

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA**

**IN THE MATTER OF THE APPLICATION BY PREVAILING WIND PARK, LLC
FOR A PERMIT FOR A WIND ENERGY FACILITY IN BON HOMME, CHARLES MIX,
AND HUTCHINSON COUNTIES, SOUTH DAKOTA, FOR PREVAILING WIND
PARK ENERGY FACILITY**

SD PUC DOCKET EL-18-026

**PREFILED REBUTTAL TESTIMONY OF DR. MARK ROBERTS
ON BEHALF OF PREVAILING WIND PARK, LLC**

September 26, 2018

1 **I. INTRODUCTION**

2

3 **Q. Please state your name.**

4 A. My name is Dr. Mark Roberts.

5

6 **Q. Did you provide Supplemental Direct Testimony in this Docket?**

7 A. Yes. I submitted Supplemental Direct Testimony in this docket on August 10, 2018.

8

9 **Q. What is the purpose of your Rebuttal Testimony?**

10 A. The purpose of my Rebuttal Testimony is to respond to the testimony of Professor
11 Mariana Alves-Pereira, Jerry Punch, Ph.D., and Richard James, each of whom
12 submitted testimony on behalf of Intervenors in this docket.

13

14 **Q. Are there any exhibits attached to your Rebuttal Testimony?**

15 A. The following exhibits are attached to my Rebuttal Testimony:

16 • Exhibit 1: Ministry for the Environment, Climate and Energy of the Federal
17 State of Baden-Wuerttemberg, Germany (2016). *Low-frequency Noise Incl.*
18 *Infrasound from Wind Turbines and Other Sources*. LUBW Landesanstalt fur
19 Umwelt, Messungen and Naturschutz Baden-Wuerttemberg.

20 • Exhibit 2: Akira Shimada and Mimi Nameki (2017). *Evaluation of Wind*
21 *Turbine Noise in Japan*. Ministry of the Environment of Japan.

22 • Exhibit 3: Danish Energy Agency (2009). *Wind Turbines in Denmark*.

23 • Exhibit 4: Frits van den Berg, Public Health Service Amsterdam, and Irene
24 van Kamp, National Institute for Public Health and the Environment (2017).
25 *Health effects related to wind turbine sound*. Swiss Federal Office for the
26 *Environment*.

27 • Exhibit 5: Stephen Chiles (2010). *A new wind farm noise standard for New*
28 *Zealand, NZS 6808:2010*. Proceedings of 20th International Congress on
29 Acoustics, ICA 2010.

- 30 • Exhibit 6: Eja Pedersen, Högskolan i Halmstad (2003). *Noise Annoyance 116*
31 *from Wind Turbines: A Review*. Swedish Environmental Protection Agency.
- 32 • Exhibit 7: Hitomi Kimura, Yoshinori Momose, Hiroya Deguchi, and Nameki,
33 Mimi (2016). *Investigation, Prediction, and Evaluation of Wind Turbine Noise*
34 *in Japan*. Ministry of the Environment of Japan.
- 35 • Exhibit 8: C. Yan, K. Fu and W. Xu. *On Cuba, diplomats, ultrasound, and*
36 *intermodulation distortion*. *University of Michigan Tech Report*. March 1,
37 2018.
- 38 • Exhibit 9: Crichton, F., et al. (2014). *The link between health complaints and*
39 *wind turbines: Support for the nocebo expectations hypothesis*. *Frontiers in*
40 *Public Health* 2:220.
- 41 • Exhibit 10: Enck, P., et al. “New Insights Into the Placebo and Nocebo
42 Responses,” *Neuron* (July 31, 2008): Vol. 59, No. 2, pp. 195–206.
- 43 • Exhibit 11: Colloca, L. (2017). *Nocebo effects can make you feel pain:*
44 *Negative expectancies derived from features of commercial drugs elicit*
45 *nocebo effects*. *Science*, 358(6359): 44.

46

47 **II. RESPONSE TO TESTIMONY OF PROFESSOR MARIANA ALVES-PEREIRA**

48

49 **A. Overview.**

50

51 **Q. Have you reviewed the Prefiled Testimony of Prof. Mariana Alves-Pereira,**
52 **submitted on behalf of Intervenors in this proceeding?**

53 A. Yes. I reviewed Prof. Alves-Pereira’s testimony, as well as the exhibits attached to
54 her testimony.

55

56 **Q. Please summarize your response to Prof. Alves-Pereira's testimony.**

57 A. As I discussed in my Supplemental Direct Testimony, I am aware of Prof. Alves-
58 Pereira's assertions regarding vibroacoustic disease. A majority of the work
59 involving vibroacoustic disease has originated from Dr. Castelo Bronca's research
60 group in Portugal, of which Prof. Alves-Pereira is a member. A majority of the
61 research group's efforts have focused on low frequency sound at high levels (e.g.,
62 120 decibels and above, well above the sound levels of wind turbines). Their work
63 has not been replicated by other research groups to the point where vibroacoustic
64 disease has been accepted as a medical diagnosis. As I discussed previously,
65 based on my work and review of reliable scientific literature, I am not aware of any
66 link between wind turbines and what Prof. Alves-Pereira describes as vibroacoustic
67 disease.

68

69 **B. Scientific Method.**

70

71 **Q. Professor Alves-Pereira references the scientific method and evidence-based**
72 **medicine in her testimony. (Alves-Pereira Direct, lines 63-66.) Please describe**
73 **these concepts.**

74 A. I previously discussed the scientific method in detail in my Supplemental Direct
75 Testimony. To summarize, during a clinical encounter between a patient and a
76 physician, medical information is collected and analyzed. First, the physician will
77 note the patient's report of symptoms and concerns. That consists of what the
78 patient says he or she is experiencing. This may include the patient's attribution of
79 their symptoms (headache, dizziness, upset stomach, etc.) to some event or activity.
80 This is often referred to as the "subjective" information and refers to what the patient
81 reports. Next, the physician attempts to obtain information that will verify or clarify
82 the patient's reported symptoms or concern (objective information). This verification
83 consists of probing questions to clarify the information and includes assessment of
84 past medical history (previous injury or illness), collection of information during the
85 physical examination, and testing (laboratory and or imaging). Next, the physician
86 assesses the subjective information and the objective evidence and compares this

87 information with the physician’s clinical experience, training, and other medical
88 knowledge to arrive at a diagnosis and a plan for treatment. In common conditions
89 (flu, high blood pressure, gastrointestinal conditions, etc.), the physician will usually
90 have sufficient experience to make the diagnosis without going into the published
91 literature. In other cases, the physician may need to gather additional information or
92 refer the patient on to a specialist.

