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March 4, 2013

VIA RESS AND COURIER

Ontario Energy Board
2300 Yonge Street
P.O. Box 2319
Suite 2700
Toronto, ON M4P 1E4

Attention: Ms Kirsten Walli
Board Secretary

Dear Ms. Walli:

Re: Varna Wind Inc. Leave to Construct Application
Board File No: EB-2012-0442
Varna Wind Inc. Interrogatory Responses

Please find attached the responses to the Interrogatories of Bd Staff, Group, HONI, Oldfield and Ritzema in the above-noted application.

Sincerely,

signed in the original

George Vegh

GAV:mt
att.

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act*, 1998, S.O. 1998, c.15, Schedule B;

AND IN THE MATTER OF an application by Varna Wind Inc. for an order or orders pursuant to section 92 of the Ontario Energy Board Act, 1998 granting leave to construct transmission facilities in the Municipalities of Bluewater and Huron East.

VARNA WIND RESPONSES TO BOARD STAFF INTERROGATORIES

Bd Staff Interrogatory 1:

At Exhibit B/Tab 1/Schedule 1, Varna Wind Inc. (the "Applicant") states:

> ***"Varna Wind, Inc. (the "Applicant") is a special purpose vehicle established for the development, construction and operation of the Bluewater Wind Energy Centre ("BWEC"). The Applicant is a corporation constituted under the laws of New Brunswick. The Applicant is a wholly-owned subsidiary of NextEra Energy Canada, LLC, which in turn is a wholly-owned subsidiary of NextEra Energy Resources Inc. NextEra Energy Canada, ULC was incorporated as an Alberta corporation in 2006, with its head office in the City of Toronto, Ontario. NextEra Energy Canada, ULC and NextEra Energy Resources, LLC through their respective wholly-owned subsidiaries, both carry on the business of developing, owning, and operating energy generation facilities".***

(a) ***What experience does the Applicant have in the construction and operation of a similar type of facility as that proposed in this application?***

(b) ***Please indicate what corporate organization capabilities exist to complete the applied for project.***

(c) ***Please indicate whether the Applicant intends to make use of contractors and provide a summary of their experience in regards to the construction of such projects.***

Answers:

a) The Applicant is a wholly owned subsidiary of NextEra Energy Canada, ULC ("NEER Canada") which in turn is a wholly owned subsidiary of NextEra Energy Resources LLC,

("NEER"). NEER is a wholly owned subsidiary of NextEra Energy, Inc. ("NextEra"). The applicant benefits from the vast experience of all of its affiliates and parent companies.

NextEra is a leading clean energy company with 2012 revenues of approximately $14.3 billion, with a generating capacity of more than 42,000 megawatts and nearly 15,000 employees in the United States and Canada. The company holds an A-rated investment grade credit rating and has substantial experience in financing large electric infrastructure projects. NextEra operates and maintains an extensive network of distribution and transmission lines as well as substations.

NEER is the largest owner and operator of renewable energy generation facilities from the wind and sun in North America. NEER has standardized processes and procedures that ensure consistent, repeatable results from site to site. NEER operates a portfolio of facilities totalling 18,122 net megawatts from power plants in 24 states and 4 Provinces.

NEER Canada constructed, owns and operates two existing facilities in Canada:

- Ghost Pine Wind Energy Centre (82 MW), Kneehill County, AB
- Conestogo Wind Energy Centre (23 MW), Township of Mapleton, ON

In addition, NEER Canada owns and operates five existing facilities in Canada:

- Mount Miller Wind Energy Centre (54 MW), Murdochville, QC
- Mount Copper Wind Energy Centre (54 MW), Murchochville, QC
- Pubnico Point Wind Energy Centre (31 MW), Yarmouth, NS
- Moore Solar Energy Centre (20 MW), Lambton County, ON
- Sombra Solar Energy Centre (20 MW), Lambton County, ON

b) The corporate organizational capabilities that exist to complete the applied for project are considerable.

NextEra Energy, Inc. owns and maintains more than 7,300 miles of transmission lines between 69 kilovolts and 500 kilovolts and nearly 800 substations in North America. NextEra has successfully completed transmission projects in different regulatory and geographic environments.

The relative size and technical and financial capabilities of NextEra Energy companies can provide significant benefits. One important advantage is our full access to the capabilities of NEER's affiliate, Florida Power & Light Company, which is one of the largest U.S. utility franchises, with over 6,500 miles of transmission and over 4,200 miles of distribution network.

NextEra's strengths in executing large and complex transmission projects include:

Technical Expertise – NextEra has the technical experience in development, engineering, procurement, construction, operations and maintenance of transmission systems NextEra has successfully applied different technologies and a variety of designs in transmission line construction, in a safe and timely manner.

