation are available here, Ref 19: MAS AM Paper Denver Aug 2013 MAS AM Presentation Denver Aug 2013

The paper summary states;

"In the UK the cause of amplitude modulation (AM) and the ability to predict its occurrence is considered abstruse by many. Few have experienced or measured AM and yet conclusions are frequently made asserting that it is rare and that any action to counter its effects is limited by minimal knowledge surrounding its nature and cause. This paper aims to advance current knowledge and opinion of AM.

Methods used to successfully investigate AM are confirmed. AM should be measured during evening (after sunset), night time or early morning periods. Meteorological effects, such as atmospheric stability, which lead to downward refraction resulting from changes in the sound speed gradient alter the character and level of AM measured.

AM is generated by all wind turbines including single turbines. Propagation conditions, mostly affected by meteorology and the occurrence of localised heightened noise zones determine locations that will be affected. Measurements from eleven wind farms have been presented and discussed in relation to current research and theory. Findings confirm that AM occurrence is frequent and can readily be identified in the field by measuring under suitable conditions and using appropriate equipment and settings.

Audible features of AM including frequency content and periodicity vary both within and between wind farms. Noise character can differ considerably within a short time period. The constant change in AM character increases attention and cognitive appraisal and reappraisal, inhibiting acclimatisation to the sound. It is advised that those responsible for approving and enforcing wind energy development improve their understanding of the character and impact of AM."

This paper was a 'game changer' with respect to the recognition of amplitude modulation (AM). MAS completely demolished the long-held position of denial by wind industry acousticians that AM affects only a few

wind turbines, that its occurrence is infrequent and that it is difficult to predict.

MAS had by this time identified over 75 wind farms that were causing noise complaints.

October 2013

A Summary of the 'Bad Science' behind the Wind Turbine Noise Guidelines

By David Unwin & Richard Cox

Available here, Ref 20; Bad Science DECC Meeting Presentation 9 Oct 2013 Final

A two-part presentation made to Secretary of State Ed Davey MP and DECC officials on 9 October 2013 at Westminster in response to the Good Practice Guide released by the Institute of Acoustics Noise Working Group (IOA NWG). The meeting was facilitated by Chris Heaton-Harris MP and supported by Mike Stigwood of MAS.

The presentation builds on the three-legged stool principal for ETSU noise assessment taken from the Unwin, Cox SIPP Summer 2013 paper.

- **Leg A** – The estimation of existing background noise, leading to derived limits.
- **Leg B** – The prediction of turbine noise.
- **Leg C** – Comparison of derived noise limits with predicted noise to determine compliance.

The presentation focused on the bad science employed by the IOA NWG in the Good Practice Guide.

The failure to adequately allow for wind shear in the assessment process is where we find the most serious consequences of the bad science on the assessment process and the most blatant attempt to mislead. By manipulation of the methodology for assessing the wind shear effect, the Good Practice Guide mandates a sophisticated and deceptive averaging process for wind shear that fails to consider the periods when wind shear is higher than average. This methodology permits much higher noise levels to the advantage of the wind farm developer.

The following concerns were expressed during the meeting with the Secretary of State:

- IOA Noise Working Group (NWG) members taken from the wind industry - Conflict of interest?
- No statisticians, meteorologists, academics or health professionals included in the NWG, why?

- Several consultation responses that we are aware of were not considered or published. Why?
- No credible independent peer review process.
- Any consultation comments at odds with IOA NWG views have been ignored. A summary report showing why consultation responses were not included has not been issued as promised by Richard Perkins to Chris Heaton-Harris MP – Why?
- The GPG Supplementary Notes (the all-important small print) have not been released – Why?
- **NWG have failed to demonstrate that a 'grown-up conversation' has taken place with the wider scientific community and that the outcome is demonstrably based on sound science**

Evidence of failure of wind farm guidance to protect well being

By Mike Stigwood, MAS Environmental and presented to the Secretary of State, Ed Davey at the same Westminster meeting on 9 October 2013. Available here, Ref 21; Evidence-of-failure-of-wind-farm-guidance-Stigwood-Oct-2013

Evidence presented by Stigwood to Ed Davey MP demonstrated the extent of the noise nuisance problem and included:

1. *"All the wind farms causing complaints that we have so far investigated are considered to comply with ETSU-R-97 except one case which is marginally over the limit.*
2. *A large number of wind farms are causing noise complaints and obvious evidence of harm to well-being such as sleep disturbance (more than 75 we know of and likely to double) = ETSU-R-97 fails to protect.*
3. *ETSU-R-97 is incapable of controlling / preventing adverse effects or being modified to achieve that purpose.*
4. *Proportionally wind farms causing problems is higher than any noise source investigated in my career, including music venues, metals recycling sites and transport noise. Reason = sleep disturbance and stark contrast in noise character.*
5. *Well-being of a significant minority of communities are being jeopardised for the policies. Potentially between 80-160 wind farms causing problems and 1000's homes affected.*
6. *Research shows Excess Amplitude Modulation (EAM) = main problem and caused by all large wind farms. It is common and not rare as suggested by UK Government policy. Wider international acceptance.*
7. *Government proposals for community support are divisive, causing more damage and dividing communities.*
8. *Reliance by UK Government on experts of known persuasion (who are reliant on industry and derive major income with pointless compliance tests that do not fail) is the reason for the problem. The same problem arises with the Institute of Acoustics who are dominated by*

acousticians reliant on industry and who selected a working group dominated by individuals of known persuasion.

9. *Findings are due for release in 2014 with supporting evidence."*

The MAS handout material includes links to audio files that enable samples of AM audio soundtrack from several wind farms to be experienced.

It is significant that all the wind farms causing noise complaints that MAS has investigated at this time were considered to be ETSU compliant. This alone provides evidence that ETSU is failing to protect wind farm neighbours.

December 2013

Wind Turbine Amplitude Modulation

A research report by RenewableUK (ReUK), the UK wind power trade association. The report available in 6 separate documents, Ref 22:

1.-ruk_brief_summary_v2
2. Ruk report - Temple
3. Ruk report - Temple
4.-ruk_wind_turbine_amplitude_modulation_dec_2013_v2
5.-ruk_planning_condition_v2
6.-ruk_rationale_for_the_planning_condition_v2

This ReUK report was launched with accompanying press releases and the following introduction:

"The wind energy industry today publishes detailed scientific research into the identification, occurrence and resolution of an acoustic characteristic known as Other Amplitude Modulation (OAM). This work, led by RenewableUK is the largest study of its kind to date".

The findings claim to represent a significant advancement in the scientific understanding of the acoustic characteristics associated with OAM, including its causes and mitigations. While the wind industry is now showing that they recognise amplitude modulation as an important issue, in their report they still downplay its significance.

Additional documents forming part of the ReUK report can be found on the REF website at the bottom of the page:
REF Efficacy of the RUK AM Condition 2014

Template planning condition on amplitude modulation

By J Bass of RES on behalf of ReUK.
Template AM planning condition ReUK 2013

This template planning condition forming part of the ReUK report on AM proposed a method to control wind turbine amplitude modulation.

This ReUK report and the template planning condition are subsequently widely criticised.

February 2014

'Coventry and Lawrence'

Judgment by Lords Neuberger, Mance, Clarke, Sumption & Carnwath
Available here, Ref 23; Coventry and others (Respondents) v Lawrence and another (Appellants)

A judgement of the Supreme Court which may have significant implications for nuisance cases in the future. Although not a wind farm case it does deal with noise as a nuisance and is applicable for wind turbine noise nuisance cases. This judgment deals with issues such as the ability to acquire a right to commit a noise nuisance and 'coming to the nuisance' that may need new approaches.

An important implication of the Coventry and Lawrence judgement is that a planning condition does not authorise a person to commit a nuisance. Compliance with a planning condition does not mean that a nuisance has not been committed.

The subsequent INWG work package WP 6.1 by Richard Cowen dated June 2015 provides a detailed discussion of public and private nuisance and the implications of the Coventry and Lawrence judgment.

March 2014

The Efficacy of the RenewableUK (ReUK) Condition in controlling wind farm amplitude modulation (AM) noise

By Lee Moroney, John Constable, Renewable Energy Foundation (REF)
Available here, Ref 24; REF Efficacy of ReUK AM condition 2014

This highly critical appraisal of the ReUK template planning condition concludes with the following;

- *"The proposed RUK AM condition would not be breached by recorded wind farm noise data with high levels of AM measured at Askam, a site widely recognised to be producing severe AM problems, and at Swaffham, from data where the AM is clear and significant in magnitude. By comparison, data from both the Askam and Swaffham sites would be in breach of the Den Brook AM condition.*
- *The authors conclude from these facts that the RUK AM condition is manifestly inferior to the Den Brook condition and does not offer to wind farm neighbours any realistic or significant protection against AM disturbance.*
- *The RUK AM condition is too complex and computationally intensive to provide a reasonably accessible and transparent methodology for assessing excessive AM noise. Even acoustic professionals will struggle*

with this method, and Local Authority Environmental Health Officers are extremely unlikely to have either the resources or the training to undertake such compliance tests. This is unacceptable, particularly when more effective alternatives, such as the Den Brook method, suffer no such defects.

- *The RUK condition method results in an understated value of the true peak-to trough levels of the AM noise. This is obviously unacceptable.*
- *The RUK AM condition is limited to a maximum penalty of 5dB linked to overall noise levels, so where there is 5dB headroom – which is often the case at night-time when ETSU-R-97 wind farm noise limits are higher, background noise levels lower and AM more likely to be a nuisance – there is no sanction against AM of any level or duration.*
- *It is unreasonable to treat the annoyance arising from the beating noise character of wind farm AM noise as an adjunct to the total sound levels rather than as a distinct problem in its own right. Applying a correction to the measured sound levels will not address the issue of noise complaints arising from excess AM noise; it should be treated as a standalone problem. This is because annoyance is not linked to overall noise level, but to its modulation even at low noise levels. It is AM that has to be removed not just compensated for in a way which is demonstrably ineffective."*

This analysis by REF highlights the attempt by the wind industry to introduce an opaque and dishonest methodology in the guise of 'controlling' AM.

March 2014

A Critique of the RenewableUK report on wind turbine amplitude modulation

A presentation at the Institute of Acoustics meeting titled; '**AM, and where next for ETSU-R-97**' at Newport on 20 March 2014. By Cox, Hulme, Sherman & Unwin and available here, Ref 25: Newport IoA Presentation 20Mar2014

This detailed critique of the ReUK report includes the following comments;

- *"The ReUK report has highlighted aspects of turbine noise previously denied by the wind industry and includes an admission that the AM problem is 'too large to ignore'.*
- *The claims that AM is rare and infrequent have not been substantiated since no survey was carried out; however, evidence elsewhere shows it to be widespread.*
- *The report claims are not supported by the evidence from the study and indicates a disconnect between ReUK who commissioned the study and the authors who carried it out.*
- *The claimed root cause of OAM being blade stall is unproven and admitted to as such by the report authors. As a result, the proposed mitigation strategy, even if it was available would fail to work."*

After reluctantly acknowledging the existence of AM and three years working on their report, with most of the work completed by early 2012, only in December 2013 was the report released. With this report ReUK and its acousticians continue with their denial of AM being the problem it is and now attempt to introduce a benign planning condition.

