PROPOSED FLYERS CREEK WIND FARM
BLAYNEY SHIRE COUNCIL AREA
MP_08 0252

Re: Infigen's application for Modification 3

SUBMISSION

TO

NSW DEPARTMENT OF PLANNING & ENVIRONMENT

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June 2017

5th June 2017

Submission to:

Resource Assessments
Department of Planning & Environment
320 Pitt Street
GPO Box 39
Sydney NSW 2001

Dear Mr Davies

Re: Flyers Creek Wind Farm MP 08_0252 – Modification 3

1. INTRODUCTION

We refer to previous submissions were have made to the NSW Department of Planning & Environment (previously known as the NSW Department of Planning & Infrastructure) concerning the planned, and subsequently approved, Flyers Creek Wind Farm:

(i)	Original submission – Dr Alan Watts	December 2011
(ii)	Original submission – Dr Colleen Watts	December 2011
(iii)	Supplementary submission – Drs Alan & Colleen Watts	October 2012
(iv)	Submission to PAC – Dr Alan Watts	February 2014
(v)	Submission to PAC – Dr Colleen Watts	February 2014

In addition we have made several other relevant submissions to the DoPE concerning the impacts of wind farms, including:

(i)	Submission re Draft NSW Planning Guideline Wind Farms – Drs Alan & Colleen Watts	March 2012
(ii)	Submission re Wind Energy: Assessment Policy Drs Alan & Colleen Watts	September 2016

We have also made submissions to the three Federal Parliament Senate Enquiries into industrial wind turbines and their ramifications; to the NHMRC and to other State's enquiries.

This submission forms an addendum to the material listed above.

Over the past decade when there has been an attempt to regulate the wind industry we have seen a steady erosion of any protection of the community's interest, particularly but not exclusively in the area of health sequelae due to the operation of industrial wind turbines (IWT).

This has been particularly noticeable in the changes made between the 2012 Draft Guidelines and the 2016 Wind Energy Guidelines. The latter is a watered-down version full of motherhood statements

and offers no real protection to the community. For example the 2016 version has removed all discussion of setback distances and presumably relies on predictions of sound. Our previous submissions have addressed this issue in detail but there is a very real sense that the DoPE does not want to ackowledge this issue and its very real implications.

We are members of the Flyers Creek Wind Turbine Awareness group (FCWTAG). We support and endorse the group's current submission to the DoPE concerning the Flyers Creek Wind Farm Modification 3 application. The submission has made several statements of fact, and backed them up with considered and critical argument.

The Department of Planning and Environment must be aware of the significant anger, disaffection and depression that has been caused by the relentless roll-out of approvals for industrial wind farms in NSW – Flyers Creek Wind Farm is but one.

It is time that DoPE (and the PAC) started listening to community concerns, addressed the possibility that wind farms (being utterly unfit for purpose) should not be approved at all and stopped acting as an extension of the wind industry.

2. IMPACTS OF TURBINE REMOVAL

Previous IWT hosts at R014, R024 and R056 are no longer participating in the wind farm project. In so doing IWTs 4, 13, 14, 16 are to be removed from the project. This forms part of Modification 3. These three properties become non-hosts and should be allowed the same considerations as other non-hosts.

The closest IWT to R014 will now be #9 at 1.3 kms.

The closest IWT to R024 will now be #3 at 1.8 kms.

The closest IWT to R056 will now be #15 at 0.9 kms.

The 2012 Draft Guidelines considered 2 kms to be an appropriate set-back distance for non-hosts. The 2016 Wind Energy Guidelines has managed to delete any mention of distance but this does not remove the grave concern that community members living too close to IWTs ***will*** be adversely effected.

Despite numerous requests for the States, the Federal Government and the NHMRC to investigate appropriate set back distances, and the impacts of living too close to IWTS, to date none have been undertaken.

We must therefore rely on studies undertaken internationally and the evidence is mounting that setback distances of much greater than 2 kms are needed to ameliorate or eliminate sound impacts.