Operational Excellence –NextEra operates and maintains complex transmission and distribution systems to ensure safe and reliable operation as well as uninterrupted and efficient electric service. Extensive diagnostics are used to assess facility conditions, forming the basis to develop plans for asset maintenance and replacement. NextEra's state-of-the-art control centers allow the maintainance of our system reliability in a cost effective manner.

Financial Capabilities – NextEra is a leading clean energy company with revenues of approximately $14.3 billion in 2012; an A-rated investment grade credit rating; and experience in financing large electric infrastructure construction projects. These strong financial credentials also support NextEra Energy Transmission as a reliable partner with the ability to finance large projects.

c) Yes, Varna Wind Inc. intends to use contractors to construct the Facility. The electrical and civil engineering firm of TetraTech has been retained to perform the engineering and design scope of work related to the Facility. An overview of their expertise is attached as Schedule 1.

The Request for Proposals for the Engineering and Procurement Contractor ("EPC") for construction of the Facility was issued on February 12th, 2013 and is currently expected to be awarded in the second quarter of 2013.

Bd Staff Interrogatory 2:

At Exhibit C/Tab 1/Schedule 1, the Applicant has provided a table of milestone dates. Please update this table if the datesa for the noted events have changed.

Answer:

The dates for the noted events have not changed.

Bd Staff Interrogatory 3:

Preamble: At Exhibit D/Tab 1/Schedule 1, the Applicant states:

> ***"Sections of the Transmission Line will be constructed within Municipal rights-of-way, and the remaining sections will be built on easements acquired from private land owners. Please see Exhibit D, Tab 1, Schedule 2 for a map illustrating the route of the***

line, the lot number and concession number through or adjacent to which the line runs and the location of private easements and the Municipal rights-of-way".

At Exhibit F/Tab 1/Schedule 1/Paragraph 33, the Applicant states:
"Approximately twelve (12) kilometres of the Transmission Line is planned to be located in the Municipal rights-of-way. Please refer to Exhibit D, Tab 1, Schedule 2 for a map illustrating the location of these Municipal rights-of-way.

The Pin, Lot and Concession numbers, the location of the easements and the location of the Municipal rights-of-way are not discernible from the map that is provided at Exhibit D/Tab 1/Schedule 2. Please provide an updated map using an appropriate scale that better identifies the above noted information.

Answer IR 3:

Please see Schedule 2.

Bd Staff Interrogatory 4:

Preamble: At Exhibit F/Tab 1/Schedule 1/Paragraph 29, the Applicant states:

"The Applicant has acquired land rights to private lands needed for the Transmission Line."

At Exhibit F/Tab 1/Schedule 1/Paragraph 29, the applicant states:

"The Applicant has had extensive discussions regarding the Transmission Line and the Transmission Easement with all of the landowners along the Corridor, including Adjacent Landowners".

Further at Exhibit F/Tab 1/Schedule 1/Table A, the Applicant has provided a list of "Privately-Owned Land Parcels with Transmission Line Infrastructure".

(a) Please clarify whether Table A includes all directly affected landowners (i.e. Transmission Line infrastructure will be located on their property)? Please update the table if necessary.

ANSWER IR 4(a):

The Applicant confirms that Table A includes all directly affected landowners (i.e., transmission infrastructure will be located on their property). As indicated at Exhibit F/Tab 1/Schedule 1/Page1, "Poles placed within the Municipal rights-of-way will be located to minimize impact to landowners adjacent to the Corridor (the "Adjacent Landowners"). If poles are placed within the

Municipal rights-of-way, additional aerial overhang, guy and anchor and temporary construction easements may be acquired from the Adjacent Landowners under certain circumstances."

(a) Please expand the table at the above reference and identify landowners who have executed easement agreements and those landowners with whom negotiations are still on-going. (2) In your response, please include both directly affected landowners and Adjacent Landowners. (3) Please also identify the type of easement that is required (temporary or permanent) and the size of the easement. (4) Please ensure the Pin, Lot and Concession numbers are consistent with the information provided in response to interrogatory 3.

ANSWER IR 4(b):

All of the properties listed in the table found at Exhibit F/Tab 1/Schedule 1/Table A have executed agreements with the applicant. In addition, the expectation is that all of these land owners will be directly affected with both a temporary and permanent easement - Temporary construction and permanent easement that will host infrastructure. Please see Schedule 3 for the tables requested.

Bd Staff Interrogatory 5:

Preamble: At Exhibit F/Tab 1/Schedule 1/Paragraph 33, the Applicant states:

"Approximately twelve (12) kilometres of the Transmission Line is planned to be located in the Municipal rights-of-way…. A road use agreement will be entered into between the Applicant and the affected Municipalities, which will address the Applicant's access to the Municipal rights-of-way".

(a) What is the status of the road use agreement this is referenced above?
(b) What is the status of the agreement for the land required for the Circuit Breaker and the Substation?