93
94 For an example of this process: Patient comes to the doctor with severe headache
95 and is concerned that he might have a brain tumor. The doctor does not
96 immediately schedule the patient for brain surgery but instead evaluates the patient
97 in an orderly process that rules in or rules out the presence of a brain tumor. The
98 physician evaluates what the patient reports, the outcome of the physical
99 examination and tests or imaging, then assesses this information, makes a
100 diagnosis, and develops a treatment plan.

101
102 **Q. Prof. Alves-Pereira asserts that “[w]hen it comes to studying the health effects**
103 **of ILFN exposure, however, these fundamental axioms of the Scientific Method**
104 **and Evidence-based Medicine are somehow forgotten, or deemed not**
105 **applicable.” (Alves-Pereira Direct, lines 68-70.) What is your response?**

106 A. I do not agree. The publications attached to my Supplemental Direct Testimony and
107 this Rebuttal Testimony utilize the scientific method. Despite Prof. Alves-Pereira’s
108 assertions otherwise, it is not sufficient to take the patient’s reported health concerns
109 and immediately draw a conclusion regarding causation without including an
110 evaluation of objective evidence and appropriate peer-reviewed, published literature.
111 The key point is to look at the “evidence” – that is, objective findings from a clinical
112 evaluation conducted by a physician that bases opinions based on data that has
113 passed review.

114
115 **Q. Prof. Alves-Pereira states that “[a]nnoyance is not an objective parameter and**
116 **hence, in accordance with the axioms of Evidence-based Medicine, cannot be**

117 **used to ascertain de facto health effects.” (Alves-Pereira Direct, lines 77-78.)**

118 **What is your response?**

119 A. I agree. This statement is consistent with my prior testimony and the fact that
120 “annoyance” is the most commonly recognized “effect” in the applicable peer-
121 reviewed published literature and the reviews by scientific committees that I have
122 previously identified. Annoyance in and of itself is not a health effect but instead is a
123 normal physiological response to one’s surroundings. As I have testified many times
124 before, one person’s music can be perceived as an annoying noise by another
125 person. It is the perception of the noise that often makes it annoying - not the noise
126 itself. I note, however, that Prof. Alves-Pereira’s statement here seems inconsistent
127 with the remainder of her testimony. She appears to transform complaints of
128 annoyance into objective health issues solely because the complaints were
129 described to a doctor.

130

131 **Q. Prof. Alves-Pereira states that, “[i]n accordance with the axioms of Evidence-**
132 **based Medicine and, even more fundamentally, the Scientific Method,**
133 ***psychosomatic illnesses must also be clinically corroborated*; their proposed**
134 **existence based on mere assertions is not scientifically valid.” (Alves-Pereira**
135 **Direct, lines 83-86.) What is your response?**

136 A. Again, I agree. This statement is entirely consistent with my testimony and well-
137 accepted peer-reviewed literature. However, it is not consistent with the remainder
138 of Prof. Alves-Pereira’s testimony, where she indicates that a person’s report of
139 illness is sufficient for there to be the documented occurrence of a health issue
140 related to wind turbines.

141

142 **Q. Prof. Alves-Pereira discusses the scientific validity of self-reported health**
143 **complaints in lines 134-50 of her testimony. Do you have a response?**

144 A. Yes. Prof. Alves-Pereira’s discussion is not consistent with the normal clinical
145 process I have previously described in this testimony. Self-reported health
146 complaints are certainly part of the clinical process, but they do not become
147 scientifically valid simply because they are reported to a physician. Rather, as I

148 discussed previously, a patient’s self-reported health complaints are subjective
149 information – they are one part of the clinical evaluation process, but a patient’s
150 recitation of a series of subjective symptoms to a physician does not make those
151 symptoms objective evidence. Prof. Alves-Pereira uses the term *anamnesis* to
152 bolster her argument. Although a medical term, the term *anamnesis* simply refers
153 to the patient history as described by the patient. It does not confer special
154 verification. Again, in the normal clinical process, the physician takes what the
155 patient reports, what is identified from the physical examination along with any
156 laboratory testing or imaging results, and compares this information to his or her
157 clinical experience, training, and current medical information to make a diagnosis, if
158 possible, and set out a treatment plan, or refers the patient on to a specialist for
159 further assessment.

160

161 **C. Infrasound and Wind Turbines.**

162

163 **Q. Prof. Alves-Pereira discusses infrasound and low-frequency noise, or “IFLN.”**

164 **What is infrasound?**

165 A. As I described in my Supplemental Direct Testimony, infrasound is sometimes
166 referred to as “low frequency” sound and is sound that is between 0 hertz (“Hz”) and
167 20 Hz. A level of 20 Hz is commonly considered to be the low end of the range of
168 human hearing. It is very important to specify the sound because the human ear
169 responds differently to different frequencies.

170

171 **Q. What are sources of infrasound?**

172 A. As I noted in my Supplemental Direct Testimony, human organs produce infrasound.
173 For example, heart sounds are in the range of 27 to 35 dBA at 20-40 Hz, and lung
174 sounds are reported in the range of 5-35 dBA at 150-600 Hz; these sources are in
175 the range of sound produced by wind turbines. In addition, infrasound comes from
176 numerous natural and man-made sources. With respect to natural sources, waves,
177 thunder, and waterfalls are natural sources of infrasound. With respect to man-

178 made sources, common household objects such as washing machines, fans and
179 heating and refrigeration systems are also sources of infrasound.

180

181 **Q. Professor Alves-Pereira discusses infrasound, particularly that from wind**
182 **turbines, and its potential impacts on human health. Are you aware of any**
183 **recent studies on this topic?**

184 A. Yes. Researchers in the United States (Massachusetts) (2012) (Roberts
185 Supplemental Direct Testimony, Exhibit 7), Germany (2016) (Exhibit 1), Japan
186 (2017) (Exhibit 2), France (2017) (Roberts Supplemental Direct Testimony, Exhibit
187 3), Denmark (2009) (Exhibit 3), Switzerland (2017) (Exhibit 4), New Zealand (2010)
188 (Exhibit 5), Sweden (2003) (Exhibit 6), and Australia (2015) (Roberts Supplemental
189 Direct Testimony, Exhibit 2c) have reviewed the literature regarding infrasound from
190 wind turbines. Each study, using recognized scientific methods, concluded that
191 infrasound levels are multiple orders of magnitude below the threshold of human
192 hearing. For example, the 2016 German study concluded that “[t]he infrasound
193 levels generated by [wind turbines] lie clearly below the limits of human perception.
194 There is no scientifically proven evidence of adverse effects in this level range.”
195 (Exhibit 1, at 12.) Similarly, the Ministry of the Environment of Japan’s 2016 study
196 *Investigation, Prediction, and Evaluation of Wind Turbine Noise in Japan* states that,
197 “Super-low (below 20 Hz) frequency range components of wind turbine noise are at
198 imperceptible levels. Therefore, wind turbine noise is not an issue caused by super-
199 low frequency range.” (Exhibit 7, at 5760.) These are just a few of the reports of
200 expert panels at state, national, and international levels that have not found a
201 specific health condition associated with wind turbines.