A recent research paper from Germany is a case in point:

- *Weichenberger, M et al (2017). Altered cortical and subcortical connectivity due to infrasound administered near the hearing threshold – Evidence from fMRI* https://doi.org/10.1371/journal.pone.0174420

The results and conclusion from this study are very important and are tabulated in the Appendix. A careful read of the disturbing findings is recommended.

They strongly suggest that there are adverse health impacts caused by low frequency sound and infrasound generated by industrial wind turbines. These are not negligible health impacts but are potentially serious with ultimately life-threatening implications.

The wind industry has always denied any health effects of wind turbines. In fact the production of infrasound is always denied. Most sound measurements are reported and discussed using dB(A) – A weighted – readings which effectively filter out any infrasound. More realistic measurements could be made using dB(C), dB(G) or indeed unweighted readings which would give a better indication of the presence of low level frequency sound and infrasound. DoPE seems incapable of insisting on these more meaningful measurements.

However, despite the wind industry's assertions to the contrary, there are an increasing number of reports and studies that show that IWTs do produce LFS and infrasound, and that this increases with the size of the IWTs.

All of the Virpac modelling and extrapolation infers the construction of 2.5 MW wind turbines yet no decision has been ever been made public as to what the brand and eventual size of the wind turbines will be at Flyers Creek. In a likely scenario they will be larger with a resulting greater production of LFS and infrasound. **There also appears to be NO planned consequences for Infigen should it exceed its allowable upper noise production.**

Moreover, as pointed out in the FCWTAG's submission, accelerating mining activities and other industrial activities already produce a level of infrasound which is concerning. There has been no effort by Infigen or Virpac to address the problems of cumulative effects. These could be very considerable. It may also lead to a situation where no industrial operation around the Flyers Creek area will take responsibility for the infrasound and LFS in the environment. This however will be of small comfort to those who suffer the ill-effects of infrasound. **It is therefore incumbent on the government (i.e. the DoPE) to protect the community from health impacts that are inevitably going to occur.**

In this very particular instance the residents of R014, R024 and R056 should have those IWTs that are less than 2 km from their property removed, i.e. IWTs 3, 9 and 15.

3. CONCLUSION

The assertions by Infigen that Modification 3 will have a reduced impact on surrounding residents provides no reassurance. Any wind farm of any size will have impacts. To place industrial edifices of the anticipated size of IWTs into a rural (relatively densely populated) environment is a complete travesty.

While we argue the specific impact that will remain for the now non-hosts at R014, R024 and R056 with the retention of IWTs 3,9 and 15, in fact there will be unacceptable impacts for the whole Flyers Creek Wind Farm area.

This wind farm should never have gained DoPE approval in the first place. The area has always been an inappropriate location for a wind farm with its already industrialised activity (mining) and its considerable number of small property holders (particularly at the northern end).

With serial problems now arising in the renewable energy industry itself and with the increasing wind energy being delivered to the grid (intermittency, unreliability, instability of the grid, expensive tax-payer funded subsidisation, the requirement for parallel back-up, rising electricity prices and a host of other environmental, agricultural, health and community problems) it is surely past time for the government to critically assess the complete worthlessness of IWTs.

Approval for the Flyers Creek Wind Farm should be rescinded. History will judge this government poorly as the stupidity and inevitable appalling consequences of the proliferation of IWTs becomes apparent. This fact is already becoming accepted internationally and it is time for Australia to take off its blinkers and make care of its community its top priority.

Alan C Watts OAM Colleen J Watts OAM

June, 2017

4. APPENDIX

- Weichenberger, M et al (2017). Altered cortical and subcortical connectivity due to infrasound administered near the hearing threshold – Evidence from fMRI https://doi.org/10.1371/journal.pone.0174420

Discussion

The results of the present study can be summed up in the following way: Prolonged IS exposure near the participants' individual hearing threshold led to higher local connectivity in three distinct brain areas–rSTG, ACC and rAmyg–, while no such effect was observed for stimulation above the hearing threshold. Our data also shows that near-threshold IS was associated with connectivity changes on the network level, emphasizing the role of the rAmyg in IS processing. To our knowledge, this study is the first to demonstrate that near-threshold IS does not only produces physiological effects, but that the neural response involves the activation of brain areas, which are important for auditory processing but also for emotional and autonomic control. These findings thus allow us to reflect on how (sub)-liminal IS could give rise to a number of physiological as well as psychological health issues, which until now have only been loosely attributed to noise exposure in the low- and very low-frequency spectrum.

