



Wind Turbines: An Exploration of Research Participants' Living Experiences as a Consequence of Ontario's Green Energy Act

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Abstract

In 2009, the province of Ontario, Canada enacted the Green Energy Act. Those appealing an approval of a Wind Power Plant (WPP) were challenged by a high burden of proof—proof of causality. The requirement was that, before the project was constructed and operating, it must be shown that it “will cause” serious harm to human health, or “serious and irreversible harm” to plant or animal life, or the natural environment. **Methods:** This ethics-reviewed study used the Grounded Theory methodology. It conducted face-to-face interviews with those who had previously lived or were currently living within 10 km from a WPP. Audio files were transcribed to text, and the data were coded and analysed using NVivo Pro (v.12.6) software. **Objectives:** To explore and generate a substantive theory of the events that motivate research participants living within 10 km from a WPP to contemplate their housing decisions. **Results:** Data analysis revealed that the Green Energy Act

#Until his death on February 12, 2023, Mr. James was an active and contributing author of this article and supported its publication.

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contributed towards participants considering their housing decisions. They became informed and took action by participating in government processes that included observing Environmental Review Tribunals, other judicial proceedings and filing complaints/Incident Reports. **Discussion:** Through the candid and insightful observations by research participants, those with an interest in health policy, authorities, policy makers, researchers, practitioners, social scientists, and members of the public, will gain an awareness of the effects the Green Energy Act had on research participants.

Subject Areas

Civil Engineering, Sociology

Keywords

Wind Turbines, Green Energy Act, Government Policy, Grounded Theory, Contemplating to Vacate a Home, Housing Decisions (Internationally, USA, Canada)

1. Introduction

Wind Power Plants (WPPs) produce electricity by “having an array of wind turbines in the same location” [1]. These power plants include infrastructure and support systems such as: substations, transformers, and transmission lines as well as industrial scale wind turbines. This results in a footprint that can include hundreds of acres, exposing neighbors to their impacts.

In addition to the term WPP, other terminologies have been used in the literature and online. Examples are: wind energy conversion systems (WECS); industrial wind turbines (IWTs); wind turbines (WTs); utility-scale wind turbines; and wind farms. Each term typically includes the wind turbines themselves and the infrastructure components.

Ontario’s Green Energy Act (GEA) was passed on May 14, 2009. The intention was to “remove barriers”, and “attract new investment, create new green economy jobs and better protect the environment” [2]. However, there was uncertainty whether the goal would be achieved [3].

Those appealing a Renewable Energy Approval (REA) had to prove that the project “will cause serious harm to human health”, or “serious and irreversible harm” to plant or animal life, or the natural environment [2]. This proof of causality applied before the WPP project was constructed and operating.

After almost a decade on December 7, 2018, Ontario’s Minister of Energy, Northern Development and Mines announced the Green Energy Repeal Act. Its purpose was to eliminate legislation that “introduced disastrous changes” to Ontario’s energy system that resulted in a precipitous rise in costs of electricity rates [4]. This Act also restored planning decisions to municipalities that were stripped by the previous government and ensuring local voices have the final say

on energy projects in their communities [4].

While the newly elected government repealed the GEA, the WPPs that were approved under the 9-year Act have continued to operate in proximity to neighbours' homes.

This ethics-reviewed study used the qualitative Grounded Theory methodology to conduct a community-based study in Ontario, Canada. It explored the events that motivated individuals and families living within 10 km of WPPs/IWTs to contemplate vacating/abandoning their homes. To date, three previously published articles presented: preliminary results; an overview of findings; and the benefit of using Grounded Theory methodology [5] [6] [7].

Reports of neighbours vacating/abandoning their homes are available through scientific references, the internet and social media. However, there is limited research regarding this decision-making process. In addition, the outcomes of these experiences of vacating/abandoning one's home are largely unknown.

This original research explored participants' living experiences. It was found that the GEA motivated participants to become informed and taking action by contacting authorities and local health units and attending various judicial proceedings.

The data that were derived from the participants' descriptions were far reaching. In order to be comprehensive, this has resulted in the publication of up to 8 papers overall.

2. Methodology

Methodological details are available in previously published peer-reviewed articles [5] [6] [7]. Participants were required to be 18 years of age or older and proficient in the English language. With informed consent of all participants, trained interviewers began each interview with a single, non-leading question, *i.e.*, to discuss the events that led them to contemplate vacating their home. An invitation to participate in the study was distributed to community group leaders and neighbours who were known to have permanently vacated their homes or were contemplating to do so. There were no restrictions on distribution of the recruitment materials. Participants were advised that they would have an opportunity to describe the circumstances that may have influenced "whether to vacate or remain in their home". The study would explore the "extent of these occurrences and the impact or lack of impact" of living within 10 km of a wind energy facility. The study's purpose was summarized. Other details included the personal (face-to-face) interview process (whenever possible). All 67 participants agreed to have their interviews recorded. They were offered an audio copy at the conclusion of the interview. The audio files were converted to text. NVivo Pro (v.12.6) software was used to analyze and code the data. The Grounded Theory's iterative methodology was followed. This resulted in concluding the interviews with the 67th participant when saturation occurred and no new data were acquired.

Themes, Sub-Themes and the 5 Elements

Strauss and Corbin (1998) proposed a coding paradigm intended to assist with data analysis suggesting “what to look for when coding”. A version of this approach, the 5 Elements, has been described by Rose *et al.* [8].¹

To avoid introducing a potential bias, the initial question asked by the interviewers was framed as neutrally as possible: “*Can you discuss the events that led you to decide to vacate your home or think about vacating your home?*”

In response to the opening question, all 67 participants identified the central phenomenon/event as being associated with the WPPs/IWTs. These facilities were located within 10 km of their family homes and were either operating or anticipated [6].

Preliminary findings by Krogh *et al.* revealed that:

While the study methodology did not include a structured survey instrument or a research question specific for collecting health symptoms, comments about health arose spontaneously and consistently across participants. This factor was considered by participants as the impetus for decisions on housing choices. Participant data supported that the central phenomenon/event was the siting of an IWT facility within 10 km of rural family homes [5].

A comparison of the use of the qualitative and quantitative methodologies was provided by Krogh *et al.* Findings included that there were benefits of having used a qualitative methodology, specifically the Grounded Theory, for this topic. This methodology was applicable to this study with the development of a coherent theory which explained participants’ housing decisions. The use of this methodology and the outcomes of using a systematic method to transcribe, code, and analyze the data acquired during the interviews were applicable to the vacated/abandoned home study [7].

The application of the 5 Elements is illustrated in **Figure 1: Themes and sub-themes and their relationship to the 5 Elements** [6].

The 5 Elements and their relationship to this study’s analyzed data are:

Element 1: the “*central phenomenon*”, the focus of the study is the siting of IWTs within 10 km of participants’ homes as described in **Figure 1**, Element 1.

Element 2: the “*causal conditions that contributed to the phenomenon*” includes findings of the primary and sub-themes of the effects of environmental interference and altered living conditions as described in **Figure 1**, Element 2.

Element 3: the “*context in which the phenomenon is embedded*” is associated with a government policy resulting in participants becoming informed and taking action through government and other processes as described in **Figure 1**, Element 3.

¹Susan Rose, Nigel Spinks & Ana Isabel Canhoto, 2015. Chapter 6: Management Research: Applying the principles© 2015. Figure 2 Coding paradigm (adapted from Corbin and Strauss 1990).