Much of the ReUK report would appear to be a smoke screen to justify the replacement of the Den Brook AM planning condition, a planning condition that has been shown to work. The proposed ReUK planning condition would obfuscate and fail to trigger even with the most intrusive AM.

This presentation fully rebutted the ReUK report arguments on the cause and solutions to AM.

The widespread criticism of the IOA Good Practice Guide and the RenewableUK AM report was seen have had a significant impact. The IOA responded by forming a new AM working group and launching a new study into wind turbine amplitude modulation.

The launch of this IOA AM study raised immediate concerns among many independent campaigners around the country who were fighting the wind turbine noise problem. Over a period of just a few days these campaigners who had previously been loosely collaborating came together and formed the Independent Noise Working Group (INWG) to counter the IOA study into AM.

August 2014

Institute of Acoustics AM Working Group Options Document

Announced on the IOA web site on 1 August 2014 by the Working Group Chair; Richard Perkins, and subsequently updated.
Available here, Ref 26; IOA NWG AM Scope of Work 2014

This document provided details of the IOA working group study into amplitude modulation. It documents the working group membership, meeting schedule, goals, success criteria and work plans.

This IOA sponsored study into AM appeared to be a response by the wind industry and government to the widely criticised AM study conducted by the wind industry trade body RenewableUK released December 2013.

August 2014

IOA President letter to Ed Davey, Secretary of State DECC

From William Egan, President of the IOA to DECC and available here, Ref 27:
Letter re AM IoA to Ed Davey MP 7Aug14

This letter dated 7 August 2014 followed release of the Options Document on 1 August 2014 and the release of the Good Practice Guide Supplementary Guidance Notes. The letter requested DECC to:

- Accept and confirm the Supplementary Guidance Notes which sit alongside the Good Practice Guide.
- To consider a penalty scheme for wind turbine amplitude modulation by conducting an independent research project.

Additionally, the letter advised the Secretary of State of the formation of a working group to study amplitude modulation with a warning, quote;
"The incidence of AM is reported to be increasing the number of complaints from onshore wind farms and a number of nuisance cases are understood to be currently being progresses through the courts. Without a Government steer on the matter of AM, it is likely that Judges may accept a lower threshold of acceptance than current Government support for onshore may suggest, which could restrict the roll-out of onshore wind in the UK".

This letter was seen by many as a clear case of the Institute of Acoustics lobbying government on behalf of the wind industry for a more permissive assessment regime for wind turbine noise.

August 2014

Independent Noise Working Group (INWG) formation

INWG web site available here, Ref 28: https://inwg.org.uk/

The INWG formed during August 2014 in response to the announcement by the Institute of Acoustics that it was forming a Noise Working Group to conduct a study into wind turbine noise amplitude modulation (AM).

The primary objective of the INWG at that time was to conduct an independent study into wind turbine noise AM that would be able to credibly challenge the methodologies and recommendations of the Institute of Acoustics sponsored AM study.

The INWG consisted of a multi-disciplinary team drawn from across the country, fully independent of the wind industry supply chain with expertise or access to expertise including acoustics, environmental health (LPA), health & sleep, legal & planning, physics, meteorology, statistics & data analysis. The INWG was jointly sponsored by Chris Heaton-Harris MP (Conservative, Daventry) and the National Alliance of Wind Action Groups (NAWAG).

The subsequent INWG AM study was presented to Government at Westminster on 13 October 2015 and at the Institute of Acoustics conference at Harrogate on 15 October 2015.

Since 2015 the INWG has continued the campaign to have the ETSU wind turbine noise guidance updated.

The principal aim of the INWG is ensuring that the acoustic impacts from wind turbines are properly controlled in order to protect public health and wellbeing.

October 2014

BS4142:2014 Titled: 'Methods for rating and assessing industrial and commercial sound'

Copyright material available for purchase from British Standards.

The scope of BS4142 includes sound from fixed installations which comprise mechanical and electrical plant and equipment. It is applicable for outdoor locations for the purposes of investigating complaints and assessing sound from proposed new, modified or additional sources of sound of an industrial or commercial nature.

The substantially revised standard BS4142: 2014 has addressed concerns which led to its exclusion for use with wind turbines when ETSU-R-97 was written. BS4142 now includes extended analysis of special characteristics in noise. This renders it suitable for wind turbine noise containing AM. Comparative tests show it is better suited at determining impact than ETSU-R-97 derived methods which are formulated on the absence of any significant character content.

October 2014

Complaint letters to the Engineering Council

In a coordinated nationwide campaign, letters of complaint against the Institute of Acoustics and its Noise Working Group were sent to the Engineering Council during September 2014. The INWG is aware of at least 10 letters having been sent.

Professional institutions including the Institute of Acoustics are regulated by the Engineering Council and are required to comply with the Engineering Council Codes of Conduct and its Ethical Principles.

These detailed individual letters questioned the IOA NWG's professional independence, its credibility, and compliance with the required Codes of Conduct and Ethical Principles. It was recommended that the Engineering Council urgently investigate these allegations of bias in favour of the commercial interests of the wind industry and of its consultants for prioritising commercial interests ahead of protecting the public from wind turbine noise and its associated effects on health.

A most unhelpful response letter received by each of the complainants from the Engineering Council dated 17 October 2014 informed that the complaints against the IOA should be taken up with the IOA itself. The letter is available here, Ref 29: Engineering-Council-response-17-Oct-2014

Although the complaint letters to the Engineering Council failed to have any immediate effect on the unethical behaviour of the IOA, it did highlight the way the 'Establishment' has closed ranks in support wind power development. It becoming clearer now that this support extends to the retention of ETSU and its overly permissive noise limits while ignoring the health consequences.

November 2014

Initial findings of the Cotton Farm wind farm long term community noise monitoring project

Presented at Inter-noise 2014, Melbourne, Australia by Mike Stigwood, Duncan Stigwood, Sarah Large, MAS Environmental, UK
Available here, Ref 30; Stigwood MAS Internoise 2014 Cotton Farm

The paper Abstract states; *"This paper provides early results of a long-term study of community impact from wind farm noise and uses of the data obtained. A continuously recorded database of noise collected under different meteorological conditions has allowed detailed analysis of particular characteristics such as amplitude modulation and also the reliability of assessment methodologies for predicting and quantifying impact. Surprising outcomes are explored including upwind impact.*

In 2013 MAS Environmental established a permanent monitoring station to record and publish data online located 600m from the nearest turbine to correlate the impact upon the community and provide an extensive database. This paper maps the evolution of the project. Online data enables a wider study of the effect of meteorological change on noise immission in a flat eastern area of the UK.

Anyone can independently observe and listen to the audible elements of the noise that people complain about. This tool aids understanding as well as predicting times of likely adverse impact."

The database has enabled testing of proposed controls, particularly in relation to audible amplitude modulation and demonstrated that the recent RenewableUK proposed control mechanism fails.

Data obtained challenges claims of blade stall as the primary cause of far field AM and wind farm noise prediction methodologies.

November 2014

The results of an acoustic testing program, Cape Bridgewater wind farm

By Steven Cooper, The Acoustic Group, Australia
Available here, Ref 31; Cape Bridgwater report 2014 Cooper

This appears to be a first of its kind in Australia or elsewhere, in that it is a joint exercise between a wind farm operator and residents. Additionally, this paper provided an important advance in the recognition and understanding of low frequency effects. **Resident's observations identified 'sensation' as the major form of disturbance from the Cape Bridgwater wind farm.**

It was also confirmed that there is a unique signature attributed to wind farms that involves a peak at the blade pass frequency and the first five harmonics of that frequency. This unique infrasound pattern has been labelled by the author as the 'wind turbine signature'. This signature is present when the turbines are operating but does not occur with the wind farm shut down.

By including narrowband analysis in the description of the acoustic environment, the study confirms that the infrasound obtained in a wind farm effected environment is different to that in a natural acoustic environment.

December 2014

Institute of Acoustics statement in respect of wind farm noise assessment

Statement available here, Ref 32; IOA-statement-on-wind-farm-noise-assessment-19-12-2014

The IOA released this most extraordinary statement on their web site on 19 December 2014. This in an apparent response to recent criticism and complaints to the Engineering Council with regards to the ethics surrounding the IOA noise working group and their close connections to the wind power industry. The complaint letter campaign and Engineering Council response dated October 2014 is discussed earlier in this timeline.

This IOA statement attempts to clarify the position of the IOA in respect to ETSU-R-97, the IOA Bulletin Method, the IOA Good Practice Guide, Amplitude Modulation and the IOA AM Working Group.

Incredibly, in countering criticism of the IOA NWG, the IOA Bulletin Method and the IOA Good Practice Guide, the IOA has claimed that, since their methodologies have been debated at planning inquiries and accepted by Planning Inspectors, they must be correct.

This claim turns around the accepted scientific practice often referred to as the 'Scientific Method', with the science debated and verified by the experts, with Planning Inspectors normally accepting expert, and in theory unbiased, opinion from experts. **However, here the IOA are suggesting that the politically directed Planning Inspectorate should be adjudicating the science.**

January 2015

Letter from S Ambrose to S Cooper: Cape Bridgewater study

By Stephen Ambrose, SE Ambrose & Associates, ME, USA
Available here, Ref 33; S Ambrose Letter Cape Bridgewater to StevenCooper-22Jan2015

The letter dated 22 January 2015 commenting on the November 2014 Cape Bridgewater study starts with: *"Congratulations, I commend you for pursuing scientific truth by investigating the human response to large wind-turbines in the acoustic environment. Your correlation of human response journal entries with scientific waveform analysis clearly shows hearing is not limited to audible sounds. Research continues to reveal that the ear has multiple functions and capabilities. This study merits recognition by acoustic and public health professionals for more research."*

It goes on with: "*Your study goes far beyond the 1980s Neil Kelley et al. studies that identified operating wind-turbines can produce airborne transmissions that humans detect as "sensations". Bray/James research showed that one-third octave band filters could not measure the low-frequency peaks produced wind-turbines. Neighbors' complaints were ignored by the majority. Acoustic experts failed to understand the limitations of their instruments and analysis methods*".

Ambrose continues with; *"Before wind turbines, the highest negative community reaction was vigorous community action to stop the noise. Wind turbines have raised the bar to home abandonment. This life-saving option is not affordable; most experience diminished quality of life, degradation of health, and loss of wellbeing. The population majority remains unknowing and unaffected by wind turbines because they live far away or genetically protected from "sensations". I was surprised to learn that I should not live near a wind turbine neighbor."*

The Ambrose letter highlights the concerns and issues with low frequency noise in the USA and Australia are exactly the same as in the UK. Also, that there are fortunately still a small minority of honest professional acousticians that are prepared to challenge the bad science perpetrated by the wind industry.

February 2015

Letter to Chris Heaton-Harris MP from Ed Davey MP Secretary of State

This letter from Edward Davey MP, Secretary of State, Department of Energy & Climate Change is available here, Ref 34: Davey-letter-to-Heaton-Harris-12Feb2015

The letter dated 12 February 2015 provides an acknowledgement by the Secretary of State for Energy and Climate Change that a planning condition is now required to control amplitude modulation.