202

203 An independent review of the literature relative to wind turbines and health was
204 commissioned by the National Health and Medical Research Council (“NHMRC”)
205 with the goal of determining whether there was an association between exposure to
206 wind farms and human health effects. The document is approximately 300 pages
207 and covers peer-reviewed, published literature, government reports, and some lay
208 publications. The overall conclusions of this extensive review were:

209 “[t]here is no consistent evidence that noise from wind
210 turbines—whether estimated in models or using distance as
211 a proxy—is associated with self-reported human health
212 effects. Isolated associations may be due to confounding,
213 bias or chance.” (Roberts Supplemental Direct Testimony,
214 Exhibit 2c.)

215
216 Most recently, the March 2017 French National Agency for Food Safety,
217 Environment and Labor (“ANSES”) carried out measurement campaigns near three
218 wind farms. A summary of this study is included as Exhibit 3 of my Supplemental
219 Direct Testimony (the original study is in French). The summary notes that the study
220 concluded:

- 221 • “the results of these campaigns confirm that wind turbines are sources of
222 infrasound and low sound frequencies, but no exceedance of the audibility
223 thresholds in the areas of infrasound and low frequencies up to 50 Hz has
224 been found”;¹ and
- 225 • “all the experimental and epidemiological data available today do not show
226 any health effects related to exposure to noise from wind turbines, other than
227 noise-related annoyance.”

228 (Roberts Supplemental Direct Testimony, Exhibit 3.)

229

230 **Q. Do you agree with the ANSES conclusions?**

231 A. Yes. They are consistent with the peer-reviewed literature on wind turbine noise.

232

233 **Q. In response to the question, “[w]hy are some people affected and others not
234 within the same household” regarding infrasound, Prof. Alves-Pereira**

¹ French Agency for Food, Environmental and Occupational Health & Safety, *Exposure to low-frequency sound and infrasounds from wind farms: improving information for local residents and monitoring noise exposure* (Mar. 30, 2017), <https://www.anses.fr/en/content/exposure-low-frequency-sound-and-infrasounds-wind-farms-improving-information-local>; see also Roberts Supplemental Direct Testimony, Exhibit 3.

235 **discusses “two exposure-linked factors.” (Alves-Pereira Direct, lines 180-88.)**

236 **Do you have a response?**

237 A. Yes. First, without evidence, Prof. Alves-Pereira asserts that individuals are
238 negatively affected by infrasound. Second, Prof. Alves-Pereira makes the assertion
239 that two “exposure-linked factors” “profoundly condition the onset of symptoms
240 among families living in ILFN-contaminated homes.” She identifies these factors as
241 “prior ILFN exposure histories” and “residential time exposure patterns.” Although
242 these phrases may sound official and technical, they are not. Prof. Alves-Pereira
243 provides no scientific support for her assertions, and I am not aware of any. We are
244 all exposed to all sorts of sounds all the time. None of the reviews by governmental
245 organizations and other groups of scientists impaneled to review the material relative
246 to wind turbine sound and health effects have referenced the process of “exposure-
247 linked processes” that Prof. Alves-Pereira has used.

248

249 **Q. In response to the same question, Prof. Alves-Pereira then discusses**
250 **“individual susceptibility factors.” (Alves-Pereira Direct, line 189.) Do you**
251 **agree?**

252 A. No. As with her assertions regarding “exposure-linked factors,” Prof. Alves-Pereira
253 provides no scientific support for her statements, and I am not aware of any.

254

255 **Q. Prof. Alves-Pereira states that she and her group are collecting data regarding**
256 **wind turbines, including “conducting extensive interviews among the**
257 **complaining populations.” (Alves-Pereira Direct, line 214.) What are your**
258 **thoughts on these statements?**

259 A. Prof. Alves-Pereira’s statements demonstrate the serious flaws of her described
260 “study.” It is hard to evaluate the study without reading it, but Prof. Alves-Pereira’s
261 reliance on “complaining populations” without comparison to noise exposure
262 measurements and her evaluation of common everyday health issues has been
263 repeated by many researchers opposed to wind energy, starting with Prof. Nina
264 Pierpont. This method of research is fraught with bias that cannot be overcome.
265 Prof. Alves-Pereira appears to have already concluded that her research is going to

266 find adverse health impacts from wind turbines. As such, she is only conducting
267 interviews with complaining persons. However, the research she describes collects,
268 at best, anecdotal information. As I have stated time and again, interviewing
269 complaining populations is not an epidemiological study and does not follow the
270 scientific method that must be followed to move from an observation, to correlation,
271 and ultimately to causal proof.

272

273 **Q. Prof. Alves-Pereira asserts that “[s]afe distances have not yet been**
274 **established for the IFLN generated by wind turbines.” Do you agree with this**
275 **conclusion?**

276 A. No. Again, Prof. Alves-Pereira implies that there are adverse health effects from
277 wind turbines, but she fails to back up these claims with scientific data. Put simply,
278 adverse health effects have not been linked to infrasound generally or to infrasound
279 generated by wind turbines, more specifically.

280

281 **D. Prof. Alves-Pereira’s Statements Regarding My Supplemental Direct**
282 **Testimony.**

283

284 **Q. Prof. Alves-Pereira asserts that your testimony treats wind turbines, rather**
285 **than infrasound, as “agents of disease.” Do you agree?**

286 A. No. Prof. Alves-Pereira misunderstands my testimony and my opinions. What I
287 have clearly stated is that the peer-reviewed, published literature and the results of
288 numerous reviews of that literature do not indicate that infrasound at the levels
289 generated by a wind turbine is an “agent of disease.” I certainly have not confused
290 these concepts, as Prof. Alves-Pereira appears to believe. However, the literature
291 also clearly identifies the presence of wind turbines as a point of annoyance for
292 some individuals.