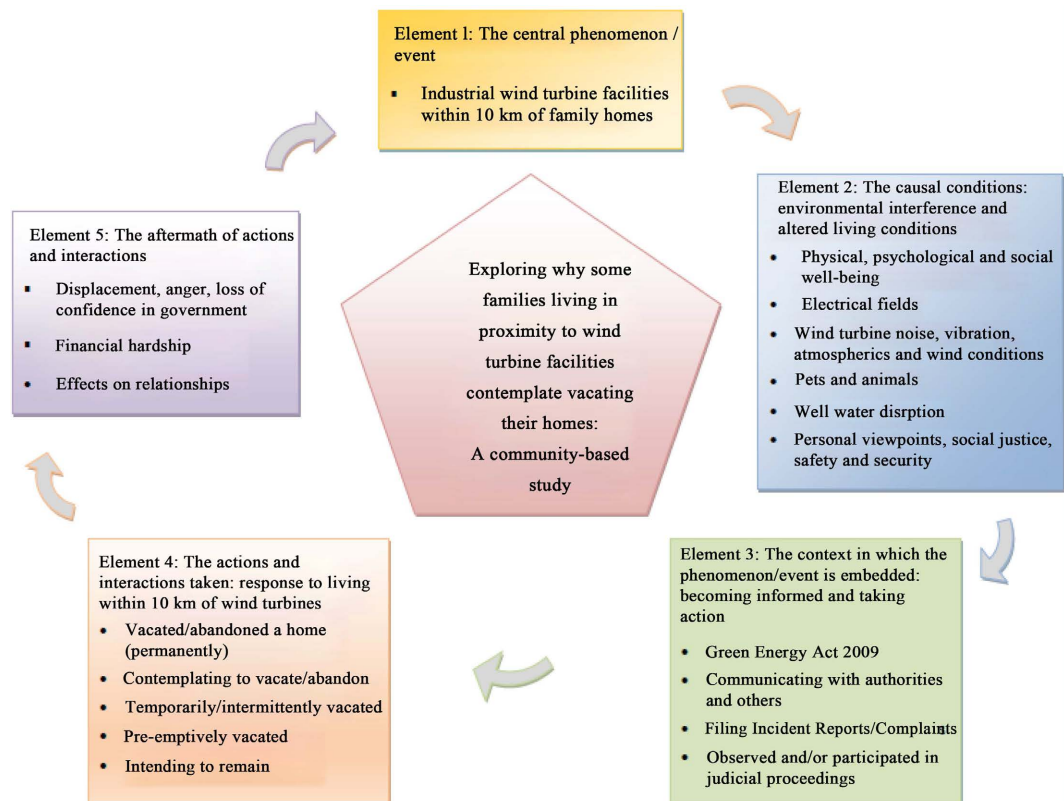


Figure 1. Reproduced from the Open Access Library Journal [6].

Element 4: the “actions and interactions taken by people in response to the phenomenon” resulted in participants contemplating housing decisions as described in **Figure 1**, Element 4.

Element 5: the “consequences of those actions and interactions taken in Element 4” include an “aftermath” as described in **Figure 1**, Element 5.

This article explores the primary theme of Element 3, whereby participants became informed and took action.

Some of the findings associated with the sub-themes of Element 2 have not yet been published. These include effects related to: wind turbine noise, vibration, atmospheric and wind conditions; medical diagnoses provided by participants’ physicians and physician specialists; effects on safety, trust, social justice; an “aftermath” of participants’ living experiences; and effects on pets, animals and well-water disruption. These findings and those associated with the primary themes of Element 4 will be presented in the future.

As proposed by Castillo-Montoya, every effort was made to “create an inquiry-based conversation” [9] that would accurately represent the voices of participants. This includes the use of verbatim quotations throughout this paper.

To maintain participant confidentiality, the authors have intentionally avoided reporting details in the participants’ descriptions that could identify specific individuals, geographical locations, siting distances, or the WPP projects. In addition, when appropriate, this article uses the terminologies of “neighbour” (Can-

ada) and “neighbor” (USA).

Tables 1-4 provide examples of participants’ descriptions of effects associated with the topic under discussion. Each example is offered by a different participant.

3. Results and Discussion

3.1. Ontario Canada’s Green Energy Act (GEA)

A participant described the desire to help others understand the GEA’s effects.

The Green Energy Act...I just know that the truth will come out in the end. This truth, and I’m speaking of today...it will be exactly what people need to know...If this helps even one family, even one farmer, that’s really good...I don’t know what the future holds...but I do know how affected I’ve been. I’ve been to a lot of meetings...I’ve spoken up at every one...if I could help with this, then that’s why I’m here.

During 2007 to 2009, neighbours living in proximity to WPPs described their adverse health effects (AHEs) [10] (a-c) [11] [12] (a-f). Some reported they had taken the step to vacate their homes.

During a GEA Standing Committee public hearing, a witness testified that due to the noise and lack of sleep, the IWT located behind their home was permanently “shut down.” In addition, three or four other IWTs were “running on low rpm” and were shut down at night [12] (a). A witness from a group of families testified about the emotional and social stresses and having to defend their health problems at community events. The witness commented that:

...dysfunctional community relations have been created by the wind project representatives and some community members trying to discredit the validity of our problems [12] (b).

In addition, the witness testified that:

The family unit for each family has deteriorated and has been torn apart. We begged for sleep, and four families were billeted by the wind company from their homes for 90 to 180 days in motels, hotels and a rooming house [12] (b).

Furthermore, a group of neighbours advised the GEA Standing Committee that while some politicians and the wind industry tried to “cast doubt by disrespecting” their experiences, their deteriorating health changes were “not opinions” [12] (b). AHEs included: sleep deprivation, lack of concentration; feeling unwell, *i.e.*, depression, tiredness, anxiety and stress. It was noted that the effects start to “subside when you leave the polluted environment of your home” [12] (c). One of the witnesses testified that his doctor had advised him to “leave the home” and he was now living in town. However, he went back and forth to his farm to do chores and look after a “feedlot of 550 cattle” [12] (d).

The GEA Standing Committee members were advised that even pets were “affected while in the home, losing hair, sore ears, but not when away from the home” [12] (c).

Table 1. Participants' descriptions of effects associated with the GEA.

Each example is by a different participant.
[brackets] indicate where data have been omitted to maintain privacy.

Before the Green Energy Act that's when we noticed that it [the planned WPP] was really heating up in communities, splitting people against people because some people wanted it, some people didn't want it. You became involved.

Once, we had a gentleman from [location] come and just talk. It was very early days. Pre-Green Energy Act. Nobody knew very much what was to be happening over the next while... Then you hear that the MOECC [Ministry of Environment and Climate Change] is not enforcing the noise regs [regulations] and we don't have regs for infrasound. Isn't that great? Unless the government changes everything it's up in the air.

Then the Green Energy Act consultation came up [there were] different venues where you could go and talk about it... part of informing the government before the regulations even came into place for the Green Energy Act... I truly honestly thought that somebody from the ministry or some level of government would be on our door the next week saying, "Okay, what's going on?" So that they could investigate... I was beginning to realize how bad it was.

...this Green Energy Act... our community is being destroyed or the traditions of it are being destroyed. And that is appalling to me... They claim to be transparent, they claim that they want to be good community neighbours and all that yet it's so obvious that they're not... We have lost friends, we have tried not to make this about the people who are getting turbines.