Thus far, evidence regarding the influence of IS on brain activity is limited to two fMRI-studies. Dommes et al. [18] were the first to show that monaural stimulation with a 12-Hz IS tone led to an activation of the bilateral STG, when stimuli were applied at SPLs of 110 as well as 120, but not at 90 dB. However, this pioneering study suffered from the methodological drawback that during 12-Hz stimulation 36-Hz harmonics had been present, which left some room for doubt whether it had really been the IS component that triggered the neural response. In addition, Dommes et al. (2009) were not able to draw reference to psychophysical data about the participants' hearing thresholds or verbal reports and could therefore only speculate that IS exposure at 110 and 120 dB must have led to a hearing sensation, whereas stimulation with 90 dB should not have exceeded the hearing threshold. Recently, Weichenberger et al. [19]

also reported bilateral STG activation in response to supra-threshold IS stimulation, however, in this study an improved setup that prevented higher harmonics from reaching the participants' ear in combination with acoustically well-characterized participants giving verbal reports after the scan session were employed. Surprisingly, we are facing an entirely different situation in the present study, as STG activation was absent during supra-threshold stimulation, but clearly present when IS was administered near the hearing threshold. These results are particularly noteworthy, since not only the experimental setup but also 11 out of the 14 participants were identical across Weichenberger et al.'s [19] and the present investigation. It thus appears that the seemingly contradictive results cannot be attributed to different instrumentation or participants, but rather point towards truly different neural responses which have been uncovered due to the nature of data acquisition as well as the time course of stimulus application chosen in this study. Since we were interested in studying the brain's response to IS under conditions, which more closely resemble those found outside of the laboratory, we chose significantly longer stimulus intervals (200 s) and also provided a constant level of stimulation throughout the entire interval. This is in contrast to the aforementioned studies, in which short stimulus intervals consisting of multiple successive tone bursts (1 and 3 s respectively) with interleaved image acquisitions were employed. The absence of STG activation during supra-threshold IS exposure could therefore be the result of stimulus-specific adaptation, according to which the BOLD signal gradually decreases in response to ongoing stimulus administration [68–69]. However, although stimulus-specific adaptation times of up to tens of seconds have been reported in the auditory cortex of animals [70], nothing is known about adaptation over comparable time-scales in humans. In addition, this explanation cannot account for why near-threshold stimulation would be affected to a lesser extent by such mechanisms. In contrast, we hypothesize that our results rather reflect the complex involvement of different physiological processes in response to near-threshold and supra-threshold IS, as well as the interference of attentional effects, which may play an increasingly important role when stimuli are presented over longer durations. Several studies provide evidence for the existence of a 'subconscious hearing route' for IS, according to which IS may exert effects on the organism via outer hair cells, even if presented at SPLs below the hearing threshold [71, 31]. While inner hair cells–the main signal transducers involved in 'conscious hearing'–connect with fusiform cells of the cochlear nucleus from which the signal is then relayed to higher levels of the auditory system, outer hair cells terminate in the granule cell regions of the cochlear nucleus [72] and from there on connect to numerous auditory as well as non-auditory cortical processing sites [73]. Importantly, since some of these centres are involved in attentional control and arousal [74], it has been suggested that activation of this pathway could for example wake people up at night, while leaving them unable to pin down what it actually was that caused them to waken [75]. Similarly, in our experiment,