293

294 **Q. Prof. Alves-Pereira asserts that “studies comparing people who live near wind**
295 **turbines with those who do not” are not scientifically valid. (Alves-Pereira**
296 **Direct, lines 314-15.) Do you agree?**

297 A. No, not at all. The cornerstone of an epidemiological study – and the scientific
298 method – is the fact that there is a comparison group. It is critical to have a
299 comparison group to determine whether there is an increase in health factors –
300 This is especially important with respect to issues like wind
301 turbine effects, where there are subjective complaints with the overlay of annoyance.
302

303 **Q. Professor Alves-Pereira asserts that “receiving 10 chest x-rays per day for a
304 year, might indeed begin to pose a problem in terms of health effects. It is the
305 same with IFLN.” (Alves-Pereira Direct, lines 363-64.) Do you agree?**

306 A. This is not a valid comparison. There is a significant body of reliable, published,
307 peer-reviewed literature regarding the adverse effects of x-rays, starting with
308 Madame Curie. By contrast, there is no evidence that the sound levels generated by
309 wind turbines cause specific health effects, let alone any health effects separate and
310 distinct from the infrasound we are exposed to in our environment 24 hours a day.
311

312 **E. Discussion of Certain Exhibits to Professor Alves-Pereira’s**
313 **Testimony.**
314

315 **Q. Prof. Alves-Pereira attaches a document titled *Neurological Manifestations***
316 ***Among US Government Personnel Reporting Directional Audible and Sensory***
317 ***Phenomena in Havana, Cuba* as Exhibit 3 to her testimony (“Havana Paper”).**
318 **Are you familiar with the Havana Paper?**

319 A. Yes. The “Havana Paper” is a brief description of health investigations of U.S.
320 government personnel serving on diplomatic assignment in Havana, Cuba, that they
321 experienced “neurological symptoms” thought to be associated with exposure to
322 auditory and sensory phenomena in 2016 and 2017.
323

324 **Q. In your opinion, does the Havana Paper provide the Commission with helpful**
325 **information related to this Project?**

326 A. No. Prof. Alves-Pereira asserts that the symptoms reported by the Cuban diplomats
327 “are very similar to those made by families living in IFLN-contaminated homes.”

328 This assertion is not well-founded. Diplomatic staff complained of a high-pitched
329 noise. Researchers at the University of Michigan analyzed audio records provided
330 by the United States Department of State. The researchers' analysis indicated that
331 the sound recording in the Cuba Embassy was a mixture of high frequency sound
332 (ultrasound) in the thousands of Hz range. The sound identified as potentially
333 affecting Cuban diplomats was thousands of times higher than the frequencies
334 generated by wind turbines. (Yan, et al. 2018, Exhibit 8.) Prof. Alves-Pereira's
335 comparison of the Cuban Embassy investigation is misguided and inapt.

336

337 **Q. Prof. Alves-Pereira attaches a document titled *Occupational and Residential***
338 ***Exposures to Infrasound and Low Frequency Noise in Aerospace***
339 ***Professionals: Flawed Assumptions, Inappropriate Quantification of Acoustic***
340 ***Environments, and the Inability to Determine Dose-Response Values as***
341 **Exhibit 4 to her testimony ("Aerospace Paper"). Are you familiar with the**
342 **Aerospace Paper?**

343 A. Yes. The Aerospace Paper is co-authored by Prof. Alves-Pereira and asserts, as
344 Prof. Alves-Pereira does in her testimony, that the dBA metric is not adequate to
345 protect against excessive infrasound exposure.

346

347 **Q. In your opinion, does the Aerospace Paper provide the Commission with**
348 **helpful information related to this Project?**

349 A. No. This paper focuses on the noise levels associated with the aerospace industry,
350 which are orders of magnitude greater than the noise levels measured at wind farms.
351 The graphs shown in that paper are illustrating levels of 70+ decibels. In addition,
352 under the disclaimer on page 96 of the paper, the authors state that they "[a]re not
353 producing an environmental noise assessment report focused on wind turbines."

354

355 **Q. Prof. Alves-Pereira attaches a document titled *Infrasound and Low Frequency***
356 ***Noise: Shall we Measure it Properly?* as Exhibit 5 to her testimony (“ILFN**
357 **Paper”). Are you familiar with the ILFN Paper?**

358 A. Yes. As Prof. Alves-Pereira notes, it is a “more informal paper” that described her
359 fieldwork in Ireland.

360

361 **Q. In your opinion, does the ILFN Paper provide the Commission with helpful**
362 **information related to this Project?**

363 A. No. The paper lacks significant information needed to assess it. First, the testing
364 does not report background levels of low frequency sound in the homes. Secondly,
365 there is no indication of the type of wind turbine or power output that could give the
366 reader an indication of the contribution of these factors. The report uses a set of
367 observations that are not adequately described to bolster Prof. Alves-Pereira’s
368 claims regarding low frequency noise measurements. In addition, the report does
369 not appear to have been published, which would have subjected it to peer review.

370

371 **Q. Prof. Alves-Pereira attaches a document titled *An Evaluation of***
372 ***Environmental, Biological, and Health Data from the Island of Vieques, Puerto***
373 ***Rico* as Exhibit 6 to her testimony (“Vieques Paper”). Are you familiar with the**
374 **Vieques Paper?**

375 A. Yes.

376

377 **Q. In your opinion, does the Vieques Paper provide the Commission with helpful**
378 **information related to this Project?**

379 A. No. The Vieques Paper highlights how the investigation of public health events can
380 be performed but sheds no light on the questions regarding wind turbines and
381 health. It does, however, highlight the fact that the claim made by the Portuguese
382 research group that there was a high level of vibroacoustic disease among Vieques
383 fisherman was not confirmed by an independent review panel. Rather, the
384 independent review panel determined, after conducting blind-coding and repetition of

385 that analysis by Mayo Clinic, that there was no evidence to indicate clinically
386 significant heart disease. (Alves-Pereira Direct, Exhibit 6 at A-52.)

387

388 **Q. Prof. Alves-Pereira attaches a document titled *Vibroacoustic Disease:***
389 ***Biological effects of infrasound and low-frequency noise explained by***
390 ***mechanotransduction cellular signalling* as Exhibit 7 to her testimony (“2006**
391 **VAD Paper”). Are you familiar with the 2006 VAD Paper?**

392 A. Yes.

393

394 **Q. In your opinion, does the 2006 VAD Paper provide the Commission with**
395 **helpful information related to this Project?**

396 A. No. As noted by the researchers in the 2006 VAD Paper, there has been “much
397 controversy and acrimonious debate over whether or not acoustical phenomena can
398 cause extra-auditory effects on living organisms.” In addition, it is not evident from a
399 review of the published literature that the findings, referred to as vibroacoustic
400 disease or “VAD” by these researchers, has been confirmed by others or generally
401 accepted by medical or acoustical professions. There are no epidemiologically-
402 sound studies that have found what these researchers refer to as vibroacoustic
403 disease associated with wind turbines. The fact that there is not widespread
404 acceptance is evidenced by the fact that the International Classification of Disease
405 10th Edition (“ICD-10”) does not list vibroacoustic disease. The ICD-10 is the tenth
406 revision of the codes for recognized diseases, health complaints, and causes for
407 disease and injury listed by the World Health Organization and is used by the
408 National Center for Health Statistics to code and classify illness and deaths in the
409 United States. The ICD-10 classification lists over 14,000 major diseases and
410 injuries but can be expanded to 70,000 codes when the major categories are
411 expanded.