Answers:

a) The status of the three Road Use Agreements ("RUA") under discussion are as follows for each municipality:

   i. County of Huron – A draft of an RUA that the County entered in to with another wind energy project proponent was forwarded to the Applicant on December 10, 2012 for consideration. It is under review by the Applicant. It is anticipated that a response will be

circulated to the County by March 31, 2013 and an agreement entered in to by start of construction for BWEC and Facilities.

ii. Municipality of Huron East – All of the Facility that is located within a Municipal Right of Way is in the Municipality of Huron East (~12km). The Municipality has communicated to the Applicant that it will provide the first draft of the RUA. The Applicant has not received anything yet. It is anticipated that an agreement will be entered in to by start of construction for the Facilities. There are no components of the BWEC located in Huron East.

iii. Municipality of Bluewater – Staff and Council of the Municipality informed the Applicant in mid-2012 that they would provide the first 'draft' of a RUA for consideration. They have yet to do so despite repeated requests by the Proponent. At a February 5th 2013 special meeting of Council, a draft RUA was included in the agenda materials circulated (and made available to the public) and discussed by Council. A motion to release that draft to Proponents in the Municipality was passed. However, at a subsequent meeting on February 19th, 2013 the Proponent clarified with Council and the CAO that they had not, in fact, released the document to the Proponent. They agreed that they had not.

b) Regarding the Circuit Breaker and the Substation, Option Agreements, in which are embedded the terms and form of Lease or Purchase Agreement as applicable, have been executed for the land required for each component of the Facility.

Bd Staff Interrogatory 6:

Preamble: At Exhibit F/Tab 1/Schedule 1/Paragraph 43, the Applicant states:

> ***"A number of routes along back-country corridors were considered in various places along the route, but were disqualified…."***

Please identify the alternate routes that were considered and provide reasons why these routes were disqualified.

Answer IR 6:

1) Several route options approximately half a concession to the north of the proposed route were considered for the portion along Centennial Road. The routes would have been located predominantly at the backs of fields along property lines. At the turning point where the preferred option currently runs north along Hensall Road, the alternative routes would have been located west of but mostly parallel to Hensell Road, again along lot property lines. There were two major issues that disqualified these options:

a. *Environmental impacts:* Located along Bannockburn Line between Pavillion Road and Staffa Road and along the Bannockburn River is the Upper Bannockburn River Wetland Complex, which is a Provincially Significant Wetland (PSW). At the time of the development of this line, it was not possible to propose any infrastructure within a PSW, not even an overhead span. Therefore, the Applicant had to look for existing points where the PSW had already been disturbed, i.e. roads or bridges. In addition, paths through several woodlots that are located in the back of fields would have needed to be cut along the proposed alternate routes. Evaluations of significance for habitat could not be completed until spring 2013. If any significant habitat had been found, it would have been a fatal flaw to the plan for tree removal and no path through the woodlot would have existed.

b. *Landowner refusal:* On the eastern portion of these potential routes (the alternate route west of and parallel to Hensall Road), the Applicant was unable to acquire any landowner interest, despite numerous attempts and forthright responses to all inquiries or concerns.

2) Several route options approximately half a concession to the south of the proposed route were considered for the portion along Centennial Road. It would have been located predominantly at the backs of fields along property lines. At the turning point where it currently runs north along Hensall Road, it was considered to locate west or east of but mostly parallel to Hensell Road, again along lot property lines. The main concerns that disqualified these alternatives are as follows:

a. *Environmental impact:* In addition to the Upper Bannockburn River Wetland Complex described in 1(a), the Upper Bayfield River Wetland located approximately 0.6 km northeast of Tile Road, between Kippen Road and Perth/183 Road, stretches for a distance of approximately 2.6 km and is also a Provincially Significant Wetland (PSW). At the time of the development of this line, it was not possible to propose any infrastructure within a PSW, not even an overhead span. Therefore, the Applicant had to look for existing points where the PSW had already been disturbed, i.e. roads or bridges. A path through several large woodlots would have needed to be cut along the route. Evaluations of significance for habitat could not be completed until spring 2013. If any significant habitat had been found and based on preliminary ecological land classifications, it was felt that there would be, it would have been a fatal flaw to the plan for tree removal and no path through the woodlot would have existed. No workaround existed for most of these locations, except along existing roadways. It

was anticipated that a wetland complex along the portion considered east of Hensall Road would be a PSW.

b. *Landowner refusal:* On the eastern portion of this route and west of Hensall Road, the Applicant was unable to acquire any landowner interest, despite numerous attempts and forthright responses to all inquiries or concerns.

3) Other roadways in the area were considered but disqualified for a number of reasons, including a significant number of residences along the routes, greater potential overlap with existing distribution infrastructure, and higher numbers of small severed lots. These included routes along Staffa Road, Pavillion Road, Mill Road, Tile Road, Kippen Road, Perth/Road 183, and Hannah Line.