March 2015

Report on the committee's inquiry into wind energy

Produced for the Northern Ireland Assembly with the report dated 29 January 2015 and released March 2015 is contained in 7 volumes available here, Ref 35:

wind-energy-volume-1.pdf
wind-energy-volume-2.pdf
wind-energy-volume-3.pdf
wind-energy-volume-4.pdf
wind-energy-volume-5.pdf
wind-energy-volume-6.pdf
wind-energy-volume-7.pdf

This full inquiry into wind energy conducted by the NIA Committee for the Environment provides what is probably the most comprehensive and credible review of the impacts of wind turbines carried out at that time. The report stated that the issue of wind turbine noise was the most contentious aspect of the inquiry. The key recommendations from the report include:

- *"The Department should review the use of the ETSU-97 guidelines on an urgent basis, with a view to adopting more modern and robust guidance for measurement of wind turbine noise, with particular reference to current guidelines from the World Health Organisation. The Department should bear responsibility for ensuring that arrangements be put in place for on-going long-term monitoring of wind turbine noise";*

- *"The Department, working with local universities, should commission independent research to measure and determine the impact of low-frequency noise on those residents living in close proximity to individual turbines and wind farms in Northern Ireland."*

ETSU is heavily criticised in this report, which suggests that the current BS4142 revision (BS4141:2014) be considered when determining if ETSU should be updated.

It is difficult to see how the administrations in the rest of the UK can reasonably ignore these most carefully evidenced recommendations that conclude ETSU is not fit for purpose.

While the Northern Ireland Assembly report was highly significant and credible with its damming appraisal of ETSU, it appears to have been totally ignored by the UK establishment including the IOA.

April 2015

Cotton Farm Wind Farm – Long term community noise monitoring project – 2 years on

6th International Conference on Wind Turbine Noise, Glasgow; Stigwood, Large, Stigwood
Available here, Ref 36; Cotton Farm monitoring Stigwood Glasgow 2015

In 2013 MAS Environmental established a permanent monitoring station to record and publish data online, located 600m from the nearest turbine, to correlate the impact upon the community and provide an extensive database. Previous papers in 2014 on this project have described its background and the early results of the data collected, especially in relation to the occurrence of the special characteristic amplitude modulation.

This paper includes further evaluation of the now extensive database collected over nearly 2 years and how noise features correlate with community response / complaints, including analysis of some of the prominent characteristics recognized as a feature of the community noise as created by this wind farm and how they impact. This part of the long-term study focuses on the parameters and procedures used to identify AM noise. Analysis of the inability of noise controls to reflect true impact in relation to Cotton Farm wind Farm data is also explored.

April 2015

Stationary wind turbine infrasound emissions and propagation loss measurements

6th International Conference on Wind Turbine Noise, Glasgow; Les Huson.
The paper is available here, Ref 37: Stationary WT infrasound Huson 2014

Huson provides evidence of stationary wind turbines emitting infrasound below 8 Hz during high wind conditions due to resonances of blades and towers.

April 2015

Constraints imposed by and limitations of IEC 61672 for the measurement of wind farm sound emissions

6th International Conference on Wind Turbine Noise, Glasgow; Les Huson
The paper is available here, Ref 38: Huson2-constraints-imposed-by-and-limitations-of-IEC-61672-WTN Apr2015

Huson provides evidence that available sound meters compliant with IEC 61672 are unsuitable for measurements where infrasound is present as typically found in WTN emission at frequencies below 6 Hz or where there are low background noise levels.

In his conclusions Huson states *"The author is aware of numerous wind farm assessments, made in accordance with the ETSU-R-97 methodology, where data has been used in preparing trend lines from background and post-construction operating conditions that is outside the range of measurement for which the sound level monitoring equipment is compliant with IEC 61672.*

Such charts are presented as examples of good practice in the IoA Good Practice Guide. The author knows of no ETSU-R-97 type assessment where account has been made for such non-compliant data that is outside the measurement range of the instruments."

May 2015

Amber Rudd MP, Conservative - Secretary of State, Energy and Climate Change (11 May 2015 to 14 July 2016)

While the written ministerial statement halted further development of onshore wind power in England, the noise problem, complaints and suffering continued arising from existing wind turbines. Also, the ban in England did not apply to Scotland where onshore wind continued unabated and encouraged by the Scottish government.

June 2015

House of Commons Written Statement (HCWS42) made by: Secretary of State for Communities and Local Government (Greg Clark) on 18 Jun 2015.

The statement is available here, Ref 39: gregclarkwrittenstatement18-6-2015.pdf

The opening sentence states, quote, *"I am today setting out new considerations to be applied to proposed wind energy development so that local people have the final say on wind farm applications, fulfilling the commitment made in the Conservative election manifesto."*

This written Ministerial statement effectively halted further development of onshore wind power in England.

After almost a year of intensive work the INWG study into wind turbine noise and amplitude modulation was nearing completion.

July 2015

INWG Meetings with Government Ministers

INWG and MAS Environmental, supported by Chris Heaton-Harris MP held meetings with government ministers at Westminster on 7 July 2015 to communicate preliminary findings from the INWG study. The meeting documents are available here, Ref 40; Discussion document for 7 July meetings INWG and here, Ref 41; AMPLITUDE MODULATION DISCUSSION DOCUMENT MAS July 2015

Separate meetings were held with James Wharton MP (DCLG), Liz Truss MP (DEFRA) and Jane Ellison MP (Dept of Health). Preliminary findings and recommendations from the INWG Amplitude Modulation Study were presented. The study findings included:

- *EAM occurs frequently, often for extended periods and can affect*

all wind turbines.

- *Confirmed there are ill health effects at the noise levels and separation distances permitted by ETSU.*
- *Without an AM planning condition there is no effective legal remedy against AM noise. Local authorities are unable to deal effectively with AM.*
- *LFN is relevant to AM and an integral component of WT noise.*
- *ETSU is not 'fit-for-purpose' (Northern Ireland Assembly report, Jan 2015 recommends that ETSU be reviewed on an urgent basis).*

The study recommendations included:

- *ETSU noise guidance to be replaced with a code of practice based*
- *on BS4142:2014*
- *Independent research required into the health effects of wind turbine noise including AM, LFN and infrasound.*
- *An effective AM planning condition is required for every wind turbine planning approval.*
- *Continuous noise monitoring should be required for every wind turbine planning approval.*
- *Effective remedy required for retrospectively dealing with noise nuisance including AM from existing wind turbines*

The release of the INWG study into amplitude modulation was a highly significant milestone in the campaign to replace ETSU. It was a huge achievement by a dedicated team of volunteers. The study was completed in only one year and achieved its original objectives.

It also proved to be highly credible, enabling it to challenge the findings of the IOA study in every respect. However, the IOA study would not be released for another year.

October 2015

The INWG Wind Turbine Amplitude Modulation & Planning Control Study

The study report was released during October 2015 when it was presented to Government at Westminster on 13 October. The issues addressed by the study include;

- **Long–term denial by the wind industry and its acousticians of noise problems including:**
  - **Excess Amplitude Modulation (EAM)**
  - **Need for a planning condition**
  - **Health effects**
  - **That Low Frequency Noise (LFN) is relevant**
- **Continued wind industry defence of the ETSU-R-97 (ETSU) noise assessment guidelines**

- **Similar noise problems in other countries where noise assessment is based on ETSU**
- **No effective protection (legal remedy) against EAM from existing wind turbines**

The INWG study resulted in reports for each of the work packages with work package 10 providing an overall summary of the study, its findings and recommendations. The study work packages being;

WP 1; The Fundamentals of Amplitude Modulation of Wind turbine Noise

By John Yelland, available here, Ref 42; INWG WP1 Yelland 2015
Dr Yelland investigates the science behind wind turbine noise and amplitude modulation. The objective of WP1 is defined as: To provide a technical description and definition of a characteristic of wind turbine noise that has become known as amplitude modulation and to investigate its measurement, its possible causes and any feasible mitigation.

WP1 provides what is arguably the most comprehensive discussion to date on the science behind wind turbine noise and amplitude modulation. Yelland is highly critical of current industry practice to exclude the measurement of low frequency noise below 100Hz based on the assumption that 'what you can't hear can't hurt you'. WP1 also includes a highly critical analysis of the of the ReUK AM report from December 2013.

WP 2.1; Review of Reference Literature

By Richard Cox, available here, Ref 43; INWG WP2.1 Cox 2015

Cox presents the results of a review of the available literature on wind turbine noise (WTN). Over 160 documents are included in the INWG study of amplitude modulation and of these at least 85 documents can be considered as technical in content. This contrasts with the IOA AMWG literature review, which lists a total of just 35 documents. The objectives of INWG WP 2.1 are defined as:

- Review the evolution of knowledge regarding WTN and AM;
- Collate the reference literature relevant to this INWG study and produce a common reference list for the study work packages;
- Provide a short description of each reference document.

The executive summary states; *"Throughout the period reviewed, aided by its acoustic, political and legal consultants, the UK wind industry has sought to hide the true science behind WTN and its effects on people through a concerted strategy of obfuscation and political lobbying. Studies under the auspices of the Institute of Acoustics (IOA), by the wind industry and government into AM and its excess (EAM) are shown to be a diversion to*

avoid answering the scientific questions that really matter. This has been aided by compliant government officials who have been focused on removing barriers to the deployment of wind power generating capacity and by the wind industry effectively taking control of the IOA's successive 'Noise Working Groups'."

WP 2.2; AM Evidence Review

By Sarah Large, available here, Ref 44; INWG WP2.2 Large 2015

Large looks primarily for evidence of audible amplitude modulation noise in support of its existence and prevalence. Amplitude modulation (AM) can be defined as the regular (cyclic) variation in noise level, usually at blade passing frequency, which exhibits a change in the noise character of the wind farm noise as the decibel level rises and falls.

The executive summary states; *"The data described below is conclusive that AM exists and it shows AM is being generated by the majority of wind energy developments. It also shows that AM can be generated by all turbines regardless of size, model or type. AM is not rare but is prevalent and whilst meteorology may not be the sole determinant, under certain meteorological conditions adverse AM can occur for long periods of time."*

WP 3.1; Study of Noise and Amplitude Modulation Complaints Received by Local Planning Authorities in England

By Trevor Sherman, available here, Ref 45; INWG WP3.1 Sherman 2015

Sherman analyses responses from a survey of local planning authorities (LPAs) to determine the extent of the wind turbine noise problem across England. The objectives of INWG WP 3.1 are defined as:

- To quantify the noise and excess amplitude modulation (EAM) complaints received by LPAs in the last five years;
- To establish how LPAs investigate and mitigate for noise and EAM nuisance and through this determine the guidance they need;
- To assess the frustrations and ideas coming forward from LPAs and through this determine a way forward.