412

413 **Q. Prof. Alves-Pereira attaches a document titled *Vibroacoustic Disease I: The***
414 ***Personal Experience of a Motorman* as Exhibit 8 to her testimony (“Motorman**
415 **Paper”). Are you familiar with the Motorman Article?**

416 A. Yes. This is a layperson’s account of a presumed occupational exposure to low-
417 frequency sound.

418

419 **Q. In your opinion, does the Motorman Article provide the Commission with**
420 **helpful information related to this Project?**

421 A. No. The Motorman Article is a layperson’s opinion and has no scientific data to
422 contribute to a discussion about wind turbines.

423

424 **Q. Prof. Alves-Pereira attaches a document titled *Vibroacoustic Disease and***
425 ***Respiratory Pathology III – Tracheal and Bronchial Lesions* as Exhibit 9 to her**
426 **testimony (“VAD Respiratory Paper”). Are you familiar with the VAD**
427 **Respiratory Paper?**

428 A. Yes. This is a case series published by Prof. Alves-Pereira’s research group. It is a
429 report of the results of biopsies of the respiratory tract of four individuals (two of
430 whom were smokers), three of whom were employed in occupations involving
431 aviation, and all of whom had been diagnosed with what Prof. Alves-Pereira terms
432 vibroacoustic disease. As pointed out earlier, case series are not epidemiological
433 studies.

434

435 **Q. In your opinion, does the VAD Respiratory Paper provide the Commission with**
436 **helpful information related to this Project?**

437 A. No. This paper has nothing to do with wind turbines. It also does not follow the
438 scientific method of risk evaluation – there is no objective assessment of intensity,
439 duration, or frequency of low-frequency noise exposure that would identify whether
440 any of the individuals experienced low-frequency noise above normal background
441 levels. In addition, there is no assessment of the individuals’ occupational history,
442 which could have included chemical exposures that adversely affect the upper

443 respiratory system and potentially produce cell damage similar to that described in
444 the case series.

445

446 **Q. Prof. Alves-Pereira attaches a document titled *Vibroacoustic Disease in a Ten*
447 *Year Old Male* as Exhibit 10 to her testimony (“2004 VAD Paper”). Are you
448 familiar with the 2004 VAD Paper?**

449 A. Yes.

450

451 **Q. In your opinion, does the 2004 VAD Paper provide the Commission with
452 helpful information related to this Project?**

453 A. No. This is a case report of claimed low-frequency noise exposure, but it is not clear
454 that the source was identified, nor was the sound level quantified sufficiently to
455 support the claimed effect. Once again, a “diagnosis” of what Prof. Alves-Pereira
456 describes as vibroacoustic disease is made when, in fact, this is not a clinically
457 recognized medical condition beyond the Portuguese researchers.

458

459 **F. Conclusion Regarding Prof. Alves-Pereira’s Testimony.**

460

461 **Q. What is your overall impression of Prof. Alves-Pereira’s Testimony?**

462 A. Prof. Alves-Pereira has not established that the peer-reviewed, published literature
463 has documented a health problem associated with low-frequency sound at the levels
464 generated by wind turbines, let alone that low-frequency sound from any source
465 causes such health problems.

466

467 **III. RESPONSE TO TESTIMONY OF JERRY PUNCH, Ph.D.**

468

469 **Q. Have you reviewed the Prefiled Testimony of Jerry L. Punch submitted on
470 behalf of Intervenors in this matter?**

471 A. Yes. I reviewed the testimony submitted by Dr. Punch, as well as the exhibits
472 attached to that testimony.

473

474 A. 2016 Punch and James Paper.

475

476 **Q. On page 4 of his testimony, Dr. Punch references an article he authored titled**
477 ***Wind turbine noise and human health: a four-decade history of evidence that***
478 ***wind turbines pose risks, which he attaches as Exhibit 2 to his testimony (the***
479 **“2016 Punch and James Paper”). Are you familiar with the 2016 Punch and**
480 **James Paper?**

481 A. Yes. I have observed this article on a number of anti-wind websites and seen it
482 produced at various hearings. It is not consistent with the opinions of local, state,
483 national, and international panels of experts who have reviewed the peer-reviewed,
484 scientific publications related to wind turbines and health effects.

485

486 **Q. Dr. Punch states that the 2016 Punch and James Paper was peer reviewed. Do**
487 **you agree?**

488 A. No. A summary of the 2016 Punch and James Paper describes the purported “peer
489 review” of this paper as follows:

490 This paper has been reviewed both by the anonymous Noise
491 & Health reviewer and by three other reviewers who have
492 substantial professional experience in the area of wind
493 turbine noise. We gratefully acknowledge the helpful
494 contributions of Keith Johnson, Esq., Michael Nissenbaum,
495 MD, and Daniel Shepherd, PhD.

496

497 Mr. Johnson provided a review from the perspective of an
498 attorney who represents interveners in wind turbine siting
499 cases. Dr. Nissenbaum provided a review from the
500 perspective of a medical professional and expert in how
501 ionizing and non-ionizing radiation affects humans. Dr.
502 Shepherd provided a review from the perspective of a
503 psychoacoustician with experience in how wind turbine
504 sound affects people. Each of these reviewers’ comments on
505 earlier versions of our manuscript led to the final document.
506 The opinions or assertions contained herein, however, are
507 the personal views of the authors and are not to be

508 construed as reflecting the views of Michigan State
509 University or Central Michigan University.²
510

511 This does not describe the typical level of rigorous peer review I would expect before
512 labeling a report “peer reviewed.” A law degree is not recognized as a science
513 degree and, notably, Mr. Johnson is described as representing opponents to wind
514 projects. It is also notable that Dr. Nissenbaum is on the Board of Directors of “The
515 Society for Wind Vigilance,” which is a well-known and decidedly anti-wind group.³
516 Similarly, Dr. Shepherd is one of that group’s “Scientific Advisors.”⁴ As such, these
517 “reviewers” may have been predisposed to agreeing with Dr. Punch and with groups
518 opposed to wind energy.