participants were constantly left guessing, whether stimulation actually occurred or not when near-threshold IS was presented, whereas during supra-threshold stimulation, participants were clearly able to allocate attention towards or away from the percept throughout the entire stimulus interval. We therefore suggest that persistent exposure to supra-threshold IS may have led to a top-down attenuation of the signal via attentional mechanisms, whereas in the absence of a clearly identifiable percept, STG activation remained high. However, it needs to be mentioned that the average (median) SPL of the supra-threshold stimulus (122,3 dB SPL, as determined via individual loudness scaling) was very close to the safety limit of 124 dB SPL, which probably points towards the presence of a ceiling effect. We therefore cannot rule out that participants may have reported a medium-loud hearing sensation at even higher SPLs, if our ethical guidelines would have allowed us to apply stimuli at such intensities. The ceiling effect may have led to slight discrepancies with respect to inter-individual loudness perception during the supra-threshold runs and thus have produced additional variability in our imaging data. Nevertheless, we conclude that the effect was probably not pronounced enough to suppress an otherwise significant effect. It also needs to be noted that in contrast to the aforementioned studies on IS processing, near-threshold stimulation led to a cortical response of the ispilateral side, as compared to a bi-hemispheric, yet also stronger response of the contralateral side (i.e. the left auditory cortex) when supra-threshold stimulation was employed [18–19]. This touches on the aspect of a presumed lateralization of the auditory system, the true nature of which is still part of an ongoing debate, as evidence both in favor of a contralateral dominance for monaurally presented sounds [76–77], as well as a left hemispherical preference irrespective of which ear is stimulated (Devlin et al., 2003) [78] has been put forward. It thus appears that while the preceding accounts seem to support the notion of "contralateral dominance" extending to sounds in the infrasound spectrum, the results of the present studies could rather be explained by the fact that evoked otoacoustic emissions (which are generated via outer hair cells) also tend to be more pronounced on the right ear [79–80]. However, more information needs to be gathered on how OHC signals are processed up-stream on the level of the brainstem, and in what way OHC activation influences the activity of auditory (and possibly non-auditory) centres.

The ACC is generally regarded as a key player in the monitoring and resolution of cognitive [81–83], as well as emotional conflicts [84–87]. Interestingly, a recent meta-analysis by Meneguzzo et al. [88] also revealed that the ACC reliably exhibits activation in response to both sub- as well as supraliminally presented arousing stimuli, which led the authors to suggest that this brain area may function as a gateway between automatic ('pre-attentive') affective states and higher order cognitive processes, particularly when affect and cognition are in conflict. In addition, the authors explicitly gave credit to the

fact that the term ‘conflict’ may also include unexpected perturbations of the body’s physiology in the absence of conscious awareness. Moreover, another line of research also highlights the ACC’s involvement in autonomic control via its extensive connections with the insula, prefrontal cortex, amygdala, hypothalamus and the brainstem [89–90]. ACC activation in response to near-threshold IS stimulation could therefore be interpreted as a conflict signalling registration of the stimulus which, if not resolved, may lead to changes of autonomic function.

Similarly, the amygdala is well know for its involvement in emotional processing, especially with respect to fear conditioning, but also in the broader context of stress- and anxiety-related psychiatric disorders [91]. Several studies have documented activation of the amygdala in response to aversive sensory stimuli across different modalities, such as odorants [92], tastes [93], visual stimuli [94–96], as well as in response to emotional vocalization [97–99] and unconditioned sounds that are experienced as aversive [100–102]. Activation of the rAmyg during near-threshold IS exposure may be of particular interest for a risk assessment regarding IS, because the amygdala is known to be involved in auditory processing and may also play a major role in debilitating tinnitus and hyperacusis [103]. It is a fairly established finding that auditory input can be processed along two separate neural pathways, the classical (lemniscal) and the non-classical (extralemniscal) pathway [104–105]. While signals travelling along the classical pathway are relayed via ventral thalamic nuclei mostly to the primary auditory cortex, signals traveling along the non-classical pathway are bypassing the primary auditory cortex as dorsal thalamic nuclei project to secondary- and association cortices and also to parts of the limbic structure such as the amygdala. Importantly, the non-classical pathway (frequently called the ‘low route’) allows for direct subcortical processing of the stimulus in the amygdala, without the involvement of cortical areas [106–107] and may therefore play a crucial role in the subliminal registration of ‘biologically meaningful’ stimuli, such as near-threshold IS. In fact, it has been suggested that in certain forms of tinnitus, activation of the non-classical pathway can mediate fear without conscious control [108] and, via its connections to the reticular formation [109], also exert influences on wakefulness and arousal. Additional evidence for the amygdala’s involvement in subliminal processing and autonomic control comes from a study conducted by Gläscher and Adolphs [110], in which patients with unilateral as well as bilateral lesions of the amygdala were presented emotional visual stimuli of varying arousal sub- as well as supraliminally, while skin conductance responses (SCRs) were recorded as a measure of autonomic activation. Interestingly, it could be shown that the left amygdala decodes the arousal signalled by the specific stimulus (linked to a conscious fear response), whereas the rAmyg provides a global level of autonomic activation triggered automatically by any arousing stimulus (linked