The executive summary, at para 1.3 'Extent of the problem' states: *"In England, of the 203 responses to the survey 54 LPAs have received complaints about noise from industrial wind turbines. This should not be interpreted as 27% of wind farms giving rise to noise complaints; many of the LPAs which reported no complaints may well have no operating wind farms in close proximity to housing. Of the 54 LPAs, 17 have also investigated complaints about EAM. Over 600 individual complaints had been received with the majority being in the five year period 2010-14."*

at para 1.4 'Awareness of Mitigations' states; *"…Some LPAs show strong confidence in ETSU-R-97 ('ETSU') and its companion Good Practice Guide (GPG). Others challenge its validity and are seeking a more robust way to deal with EAM at all stages in the application and development process. They are calling for objective science-based guidance on measuring and testing for EAM as well as nationally agreed standards that are consistently applied and proven mitigations for EAM. There are many frustrations with the current arrangements."*

WP 3.2; Excessive Amplitude Modulation, Wind Turbine Noise, Sleep and Health

By Dr Christoper Hanning, available here, Ref 46; INWG WP3.2 Hanning 2015

Dr Hanning summarizes the effects of Excessive Amplitude Modulation (EAM) on people living close to wind turbines including annoyance, sleep disturbance and health effects through a review of the available health related literature. His report discusses ETSU's inability to protect noise sensitive receptors from sleep disruption and therefore harm to their health and in this context to consider the contribution of EAM. The objective of WP3.2 is defined as:

- To summarize the effects of Excessive Amplitude Modulation (EAM) on people living close to wind turbines including annoyance, sleep disturbance and health effects through a review of the available health related literature.

The executing summary states; *"A large body of evidence, presented below, demonstrates that human sleep and health are adversely affected at wind turbine noise levels permitted by ETSU. There is particular concern for the health of children exposed to excessive wind turbine noise. The inadequate consideration of excessive amplitude modulation (EAM) is a major factor in the failure of ETSU to protect the human population."*

WP 4; Den Brook

By Michael Hulme, available here, Ref 47; INWG WP4 Hulme 2015

The Den Brook wind farm and Michael Hulme gained national fame with the four-part BBC documentary titled '**Wind Farm Wars**' screened during 2011. The documentary is still available on YouTube at; Wind Farm Wars BBC 2011

In WP4 Hulme documents the legal, planning and technical issues surrounding the Den Brook AM planning condition (2009). This work package details the enormous effort Renewable Energy Systems (RES), the wind farm developer, has gone to over the previous 8 years to ensure first that an AM

planning condition is not applied, then to have the applied planning condition removed, and finally to have it sufficiently weakened presumably to ensure it prioritises development and operation of the wind farm rather than provide intended protection against EAM. The objective of WP4 is defined as:

- To document the legal, planning and technical aspects surrounding the Den Brook AM planning conditions.

The executive summary includes the statement;
"Developments during the first five years of the proposed Den Brook wind farm, located near North Tawton, West Devon, are well documented on aspects related to Excess Amplitude Modulation (EAM) by the four-hour, BBC2 documentary series 'Wind Farm Wars'. Whilst briefly capturing the project from its beginnings, WP4 more specifically examines the development of EAM related matters since the documentary filming ended and planning permission was granted for a second time in December 2009, but this time, with unprecedented EAM noise controls and conditions appended."

WP 5; Towards a draft AM Condition

By Sarah Large, available here, Ref 48; INWG WP5 Large 2015

Large investigates options for the control of AM. The objectives of WP5 are defined as:

- To conduct a review of existing or proposed methods of identifying and controlling EAM.
- To develop and propose one or more EAM control methods for further testing with the view to use as an EAM planning condition.
- To ensure that any EAM condition takes account of the psycho-acoustic response as far as practicable and account for other character features associated with AM (e.g. tonality, low frequency noise, impulsivity).

And that the final AM condition should be:

- Provided in a simple format that can be applied as a standard planning condition that is comprehendible to the lay person.
- Accompanied by relevant software or guidance notes on its application and use.
- Must be robust and must prevent AM that has been justifiably complained of and / or is deemed to constitute noise nuisance.

Four main methods for assessing or limiting EAM have been critically examined in this work package. The executive summary at para 1.8 states;
"The 2014 version of BS4142 was also used to assess impact at two of the six

sites. BS4142 has previously been dismissed, both in ETSU-R-97 and by others, as an appropriate means of control for wind farm noise. The issues raised to support these arguments have been examined below and found inapplicable to the new version of the standard. BS4142:2014 was found to work very well for assessment and control of cumulative wind farm noise and character impact."

WP 6.1 & supplementary paper WP 6.1A; Legal Issues: The Control of Excessive Amplitude Modulation from Wind Turbines

By Richard Cowen, WP 6.1 is available here, Ref 49; INWG WP6.1 Cowen 2015 and WP6.1A is available here, Ref 50; INWG WP6.1A Supp Cowen 2015

Cowen considers the legal issues surrounding wind turbine noise nuisance. The objectives of WP6.1 are defined as:

- To assess the legality of the Den Brook Condition relating to EAM following the judgement of the Court of Appeal;
- To assess the legal appropriateness of other remedies such as Statutory and Private Nuisance that have been recommended since that judgement or may be available to persons affected by EAM;
- To recommend the most appropriate course of action that will provide legal protection to residents hosting wind farms should EAM occur.

In the Supplementary Paper 6.1A Cowen considers the legal issues for claimants relating to shell companies.

WP 6.2; Control of AM noise without an AM planning condition using Statutory Nuisance

By Bev Gray, available here, Ref 51; INWG WP6.2 Gray 2015

Gray reviews from a community perspective the practical experiences and causal effects of Statutory Nuisance laws when used as a means of protection from Excessive Amplitude Modulation (EAM). This work package compliments WP6.1 – legal review. The objectives of WP6.2 are defined as:

- Review EAM noise nuisance complaints procedures and the difficulties of applying Statutory Nuisance by local authority officers.
- Proposals to ensure a more effective method of EAM control than the existing statutory nuisance.

WP 8; Review of Institute of Acoustics Amplitude Modulation Study and Methodology

By Richard Cox with contributions by Richard Cowen, Bev Gray, Melvin Grosvenor, Chris Hanning, Mike Hulme, Les Huson, Trevor Sherman, Mike Stigwood & John Yelland, available here, Ref 52; INWG WP8 Cox 2015

Cox reviews the activities of the Institute of Acoustics and its Noise Working Groups with respect to wind turbine noise amplitude modulation. WP8 takes a highly critical look at the IOA noise working group's AM study and their methodologies concluding the executive summary with;

"The recent decision by DECC to award the contract for an 'independent study into AM' to WSP / Parsons Brinckerhoff ensures that Richard Perkins as Technical Director of the Acoustics, Noise & Vibration Team at WSP / Parsons Brinckerhoff and also as Chairman of the IOA NWG and a senior member of the IOA Council is now able to influence both AM studies. The conclusion to be drawn is from all of the above is that the long term wind industry strategy of obfuscation, whilst capitalising on the IOA's trusted and respected position as a scientific institution is set to continue."

WP 9; The Cotton Farm Monitor Experience

By Bev Gray with contributions by Jeff Tossell, available here, Ref 53; INWG WP9 Gray 2015

Gray provides a review of a rural community's experience in setting up and carrying out long term continuous noise monitoring and recording of wind farm noise. The objective of WP9 is defined as:

- To document the experience of fighting a wind farm application and the decision to carry out long term noise monitoring by the local community to prove the existence and frequency of noise emanating from a newly built wind farm.

The long-term noise monitor experience pioneered by the local community around the Cotton Farm wind farm proves this is not only practical and cost effective but essential for contesting noise nuisance.

Wind turbine noise recordings from the Cotton Farm turbines and from other sites are available at the MAS website;
https://www.masenv.co.uk/listening_room

WP10; Two Decades of Deception

By Cox, Cowen, Gray, Hanning, Hulme, Sherman & Yelland of INWG and Large of MAS Environmental, available here, Ref 54; INWG WP10 Cox 2015

WP10 summarises all the AM Study Work Packages and brings forward the INWG's key finding and recommendations. The number one recommendation to government being:

As recommended by the Northern Ireland report of January 2015, ETSU should be replaced with a procedure based on the principles of BS4142: 2014.

This will bring wind turbine noise assessment into line with other industrial noise controls. New guidance of this type should be formulated in a Code of Practice that sets out a BS4142: 2014 type methodology that reflects noise character and relates impact to the actual background noise level and not an artificial average.

October 2015

INWG meeting at Westminster with DECC

INWG (Sherman, Cox) with MAS Environmental (Stigwood, Large), supported by Chris Heaton-Harris MP meeting with Andrea Leadsom MP, Minister of State and Department of Energy and Climate Change and DECC officials on 13 October 2015. Available here, Ref 55; DECC Meeting Cox INWG Oct 2015
And here, Ref 56; DECC Meeting Large MAS Oct 2015

INWG presented the findings and recommendation of the AM study to the Minister and DECC officials. The INWG AM study recommendations include:

- *"ETSU noise guidance to be replaced with a code of practice based on BS4142:2014.*
- *Independent research is required into the health effects of wind turbine noise including EAM and LFN.*
- *An effective AM planning condition required for every wind turbine planning approval .*
- *Continuous noise monitoring (with data transparency) should be required for every medium & large wind turbine planning approval.*
- *Effective remedy required for retrospectively dealing with noise nuisance including EAM from existing wind turbines.*
- *Government should disassociate itself from the IOA until the conflict of interest and ethics issues are resolved and full transparency restored."*

MAS presented their experience of AM from multiple wind farms and how it is affecting people living near to the turbines. The character and features of the noise were discussed along with the extent of the problem and the effects it is having.

October 2015

INWG Wind Turbine Amplitude Modulation & Planning Control Study

A paper presenting the INWG AM study by Cox, Cowen, Gray, Hanning, Hulme, Sherman & Yelland of INWG and Large MAS Environmental was included in the Proceedings of the Institute of Acoustics conference, October 2015; (Vol.37. Pt.2 2015)

The published paper is available here, Ref 57;
INWG Wind Turbine AM & Planning Control Study Harrogate 2015

The INWG paper Abstract published by the Institute of Acoustics states;
"*The Independent Noise Working Group (INWG) formed during August 2014 is an independent group of concerned experts and non-experts having no connections with the wind industry supply chain. The objective of the INWG being to conduct an independent and scientific study into wind turbine noise AM that is able to credibly challenge the methodologies and findings of the IoA sponsored AM study published to date.*

The INWG study conclusively demonstrates that EAM is a frequent occurrence and that wind turbine noise adversely affects sleep and health at the setback distances and noise levels permitted by ETSU. There is irrefutable evidence presented to discredit wind industry claims that ETSU provides a robust assessment methodology. Evidence related to low frequency noise (LFN) and its relevance to wind turbine noise assessment is also examined. The need for an AM planning condition is considered and the situation surrounding the Den Brook wind farm AM planning condition is investigated. Methods of AM control have been tested including the methodologies being proposed for assessment by the IoA AMWG. The study concludes with recommendations for a more robust noise assessment process including the control of EAM."

The conference presentation is available here, Ref 58; INWG AM Presentation Cox Harrogate 2015

The presentation included the AM study findings and recommendations made to government at Westminster on 13 October 2015.

October 2015

INWG Press Release; Two Decades of Deception of Wind Turbine Noise

Released on 13 October 2015 by the Independent Noise Working Group and sponsor, Chris Heaton-Harris MP. The press release is available here, Ref 59:
INWG Press release DECC 13102015

The press release based on work package 10 included, quote;

"*The wind industry and its acousticians have for many years been denying there are noise related problems associated with industrial wind turbines. A report released this week, and presented to the Department of Energy and Climate Change by the Independent Noise Working Group (INWG), shows how a small group of wind industry funded acousticians have taken control of*

the Institute of Acoustics (IoA) noise working groups. This façade of respectability afforded by the Institute of Acoustics has enabled the wind industry to dominate government noise assessment policy and planning guidance by providing inaccurate and misleading scientific advice. The parallels with the Volkswagen emission scandal are quite remarkable."