519

520 **Q. In your opinion, does the 2016 Punch and James Paper provide the**
521 **Commission with helpful information with respect to this Project?**

522 A. No. The stated goal of the article is to “provide a systematic review of legitimate
523 sources that bear directly and indirectly on the question of the extent to which WT
524 noise leads to the many health complaints that are being attributed to it.” The
525 authors state that they used Google, Google Scholar, and PubMed for this
526 information. I note that a Google search regarding wind turbines and health effects
527 returns millions of results, which are not consistently reviewed or otherwise fact-
528 checked. The scientific alternative is the U.S. National Library of Medicine, National
529 Institute of Medicine’s PubMed, which comprises more than 28 million citations for
530 biomedical literature from MEDLINE, life science journals, and online books. My
531 PubMed search of “wind turbines health effects” on September 23, 2018, returned
532 only 54 articles in the scientific literature. In my experience, there is a lot of

² See *National Wind Watch: Presenting the Facts about Industrial Wind Power* website link, available at <https://www.wind-watch.org/documents/wind-turbine-noise-and-human-health-a-four-decade-history-of-evidence-that-wind-turbines-pose-risks/> (last accessed Sept. 19, 2018).

³ Dr. Punch’s co-author, Richard James, is also on this Board of Directors. Similarly, Drs. Phillips, Salt, and Thorne, each of whom are quoted in the 2016 Punch and James Paper, are “Scientific Advisors” to The Society of Wind Vigilance and have each written opinion pieces against wind turbines.

⁴ See <http://www.windvigilance.com/home/advisory-group> (last accessed Sept. 19, 2018).

533 “information” in the lay press, internet, or word of mouth, but very little of it is
534 objective scientific evidence.

535

536 **Q. Dr. Punch states: “I believe that a substantial proportion of people living in the**
537 **vicinity of the proposed Project can be expected to experience not only**
538 **annoyance, but also a variety of adverse health effects.” Do you agree?**

539 A. No. Dr. Punch’s “belief” is not a scientifically-validated conclusion. His “belief” is
540 also not supported by the published, peer-reviewed literature on this topic, as I
541 discussed in my Supplemental Direct Testimony. Annoyance is not a health effect
542 but a normal, everyday psychological and physiological response often manifested
543 when a person does not like or does not agree with something occurring in his or her
544 life. For example, a baby crying may be reassuring to a mother that the baby is
545 breathing, is hungry, or needs its diaper changed, but a crying baby on an airplane
546 may be annoying to some fellow passengers.

547

548 **Q. Dr. Punch asserts that the 2016 Punch and James Paper “indicate[s] that there**
549 **is a strong association between exposure to wind turbines and the health**
550 **complaints, and they strongly suggest that the link is causative.” (Punch**
551 **Direct, lines 150-52.) Do you agree?**

552 A. No. Based on Dr. Punch’s testimony, he is not relying upon evidence from
553 epidemiological studies conducted using the scientific method. To the extent Dr.
554 Punch is referring to the process of asking individuals if they experienced health
555 conditions before wind turbines were installed, this is not a reliable study method, as
556 I have previously discussed (e.g., recall bias).

557

558 **Q. Dr. Punch states that “general causation and specific causation . . . differ**
559 **based on the targets of interest: the general population versus targeted**
560 **individuals, respectively.” (Punch Direct, lines 159-60.) Do you agree with this**
561 **characterization?**

562 A. No, Dr. Punch is not correct. General causation refers to the science that identifies
563 the cause of disease - the risk factors or characteristics generally associated with

564 the development of a disease. Specific causation refers to the determination that an
565 individual has the risk factors or characteristics associated with the disease or health
566 condition at a sufficient level to reasonably conclude the cause of an individual's
567 disease or health condition.

568

569 **B. Dr. Punch's Statements Regarding My Supplemental Direct**
570 **Testimony.**

571

572 **Q. Dr. Punch states that your "testimony rests primarily on [your] credentials in**
573 **epidemiology and apparently not on [your] first-hand experience with people**
574 **who have been exposed to wind turbine noise over long periods of time."
575 (Punch Direct, lines 175-77.) Do you have a response?**

576 A. Dr. Punch appears to misunderstand what qualifies someone to evaluate an
577 exposure situation based on the scientific method. I spent 17 years in the Oklahoma
578 State Department of Health. During most of that time, I evaluated health concerns
579 involving communicable and environmentally-related disease for Oklahoma
580 residents. I use the same scientific method to evaluate health concerns anytime I
581 am asked to evaluate a potential exposure situation, regardless of the purported
582 cause.

583

584 **Q. Dr. Punch also states that you "essentially dismiss[] most of the nine**
585 **[Bradford Hill] criteria by naming them, without discussing their implications."
586 (Punch Direct, lines 180-81.) What are the Bradford Hill criteria?**

587 A. The "Bradford Hill" criteria were proposed by Sir Austin Bradford Hill in 1965. They
588 are a set of nine criteria to provide epidemiologic evidence of a causal relationship
589 between a presumed cause and an observed effect when the association of cause
590 and effect are sufficiently identified. In other words, the criteria are used to evaluate
591 the strength of an association between a disease and its supposed causative agent.
592 Sir Bradford Hill made it clear in his 1965 Presidential Address at the Royal Society
593 of Medicine where he stated "*Disregarding then any such problem in semantics we*
594 *have this situation. Our observations reveal an association between two variables,*

595 *perfectly clear-cut and beyond what we would care to attribute to the play of chance.*
596 *What aspect of that association should we especially consider before deciding that*
597 *the most likely interpretation of it is causation?”* Sir Bradford Hill then went on to list
598 his nine criteria.

599

600 **Q. What is your response to Dr. Punch’s assertion that you “dismissed” the**
601 **Bradford Hill criteria?**

602 A. I disagree. My assessment methods are consistent with the Bradford Hill criteria. It
603 is apparent from the peer-reviewed, published research that specific health effects
604 have not been proven to be associated with sounds produced by wind turbines.

605

606 **Q. Dr. Punch cites a paper prepared by Dr. Carl Phillips. Are you familiar with Dr.**
607 **Phillips?**

608 A. Yes. Despite Dr. Punch’s statement otherwise, Dr. Phillips is not an epidemiologist.
609 Instead, he holds a Ph.D. in public policy and is a “Scientific Advisor” to the Society
610 for Wind Vigilance.⁵ As I noted earlier, this is a well-known anti-wind group.

611

612 Dr. Phillips’ arguments center on the opinion that there is sufficient “scientific
613 evidence” that wind turbines cause a multitude of symptoms and disease for
614 residents living nearby. The basis of his opinion is that “people can observe that the
615 noise from the turbines seems to be bothering them, and can surmise that what they
616 are noticing may be causing their disease.” While this sort of information provides
617 impetus to explore what might be the underlying health issues and concerns, it does
618 not confirm a causal pathway. It is, at most, an association that requires careful
619 evaluation and hypothesis testing. An observation of noise that one concludes is
620 bothersome does not necessarily translate into a cause of disease without objective
621 measurements. As I have discussed previously, others who have done these kinds
622 of objective measurements have, in fact, *not* found any causal relationship between
623 wind turbines and adverse health effects.