I felt as though the Green Energy Act... Our rights have been ripped from us. Wherein it's an incredible piece of legislation, it really makes you a villain. It's so clever how it blocks every avenue...

...the Green Energy Act... There's been so much stuff that's been printed about why we don't need these turbines, why it's a waste of money, how they're not really green... our fight is with the government and with the wind companies that have put us in this situation.

Everyone thinks the Green Energy Act is what has allowed this proliferation, but it goes deeper than that. We sit out here, now, waiting for the next turbine proposal, gravel pit, quarry, water taking corporation or industrial farming outfit, to try to come in and take whatever they can to make a buck are all mandated to go ahead in the provincial planning policy... another group of turbines went up... I really thought we were far enough away and I did not see it coming... We used to feel safe here.

There were obviously a great number of highly talented public servants that wrote this thing [GEA] to block every possibility of controlling this by municipalities or townships or local people... until the Green Energy Act came along... It was done through their local township, their local government, their municipality...

In the very beginning it was aesthetics... But then, we realized that it was more than just the looks of it, it was what they were doing to the health of people, and we just knew that it was wrong...

Continued

Our township has done its best, I think, in many ways to try and mitigate what they can but most of their authority is gone via the Green Energy Act. They can only fight with road user agreements and little petty things like that.

...they took all of the decision making out of the local council. The Green Energy Act mandated it in the first place because it tied everybody's hands. Nobody could do anything about it. It could be just sanctioned from above.

They [municipalities] can't make these big decisions, the yes or no, for a [WPP] project.

...the professionals that we trusted to ensure our safety, the engineers that put that okay to monster wind turbines being above our homes...They put their okay that they [IWTs] would be safe but they weren't safe, they made us really sick, made our neighbours really sick. When we even told the government about that prior to the Green Energy Act, they still didn't change anything...How can you build an industry that harms people...The Green Energy Act is its own law...our project was built before the Green Energy Act and we had no protection and after the Green Energy Act, there's still no protection and that's wrong. It's just plain wrong.

...there is no safety, there is no insurance from the government that they're going to protect you from exposure anywhere you live. They're just putting them in, well in anywhere where they feel like putting them in, and we don't need them...Until something is changed and the Green Energy Act is maybe rebuilt...that these projects are not green and they're affecting people's health...I don't know where to go. I just don't.

The Green Energy Act undermining some of the protections that are in place... Embedded by the Green Energy Act in the regulations. Quite frankly, I feel like instead of my government fulfilling its mandate to protect communities...they used my tax paying dollars to oppose me and to discredit me, and have not replied to any of the information I've given them. I've communicated freely with the company that's managing the wind turbines...Never, did anybody reply to me.

[After] the Green Energy Act, even if you do have a problem, what hope would you have of ever getting it resolved?

Other witnesses testified to concerns about the loss of rights and a risk to health [12] (e) and the lack of protection of neighbours' agricultural land, livelihoods, personal health and the health of their animals [12] (f).

After the above presentations, Dr. Robert McMurtry, Professor Emeritus and former Dean of Medicine and Dentistry, (Western University, Canada) provided the GEA Standing Committee with a preview of the results of an Ontario study that described the findings of neighbours' AHEs [13]. Subsequently, the results of this study were published in a peer-reviewed scientific journal [14].

3.2. Responses to the GEA

It was suggested by Whiteley *et al.* that the government "erred by creating an in-

flexible policy/statute”. In addition, the policy ensured that IWTs would be “approved, erected and become operational at any cost”. Suggestions were presented for mitigating some of the policy’s outcomes and how to prevent the impacts on “social justice from happening again.” It was observed that the government actions taken to “achieve this position” were contrary to widely held “fundamental principles of administrative law and governmental legitimacy” [15].

Furthermore:

There were many obstacles in even filing an appeal, one of those being that appeals of Renewable Energy Approvals were cost-prohibitive, with legal fees ranging from several thousand to millions of dollars [15].

An analysis by an Ontario researcher summarized some of the GEA’s expected effects. Examples included: a 50% increase in electricity rates; an inability to reach the creation of 50,000 jobs; rural environmental degradation; an increase in health and stress problems; and a loss of property value [16].

Fast *et al.* observed that in order to avoid potential delays by “recalcitrant residents” the Ontario Planning Act was amended so that municipalities no longer had “direct control over land-use decisions.” In response to this amendment, 89 Ontario municipalities passed resolutions declaring themselves as “unwilling hosts.” Another finding was that the issues concerning the social acceptance of wind energy are major challenges for policymakers, communities and wind developers. The authors also commented that this had an impact on the legitimacy of societal decisions to pursue wind energy [17].

During this time, a media outlet reported a former Premier of Ontario saying that: regarding “wind-farms”, it was okay to “object on the basis of safety issues and environmental standards”. But if there were “real concerns”, put them forward. But “don’t say, ‘I don’t want it around here’...NIMBYism will no longer prevail” [18].

Fast *et al.* suggested that:

Given the empirical evidence suggesting that a “not in my backyard” (NIMBY) motivation inadequately describes wind energy siting disputes¹³, it was a risky strategy [17].

A news outlet reported that regarding proof of causality, Dr. Lynn, a former Ontario MOH (Medical Officer of Health) had acknowledged:

Proving causality from environmental exposures has always been tricky, Lynn said, and the research is only now beginning to catch up to the wind turbine industry. “It’s difficult to get all of these things with good evidence”, she said, “Smoking took us 50 years to prove it was causing heart disease, lung disease and all that kind of stuff. And we knew it did long before that [19].”

Proving causality is ranked by the BioInitiatives Working Group:

...proof of causality ranks at about 95% to 99% certainty and is rarely poss-

ible for biological systems; the Precautionary Principle ranks at the about the 50% medium level, consistent with civil and some administrative law; and environmental protection has a low level of certainty (10% to 30%) [20].²

It was proposed by authors Punch and James that based on information from scientific and peer-reviewed publications, papers presented at scientific conferences, government documents, and print and web-based media, there is sufficient evidence to establish:

a general causal link between a variety of commonly observed adverse health effects and noise emitted by industrial wind turbines [21].

3.3. Defining “Serious Harm to Human Health”

Ontario’s first Environmental Review Tribunal (ERT) that was held under the GEA received testimony under oath from 11 international expert witnesses. While the appeal was dismissed, the Decision acknowledged “serious harm to human health” included both direct and indirect impacts:

...“serious harm to human health” includes both direct impacts (e.g., a passer-by being injured by a falling turbine blade or a person losing hearing) or indirect impacts (e.g., a person being exposed to noise and then exhibiting stress and developing other related symptoms). This approach is consistent with both the WHO definition of health and Canadian jurisprudence on the topic [22].

This Decision also acknowledged the potential for IWTs harming humans.

This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree [22].

While the above Decision acknowledged both direct and indirect effects, the “degree” of what constitutes serious harm was unclear. In an effort to determine the legal definition of “serious harm to human health” a neighbour planning to appeal a REA requested that the MOE (Ministry of Environment) clarify the legal definition of “will cause”. He also requested the “medical source” used in support of the definition as well as the legal definition of causing serious and irreversible harm to plant and animal life. Other requests were whether “irreversible” meant being outside a certain boundary and whether the prediction of extinction met global, federal, provincial or regional laws [23].