July 2016

Theresa May MP, Conservative – Prime Minister from 13 July 2016 to 24 July 2019

July 2016

Greg Clark MP, Conservative - Secretary of State, Business, energy and industrial strategy (14 July 2016 to 24 July 2019)

August 2016

Institute of Acoustics (IOA) Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group Final Report

By the IOA NWG; Bass, Cand, Coles, Davis, Irvine, Leventhall, Levet, Miller, Sexton & Shelton their final report on 9 August 2016, available here, Ref 60: AMWG Final Report-09-08-2016

The IOA AM study was subsequently presented at the Internoise conference at Glasgow on 23 August 2016. The INWG subsequently reviewed the IOA AM report, and is discussed in WP 8.1 released during January 2017.

August 2016

A review of research into the human response to amplitude-modulated wind turbine noise and development of a planning control method

By Perkins, Lotinga, Berry, Grimwood, Stansfeld; August 2016. The Inter.noise 2016 paper is available here, Ref 61: WSP AM paper Inter.noise 2016

Known as the WSP/PB wind turbine AM review, it was awarded by the government DECC to the acoustic consultant WSP/PB in August 2015. The report itself was submitted to government during August 2016 but was not made publicly available. However, WSP/PB presented a paper at the Inter.noise 2016 conference at Hamburg summarising the results of the study.

October 2016

Wind turbine AM review

By WSP/Parsons Brinckerhoff, authors: Perkins, Singleton, Stansfeld, Grimwood, Berry. The redacted report is undated and available here, Ref 62: WSP_PB-AM-Proposalv5redacted-April2015.pdf
Phase 1 report: WSP-PB Phase 1 report WT AM_Issue_1_291015
Phase 2 report: WSP PB Phase 2 report WT AM Issue_3__FINAL

Following a Freedom of Information request, the undated WSP/PB wind turbine AM report was eventually released on 25 October 2016. The report

was subsequently reviewed by INWG and is discussed in WP 8.1 released during January 2017.

December 2016

Institute of Acoustics workshop titled: 'ETSU-R-97 - Time to move on'

Held at Birmingham on 7 December 2016, refer to IOA ETSU Time to move on event

The event description states: *"ETSU-R-97, the wind turbine noise assessment method used in the UK for planning purposes, has remained unchanged since 1996. It has, however, been heavily criticised, by some, throughout its life. Identified shortcomings on consistency of approach have been tackled through the publication of good practice guidelines, informal articles and investigations into amplitude modulation (AM). Nothing has changed on the basic methodology it applies or the 'limits' based approach it advocates including the actual limits themselves."*

Papers presented include:

What might an Alternative to ETSU-R-97 Look Like?

By McKenzie and Bullmore
Available here, Ref 63: IoA WT Noise 2016 McKenzie and Bullmore

This presentation by leading wind industry acousticians advocated two variations on the existing ETSU methodology, plus a third option to simply continuing with ETSU as it is.

No consideration or even mention was made for the option of adopting BS4142. BS4142 being the noise guidance that applies to virtually all other similar noise generating industrial activities and has been demonstrated to be technically suitable for use with wind turbines.

The December 2016 presentation by McKenzie and Bullmore was similar in content to their presentation at the IOA Harrogate conference held October 2015. It showed a realisation that as a result of years of criticism of ETSU, it would eventually have to be replaced. The problem for the wind industry is how to replace ETSU with something equally or more permissive that will permit a continuation of 'business as usual' and for the new generation of larger wind turbines.

It is striking that of the several methodology options discussed in their presentation, the ready-made and proven methodology namely BS4142, was not even mentioned.

January 2017

WP 8.1; Review of WSP/Parsons Brinckerhoff and Institute of Acoustics Amplitude Modulation Studies

This INWG work package with Appendices, by Cox, Cowen, Gray, Grosvenor, Hanning, Hulme, Huson, Sherman, Stigwood & Yelland was released on 12 January 2017
Available here, Ref 64; INWG WP8.1 Cox 2017
And here; INWG WP8.1 Appendices Cox 2017

This review by INWG was carried out following the release of the IOA AM study report during August 2016 and the WSP/PB AM report in October 2016. Although a summary of the WSP/PB report to the UK government was presented at the Inter.noise conference at Hamburg on 23 August 2016, the full report was withheld. It was only released following a Freedom of Information Request on 25 October 2016.

WP8.1 was delayed by over a year after the release of the main INWG study while waiting for the IOA NWG and WSP/PB AM reports. However, it is arguably the most important INWG work package as it exposes the extent of the skulduggery and deception of the wind industry acousticians.

WP8.1 highlights the coordination between the IOA NWG and the WSP/PB acousticians, all who are closely connected with the wind industry. Then when tested, their recommendations for controlling AM were shown to fail.

Les Huson tested the IOA report hybrid AM methodology as described at appendix F and conducted testing using real turbine noise data described at appendix G. **The conclusion from this preliminary testing, is that the AMWG AM measurement metric under records the actual level of AM at best and will completely miss recording intermittent AM and situations where there are multiple turbines operating at different rotational speeds.**

The INWG initial concerns with these two reports and the lack of independence with the IOA NWG were also outlined in the press release dated 5 October 2016 discussed above. These concerns include:

- The latest proposals deal only with new wind turbine planning applications leaving residents living near existing turbines unprotected and effectively abandoned.
- A failure to investigate the extent of the turbine noise problem and to continue to downplay the significance of the AM problem. INWG work package 3.1 thus remains as the most comprehensive survey data available.
- The untested and unproven nature of the proposed AM measurement and control scheme.
- The lack of independence of the report authors.

WP 8.1 reveals that these latest IOA NWG and WSP/PB AM proposals are basically reworked versions of the heavily criticised 2013 ReUK AM study proposals, with some of the same authors involved. However, the following

important admissions are made within these latest two reports after many years of denial:

- That modulating WTN-like sounds are more annoying than similar noise levels without significant modulation.
- The threshold of perception of AM is around 2dB and increasing modulation depth is associated with increased annoyance. That where there are high levels of AM, the adverse effects could be significant and on this basis a control for AM is required.
- That wind turbine related noise annoyance is associated with increased risk of sleep disturbance and stress. Additionally, the annoyance increases during normal resting periods during the late evening, night-time and early morning. However, the potential impacts on health are still not accepted by WSP/PB, and other reports which do suggest a causal link are ignored.
- That AM cannot be predicted at the planning stage so the likely default position for a planning decision maker should be to apply an AM planning condition unless there is good reason not to.

The recommendations made to government ministers arising from this INWG analysis are:

- **The AMWG and WSP/PB untested and unproven proposals for the measurement and control of AM should be rejected by government unless proven to be a reliable and effective solution to protect wind turbine neighbours.** These proposed methodologies have not been tested with real wind turbine noise data and shown to be able to control AM in an accurate and reliable way. Thorough independent testing is required to prove or disprove the proposed scheme. Initial testing, by the INWG, of the IOA AMWG AM measurement metric **demonstrates the need for credible independent testing.**

- **That Government introduces regulation to the wind industry requiring licencing of individual wind turbine or wind farm sites in a similar manner to other polluting industries**. This being the only means to effectively control noise nuisance and the related health effects from existing wind turbines and so provide a reasonable and workable resolution for wind turbine neighbours. The applicability of these latest proposals to new wind turbine planning applications only would still leave people living near existing wind turbines unprotected other than by taking legal action for nuisance or relying on their Local Authority to pursue a statutory nuisance action. Since the wind industry has shown itself consistently to be unable or incapable of self-regulation on noise issues, Government intervention is required.

INWG WP 8.1 although delayed while awaiting the IOA and WSP/PB reports, became arguably the most important INWG work package as it

exposed the extent of the deception by wind industry acousticians, facilitated by complicit government officials. There is no doubt that WP 8.1 became a serious embarrassment and setback to the wind industry.

Following the disastrous IOA and WSP/PB reports and then the INWG WP 8.1 critique there was no visible government movement on this for several years. It was only during 2021 that a contract was awarded to WSP to conduct a consultation and review of ETSU. This commenced with the stakeholder consultation, with a closing date of September 2021.

March 2017

INWG / MAS meeting at Westminster with DECC

INWG (Cox, Cowen, Gray, Grosvenor, Yelland) with MAS Environmental (Stigwood, Large), supported by Chris Heaton-Harris MP, Heidi Allen MP, Victoria Atkins MP and Natascha Engle MP, met with Jessie Norman MP, Parliamentary Under-Secretary of State for Industry and Energy at the Department of Energy and Climate Change and DECC officials on 1 March 2015. Meeting document is available here, Ref 65:
INWG discussion document for DBEIS meeting 1 Mar 2017

At this meeting, INWG and MAS presented the findings and recommendations from WP 8.1 reviewing the WSP and IOA amplitude modulation studies.

The key messages conveyed to the minister were:

- That the WSP/PB report is not only unfit for purpose but is downright misleading and should be rejected by Government.
- That there is a clear attempt in this report to bury the health effects of WTN despite overwhelming evidence to the contrary.
- What the combined Parsons Brinckerhoff and Institute of Acoustics reports propose is virtually the same AM control scheme as proposed by RenewableUK in their 2013 report. This report by the wind industry trade association was heavily criticised and failed to control AM.

INWG repeated the recommendation that ETSU be replaced by BS4142 and referred to a FOI response dated 3 Feb 2017 that released emails showing:

- **Confirmed that if ETSU withdrawn, BS4142 could be used to fill the gap.**
- **Context aspect and noise limits would need to be applied**
- **BS4142 could result in some planning applications being rejected that would be granted under ETSU**

The March 2017 DECC meeting demonstrated that Government Ministers without a scientific or engineering background will be unlikely to

comprehend the complex technical issues and implications relating to wind turbine noise. Hence, they are not able to sensibly challenge government officials or their advisors on these matters. Such scientifically illiterate government ministers are entirely at the mercy of their officials.

May 2017

Environmental Noise Pollution: Has Public Health Become too Utilitarian?

By Prof. Alun Evans, Centre for Public Health, Queens University, Belfast, dated May 2017. Available here, Ref 66; Environmental Noise Pollution: Has Public Health Become too Utilitarian?

In this paper Professor Evans questions the acceptance of the Collateral Damage caused by wind farms. The paper abstract states;

"Wind turbines produce a range of sound but it is the Infrasound and low frequency noise which deserves special attention. Infrasound is considered to be below the range of human hearing so it is not measured in routine noise assessments in the wind farm planning process. There is, however, evidence that many can register it and a sizeable minority is sensitive, or becomes sensitised to it. The actual route of transmission still requires elucidation.

The net effect of the entire range of noise produced is interference with sleep and sleep deprivation. Sleep, far from being a luxury is vitally important to health and insufficient sleep, in the long term, is associated with a spectrum of diseases, particularly Cardiovascular. The physiological benefits of sleep are reviewed, as is the range of diseases which the sleep-deprived are predisposed to.