⁵ See http://www.windvigilance.com/home/advisory-group/bio_phillips, last accessed Sept. 19, 2018.

624

625

C. The Nocebo Effect.

626

627 **Q. Dr. Punch attempts to critique your discussion of the “nocebo effect.” What is**
628 **the nocebo effect?**

629 A. The nocebo effect is the recognized human response to a negative belief or
630 impression. For example, if a patient does not think that a medication will be
631 effective, there is a high probability that the medication will not be effective. Nocebo
632 is the opposite of placebo, which is the normal response observed where, when a
633 person thinks a medication will be effective, it is more likely to be effective. The
634 nocebo effect has been described as follows: “When individuals expect a feature of
635 their environment or medical treatment to produce illness or symptoms, then this
636 may start a process where the individual looks for symptoms or signs of illness to
637 confirm these negative expectations.” (Crichton, et al. 2014, Exhibit 9.)

638

639 **Q. What is the relevance of the nocebo effect to this proceeding?**

640 A. There is clear evidence in the medical literature regarding both the placebo effect
641 and nocebo effect. (Meissner 2011.) It is real, and it is key to understanding health
642 complaints about phenomena that occur around us. Research going back decades
643 indicates that one’s perception dictates the physical and emotional response. The
644 development of social media and the internet has only intensified this focus.
645 Research into recent events such as the Boston Marathon bombing and Sandy
646 Hook shootings have shown that media coverage has broadened the extent of the
647 psychological effect. (Holman 2014.) One has to look no farther than the internet to
648 find a litany of health complaints attributed to wind turbines with little or no scientific
649 bases. When you are “told” that you are going to get sick, you become more
650 cognizant of everyday occurrences. (Fasse 2012.) A quick search of the internet
651 produces stressful and often unfounded negative assertions about wind turbines.

652

653 **Q. Dr. Punch states that, in the 2016 Punch and James Paper, he and his co-**
654 **author concluded that it is most plausible that “a variety of adverse reactions**

655 are *physiological* effects caused directly or indirectly from exposure to low-
656 frequency sound and infrasound from wind turbines.” (Punch Direct, lines
657 259-61 (emphasis in original).) Do you agree?

658 A. No. Neither Dr. Punch nor Mr. James is a physician. I do not find it convincing that
659 they can determine the cause of a health complaint simply by evaluating an
660 individual's claim. As I have discussed multiple times herein, there is an
661 established, well-recognized scientific method for conducting this type of research.
662 Dr. Punch has not followed that scientific method.

663
664 Q. Dr. Punch states that, “[w]hile psychological expectations and the power of
665 suggestion can influence perceptions of the effects of wind turbine noise on
666 health status, no scientifically valid studies have yet convincingly shown that
667 psychological forces are the major driver of such perceptions.” (Punch Direct,
668 lines 261-64.) What is your response?

669 A. Dr. Punch's statement is not true and demonstrates a lack of basic understanding
670 about the psychological factors associated with human response. Even a cursory
671 review of the literature negates this argument. For example, in a paper published by
672 Enck, et al. 2008 (Exhibit 10), the authors state: “The latest scientific evidence has
673 demonstrated, however, that the placebo effect and the nocebo effect, the negative
674 effects of placebo, stem from highly active processes in the brain that are mediated
675 by psychological mechanisms such as expectation and conditioning.”⁶ More
676 recently, a paper was published in 2017 exploring the concept that negative
677 expectations result in nocebo (perceived negative) effects.⁷ In this paper, the author
678 describes the nocebo effect as the effect of negative expectations.

679
680 Q. Dr. Punch states, “I believe that most of these adverse reactions are mediated
681 by disturbances of the hearing and balance mechanisms of the inner ear

⁶ Enck P, et al. “New Insights Into the Placebo and Nocebo Responses,” *Neuron* (July 31, 2008): Vol. 59, No. 2, pp. 195–206. (Exhibit 10.)

⁷ Colloca, L. 2017. *Nocebo effects can make you feel pain: Negative expectancies derived from features of commercial drugs elicit nocebo effects.* *Science*, 358(6359): 44. (Exhibit 11.)

682 **resulting from the low-frequency noise emitted by industrial wind turbines.”**
683 **(Punch Direct, lines 276-78.) Do you agree?**

684 A. No. Dr. Punch provides no scientific support for his belief. I am not aware of any
685 human data showing that wind turbines have a biological effect on the inner ear.

686

687 **D. Conclusion Regarding Testimony of Dr. Punch.**

688

689 **Q. What is your overall impression of Dr. Punch’s testimony?**

690 A. A review of the peer-reviewed, published data does not support Dr. Punch’s general
691 statement about health effects being attributed to the noise of wind turbines. In
692 addition, his attempts to support his opinions about specific mechanisms of adverse
693 health effects that he attributes to wind turbine noise are not reflected in the science
694 related to noise and human hearing or in the numerous reviews of the published
695 scientific works by local, state, national, and international health organizations.

696

697 **IV. RESPONSE TO TESTIMONY OF RICHARD JAMES**

698

699 **Q. Mr. James references Steven Cooper’s Cape Bridgewater study. Are you**
700 **familiar with this study?**

701 A. Yes. I believe Mr. James is referring to a study performed in Australia in 2014. It
702 was an evaluation of three households (six adults) who had previously lodged
703 multiple complaints with the wind turbine operator relative to noise levels of the Cap
704 Bridgewater Wind Farm. The individuals had reported subjective complaints relative
705 to the wind farm for more than six years prior to participating in the evaluation.

706

707 **Q. Do you believe that the Cape Bridgewater study supports any conclusion**
708 **regarding the potential health effects of low frequency sound from wind**
709 **turbines?**

710 A. No. The Cape Bridgewater study has not been peer-reviewed, and its methodology
711 flaws make the evaluation’s results suspect and unreliable:

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- 739
- Because Mr. Cooper evaluated individuals who have already made complaints about the wind farm, there was a selection bias in who participated in the study. With respect to selection bias, the selection of six individuals who had previously complained about wind turbine operations would have added the effects of recall bias into the study, meaning that the study individuals had already formed an opinion, which would have a direct effect on their reporting of subjective sensations. More simply, individuals who have already reported complaints are more likely to continue to do so.
 - The evaluation includes no reference group (or “control group”) to compare the results of the six individuals’ subjective reports. A reference group is the hallmark of an epidemiological study. A researcher cannot reliably evaluate a complaint about turbine operations, or any other stimuli, without having both a group that is exposed to the operations and one that is not to determine if there is a difference in effects that could be attributed to the stimuli.
 - In an appropriately designed epidemiological study, the subjects would be “blinded” to the status of the turbines, meaning that they would not know whether the turbines were operational. This did not occur in the Cape Bridgewater study.
 - As pointed out by the author of the Cape Bridgewater study, their sample was limited to six individuals who had previously complained – that is, the study was assessing the subjective “sensations” reported by six individuals who feel they have been adversely affected in one way or the other as a result of the wind farm. (Cape Bridgewater study at p. 212.)
 - Notably, the correlations reported by the author have not been repeated using a valid epidemiological study design.