A representative of the Ontario Ministry of the Attorney General responded:

I cannot provide you with the specific answers that you have asked for in the context of this litigation. The MOE has no general statement which sets out a position on the definitions of the terms used in the legislation [24].

²Appendix 20-B Standards of Evidence for Decision Making Differs among Professions Pg 7, 8. Appendix III (Levels of Proof Schema).

Due to the lack of “specific answers” the neighbour withdrew his application to appeal the project’s approval [25].

Subsequently in 2016, an Appellant who was appealing another REA, requested clarification on the definition of “serious harm”. The response from the Ministry of Environment and Climate Change stated that:

It should be noted that serious harm is not defined in O. Reg. 359/09 or the Environmental Protection Act, the determination of whether a renewable energy project will cause serious harm is done by the Environmental Review Tribunal (ERT), if there is an appeal, based on the evidence before it and the nature of the harm alleged [26].

In 2018, a newly elected Ontario government repealed the GEA. It delivered on its “promise to repeal” the Act that had led to the “disastrous feed-in-tariff program and skyrocketing electricity rates for Ontario families.” The government also noted it restored “planning decisions to municipalities” and that “local voices” would have the final “say on energy projects in their communities” [27].

To conclude, the WPP facilities that were approved under the GEA continue to operate. Study participants and their neighbours who live near the WPPs remain vulnerable to the potential for AHEs. For example, Wind Concerns Ontario reports that a project that was due to expire in 2026 has been extended to 2031:

The project has a long and controversial history, due to hundreds of complaints of noise pollution from residents, so severe that some people abandoned their homes. Our own findings from documents received under Freedom of Information is that the Melancthon power project was number one in Ontario for noise complaints related to the turbines and a transformer [28].

3.4. Policies, Regulations and Social Implications

In 2008, a case study examined the health risks and the “policies, regulations and social controversies surrounding wind farm noise in Ontario” [29]. They asked “how and why noise” became controversial and provided a detailed description of how Ontario established policies and regulations in order to address this concern. Among the findings was a loss of local government authority over planning matters and a:

growing mistrust in government and industry’s ability to effectively and fairly manage the risks of wind turbine noise [29].

Shain commented that regulations under the GEA:

cannot legitimately (according to a Rawlsian view) simply trump the claims and rights of subpopulations of citizens to the protection of their own and their families’ health or enjoyment of their property based on some preconceived and unconfirmed notion of overall benefit to population health [30].

McRobert *et al.* observed that the GEA advanced conflicts between developers,

regulators, residents and municipal officials. They advocated for environmental justice, fairness and health protection and stated:

Promoting and approving renewable energy projects in a manner that disregards public opinion and silences the voices of those most affected by the projects is a form of injustice, even if the result involves more wind turbines and solar panels. A process that pits communities against multinational corporations and the government in a highly stacked and unequal relationship is not the type of action that proponents of environmental protection should condone. Nor is it a laudable when multinational corporations profit with few benefits for directly affected communities [31].

Evans expressed the concept of “Collateral Damage” and the role of the Precautionary Principle:

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 [32].

A neighbor residing in the USA provided a perspective associated with living near a WPP. During a county board meeting, the neighbor stated that “we were never part of the decision making process for location”. She noted that “no one asked me if I minded how close it was and whether or not it would affect my horses, my other animals and of course us that live there”. She also commented that when the developer’s representative was questioned about the risk of effects on their horses and pets, family members from LFN/vibration, property values and whether they would buy them out, “He always said I will not have a problem so there was no need to even concern myself [33].”

Whiteley & Dumbrille concluded that it was demonstrated how government working with industry:

created bias that favoured industry over the safety and well-being of the public and the environment. The government demonstrated a failure to regulate, to the benefit of the wind industry and associated members, to the prejudice of residents [15].

4. Becoming Informed and Taking Action

Data analysis revealed that Ontario’s GEA motivated study participants to become informed and take action through a variety of approaches. They described contacting local, provincial and federal governments, their local Health Units and those in positions of authority whom they believed should be responsible to protect them. They spoke with their doctors and reached out to the WPP companies. They participated in ERTs and other judicial processes by attending and observing these proceedings as members of the audience. They supported their

neighbours and the Appellants. In addition, they spoke through informal networks in an effort to make the issues more widely known. *See Section 4.1 Attending and observing government and other proceedings.*

Each example below is by a different participant.

I had written to Health Canada...just asking for more information...We went to the public health unit. You hear just by talking to friends and family who have experienced it...the combination of this growing awareness around people who already were involved and the experiences, plus the legal side of it and the tribunals.

...the health unit...Prime Minister, and the Premier and the MOECC, and the energy person [Minister of Energy], and the councillors...my nurse practitioner...other community members...people who I meet off the street. I talk to people, relatives, people that might be coworkers, other professionals, the nose throat specialist twice...MOECC (Ministry of Environment and Climate Change) ...the township...the companies responsible.

In another case, access to a government authority was found to be limited.

I just thought about my chance meeting...at [a site] with one of the Ministers...I approached [the Minister], introduced myself and went on to explain the health problems that industrial wind turbines were causing people in Ontario. After a few minutes, it was obvious that [the Minister] was very uncomfortable talking or rather listening to me...I was told to contact [Minister's office] and when I [advised that the] office had been contacted via email and Canada Post several times with no response, [Minister then gestured to someone] ...I left.

Table 2 provides additional participant's descriptions of becoming informed and taking action.

Across the Canadian-US border, New York State Senator Rob Ortz hosted a public forum. He commented there will be more "energy projects forced upon rural and small towns across Western New York" and proposed future forums to gather facts about the impacts in order to:

educate the public and policymakers of the impacts these industrial turbines will have on the health, well-being and quality of life of the residents in the communities where they are proposed [34].

Furthermore, it was acknowledged that:

It shouldn't be incumbent of residents having to prove IWTs are unsafe, the developers should prove they are safe [34].

Participants in the vacated homes study became informed regarding the risk of living near a WPP and took action by volunteering their time, financial resources, and energy towards supporting their neighbours and community.

Table 2. Participants' descriptions of becoming informed and taking action.

Each example is by a different participant.
[brackets] indicate where data have been omitted to maintain privacy.

I had done the research about the wind turbines since [date], I was quite aware of the possibilities of having health impacts but I didn't realize just how bad they would be and if I would be personally affected by it.

About [x] years ago we had to look into wind turbines when a project was proposed about [x km] from us...I've spoken to [a former Premier of Ontario]...I said "People are getting sick. You have to do something." ...They just walk away from it.

I was very engaged in the literature and a volunteer...we have to be really close to the turbines because there's nowhere else to put them...That was the basis for starting to worry or be uncertain about whether we could tolerate living in amongst them [IWTs].

I think that we became involved in the issues with turbines in the early 2000s more because the turbines were going to be put in around [our location]...we did an awful lot of work to try to get that [IWT project] cancelled...we started to broaden our horizons. Started to get more people to start to take notice, how many halls that we've been in the course of this journey, trying to get the information out to people that, quite frankly, didn't care...they don't care that you had to sell your house, they don't care that you might not have had your health. They don't care.

We started thinking about it when we first heard that the [IWT project] was going to be built in our neighbourhood. I'm doing what I would call at that time casual internet research on wind turbines which led us to become aware of some of the physical effects that people were reporting.