Bd Staff Interrogatory 7:

Preamble: At Exhibit F/Tab 1/Schedule 1/page 8, the Applicant states:

"Based on these efforts, the Applicant proposes to construct approximately 11.5 km or 50% of the Transmission Line within private easements, of which approximately 5.9 km are on private lands on the opposite side of the road from where HONI's distribution facilities are situated. Of the 11.7 km of the Transmission Line within the Municipal rights-of-way, approximately 8.6 km or 74% are on the opposite side of the road from HONI's distribution facilities".

(a) Given the proposed Transmission Line will be sharing the right of way or will be in close proximity to Hydro One Networks Inc.'s (Hydro One) distribution lines, please provide a summary of the discussions that the Applicant has had with Hydro One in relation to this matter. Please identify any concerns that may have been noted by Hydro One in regards to this matter and what measures have been taken by the Applicant to alleviate Hydro One's concerns.

Answer: HONI has not expressed concerns regarding the location of the Facility on the opposite side of the road of existing distribution lines. HONI expressed concerns regarding co-location of distribution and transmission lines on the same pole and ultimately decided it was counter to their corporate policy to locate any circuits carrying power greater than 50kV on the same pole as distribution lines. The Proponent has complied with that policy.

(b) Please indicate the design and construction standards and procedures, relating to proximity and effects such as induction, which will protect pre-existing facilities and personnel from direct and induced currents and voltages. Include in your discussion corrosion protection, cable location identification, and grounding for safety and "tingle" or "stray" voltage.

Answer:

Design and Standards
The line design will comply with the Electrical Safety Authority's minimum electrical clearance requirements and maximum induction requirements.

Corrosion Protection
At this time the only known pre-existing facilities that may require corrosion protection are gas lines. The only known owner of gas line(s) along the route has been contacted for corrosion protection discussions.

Cable Location Identification
The construction contractor building the line will be responsible for calling in for locates (Ontario One Call). More in-depth underground location investigation may take place if there is a suspicion of pre-existing underground cables or any other underground facility such as gas lines and/or communication cables in the vicinity of a proposed pole location.

Grounding
The grounding study is not yet complete but each pole will have provision for ground rod installation. Ground rods will be installed wherever it is determined to be necessary.

Stray Voltage
This issue may arise when any new consumer or generator connects to a distribution system. The proposed Project does not connect to the local distribution system, so it should not directly lead to any stray voltage. However, the Applicant has committed to work closely with Hydro One (the Local Distribution Company) to mitigate impacts to local distribution customers should a situation arise. Hydro One, as required in the interconnection process, has completed a Customer Impact Analysis and no issues were identified.

Most cases of stray voltage occur when there is either:

- Improper grounding of on-site equipment (in which case it is an issue with on-site wiring); or,
- A change in current patterns on the distribution line, from generation or load that exposes a pre-existing condition (in which case it is an issue with the distribution utility, not with the generator or load).

By way of further background, stray voltage is not a consequence of wind energy, but rather of any project that changes the use pattern of the existing distribution system. The wind turbines are therefore not the root cause of the problem, but like any change to a system, may expose faults in that system. All types of generation (electricity generation using wind turbines included) must fully comply with utility requirements to ensure that the electricity they supply is compliant with grid and electrical code standards.

Stray voltage problems require on-site inspection for grounding problems, or examination of power quality issues with the distribution utility. In this regard, the applicant has distributed Appendix H of the Distribution System Code ("Farm Stray Voltage Distributor Investigation Procedure") to all landowners who have expressed interest in this issue.

Copies of EB-2007-0709 Ontario Energy Board Staff Discussion Paper on Farm Stray Voltage have also been circulated when more information was requested.

For additional information on the potential effects of stray voltage on livestock, see the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) website: www.omafra.gov.on.ca/english/livestock/dairy/facts/strayvol.htm

(c) In a number of letters of comment that the Board has received in relation to this application, parties have raised concerns regarding the potential effects of stray voltage on livestock. What measures has the Applicant taken to alleviate these concerns.

Please see response to Interrogatory 7(b) for an overview of the general information the Applicant provided to the public and landowners regarding stray voltage. Please see Schedule 4 for a Record of Consultation documenting communications with landowners. In addition, having received feedback from several landowners along the transmission line corridor that they were still concerned about stray voltage, the Applicant prepared and circulated a letter and package of materials to all landowners along the Corridor. A copy of that letter and package of materials can be found as Schedule 5. The package included:

- Letter from Applicant regarding Stray Voltage and procedures for how the Applicant would respond if an issue was raised after the BWEC began operations
- World Health Organization report on Electric and Magnetic Fields
- Health Canada fact sheet on Electric and Magnetic Fields at Extremely Low Frequencies
- A study by Israel et al. regarding EMF
- Appendix H of the OEB Distribution System Code (noted in IR 7(b)
- HONI materials on stray voltage
- A brochure with more information about NextEra Energy Resources LLC (parent company of the Applicant's parent company NextEra Energy Canada)

Bd Staff Interrogatory 8:

The proposed facilities are to be located in the Municipality of Bluewater and the Municipality of Huron East. In the maps that are provided the municipality boundaries are not easily discernible. With respect to the facilities that are the subject of this application please identify the municipality in which the Transmission Line, Circuit Breaker and Substation are to be located.