Governments, anxious to meet Green targets and often receiving most of their advice on health matters from the wind industry, must commission independent studies so that the Health and Human Rights of their rural citizens is not infringed. Public Health, in particular, must remember its roots in Utilitarianism which condoned the acceptance of some ***Collateral Damage*** *provided that the greatest happiness of the greatest number was ensured.*

The degree of ***Collateral Damage*** *caused by wind farms should be totally unacceptable to Public Health which must, like good government, fully exercise the* ***Precautionary Principle****. The types of study which should be considered are discussed. Indeed, the father of Utilitarian Philosophy, Jeremy Bentham, urged that government policy should be fully evaluated."*

September 2017

The Wind Turbine "Noise" Problem - Is it Infrasound, Low Frequency Noise, or Amplitude Modulation?

INWG Noise Seminar, Glasgow 22 September 2017

The background and justification for this seminar is detailed on the Winds of Justice website at; WIND TURBINE NOISE – Seminar review and up date – Winds Of Justice

Introduction
By Melvin Grosvenor: Seminar introduction - Grosvenor

The Wind Turbine "Noise" Problem - Is it Infrasound, Low Frequency Noise, or Amplitude Modulation?
By John Yelland, available here, Ref 67; Infrasound from Wind Turbines - Yelland

How Infra Sound and Low Frequencies are considered in France
By Patrick Dugast, available here, Ref 68; How infrasound and low frequencies are considered in France - Dugast

Infrasound and low frequency noise: a public health nightmare
By Mariana Alves-Pereira, Bruce Rapley, Huub Bakker, Rachel Summer, available here, Ref 69; Low Frequency Noise and Health: Which objective medical tests are appropriate?

Following the INWG seminar, the IOA published an article describing the seminar in the November 2017 edition of the Acoustic Bulletin. The article written by Dick Bowdler titled, '**Wind turbine noise: the search for an alternative truth**' appears at page 38, available here: Acoustics Bulletin Nov 2017

The Bowdler article is highly disparaging of the seminar speakers and totally unprofessional. This article should never have been approved for publication and reflects badly on the IOA. It also highlights the professional descent of a supposedly scientific institution into a mouthpiece for the wind industry.

November 2017

A planning condition for wind turbines

An article published in the IOA Acoustics Bulletin by the IOA AM Noise Working Group and others; McKenzie, Cand, Bowdler, Jiggins, Irvine, Reid, Perkins, Lottinga, Hayes and Bullmore.
Available here, Ref 70; Acoustics Bulletin Nov 2017

This article at page 56 sets out a proposed wording for a planning condition on noise for wind farms or individual wind turbines. This proposal follows on from the IOA AM study released August 2016 and has been criticised by others.

December 2018

Wind turbine noise amplitude Modulation penalty considerations

By Bowdler, Cand, Hayes and Irvine.

Available here, Ref 71; Wind turbine noise AM penalty considerations, Bowdler

A paper published by the Institute of Acoustics where the authors discuss additional considerations that could apply when applying a potential penalty in combination with a planning condition.

After another year of delay from the November 2017 IOA article, the authors claimed they could not reach any definite conclusions. Predictably, the authors recommend that further research is needed, so more delays.

It was evident at this time that the wind industry acousticians were at a loss to counter the criticism of their earlier proposals for controlling AM or come up with new proposals. However, there would have been no great incentive to change the existing ETSU guidance, with delay working to the advantage of the wind industry.

January 2019

Environmental noise guidelines for the European Region

World Health Organization; dated 30 January 2019
Available here, Ref 72; Environmental noise guidelines for the European Region

The updated WHO noise guidance included wind turbines for the first time in the 2019 revision. The guidance overview states;
"Noise is an important public health issue. It has negative impacts on human health and well-being and is a growing concern. The WHO Regional Office for Europe has developed these guidelines, based on the growing understanding of these health impacts of exposure to environmental noise. The main purpose of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise. They provide robust public health advice underpinned by evidence, which is essential to drive policy action that will protect communities from the adverse effects of noise. The guidelines are published by the WHO Regional Office for Europe. In terms of their health implications, the recommended exposure levels can be considered applicable in other regions and suitable for a global audience."

With regard to wind turbine noise the executive summary recommendation states;

"For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB L_{den} , as wind turbine noise above this level is associated with adverse health effects.

No recommendation is made for average night noise exposure L_{night} of wind turbines. The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation.

To reduce health effects, the GDG conditionally recommends that policy-makers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure. No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another."

Additionally, the main report page 85 states; "*Wind turbines can generate infrasound or lower frequencies of sound than traffic sources. However, few studies relating exposure to such noise from wind turbines to health effects are available."*

Also: "*Standard methods of measuring sound, most commonly including A-weighting, may not capture the low-frequency sound and amplitude modulation characteristic of wind turbine noise."*

April 2019

Wind Turbine Noise & Shale Gas Extraction; Towards a Robust Regulatory Roadmap?

By David Unwin
Available here, Ref 73; INWG Regulatory Roadmap Unwin 2019

Released by the INWG, this paper compares and contrasts the regulatory framework in place for onshore wind turbines with those for shale gas extraction and minerals working. A central feature of the current roadmap for building and operating onshore wind farms in England is the absence of an effective regulatory roadmap of the type that is commonly imposed on other large industrial developments in essentially rural areas.

The paper concludes that the current regulatory regime for onshore wind is too light, unable to inspire the confidence of communities close to operating wind farms that is essential to any further developments. A key recommendation being the replacement of the discredited ETSU-R-97 with a noise assessment based on the principals of BS4142 as the basis for the noise assessment.

May 2019

Judgement in the case of Milne against Stuartfield Windpower Limited.

A judgment of the Sheriff Court of Grampian, Highlands and Islands at Aberdeen by Sheriff Andrew Miller is available here, Ref 74; SCT-Milnes-v-Stuartfield-Windpower-Judgment.pdf

This case was unusual in two respects:

- The case was not settled out of court and a judgement was reached. It therefore created a legal precedent in Scotland.
- The judgement was based on the evidence from the lay witnesses, and not the acoustic experts.

This judgement under Scottish law would not create a legal precedent in England, but should be taken into account in any future cases in England. The judgement is discussed in the two press reports below.

Turbine nuisance action succeeds

An article covering the Milne judgment was published in Noise Bulletin, March 2019 and is available here, Ref 75;
Turbine Nuisance Case Succeeds in Aberdeenshire NB March2019

The court granted an Abatement Order, with this case establishing a legal precedent in Scotland. The article states; *"As this case will no doubt be used as a precedent for future actions, and the order itself used as a template for future injunctions".*

Wind farm falls foul of nuisance claim

An article covering the Milne case written by Laura Tainsh at law firm Davidson Chalmers Stewart and is available here, Ref 76;
Milne v Stuartfield Windpower Limited - Wind farm falls foul of nuisance noise claim

The article states that this judgement confirms that, "*compliance with specific noise provisions in a planning condition does not prevent claims for statutory nuisance*".

June 2019

Climate Change Act - Amendment

The Climate Change Act 2008 was amended by the Theresa May Conservative government, with a mandate requiring a 100% reduction in greenhouse gas emissions by 2050. This was referred to as the Net Zero target and is a legally binding target for the UK government.

There can be no doubt now that the introduction of Net Zero as government policy will have strengthened government resolve in the deployment of renewables and will have strengthen the hand of the wind industry and its supporters.

June 2019

BS4152:2014+A1:2019 Titled: 'Methods for rating and assessing industrial and commercial sound'

Copyright material available for purchase from British Standards and is available here: Methods-for-rating-and-assessing-industrial-and-commercial-sound

The revised BS4142 is used to assess the impact of industrial and commercial sound. It covers a range of methods starting with subjective through objective, to the reference method. BS4142;

- Provides an assessment method for the problem of tones and an assessment method for impulsive sounds.
- Acknowledges that the influence of the context in which the sound is heard is a significant modifier of the impact, in line with subjective assessments.
- Acknowledges that the influence of the context in which the sound is heard is a significant modifier of the impact, in line with subjective assessments.
- Supports current UK planning guidance and Environment Agency requirements on noise impact assessments

The updates from BS4142:2014 to BS4142:2014+A1:2019 includes some technical changes including the introduction of uncertainty into the assessment. The substantially revised standard BS4142: 2014 had already addressed concerns which led to its exclusion for use with wind turbines when ETSU-R-97 was written. BS4142:2014 included extended analysis of special characteristics in noise rendering it suitable for wind turbine noise containing AM. The revised standard BS4142:2014+A1:2019 with the introduction of uncertainty strengthens the argument for its use with wind turbines.

July 2019

Boris Johnson MP, Conservative – Prime Minister from 24 July 2019 to 6 September 2022

July 2019

Andrea Leadsom MP, Conservative - Secretary of State, Business, energy and industrial strategy (24 July 2019 to 13 February 2020)

February 2020

Alok Sharma MP, Conservative - Secretary of State, Business, energy and industrial strategy (13 February 2020 to 8 January 2021)

January 2021

Kwasi Kwarteng MP, Conservative - Secretary of State, Business, energy and industrial strategy (8 January 2021 to 6 September 2022)

January 2021

Cotton Farm wind farm noise nuisance case
Mr Keith Holl v Greencoat UK Wind UK

The Cotton Farm wind farm consisting of eight turbines located in Cambridgeshire commenced operation in 2013. Shortly afterwards residents in the local communities of Graveley, Great Paxton, Toseland and Offord were affected by the noise from the wind turbines, and began submitting noise complaints to their respective Local Authorities, Huntingdonshire District Council and South Cambridgeshire District Council.

Over the following years there were thousands of noise complaints and this resulted in noise surveys by acousticians working for the wind farm owner

Greencoat and the operator BayWa r.e. and also by acousticians working for the local community. The operator claimed the wind farm noise was compliant with the planning conditions and the ETSU noise guidance.

As a result, the local authorities refused to pursue the noise nuisance despite the ongoing complaints. The community were effectively abandoned by their local authorities despite the LPA 'duty of care' to the community. (See however the Supreme court judgment, Coventry v Lawrence, Ref 23; Coventry and others (Respondents) v Lawrence and another (Appellants) which considered the situation relating to compliance with planning conditions and nuisance.)

Details of Cotton Farm and the legal issues surrounding noise nuisance are available at the following; **'INWG 6.1 Legal Issues: The Control of Excessive Amplitude Modulation from Wind Turbines'** Ref 49; INWG WP6.1 Cowen 2015, and **WP 6.1A Supplementary Paper,** Ref 50; INWG WP6.1A Supp Cowen 2015, '**INWG WP 9 The Cotton Farm Monitor Experience**', Ref 53; INWG WP9 Gray 2015, '**INWG WP 6.2; 'Control of AM noise without an AM planning condition using Statutory Nuisance**', Ref 51; INWG WP6.2 Gray 2015, '**Initial findings of the Cotton Farm wind farm long term community noise monitoring project**', Ref 30; Stigwood MAS Internoise 2014 Cotton Farm, **'Cotton Farm Wind Farm – Long term community noise monitoring project – 2 years on'** Ref 36; Cotton Farm monitoring Stigwood Glasgow 2015.