I think the education of the broader community, the broader province has been good. Unfortunately, it came too late...as far as stopping the turbines in [IWT project]. Yes, you feel like it was a big waste of time. The government had made the decision. The contract that they made with the host, made it impossible to get out of. They didn't give us options.

Initially when neighbours decided to put turbines in, because of my knowledge and my previous studying about the possible health effects, and the effects to animals. I already thought before they turned the soil that there may be issues coming ahead, and that was [x] years ago.

I've since gone to a number of these developer open houses, and I get the same thing. Same experts in a lot of cases, they've got the same charts up on the wall. It just feels dishonest. The whole process feels very dishonest.

I went to a lot of open houses...talked to our local mayor and the councillor...helped with a petition or a protest...I don't know how many letters I would write to the MOE [Ministry of Environment] or MNR [Ministry of Natural Resources], that kind of thing I did do. I don't know how many protests that we went to Queens Park [legislature] and we protested locally. We did what we could.

[We] have written many letters...to government officials, some groups and we've gotten them [neighbours] to send in statements to the Environmental Bill of Rights...We've kept ourselves informed...we've learned more and more...it's occupied our life for [x] years now...We've reached out to the federal government. And they blew it off.

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I have many emails that I have sent to government officials. I reached out to International organizations...I get emails from other members of groups...I send letters in. I have spoken and reached out to a MPP [Member of Provincial Parliament] who is very concerned about what's happening here...[the MPP] believes that this is not the right place for wind turbines. But [MPP's] efforts have not prevailed.

I had a one-on-one in-person talk with [a former Minister of the Environment]...I've written to many, many people...our township...Ministers of Health...the health unit...people that I sent emails to federally, provincially, municipally...I don't even send them the letters anymore...We know they don't care.

The Ministry of Environment and Climate Change...I have written at least a dozen. I have even written twice to the new one [Ministry] and the [former Premier of Ontario]. I even sent a letter to the [Prime Minister of Canada]. But of course, he's not going to say anything...the Ministry of Environment and Climate Change has written back. They have a spokesperson...I would be told stuff I already know.

...the Ministry of Environment officer...advised us to contact the wind company and to report it to them...We didn't hear anything for quite awhile...their [wind developer] representative called...we met with him...he was going to make arrangements to bring an acoustical company here...The engineer said "That is infrasound". He said "We will be setting up our equipment to test for infrasound." We cleared our schedule, we waited, we waited...They never showed up...We heard nothing from the developer.

...we're at the point where we've contacted everybody we can contact...Except the lawyer. We're going to think about that...And just to clarify with her, if we sell this place, can we be held responsible? My thought is what if some family moved in, with a little kid, and that poor little kid has to go through what we've been through. Can you be held responsible down the road...That's what we want to clarify with the lawyer.

...it's a really difficult message to get out there. And everybody thinks wind is green. It's hard to change the minds of the people in Toronto. So it was very discouraging to see what the government was doing to our environment, to our trees, to our land. Irreversible damage to putting cement in the ground and never ever taking it out...That's one of the reasons why we never pursued wind turbines for ourselves because we just didn't think it's the right thing to do for the land. It had nothing to do with money. It was the land we were concerned about and of course the wildlife.

...it was horrific, terrible and that conversation continued to try and just when you would get told possible ways that it would be fixed and your health would be fixed and it never was. We went to various levels of government as well. It was the most disheartening, emotionally and mentally hard on all of us that our elected representatives did not listen to our concerns enough.

I never thought it would be this bad, or this deep, or this wrenching or this life changing.

Well, it's hard to believe that in Canada, we could have such a corrupt set-up that ignores people's health. The evidence is there and the political will, definitely, it's just the political will. We heard last night that somebody's child was being taught how wonderful wind turbines are in the school-curriculum.

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It took a while to figure out what was going on after the facility kicked in [started operating]... We were told there'll be no issues. Wouldn't see it, wouldn't hear it, the whole deal. It was turned on and it took about two days to figure out what this god-awful noise was... Because when it started, you really couldn't tell what direction it was coming from. It was encompassing, surrounding us.

We've talked to people who actually have moved out of the house... That's how come I became worried about the health effects... I just wanted to know what was happening. Here we are... [x] years later, and they're [IWTs] here. It changes, it takes up a time in your life when you really should be, we're just starting retirement. It should be better.

They [family] all know that I can't live in my house... How I'm being affected... that I want some remedy... They said... "Why didn't you go and see the wind companies?" I said, Why would I want to go to them?... What I've got to do... is build another house to live in, so I could still live on my property... There's no remedy... I want some remedy,... [no one] is doing anything about it... just blowing us off with no reason at all.

...turn them off when they're bothering us... someone needs to relocate us and for a replacement value.

We probably gave 14 years of our lives to this, and a lot of money. People don't understand how it can be that way... There's a lot of people that have contributed far more than I ever did, a financial cost as well... We started to learn a lot more about turbines... We continued to fight with various groups for many years, then it became very obvious that the turbines were a go. The [former Premier of Ontario] won a majority, so we knew that the turbines were now reality... Probably the first real concern was the health issues, some of the things that we had seen.

Both my husband and I were wary of building a new home close to wind turbines... we learned more and more about them.

The way the noise regulations are set up, the way the noise compliance test... to me it looks like it's designed deliberately to not show outside of compliance. I understood a little of acoustics. I knew that if the noise was low frequency in nature, then it would penetrate the walls quite easily. They just dismissed it to us all.

Does that mean that the wind company gets a free pass to be out of compliance? Or whenever it's gusting... it's too cold... when the leaves are on the trees. It would be so simple... where we just said, "It's really loud right now"... and then they said, "Yes, it appears that they're out of compliance."

From the Medical Officer I get all the studies saying nothing's wrong and it's in your head. He originally told me that if I contacted him again it would be harassment... Somebody else of the Ministry of the Environment has also sent me the same studies from Health Canada about there being no direct impacts. Nobody's discussing indirect.

4.1. Attending and Observing Government and Other Proceedings

Participants became informed through their attendance and observations of

various proceedings such as, Ontario ERTs and other judicial/administrative processes; local municipal meetings, and information sessions. *Each example below is by a different participant.*

Outcomes from the [Municipality], a request to municipalities that they raise a resolution that simply says, we support the principles of this challenging of the Green Energy Act based on protections for people. What do I see but our Council goes into hidden session and consults with a lawyer and comes out and says we can't support this.

There was nowhere to address [leaving a home] in the ERT. The province just refuses to take any responsibility for it. The municipal level, the provincial level, you really feel abandoned by any process that protects landowners.

Those wishing to appeal a WPP approval could request an ERT hearing. Overall, over 50 ERT hearings were held [35]. See also Section 3.1 *Ontario, Canada's Green Energy Act (GEA)* (Table 1).

The first appeal of a REA was held during 2010 and 2011. The ERT heard testimony under oath by international witnesses who were qualified as experts [36]. During testimony by a government witness, it was acknowledged that a neighbour had met with government officials regarding concerns about health impacts of IWTs. However, the witness could not recall the specific details of that discussion [36] (a). Another witness who was testifying for the proponent stated that he was aware that two families residing in the area of a WPP had stayed in motels [36] (b).

Ontario neighbours who had experienced AHEs or had concerns about this risk testified at another ERT [37] (a-c). During subsequent ERTs, some neighbours provided their medical records and testified under oath [38] (a-k) [39] (a-b). Neighbours' testimony also included concerns about pre-existing medical conditions and the potential of an increased risk of harm [37].