Answer:

The transmission line is located in the municipality of Blue Water until it reaches London Road; east of London Road it is in Huron East. The circuit breaker is in Huron East and the Substation is in Bluewater.

Bd Staff Interrogatory 9:

Preamble: In a letter of comment dated January 28, 2013, the Municipality of Huron East stated:

> ***"Staff from NextEra Energy, in consultation with Huron East staff, have identified areas whereby the relocation and/or burying of Hydro One distribution lines (at the expense of NextEra) would allow a less intrusive installation by NextEra. The Municipality is working closely with NextEra Energy to mitigate damages to existing trees and to improve setbacks from several residences".***

Please confirm if the above referenced negotiations are on-going. If they are, please provide an update on the status of the negotiations and how these negotiations will impact the proposed route and construction schedule.

Answer:

The Applicant can confirm that these negotiations are on-going. A site visit with HONI Distribution Operations representatives took place on December 18, 2012. HONI is in the process of developing the cost estimate for burying certain sections of their distribution line that the Applicant is currently proposing to locate the Facility on the opposite side of the road. Burying these distribution lines would allow the Facility to be located on the same side of the road as HONI in these locations and would alleviate some of the need for tree removal in those locations. No impact to construction schedule is anticipated.

Bd Staff Interrogatory 10:

Preamble: In a number of letters of comment that the Board has received in relation to this application, parties have raised concerns regarding the close proximity of the Transmission Line to homes and barns. For example, one letter of comment noted that "the Transmission Line is 6 meters from a barn and 10 meters from two homes".

What is the minimum setback from residential property lines, residential buildings and barns along the route of the Transmission Line?

Answer Bd Staff 10:

The applicant is not aware of any setback requirement in land development codes applicable to the proposed transmission line. However, we look to the Canadian Standards Association standard CSA-C22.3 No. 1-10, "Overhead Systems" for requirements with regard to minimum clearances required between the overhead conductor of a transmission line and land features. The CSA standard calls for a horizontal clearance that is significantly less than the clearances proposed by the Applicant in its preliminary design.

With regard to residential property lines, there are a number of transmission structures for the proposed project that are within 1 meter of a residential property line. However, these structures are located in areas where residential buildings or barns are at a considerable distance from the structure. The following are the approximate closest distances to homes and barns, and the property lines for the properties on which they are located:

Residential Structure Type	Pole to Property Line (m)	Conductor to Residential Structure (m)
Home	3	11
Barn	2	18

Bd Staff Interrogatory 11:

Preamble: In a number of letters of comment that the Board has received in relation to this application, some landowners have raised concerns with respect to the easement/option agreements that have been presented to them.

- ***(a) Please summarize the types of concerns that were noted with respect to the option/easement agreements?***
- ***(b) What steps has the Applicant taken to alleviate these concerns?***
- ***(c) Has the Applicant offered and/or provided any legal compensation to landowners to cover legal costs for those who wished to have their form of land agreement reviewed by a legal consultant, or counsel? If not, would it be prepared to do so for the acquisition of any outstanding land rights?***

Answer 11:

(a) The most commonly heard landowner concerns related to the option/easement agreement included:

- Term – that the agreement runs in perpetuity.

- Type and size of proposed transmission infrastructure - That the agreement allowed for multiple types of transmission infrastructure including but not limited to truss towers.
- Compensation should be higher or based on different criteria.
- Tree loss – the agreement made no specific mention of compensation (monetary or otherwise) for potential tree damage during the construction and operation of transmission line.
- The potential for future improvements – the agreement gives the right to add additional infrastructure or remove and improve the existing infrastructure.

(b) The Applicant made every effort to alleviate landowner concerns related to the agreement, including amending some terms, where possible, to address specific provisions. In cases where agreement terms could not be amended, the reasoning for the inclusion of the provision was fully explained and support material provided if required.

- Term – This provision was not amended. Please see Group IR #4b.
- Type and size of transmission infrastructure – the Applicant offered an amendment in the agreement to limit the type of infrastructure that could be placed on the property. The Applicant also stipulated that the line being constructed was 115kv, which limits the type of towers that can be used.
- Compensation – the Applicant offered the same compensation structure to all landowners along the length of the line. The Compensation schedule was based on land values, easement dimensions, and parcel dimensions along the proposed route.
- Tree Loss – the Applicant offered an amendment to the agreement to compensate landowners who had concerns regarding tree loss that may occur during the construction and operation of the transmission line.
- Potential for future improvements – the Applicant offered an amendment to the agreement in which the landowner would have certain rights available to them to participate in any future decision, by the Applicant, to increase the size or type of transmission infrastructure that was installed.