A local resident Keith Holl then decided to bring a Statutory Nuisance complaint on his own behalf against the wind farm operator. The Court papers relating to the Statutory Nuisance complaint were submitted to the Cambridgeshire Magistrates Court on 21 January 2020. Available here, **Ref 92**; Holl-v-Greencoat-noise-complaint-Cotton-Farm-2020

These papers show that Mr Holl first contacted the wind farm owner, Greencoat on 13 Nov 2019. Greencoat denied responsibility, asserting that responsibility was with the wind farm operator BayWa r.e. What followed was a text book case of obfuscation and delaying tactics to frustrate the legal process. This included Greencoat plc, BayWa r.e. UK Ltd and BayWa r.e. Operations Services Ltd frustrating attempts to identify the '*person responsible*' as defined by the Act.

"The repeated use of the corporate veil to shroud the identity of the operator is sufficient to raise a question in the mind of a layman as to whether information is being deliberately concealed.".

The case finally came to the Huntingdon Magistrates Court on 26 January 2021 and lasted two days. At the point when Mr Holl's acoustic expert was about to give evidence, the Greencoat team claimed this Statutory Nuisance complaint was a Criminal case and as such the acousticians evidence was not admissible as it was now more than 6 months old. As a result, the evidence

could not be given to the Court and the case was dismissed. **What the Cottom Farm case demonstrates is the virtual impossibility for the victims of wind turbine noise to obtain justice under English law.**

From a legal perspective, the issues that can be drawn from this case are;

1) The case was brought by an individual who claimed to be affected by a statutory nuisance under Section 82 of the Environment Protection Act 1990. This section enables members of the public to take proceedings if the local planning authority fails to act.

2) The proceedings are in the Magistrates Court and are "summary proceedings", i.e. they can only proceed in the Magistrates Court and not in the Crown Court.

3) Under Section 127 of the Magistrates Courts Act 1980, Summary Proceedings can only deal with events that occurred within 6 months of the proceedings being started (i.e. when the Complaint or Information was received by the Magistrates Court). Anything that happened before the 6 months period is inadmissible as evidence (although it MAY support evidence within the 6-month period) (Cases which must proceed in the Crown Court, such as murder, or may proceed either there or in the Magistrates Court, such as theft, are not subject to this 6-month rule.)

4) Although proceedings under section 82 above are started by a "Complaint" (which relates to Civil as opposed to Criminal proceedings), if the Magistrates do find a nuisance has been committed, they can in England (but not in Scotland) impose a fine as well as make an order.

5) As a result of this, it is now settled law that proceedings for Statutory Nuisance in England are Criminal, not Civil, whatever Section 82 may say about "Complaint"

6) The Standard of Proof in Criminal Proceedings is '***Beyond Reasonable Doubt***' whereas in Civil Proceedings it is '***On the Balance of Probabilities'***. It is therefore much harder to prove a criminal case than a civil one.

7) In addition, in Criminal Proceedings the Criminal Procedure and Investigations Act 1996 applies and the prosecutor (i.e. the individual in 1 above) has to serve on the defence (i.e. the wind farm company) details of all the material that he has considered but not used which may assist the defence or undermine his (the individual's) case. Many professional prosecutors, including the Crown Prosecution Service, have fallen foul of these requirements but in this case, an individual is expected to do it and get it right.

8) Statutory Nuisance when taken by an individual, as in the Cotton Farm case, therefore places a huge burden on the individual. He must comply with all the above rules and if he does not, his case will fail as a result. This is precisely what happened in the Cotton Farm case and the wind farm company exploited all the above rules to their advantage.

January 2021

Kwasi Kwarteng MP, Conservative - Secretary of State, Business, energy and industrial strategy (8 January 2021 to 6 September 2022)

September 2021

Department for Business, Energy and Industrial Strategy review of onshore wind turbine noise assessment guidance: Stakeholder Engagement Survey

The closing date for this stakeholder survey under a contract awarded to WSP was September 2021. This consultation on the future of ETSU was by invitation only and the INWG was not invited to participate. Only following a request directly to DBEIS was the INWG allowed to participate, and by then at a very late stage in the proceedings. The INWG consultation response submitted 24 September 2021 is available here, Ref 77; INWG DBEIS Stakeholder consultation response Sept 2021

The report by WSP dated October 2022 was finally released on the WSP website in February 2023 and critiqued by the INWG in April 2023.

March 2022

Uren v Bald Hills Judgement; Supreme Court of Victoria at Melbourne

Available here, Ref 78; Bald Hills judgement March 2022

This judgement against a wind farm operator for noise nuisance created a legal precedent in Australia. Although not creating a legal precedent in the UK it is highly relevant here as the noise standards and legal system are both similar to the UK. In this judgement quote; *"Noise found to be substantial and unreasonable interference with plaintiffs enjoyment of land."*

The terms of the judgement being:

- *"Bald Hills will be restrained from continuing to permit noise from wind turbines on the wind farm to cause a nuisance at Mr Zakula's house at night, and will be required to take necessary measures to abate the nuisance.*
- *Bald Hills is to pay damages to Mr Zakula in the sum of $168,000, comprising $84,000 for past loss of amenity, and $84,000 for aggravated damages.*
- *Bald Hills is to pay damages to Mr Uren in the sum of $92,000, comprising $46,000 for past loss of amenity and $46,000 for aggravated damages."*

September 2022 **Liz Truss MP, Conservative** – Prime Minister from 6 September 2022 to 24 October 2022

September 2022 **Jacob Rees-Mogg MP, Conservative -** Secretary of State, Business, energy and industrial strategy (6 September 2022 to 25 October 2022)

October 2022 **Rishi Sunak MP, Conservative** – Prime Minister from 24 October 2022 to 4 July 2024

October 2022 **Grant Shapps MP, Conservative -** Secretary of State, Business, energy and industrial strategy (25 October 2022 to 7 February 2023)

February 2023 **Grant Shapps MP, Conservative -** Secretary of State for Energy Security and Net Zero (from 7 February 2023 to 31 August 2023)

February 2023

A review of noise guidance for onshore wind turbines

This project report on the future of ETSU was commissioned by the government DBEIS and produced by WSP. The report dated October 2022 was withheld for reasons unknown for over 3 months, and finally released by WSP on 10 February 2023. The announcement appeared on their Linkedin page, and the full report on the WSP website available here, Ref 79; WSP Linkedin announcement Lotinga Feb 2023

This 400-page report followed from the earlier stakeholder engagement survey launched during 2021, with a consultation response closing date of September 2021. The WSP report was subsequently reviewed by the INWG and a report issued during April 2023, see below.

February 2023

HM Government Department for Levelling Up, Housing & Communities Reforms to National Planning Policy Consultation

This government consultation was launched on 22 December 2022 and the INWG submitted a consultation response on 27 February 2023, available here, Ref 80; INWG consultation response DLUHC Feb 2023

The INWG consultation response was primarily focused on wind turbine planning issues relating to noise. This included the effects on wind turbine neighbours, low frequency noise, amplitude modulation and the inadequacy of the ETSU noise guidance.

April 2023 **INWG Analysis of WSP Report titled: A review of noise guidance for onshore wind turbines**

By: Cox, Crosthwaite, Gray & Grosvenor

The WSP 400-page report released on 10 February 2023 was reviewed by the INWG. The critique report dated 15 April 2023 was submitted to DESNZ and is available here, Ref 81; INWG Analysis of WSP report April 2023

The INWG analysis of the WSP report, concluded that this review of ETSU by WSP is heavily biased with clear conflicts of interest;

- In the evidence review, WSP admit to examining a restricted evidence base and utilising an inferior review methodology.
- The stakeholder survey was by invitation only and judged to be highly deficient and unbalanced. Unsolicited consultation responses were ignored by the authors and not included in the WSP review. The INWG were not initially invited, but after appealing to the government DBEIS, were permitted to participate and submitted a consultation response.
- The LPA consultation rate of just 9% is highly questionable, and compares poorly against the 77% rate achieved by the INWG to a similar survey during 2014. See INWG WP 3.1
- Despite the highly deficient study methodology and stakeholder consultation, the evidence clearly shows that ETSU is unfit for use and should be replaced.

Given the strength of the evidence revealed within the WSP report, there is a clear and obvious disconnect between this evidence, and the report's conclusions and recommendations. This leads to the conclusion that the WSP report recommendations were predetermined.

The INWG recommendations communicated to government included:

- Reject the recommendations made by WSP in their review for ETSU-R-97 to be retained albeit with some revisions.
- Replace ETSU-R-97 with BS4142:2014+A1:2019 as the official guidance for wind turbine noise assessment. (**Table 1 at page 26 of the INWG report provides a comparison of the key features of BS4142 with ETSU)**
- Reject the WSP suggested proposal for a government 'position statement' on low frequency noise. This proposal is unsupported by the evidence and would conflict with the World Health Organisation (WHO) position.
- Conduct independent research into the effects on health and well-being of wind turbine noise including impacts from long term exposure, low frequency noise, infrasound, amplitude modulation and tonal noise as recommended by the WHO.
- Introduce licencing and regulation of wind power generation by a national agency such as the Environment Agency. This to include

continuous monitoring and recording of noise and turbine data (SCADA) with the data available for compliance and complaint purposes.

A theme emphasised throughout the WSP report, is use of the climate emergency and Net Zero as leverage to maintain a commercial advantage for the onshore wind industry.

The WSP review of ETSU took over 2 years to complete. Based on previous reports it is almost certain that draft versions were reviewed and amended by government officials until the desired conclusions and recommendation were achieved.

As a result of the INWG analysis, it is considered that this review of ETSU by WSP has been a whitewash and the report recommendations were predetermined.

Additionally, there is the suspicion that the WSP review of ETSU is being used as the basis of justifying a replacement for ETSU that will permit even higher levels of noise, audible and infrasonic. A more permissive guidance will be essential for government in order to permit the planned deployment of the new generation of much larger onshore wind turbines, now being justified by Net Zero targets.

July 2023

Department for Energy Security & Net Zero Consultation titled: Developing Local Partnerships for Onshore Wind in England with a closing date of 7 July 2023

INWG submitted a consultation response to the government DESNZ on 6 July 2023, available here, Ref 82;
INWG Consultation response local partnerships for onshore wind July 2023

To date there has been no feedback or response from government on the topics of this consultation.

August 2023

Claire Coutinho MP, Conservative - Secretary of State for Energy Security and Net Zero (from 31 August 2023 to 5 July 2024)

September 2023

Onshore wind turbine noise: A review of the current guidance framework for the UK Government – Part 1

An article by the authors of the WSP review of ETSU published in the Acoustics Bulletin by the Institute of Acoustics Sept/Oct 2023 edition available here, Ref 83; Acoustics-bulletin-september-october-2023

Part 1 (page 26) describes the project background, aims and methodologies employed. As such it generally summarises content from the main report and was not controversial.

November 2023

Onshore wind turbine noise: A review of the current guidance framework for the UK Government – Part 2

An article by the authors of the WSP review of ETSU published in the Acoustics Bulletin by the Institute of Acoustics Nov/Dec 2023 edition available here, Ref 84; Acoustics-bulletin-november-december-2023

Part 2 (page 26) published 2 months after Part 1 was therefore expected to continue with a summary of the evidence, conclusions and recommendations from the main report. However, Part 2 instead focused on what appears to be a response to criticisms including the earlier INWG critique of the main WSP report.

Importantly there are now also some significant U-turns by WSP in the article compared to the main WSP report. These are discussed in the INWG Briefing paper released March 2024.