During one of the ERTs, an elderly woman who could not live in her home testified under oath that she "was being denigrated and disempowered and just being named as a whining complaining woman" [38] (j).

An ERT Decision acknowledged the witnesses who had testified about their AHEs:

Each post-turbine witness testified and was subject to cross-examination. The Approval Holder and Director raised issues around the neutrality of the witnesses, given that some have ongoing law suits against the turbine companies in their area and some have spoken out publicly against wind turbines. Nevertheless, the Tribunal finds that each witness testified in a forthright manner to the best of his or her ability and recollection, and finds all of the post-turbine witnesses to be credible in reporting their symptoms, and how their symptoms negatively impact their quality of life [40].

Table 3. Participants' descriptions of attending and observing judicial and other proceedings.

Each example is by a different participant.
[brackets] indicate where data have been omitted to maintain privacy.

...increasing the scientific test that I [as a] taxpayer need to meet. How am I supposed to bring experts to the table months in advance when we have 14 days to prepare paperwork for an ERT, and assemble all our arguments, otherwise we can't bring them in later? Having forbidden new information should reveal itself. I think the Environmental Review Tribunal is also intentionally weighted against people...I see [name of lawyer] is running the JR [Judicial Review] which is challenging the Green Energy Act. It's a pretty significant action. In fact, it could wind up in the repealing of the Green Energy Act and what would that do to these harmful projects?

That is the frustration and the shock that really has hit me so far to walk into the ERT and to see our government lawyers sitting and sharing the same table with the proponent, talking to each other, talking out in the parking lot with each other and we could only afford one [cost] an hour lawyer to represent us on the other side. They had Bay Street lawyers...with at least two or three from the Ontario government and then there's our one little lawyer with an assistant.

The [causality] test is impossible...unfair is the word...the onus of proof being on the individual to prove harm...that is extremely unique in this environment. It's just unfathomable that somebody would have to prove harm...And to have a Ministry of Environment doing more harm to the environment...for this greater good that scientifically... there is no greater good from this. It was very odd having our government in there against us instead of protecting us.

We followed the ERT [for a proposed IWT project]. We followed the ERT [for another proposed IWT project]. We went there. We listened to the testimony on the environmental side, on the health side. We went to the Falconer and Drennan [ERTs and Court Cases] challenges...the government clearly know there is a problem. They'd like to sweep it under the rug, but they know there's a problem.

ERTs...the conclusion after several years and it was a learning curve. It comes down to an impossible task and somehow you just keep thinking that maybe someday it's going to be possible...it's set up to fail. The time constraints are an issue...it's dollars that it takes to win these cases...you don't have the money and to get the experts in...the wind developers can afford three experts to every one expert you put in there...on top of the test itself being impossible...I think the more money you have the more you can win the court, that's what it boils us down to...if we had billions of dollars and we were a large corporation we could swing it in our favor.

We sat through some of these hearings and tribunals of people that were directly affected, and we've met these people...What they [appellants] went through, just to watch them go through that every day, was painful. If you have any empathy for people, what they had to face...I realized they [developer's witnesses] were getting paid exorbitant amounts of money for the hour of evidence they gave over a television set.

We have been fighting the wind turbines for quite a few years and we really had hopes that the government would see reason and understand that this is not the right place for wind turbines...We kept hoping at each stage like at the ERT surely they would see and rule in our favor at the judicial review...we kept thinking, "Okay, well, that's all right we'll carry on." Each door closed and a wall was put up and there seem to be no other light at the end of the tunnel.

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I went to all the Environmental Review Tribunal sittings for 26 days...this was unbelievably difficult...At one point the judges of the tribunal, the chair, referenced that yes, safety was a concern but that would have to be dealt with somewhere else...I spent before this 15 years living outside of Ontario...I've never seen people treated like we were treated there...it was really one of the more disrespectful processes I've been involved in...every level of your concerns felt completely disregarded which I'm sure is the job of the legal team for the proponent and the government who sat beside each other, at the same table. It was patronizing, it was just really the most awful experience and it really soured my desire to live in Ontario.

Another thing I found with the legal...my area of work is in science and is in healthcare and the stuff that these lawyers were pulling out, I was like, "This is not science." I don't know where they're getting these arguments but these aren't science, I wouldn't even have been able to do that in my undergraduate degree. It was just one of those situations of you just cannot believe what's happening.

Furthermore the Decision stated:

The witnesses testified to a wide array of health problems, ranging from tinnitus and headaches to diabetes and high blood pressure, to severe psychological conditions [40].

While the Decision that was cited previously found that the evidence did not establish that the project will cause serious harm to human health. However, it found that "serious and irreversible harm" would occur to the Blanding's turtle, a species that is "globally endangered and threatened in Ontario" [40]. As a result, the ERT revoked the project approval [40] and the WPP has not been constructed.

In another case, an ERT found that:

...engaging in the Project in accordance with the REA will cause both serious and irreversible harm to plant life, animal life or the natural environment, and serious harm to human health. These findings were based on evidence regarding the impact of the Project on a species at risk, specifically little brown myotis (little brown bat or *Myotis lucifugus*) and evidence regarding the impact of the Project on aviation safety ([41] pg 3).

In addition, it was found that regarding "aviation safety":

...the Approval Holder's proposed mitigation measures were not feasible and "would not significantly reduce the likelihood of a collision with a wind turbine, or ground crash caused by wind-turbine induced turbulence for all wind turbines other than wind turbine 2 ([41] pg 9).

Furthermore, the Tribunal ruled that:

As the Tribunal has found that engaging in the Project in accordance with the REA will cause serious harm to human health, and neither the Approval Holder nor the Director have proposed effective means to mitigate this harm, the Tribunal finds that it is in the public interest to revoke the REA under s.145.2.1(4)(a) ([41] pg 10).

To conclude, some environmental Tribunals have found serious harm to pilots and serious and irreversible harm to several species. In the meantime, neighbours who were appealing a REA on the basis of health impacts, and those who were testifying to their AHEs faced the daunting requirements of proving that the WPP “will cause serious harm to human health.” This proof was required before the WPP was built and operating.

In addition, while a Tribunal acknowledged neighbours’ sworn testimony of AHEs [40], as a consequence of the GEA’s causality clause, their descriptions neither meet nor satisfied the “will cause serious harm” test. When an Appellant requested clarification of the legal definition of “will cause” [23], he was advised that this was not in the legislation [24].

4.2. Filing Complaints/Incident Reports

Participants filed complaints/Incident Reports with various authorities. A study participant described being discouraged of doing so.

Have I called the hotline to say you know I’m concerned about my health... Have I called them? No. And should I have? Well, they say I should have and I’ve even told people they should do it but have I done it myself? No...It’s the government. They’re not looking out for me and it’s a waste of time...and they won’t do anything...There’re unanswered complaints everywhere and I don’t see it as helping me or helping anybody else and so I haven’t done it because they’ve taken enough time out of my life and I look at it that way.

Table 4. Participants’ descriptions of filing complaints/incident Reports.