(c) Upon request, the Applicant provided reimbursement for legal expenses up to $1500 to landowners.

Bd Staff Interrogatory 12:

(a) In the pre-filed evidence, the Applicant states that a decision from the Ministry of the Environment (MOE) in relation to the Renewable Energy Approval (REA) application is expected in the first quarter of 2013. Has the Applicant received a decision from the MOE in relation to its REA application? And is a decision still expected in the first quarter of 2013?

(b) Have there been any objections to the granting of the REA and if so by which parties?

(c) Upon completion of the environmental assessment, please file a copy of the REA approval.

Answer:

a) The Applicant has not yet received a decision from the MOE regarding its REA. A decision is still expected in the first quarter of 2013.

b) Approximately 47 separate comments were made through the EBR to the MOE. The ranges of concerns expressed were all covered in the Applicant's REA documents and no new concerns were raised. As these comments are made to the MOE and not to the Applicant, they are anonymous and the Applicant does not know which parties made which comments.

c) The Applicant will file a copy of the REA upon completion.

Bd Staff Interrogatory 13:

Preamble: Page 2 of System Impact Assessment Report sets out the requirements that are applicable to Hydro One (the transmitter) for the incorporation of the proposed project.

(a) Please provide cost estimates and cost responsibility for the noted upgrades. If necessary, please consult Hydro One for the purposes of completing this interrogatory.

(b) Please submit the Connection Cost Recovery Agreement, when finalized.

(c) Please confirm that the Applicant is responsible for the total cost of the facilities proposed in this application and that it will have no impact on transmission rates in Ontario.

Answer:

a) Due to the commercially sensitive information included in the answer to this question, the answer has been omitted here and is being filed on a confidential basis as set out in the Board's *Practice Direction on Confidential Filings.*

b) The CCRA is under negotiation at the moment. The anticipated execution date is March 8, 2013. The Applicant will submit the CCRA with the Board when finalized.

c) Confirmed.

Bd Staff Interrogatory 14:

Preamble: The Transmission Line is privately owned and located in areas where other renewable generation facilities could be sited and may wish to connect to the line.

(a) Does the Applicant intend to apply for a Transmission Licence?

ANSWER 14(a):

No.

(b) As a privately owned line, does the Applicant see the possibility of accommodating additional connections?

ANSWER 14(b):

No.

Schedule 1

1.0 COMMERCIAL INFORMATION

1.1 TETRA TECH'S HISTORY AND ORGANIZATION (ORGANIZATION AND SISTER COMPANIES)

Tetra Tech was established in 1966 by a select group of technical experts providing engineering services related to waterways, harbors and coastal areas. In the past 45 years, Tetra Tech has hired prominent engineers and scientists while completing projects of global significance ranging from recent efforts to support the expansion of the Panama Canal; design and construction of improved New Orleans flood protection structures; and engineering design support in regards to Canadian participation in the U.S. Space Shuttle program. In supporting client needs worldwide, Tetra Tech has developed an enviable performance record of successfully completing projects in remote, austere and even hostile work locations.

Today, as a publicly traded company (U.S. NASDAQ Trading Symbol: TTEK), Tetra Tech provides comprehensive and integrated licensing, environmental, engineering design, facilities construction and construction support for a full suite of services related to power generation and distribution, hydropower and dam projects worldwide. Total company revenues at the completion of the last fiscal year were in excess of $2.6 B.

Operationally, Tetra Tech is divided into four business groups:

- Engineering & Consulting Services (ECS);
- Remediation & Construction Management (RCM);
- Engineering & Architecture Services (EAS);
- Technical Support Services (TSS).

Tetra Tech, under its ECS business group, has significantly expanded its geographic presence in recent years through strategic acquisitions and internal growth throughout Canada and the United States. Well-established Canadian subsidiary groups include: Tetra Tech WEI Inc. (formerly Wardrop), BPR, EBA Engineering Consultants, Ltd. (EBA), and Fransen Engineering, Ltd. (Fransen). These firms will be branded as Tetra Tech within the year.

1.1.1 BPR-ENERGY INC.

Established 50 years ago, BPR is one of the largest engineering firms in Canada, providing a broad range of engineering and project management services to industrial and commercial entities, major institutions, and municipalities across the country. Major utility customers include Hydro-Québec.

1.1.2 TETRA TECH WEI INC. (PREVIOUSLY WARDROP ENGINEERING INC.)

Established in 1955, Tetra Tech WEI is a Canadian-based company providing front-end studies, engineering, and environmental services for the resource management, energy, and infrastructure markets. Tetra Tech WEI offers feasibility studies, conceptual and detailed design, procurement and construction management, among other technical consulting and engineering services.