740 **Q. Mr. James attaches a document titled *Noise: Windfarms* as Exhibit 2 to his**
741 **testimony (the “Shepherd Paper”). Are you familiar with the Shepherd Paper?**

742 A. Yes. I note that its authors are all affiliated with the anti-wind group, Society for
743 Wind Vigilance. Specifically, Dr. Hanning is on that group’s Board of Directors, and
744 Drs. Shepherd and Thorne are each a “Scientific Advisor.”⁸

745

746 **Q. In your opinion, does the Shepherd Paper provide the Commission with**
747 **helpful information concerning the Project?**

748 A. No, in the sense that this is a recitation of opinions of individuals who are affiliated
749 with anti-wind groups. As I noted, Drs. Shepherd and Thorne are “Scientific
750 Advisors” for the Society of Wind Vigilance, and Dr. Hanning and Mr. James are on
751 its Board of Directors. That said, there are some thoughtful comments regarding the
752 psychological aspects of annoyance and reported health concerns. However, the
753 term epidemiology and its attribution to a number of reports or opinion pieces is
754 misleading. For example, Dr. Nina Pierpont’s work is not a scientific study, and the
755 Shepherd Paper fails to make that clear. The Shepherd Paper’s reliance on pieces
756 written by Harry, Pierpont, Krogh, Hanning, Alves-Pereira, and Nissenbaum clearly
757 indicate the slant of the article toward the views of the Society for Wind Vigilance.

758

759 **Q. The Shepherd Paper states that annoyance is an adverse health effect, relying**
760 **on the World Health Organization (“WHO”). What is your response?**

761 A. Annoyance is not an adverse health effect, it is a normal physiological response
762 which is deeply rooted in the beliefs, culture, and psychological makeup of the
763 individual. The prevention of annoyance is a worthy but unachievable goal. It is
764 important to recognize that the WHO document that the Shepherd Paper relies upon
765 is from 1999 and does not address wind turbines. Overall, it is an outdated, single
766 reference that does not reflect the current state of the research on this topic. There
767 is peer-reviewed, published research since that time, much of which I have identified

⁸ See <http://www.windvigilance.com/home/advisory-group> (last accessed Sept. 24, 2018).

768 in my testimony, that provides more reliable and relevant information for the
769 Commission.

770
771 In addition, importantly, the WHO document that the Shepherd Paper relies upon
772 defines annoyance broadly as “a feeling of displeasure associated with *any* agent or
773 condition, known *or believed* by an individual or group to adversely affect them.”⁹ I
774 further note that the WHO document discussed annoyance in terms of a
775 social/behavioral effect and states: “it should be recognized that equal levels of
776 different traffic and industrial noises cause different magnitudes of annoyance. This
777 is because annoyance in populations varies not only with the characteristics of the
778 noise, including the noise source, but also depends to a large degree on many non-
779 acoustical factors of a social, psychological, or economic nature.”¹⁰

780

781 **Q. The Shepherd Paper notes that some individuals describe themselves as**
782 **“noise sensitive.” What is your response?**

783 A. That phrase, as used in the Shepherd Paper, is not a recognized specific health
784 condition in medical literature. It is neither an illness nor a disease but more likely a
785 conditioned response. In lay terms, this might be described as a state of mind. As I
786 discussed previously regarding the nocebo effect, if a person does not like
787 something, he or she is more likely to have a negative response to any situation
788 reflective of the stimulating event.

789

790 **Q. Are you familiar with the Shirley Wind Project study by Dr. Schomer referred**
791 **to by Mr. James?**

792 A. Yes.

793

⁹ WHO, *Guidelines for Community Noise*, at 32 (1999).

¹⁰ *Id.* at xi; see also *id.* at 33 and 42 (“[A]nnoyance reactions are sensitive to many non-acoustical factors of social, psychological or economic nature, and there are also considerable differences in individual reactions to the same noise.”).

794 **Q. Do you believe that Dr. Schomer’s study provides helpful information to the**
795 **Commission with respect to this Project?**

796 A. No. The study did not use study methods such that specific conclusions could be
797 scientifically supported. It also did not demonstrate a causal relationship between
798 the wind farm and the health complaints reported by some residents.

799
800 **Q. Mr. James asserts that you are “not qualified to speak to the issue of**
801 **acoustics or human response to wind turbine noise.” (James Direct, lines**
802 **398-99.) What is your response?**

803 A. I will be the first to admit that I am not an acoustician. I am, however, a graduate
804 trained epidemiologist with 30 years of experience working in public health and 20 of
805 those years working in the areas of occupational and environmental medicine as a
806 Board Certified Physician. I am using this experience and training to assess the
807 health and exposure claims made by persons who are attributing various health
808 conditions to wind turbine noise.

809
810 **V. CONCLUSION**

811
812 **Q. After reviewing the testimonies of Prof. Alves-Pereira, Dr. Punch, and Mr.**
813 **James, do you still hold the opinions offered in your Supplemental Direct**
814 **Testimony?**

815 A. Yes. My opinions are based on peer-reviewed, published literature, and Dr. Alves-
816 Pereira, Dr. Punch, and Mr. James did not present any testimony based on similarly
817 reliable research. It is important to acknowledge that there have been more than
818 400 gigawatts of wind power generation installed around the world,¹¹ and Prof.
819 Alves-Pereira, Dr. Punch, and Mr. James base their opinions largely only on a small
820 number of self-reported complaints. As such, my opinions remain unchanged.

821

¹¹ See <https://www.worldenergy.org/data/resources/resource/wind/> (last accessed Sept. 24, 2018).

822 **Q. Does this conclude your Rebuttal Testimony?**

823 A. Yes.

824 Dated this 26th day of September, 2018.

825

A handwritten signature in black ink, appearing to read "Mark A. Roberts". The signature is written in a cursive style with a large, sweeping initial "M".

826

827 Dr. Mark Roberts

828

829 64899496