Each example is by a different participant. [brackets] indicate where data have been omitted to maintain privacy.
There’s a feeling of helplessness because we had no response...The MOECC [Ministry of Environment and Climate Change] won’t even acknowledge [us]...Whenever we get a day like that, I call them. I tell them exactly what’s going on. I have a list, three or four pages of times when I’ve called to complain.
...years later to date, and I say to date because as we speak, complaints were filed yesterday. The Premier of Ontario despite being personally contacted and copied with complaints has done nothing but send auto responses by email saying, “We’re glad you contacted us, we take your requests seriously and we will be in touch.”...We attempted to reach out to...Minister of Environment... the [Local Ministry] office...What we see in our community complaint response analysis is what residents are deeming to be adversely affecting their peaceful enjoyment of their property, what’s keeping them awake at night.
We made it our mission to compile the evidence of people filing bonafide complaints, which is again, the only thing they’re allowed to do...You would see first-hand what your neighbours were experiencing because you know they wouldn’t make up the complaint. Also, first-hand, you will see their neighbour going, “I think she’s nuts. Because I live right next door and I don’t feel a thing.” It’s a very dynamic subject and

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one that unchecked could easily force people who have bonafide concerns and are living with adverse effects, to simply shut up because of the peer pressure of what could be your very next door neighbour... You knew people in their right minds would never make something like this up to put themselves potentially in a position to be the only person on the block, for lack of better words, and face scrutiny.

I've told everyone... I send in my complaint, I mean everyone, it goes to anyone and everyone I can think of that would be responsible, or could be held accountable, or who could maybe change the situation... between the health unit and, the Prime Minister, and the Premier and the MOECC [Ministry of Environment and Climate Change], and the energy person, and the councillors. Its a pretty extensive list of people. Nothing has changed.

I phoned the police and filed a noise complaint. The police responded, agreed it was noisy. Contacted the operator who came down to the house and agreed it was noisy and said they would do something about it... the situation continued over time and the police made it clear they're not empowered to deal with this subject.

[Ontario's former Premier] said there had only been a handful of complaints from people about turbines, and then we read that so many thousands of our reports had just been dismissed. The facts are there, and somebody decides that those facts are no longer to be published or followed up on.

We have chronic conditions that have been known to be some of the main complaints, pretty much all of them... That's the last that can be heard and then the information is buried... Then we can actually have the Premier saying, "I've been advised by my advisers that there is no issue."

Who do I complain to? if I feel this is making me not feel well, I'm going to let my health officials know this has happened... Our town council was virtually copied on all complaints... Our [organized group] rolled their copying of their complaints... to include all those levels of government... the Premier... Prime Minister... Minister of the Environment... I received an auto response by email.

[By date] there are probably [over 50] complaints... if you averaged that out over a year, that's one complaint a week... My MPP [Member of Provincial Parliament] has never returned a phone call, has never returned an email... After I got a letter from the Ministry of the Environment saying that if I had any health concerns, I had to report them to the public health unit and/or my doctor, I sent that to [Medical Officer of Health]. Now, every time I send one in, he acknowledges it and says it's been logged or documented. I forget his wording, but he always acknowledges. Beyond acknowledgment, has there hasn't been anything. Never.

What we see in our community complaint response analysis is what residents are deeming to be adversely affecting their peaceful enjoyment of their property... Those are the peaks of noise that get averaged out... Not only did the [WPP] operator refuse to share the complaint file... We were told if we wanted to receive that information we would have to file a Freedom of Information request which we subsequently did. The package was over [number of pages] which was any and all information including complaints relating to communication between the operator and the government... a lot of the health-related complaints fell into pre-determined slots-nausea, headache, vertigo, tinnitus.

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...there have been so many complaints and the MOE [Ministry of Environment] does not address the complaints so it's just an exercise in futility. You go through it and you get nowhere with it. It's like you're reaching a roadblock because I think that the MOE is complicit with the government in pushing these things through.

Historically, the Ontario government has considered noise complaints as having merit. For example, prior to the introduction of the GEA, an OMB (Ontario Municipal Board) hearing held in 2007 found there was “great merit in requiring a local protocol to deal with legitimate noise complaints in a timely manner”. The Board directed that within 90 days of its Decision, the IWT developer was to present to the municipality a “Dispute Resolution Protocol” to deal with IWT noise. It also directed that monitoring stations and a “complaints monitoring and action protocol” be established to the satisfaction of several participating acousticians and the Municipality [10].

A follow-up to the directives of the above OMB Decision was conducted in 2011 by an Ontario Professional Engineer. Based on the test results provided by the developer of the WPP, the review found evidence that the project was non-compliant. Complaints were lodged by a number of neighbours in accordance with the Dispute Resolution Process without resolution. Twelve years later, neither the terms of the Ministry Certificate of Approval (Air) nor the Complaint Resolution Protocol have been met [42].

Records obtained through an Ontario Freedom of Information (FOI) request by the community coalition WCO (Wind Concerns Ontario) found that there were almost 6000 files of complaints about “wind turbine noise, vibration and sound pressure.” In 2018, 39% of the complaints noted AHEs. The records also showed that complaints did not result in “real action” by the WPP operators. This was “despite requirements” for the project approvals [43].

In 2009, the Ontario MOE (Ministry of Environment) advised that there were methodological issues for determining compliance:

The current science available for measuring noise emanating from wind turbines is technically challenging, resource intensive and will still result in measurements which are difficult to reproduce and/or interpret. There is currently no scientifically accepted field methodology to measure wind turbine noise to determine compliance or to determine non compliance with a Certificate of Approval limits [44].

Subsequently in 2011, it was reported that a supervisor of an environment ministry office warned that:

the ministry did not have the technology or capability to accurately measure wind turbine noise emissions in order to confirm compliance with regulations [28].

Devlin comments:

Despite the growing chorus of complaints and adverse health reports on the public record from neighbors, as well as solid scientific evidence that IWTs were the cause, or perhaps because of these (“sic”) them, the wind industry has steadfastly chosen to ignore them and accelerate the siting of industrial-scale wind farms near residents [45].

Complaints/Incident Reports can serve as an early warning system and result in taking action. Responses can be initiated quickly. For example, in 2009, it was reported that there were four complaints regarding an insulin syringe. In this case, the needles had detached from the syringe. As the result, 250 million insulin syringes manufactured between January 2002 and October 2009 were recalled [46].

Health Canada considers “complaints” as a health effect:

Health Canada’s approach to noise assessment is to consider a variety of internationally recognized standards for acoustics (*i.e.* United States Environmental Protection Agency (U.S. EPA 1974), CAN/CSA ISO standards). Health Canada considers the following noise-induced endpoints as health effects: noise-induced hearing loss, sleep disturbance, interference with speech comprehension, complaints, and change in percent highly annoyed (%HA) [47].

Correspondence by a former Canadian Minister of Environment acknowledged that regarding “wind turbine noise and health,” complaints were a “conclusively demonstrated” health effect:

Health Canada provides advice on the health effects of noise and low-frequency electric and magnetic fields from proposed wind turbine projects, particularly for environmental assessments done under the Canadian Environmental Assessment Act. To date, their examination of the scientific literature on wind turbine noise and health is that the only health effect conclusively demonstrated from exposure to wind turbine noise is an increase in self-reported general annoyance and complaints (*i.e.*, headaches, nausea, tinnitus, vertigo) [48].

In conclusion, there are almost 6000 files of complaints recorded in an Ontario government Freedom of Information (FOI) request [43]. It is proposed that there is sufficient evidence that the Ontario setbacks and noise guidelines are not working as expected. Health Canada acknowledges complaints are a health effect [47], and that this is “conclusively demonstrated” [48].