1.1.3 EBA

EBA provides a broad range of engineering services to diverse clients across western and northern Canada. Services include engineering design, site investigation and studies, planning, and project management for energy, mining, transportation and local governmental clients.

1.1.4 FRANSEN

Fransen provides comprehensive multi-disciplinary engineering services to assist heavy industrial, utility and energy production clients in upgrading and sustaining their facilities. Fransen is headquartered in Richmond, BC.

1.1.5 TETRA TECH

Tetra Tech serves as the lead entity. As wholly owned subsidiaries, Tetra Tech's WEI, BPR, EBA, and Fransen function seamlessly as fully integrated entities to support our Canadian clients—to NextEra, Tetra Tech is one company with one operating mandate. For contractual purposes, BPR will serve as the legal entity leading this opportunity and will be supported by WEI during execution of the work.

1.2 TETRA TECH IN NUMBERS

With 13,000 employees and 330 offices worldwide, Tetra Tech's capabilities span the entire project life cycle. (Exhibit 1.1a, below, illustrates Tetra Tech's global presence).

- 3,800 employees in Canada; 688 in BC and 426 in Alberta
- 80 offices in Canada; including 10 in BC and 4 in Alberta
- $2.6 B in revenue for 2011
- 60-year Canadian operating history

Tetra Tech is recognized as the first truly full-service wind energy environmental, engineering and construction firm in North America. Our success is a result of having worked on more than 350 wind projects, totalling more than 20,000 MW. Of that, over 15,000 MW of wind power generation is in operation or scheduled for construction.

Exhibit 1.1a. Tetra Tech's global offices and staff serve and provide innovative solutions to our clients.

1.3 LOCATION OF OFFICES IN CANADA AND THEIR ANNUAL CAPACITIES

Tetra Tech, under its ECS business group, has significantly expanded its geographic presence in recent years through strategic acquisitions and internal growth throughout Canada and the United States becoming one of the largest engineering firms in Canada.

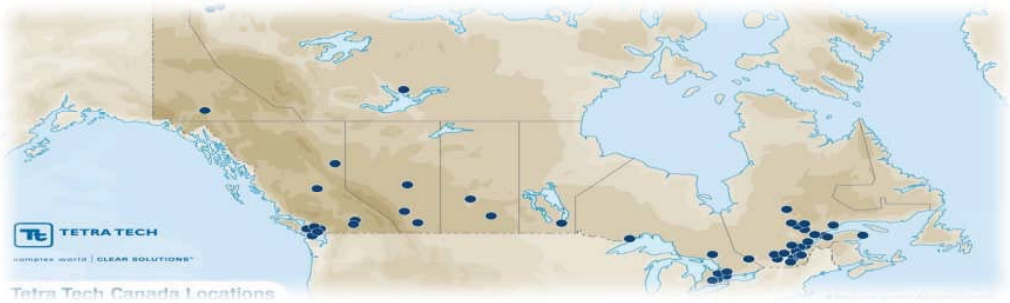
In Canada, BPR and WEI totaled nearly $ 70 Million in revenue in 2011 for Transmission and Distribution Electrical Engineering related services. This work is performed principally out of our Mississauga, Pickering and Montréal offices.

In Ontario specifically, Tetra Tech's expertise extends to all phases of a project life cycle, from feasibility studies through to design and construction, with strong experience in substation, transformers and electrical distribution. Our electrical utility experience includes major local clients *(e.g. Hydro Ottawa, Hydro One, SunEdison, PowerStream, Brookfield Power, Guelph Hydro, Toronto Hydro,)*.

Our office in Mississauga comprises over 100 Ontario based staff dedicated to transmission, distribution and renewables design engineering work. This team has the full design engineering and project management expertise required by NextEra and meets Ontario content requirements per the OPA FIT contract.

With more than 3,800 employees across the country, Tetra Tech is a diverse and full-service engineering firm. Exhibit 1. 1b illustrates the wide-ranging locations of Tetra Tech offices in Canada.

Exhibit 1.1b. Tetra Tech's 80 offices and 3,800 employees throughout Canada



For the transmission and distribution (T&D) industry and to meet the requirements of NextEra, Tetra Tech offers:

- A strong commitment to the T&D business. Tetra Tech has one of Canada's largest and most experienced team of T&D experts, engineers, and designers with knowledge of the full project life-cycle planning, design, construction and commissioning. With nearly 350 T&D equipment experts and specialists, Tetra Tech has executed projects involving 500kV substations and transmission lines, HVDC systems, overhead and underground distribution systems. Tetra Tech also performs associated services in line routing, environmental permitting, management consulting, asset management and LIDAR (more than 200 staff supporting environmental and geotechnical services in BC). Tetra Tech's total portfolio of services in the T&D market represents more than $110M in revenue annually;
- A senior management team with experience in multi-year and multi-project agreements in the electric utility market. Tetra Tech's long-term clients include

Hydro One, Manitoba Hydro, Hydro- Québec, Ontario Power Generation and SaskPower. Outside of Canada, Tetra Tech's T&D team is working with large utilities such as PacifiCorp, Pacific Gas & Electric, Iberdrola and others. Tetra Tech has developed a client-centric delivery model to make the best use of our complementary resources;

- A local presence in Ontario With over 250 staff committed to Energy projects in Ontario, Tetra Tech has a good understanding of NextEra's requirements and a strong commitment to the local economy. Exhibit 1.1c, illustrates some of Tetra Tech's long-term relationships and Master Services Agreements with some of our largest customers in Canada.