to a subconscious fear response). It is particularly noteworthy that while the rAmyg exhibited increased local connectivity in response to near-threshold IS, ICA revealed a decoupling of the rAmyg from the sensorimotor network in comparison to the no-tone condition. It has been repeatedly argued that decoupling of the amygdala from areas involved in executive control may enable an organism to sustain attention and supports working memory [111], thus potentially aiding cognitive control processes in the aftermath of stress [112]. Interestingly, the fact that functional connectivity of the rSFG was higher during near-threshold stimulation further substantiates this claim. Again, several studies demonstrate that rSFG and rAmyg share functional connections and that activity between the two regions tends to be negatively correlated [113, 112]. Thus, participants who were left guessing whether stimulation occurred, may have engaged in effortful regulation of affect, trying to minimize the consequences of stress on cognitive control networks.

Finally, our results also allow us to draw some preliminary conclusions on potential long-term health effects associated with (sub-)liminal IS stimulation. It has been reported in several studies that sustained exposure to noise can lead to an increase of catecholamine- and cortisol levels [114–116]. In addition, changes of bodily functions, such as blood pressure, respiration rate, EEG patterns and heart rate have also been documented in the context of exposure to below- and near-threshold IS [117–118]. We therefore suggest that several of the above mentioned autonomic reactions could in fact be mediated by the activation of brain areas such as the ACC and the amygdala. While increased local connectivity in ACC and rAmyg may only reflect an initial bodily stress response towards (sub-)liminal IS, we speculate that stimulation over longer periods of time could exert a profound effect on autonomic functions and may eventually lead to the formation of symptoms such as sleep disturbances, panic attacks or depression, especially when additional risk factors, such as an increased sensibility towards noise, or strong expectations about the harmfulness of IS are present. Also, while in this discussion, we put a strong emphasize on the physiological implications of prolonged IS exposure, it would also be interesting to see, whether our rsfMRI paradigm could be used to relate IS-induced changes of global-brain states and changes in the experiential domain.

Conclusion

To our knowledge, this study is the first to document changes of brain activity across several regions in response to prolonged near-threshold IS using fMRI. ReHo analysis

revealed higher local connectivity of rSTG, ACC and the rAmyg only when IS was administered near the hearing threshold and ICA showed that effects can also be found on the inter-regional level. On the one hand, these results seem to support the hypothesis that (sub-)liminal IS can exert an influence on the organism via a subconscious processing route (which supposedly involves outer hair cell-mediated signal transduction). On the other hand, though clearly audible, prolonged stimulation with IS above the hearing threshold did not lead to changes of brain activity, which could indicate that the signal processed along the conscious hearing route may have been attenuated in a top-down fashion via attentional mechanisms. Also, since the brain's response to prolonged near-threshold IS involves the activation of brains areas, which are known to play a crucial role in emotional and autonomic control, a potential link between IS-induced changes of brain activity and the emergence of various physiological as well as psychological health effects can be established. Transient upregulation of these brain areas in response to below- or near threshold IS may thus reflect an initial stress response of the body, eventually promoting symptom formation as stimulation occurs repeatedly and additional risk factor come into play. Nevertheless, further research, in particular longitudinal exposure research, is needed in order substantiate these findings and contribute to a better understand of IS-related health effects.