February 2024

Report on the High-Resolution Infrasonic and Low-Frequency Sound Recordings Conducted Within a Rural Farm in Scotland in 2022 and 2023

This report by the International Acoustics Research Organisation (IARO) authored by Mariana Alves-Pereira, Huub Bakker and Rachel Summers of IARO and Susan Crosthwaite of Citizens' Initiative, Scotland with contributions by Bruce Rapley, Philip Dickenson and Les Huson was released in February 2024. The main report is available here, Ref 85:
Rural Farm Report - FINAL

This IARO report provides a highly important advance in our understanding of wind turbine low frequency noise and infrasound, how it should be measured and how the data should be analysed. This research also provides evidence of the direct link between low frequency noise and health effects.

This evidence clearly challenges the wind industry denials surrounding the health effects from LFN and infrasound.

The IARO is an international group of researchers with a mission to investigate acoustical environments, especially with respect to features that affect humans and animals, and to publish the results. IARO holds the ethics approval for the CSI-ACHE, the Citizen Science Initiative into Acoustical Characterisation of Human Environments, the results of which are publicly disseminated.

The main report discusses noise measurements carried out at a rural sheep farm in Scotland following complaints of severe health deterioration that only began following the commissioning of a nearby wind farm. The goal of the investigation was to provide high-resolution analyses of the soundscape in and around the rural sheep farm, on behalf of all residents and farm workers (10 adults and 4 minors).

Appendix A titled: **Technical Background for Laypersons** provides a more detailed description of the measurement and analysis methodology and is available here, Ref 86:
IARO Acoustics Report Annex A Technical background Rural

The IARO analysis is explained and is compared to the current ETSU methodology.

The IARO methodology compared to ETSU allows for the identification of a wind turbine acoustic signature (WTAS) due to:

- Increased time resolution
- Increased frequency resolution
- Use of unweighted sound pressure level (SPL) measurement

The report synopsis is available here, Ref 87: IARO Synopsis Rural Sheep Farm 2024

A health report following this investigation was released by the IARO during June 2024.

March 2024

The Meenacloghspar (Wind) Limited Judgement

Delivered by The High Court, Ireland by Justice Emily Egan dated 8 March 2024, available here, Ref 88; Meenacloghspar-judgement-March-2024.pdf

This judgment creates a legal precedent in Ireland although not in the UK. Otherwise, this case is highly relevant to the UK due to the similar legal system and common use of the ETSU noise guidance. The case between Margaret Webster and Keith Rollo & Ross Shorten and Joan Carty as Co-Plaintiffs and Meenacloghspar (Wind) Limited as Defendants concerned noise nuisance.

This judgement is also important in that it highlights the extreme suffering experienced by wind farm neighbours due to wind turbine noise.

Justice Emily Egan, found in favour of the plaintiffs despite potential compliance of noise levels because, according to plaintiff testimony:

- Even with the windows closed, and despite wearing professional noise cancelling headphones, the noise and vibrations caused by the turbines still disturbed sleep.

- Sleep patterns remained extremely disrupted, and on many nights, plaintiffs would not get more than two hours sleep. This meant feeling frequently exhausted and stressed.

- Noise and vibrations would pass through the walls and could be "felt in the bones," with reverberations felt inside and outside the home.

Although there was an acknowledgement that Amplitude Modulation was a factor, the case was largely judged on the evidence of the plaintiffs and not that presented by the expert witnesses.

Furthermore, whether the operational noise levels were compliant with the ensuant planning conditions, was deemed to be of little relevance as with the Coventry & Lawrence judgement.

March 2024

INWG Briefing Paper - Onshore wind turbine noise guidance

This Briefing Paper authored by Cox, Grosvenor, Cowen, Gray and Crosthwaite was released on 28 March 2024, available here, Ref 89; INWG Briefing Paper March 2024

This Briefing Paper was written to provide an update on the INWG report titled, '*INWG Analysis of WSP Report*' dated April 2023 and to incorporate an assessment of the two-part article by WSP published in the IOA Acoustics Bulletin promoting their review of ETSU to government.

There is no doubt that the WSP authors had read the INWG critique from April 2024 of their report on ETSU, as the subsequent articles in the Acoustics Bulletin were in effect a response to that INWG critique. Additionally, in their Acoustics Bulletin articles, the WSP authors appeared to make some significant U-turns in response:

- The WSP authors discuss noise limits at length, pointing out that the ETSU-R-97 pass/fail outcome is inconsistent with the wider policy frameworks in England and Northern Ireland. These frameworks require noise impacts to be addressed in a more nuanced way.
- The WSP authors discuss and now appear to recommend the use of LA_{eq} for noise measurement, instead of LA_{90} as is currently mandated by ETSU. This is a significant change from the main WSP report.

It should be noted that adopting BS4142 would address both these issues.

In what seems to be a significant U-turn, the WSP authors now recognises that there may be some merit in the BS4142 type assessment methodology and use of LA_{eq} in place of LA_{90}.

Although the wind industry and its acousticians continue to ignore the INWG and other independent critics, it was clear that the Acoustic Bulletin articles written by the WSP authors appearing in September and November 2023 were in direct response to the INWG critique of their review of ETSU. The apparent U-turns are highly significant although it remains to be seen whether they will be implemented in any form.

May 2024

Letter to the Editor

A letter by the INWG was published by the Institute of Acoustics in the Acoustics Bulletin in the May / June 2024 edition, available here, Ref 90; INWG Letter Acoustics Bulletin May 2024.

The INWG requested the IOA to be allowed to publish an article in the Acoustics Bulletin in order to respond to the two WSP articles published in the September and November 2023 editions promoting the WSP review of ETSU. The IOA initially agreed to the INWG request but rejected the proposed INWG article, listing several objections. A revised (diluted) article incorporating all the IOA objections was subsequently submitted. This second version was also rejected but no reasons were given for the rejection this time.

However, the INWG were invited to submit a 'Letter to the Editor'. The IOA did finally allow the INWG letter to be published although it was delayed to the May 2024 edition of the Acoustics Bulletin, available here; IOA Acoustics Bulletin May 2024 at page 60.

The attempt by the INWG to have the IOA publish a response to the WSP articles in the Acoustics Bulletin was met with resistance and delaying tactics. There can be no doubt that the IOA were acting to stifle independent scrutiny of their acousticians.

June 2024

Health Report on a Rural Sheep Farm in Scotland

By Mariana Alves-Pereira, Huub Bakker & Rachel Summers of IARO and Susan Crosthwaite of Citizens Initiative, Scotland, available here, Ref 91:
Rural Farm Health Report - Final

This report dated June 2024 follows the earlier report by the IARO during February 2024 regarding the low frequency noise recordings taken at this sheep farm and the subsequent data analysis. This investigation was carried out following a request by the residents and farm workers at the sheep farm in Scotland. These sheep farm residents began suffering severe health deterioration following the commissioning of the most recent wind farm in their area. The investigation was led by the International Acoustic Research Organisation (IARO) of New Zealand supported by Citizens Initiative, Scotland.

Analysis of acoustic recordings show a practically continuous exposure of the sheep farm residents to a strong wind turbine acoustic signature (WTAS) and low frequency tones. These WTASs are not detectable with the methodologies imposed by current UK noise guidance, namely ETSU.

Since the installation of the wind farm, Mr Z, 76, has been hospitalized twice, in March 2023 and in June 2023 (airlifting required); Ms. Z1 (53, daughter) was hospitalized from June 2023 to January 2024; and Ms. Z2-4 (14, granddaughter), diagnosed with high spectrum autism at age 2, has seen her behaviour greatly and seriously aggravated, causing a devastating impact on the entire family.

In November 2023, the family Z received a letter from a Consultant in Public Health (Health Protection) [name redacted] representing NHS Highland (Inverness), where it was suggested that the symptoms developed by the rural sheep farm residents were due to psychosocial factors (I.e., a psychosomatic aetiology). Meditation, mindfulness and cognitive behavioural therapy were the recommended therapeutic courses of action.

NHS-Highland attribute a psychosomatic aetiology to the disorders developed by the rural sheep farm residents, while proffering no clinical or scientific evidence to support their position. This is contrary to the rules of Evidence-based Medicine.

This report demonstrates that medical representatives of NHS Highland irresponsibly ignored the foundational principles of the Scientific Method by:

- Disregarding the dose-response relationship, as defined in Medical Sciences, which quantifies and associates objective medical endpoints to specific quantities (doses) of a physical agent of disease.
- Using methodologically flawed studies to substantiate their scientifically indefensible position.
- Establishing a diagnosis without proffering any clinical or scientific evidence.
- Recommending a therapeutic course of action that borders on clinical negligence.

The sheep Farm residents have not received any relevant medical diagnostic tests to confirm or deny the hypothesis that their ailments are developing as the result of psychosocial factors, or any medical diagnostic tests to confirm or deny the hypothesis that their ailments are developing as the result of continuous exposure to a Physical Agent of disease.

This health report highlights the level of suffering being experienced by people living close to wind turbines. Most wind farm neighbours across the UK are suffering health impacts in silence.

July 2024 **Sir Keir Starmer MP, Labour** – Prime Minister from 4 July 2024 to present

July 2024 **Ed Miliband MP, Labour -** Secretary of State for Energy Security and Net Zero (from 5 July 2024 to present)

July 2024

Policy statement on onshore wind

This Policy Paper published by the Government on 8 July 2025 is available at: UK Government Policy Statement Onshore Wind July 2024

This policy paper removes the effective ban on further onshore wind turbine development in place since June 2015. Footnotes 57 and 58 to paragraph 163 of the NPPF no longer apply.

This change in government policy is expected to lead to a resumption in onshore wind development. However, the turbines now being proposed are significantly larger in terms of height, rotor diameter and generating capacity. These larger turbines come with a corresponding increase in sound energy, both audible and infrasonic sound energy.

One of the constraints to the deployment of this new generation of larger turbines is the need for a more permissive noise guidance that will permit higher levels of noise, especially infrasonic sound energy.

April 2025

Update to ETSU-R-97 Onshore Wind Noise Guidance

Further to the WSP review of ETSU released 10 February 2023, the government DESNZ followed up on 7 May 2024 with a request for tenders to update ETSU. Limited information on the government contract tender was made available on the contract website here: PS24055 - Update to ETSU-R-97 Onshore Wind Noise Guidance - ITQ - Contracts Finder

The closing date was 29 May 2024 and we understand the contract has since been awarded to 'Noise Consultants Ltd'. Information on Noise Consultants Ltd is available here: Noise Consultants - Environmental Noise & Vibration Experts

The contract requirements stated on the government website include:
"The successful bidder of this contract will produce two documents. An informal paper of secondary research to be shared internally with Government, and updated ETSU guidance to be published on gov.uk. The expectations of the contractor are:

The contractor Supplier will work closely with the Government throughout the duration of the contract to iterate the final product. The updated guidance will be published by, and the intellectual property of, the Government.

Above and in the attachments section we have provided a high-level overview of the Scope of Services for this Contract. Due to the sensitivity of this work, the full specification will only be provided to potential Bidders upon completion of the PS24055 Non-Disclosure Contract."

On 27 October 2024 the INWG submitted an Environmental Information Request (EIR) to the government DESNZ requesting the full specification of this contract.

On 25 November 2024 DESNZ replied to the EIR with a refusal to release the requested information.

Appendix C

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