It is recommended that Ontario authorities respond quickly by acknowledging that WPPs are being sited too close to neighbours and the noise levels are too high. Those neighbours who are reporting AHEs should be provided with remedy to their satisfaction, and that their living conditions be restored.

5. Discussion

Policy-related concerns associated with the use of wind energy were raised in

1998 by more than 60 college/university lecturers and writers. They demanded the withdrawal of all “direct and indirect subsidies in order to put a stop to the exploitation of wind energy”.

Together with groups of thoughtless operators, a policy orientated towards short term success was able to clear the way in the following manner: as a result of amendments to planning law and the law on nature conservation, our countryside is almost unprotected against the exploitation of wind energy and is therefore left at the mercy of material exploitation by capital investment. At the same time the people who are directly exposed to this technology which is hostile to man have to a large extent been deprived of their constitutionally guaranteed right to a say in the matter of the shaping of the environment in which they live [49].

Canada provided financial support for developing the WindTRM (Wind Technology Road Map). Between November 2008 and February 2009, “[T]hree industry-led, government-supported Canadian wind energy stakeholder workshops” were held. The meetings were aimed at “identifying key issues and recommendations for the growth of the wind energy industry in Canada.” A message by a Canadian Assistant Deputy Minister, co-chair of the WindTRM stated this was to achieve a “major increase on deployment of wind energy in Canada” ([50] p. 5).

In 2012, representatives of the Health Canada Wind Turbine Noise and Health study attended Health Canada’s Science Advisory Board (SAB) meeting. The intention was to obtain advice and suggestions associated with its study approach. It was acknowledged that:

Despite the projected growth of wind energy in Canada, public resistance to wind turbine farms is increasing based on concerns over potential health impacts from wind turbine noise [51].

The SAB proposed the following:

Don’t waste time on measuring the prevalence of reported health effects from wind farms; assume that they are going to proliferate in the future. There doesn’t seem to be value in trying to gauge the annoyance factors associated with aesthetics of the turbines, rather the important thing is to measure the health effects due to noise [51].

Some authorities have acknowledged the AHEs being experienced when living in proximity of a WPP [52] [53] [54] [55]. In Australia, a Senate Committee “believes that these complainants deserve to be taken seriously” [52].

In 2012, the Brown County Board of Health in Wisconsin (USA) acknowledged that some neighbors may be unable to live in their homes and formally requested:

...temporary emergency financial relocation assistance from the State of Wisconsin for those Brown County families that are suffering adverse

health effects and undue hardships caused by the irresponsible placement of industrial wind turbines around their homes and property. The State of Wisconsin emergency financial assistance is requested until the conditions that have caused these undue hardships are studied and resolved, allowing these families to once again return safely to their homes and property [53].

Subsequently in 2014, the Brown County Board of Health unanimously approved the following motion:

To declare the Industrial Wind Turbines at Shirley Wind Project in the Town of Glenmore, Brown County, WI, a Human Health Hazard for all people (residents, workers, visitors, and sensitive passersby) who are exposed to Infrasound/Low Frequency Noise and other emissions potentially harmful to human health [54].

In 2012, the Falmouth Board of Health (Massachusetts, USA) requested that:

Mass DPH immediately initiate a health assessment of the impacts of the operation of wind turbines in Falmouth. This appeal is compelled by two years of consistent and persistent complaints of health impacts during turbine operation.

Furthermore that:

Due to the increasing intensity of the reported health impacts, the Board is considering emergency actions. To determine the appropriateness of such actions, the Board requests immediate guidance on interim measures to protect the health of affected individuals while the complete health assessment is being conducted [55]. *Bold emphasis is by the author of these requests.*

In Iowa (USA), a media outlet reported that the Madison County Board of Health has gone on record “to say that there are legitimate negative health effects caused by wind turbines”.

Board Chair Dr. Kevin de Regnier said the board identified two concerns after a review of scientific literature and months of hearings and meetings with residents and MidAmerican Energy.

The two health concerns identified are:

- 1) “Flicker” caused by the sun reflecting off turbine blades creates a strobe effect that can cause headaches and nausea.
- 2) “Infrasound” is a sound wave just below what the ear can actually detect. It is created by the turbines disturbing wind flow. It too, can cause headaches and nausea [56].

WHO [57] and Health Canada [58] acknowledge that a government policy may not achieve the expected outcomes:

Different government policies, depending on their nature, can either improve or worsen health and health equity [57].

It is clear, however, that existing policies and practices are not sufficiently effective to ensure that Canadian men and women of all ages and backgrounds can have an equitable chance of achieving health [58].

A conference on wind turbine noise stated in its post-conference commented on presentations by neighbors who are affected by IWT noise:

We have had, in the past, a few presentations from wind farm neighbors who have been affected by wind farm noise. They were absent this year. If there were no people affected by wind farm noise we would not be having these conferences. We have always welcomed anyone who has a view from personal experience and without such views we cannot get the whole picture [59].

6. Conclusions

Data analysis revealed that study participants took action through a range of government processes as well as community and other interactions. They communicated with government and municipal authorities, and filed complaints/ Incident Reports. They contributed financially and by volunteering their personal time and other resources in support of their neighbours' appeals of a REA. They attended and observed ERTs and other legal/judicial processes. Overall, they supported their neighbours and their community.

While there has been limited research on this topic, the findings of the vacated homes study indicates that some Ontario neighbours and participants are unable to live in their homes.

The Bradford Hill (BH) criteria, sometimes referred to as Hill's criteria for causation, are a set of nine criteria that have become a frequently cited framework for establishing epidemiologic evidence of a causal relationship between a presumed cause and an observed effect. By applying the BH criteria, a study of WPP-related clinical, biological, and experimental data, it was concluded that exposure to WPPs is associated with an increased risk of AHEs [60].

A successful Appeal of a REA was challenged by the "high evidentiary threshold and onerous legal test" to prove causality [15]. However, WHO 1999 provides "environmental management principles on which government policies, including noise management policies, can be based".

a) **The precautionary principle.** In all cases, noise should be reduced to the lowest level achievable in a particular situation. Where there is a reasonable possibility that public health will be damaged, action should be taken to protect public health without awaiting full scientific proof.

b) **The polluter pays principle.** The full costs associated with noise pollution (including monitoring, management, lowering levels and supervision) should be met by those responsible for the source of noise.

c) **The prevention principle.** Action should be taken where possible to reduce noise at the source. Land-use planning should be guided by an environmental health impact assessment that considers noise as well as other pollutants [61]. (*Author's note: bold face emphasis is by the WHO authors*)

Goldstein (2001) comments:

The precautionary principle asserts that the burden of proof for potentially harmful actions by industry or government rests on the assurance of safety and that when there are threats of serious damage, scientific uncertainty must be resolved in favor of prevention. Yet we in public health are sometimes guilty of not adhering to this principle [62].

It is proposed that instead of waiting for scientific proof of causality, that the precautionary principle be applied. Neighbours who are reporting AHEs should obtain satisfactory resolution to their complaints.

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Ethics Review

Chesapeake Research Review, LLC (“Chesapeake IRB”) Note: Chesapeake Research Review, LLC (“Chesapeake IRB”) and Schulman Associates Institutional Review Board, Inc. (“Schulman IRB”) have merged to create Advarra, Inc. (“Advarra IRB”).

Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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