Exhibit 1.1c. Tetra Tech's long-term client relationships.

1.4 PLANS FOR FUTURE OFFICES ADDITIONS/EXPANSIONS

We currently do not have plans for future office additions or expansions. Our current locations have been established with our business growth plan in mind.

1.5 DESCRIPTION OF MAJOR PROJECTS IN CONSTRUCTION AND OPERATION

CLIENT	WINDFARM	MANDATE	POWER
IPR GDF SUEZ / BOREA CONSTRUCTION	Plateau I,II (Ontario)	**Plateau I,II windfarm** Detailed engineering of the collection system and the GE 1.5xle wind turbine foundations, including construction inspections. In operation since 2012.	18MW
IPR GDF SUEZ / BOREA CONSTRUCTION	Plateau III (Ontario)	**Plateau III windfarm** Detailed engineering of the collection system and the GE 1.5xle wind turbine foundations, including construction inspections. In operation since 2012.	9 MW
EDF-EN / BOREA CONSTRUCTION	LAC ALFRED & La Mitis	**Lac Alfred windfarm (95% completed)** Detailed engineering of the complete windfarm, which included the 315kV/34.5kV substation, the collection system and the wind turbine foundations. The wind turbines are Repower MM82 and MM92, 2.05 MW. Under construction.	324 MW (300+24 MW)
EDF-EN / BOREA CONSTRUCTION	Saint Robert & Le Granit	**Saint Robert windfarm (95% completed)** Detailed engineering of the 35 kV collection system and the wind turbine foundations. The wind turbines are Repower MM82 and MM92, 2.05 MW. Under construction.	104 MW (80+24 MW)
BOREA CONSTRUCTION/ NORTHLAND POWER	Mont Louis	**Mont-Louis 100.5 MW windfarm** Detailed design of the 230kV/34.5 kV substation and collection system, including all required HQ studies. In operation since 2010.	100.5 MW
ELECTROSAGUENAY/NORTHLAND POWER	St Ulric Jardin d'Éole	**Preliminary electrical engineering** Preliminary engineering and cable optimization of the 34.5kV collector network. St-Ulric windfarm consists of eighty-five (85) wind turbines installed in the province of Québec (Canada). In operation since 2009.	127.5MW

CLIENT	WINDFARM	MANDATE	POWER
ELECTROSAGUENAY/NORTHLAND POWER	**St-Ulric Jardin d'Éole**	**Detailed electrical engineering** Detailed engineering of the 34.5kV collector network including network configuration and layout, cable dimensioning optimization, losses optimization, load flow, short circuit calculations, protective coordination study, insulation coordination study, and drawings. St-Ulric windfarm consists of eighty-five (85) wind turbines installed in the province of Québec (Canada). In operation since 2009.	127.5MW
BOREA CONSTRUCTION/ TRANSELEC COMMON INC. / CARTIER ENERGIE ÉOLIENNE	**Carleton**	**Carleton windfarm engineering** Detailed engineering, of the substation including testing and commissioning, site survey, including all electrical studies, wind turbine foundations, and road work engineering.,. The Carleton windfarm consists of seventy three (73) 1.5MW wind turbines installed in the Gaspésie region, in the province of Québec (Canada). In operation since 2008.	109,5MW

To illustrate our Transmission Line experience, we have included a project profile in Appendix F.

1.6 LIST OF MAJOR SUBCONTRACTORS

We do not anticipate the use of subcontractors for the work quoted in this proposal.

Schedule 2

Bluewater Proposed Transmission

Huron County, Ontario, Canada

NEXTera ENERGY CANADA

Date 10/12/2012

PROPRIETARY AND CONFIDENTIAL

N

Projection: USA_Contiguous_Albers_Equal_Area_Conic
Datum: NAD 83

0 1 2 4 Kilometers

- Existing Transmission
- Private Easement 33 ft
- Road ROW 66 ft
- Bluewater Substation
- Ontario Lots

Schedule 3

Signed land owner table

PIN	LOT	CON	Ease on Title	Nature of Impact	Crossing Type	Signed Agreement	Directly Effected LO	Type of Easement	Size of Easement
412090051	11	9	No other easements on title	Infrastructure located on property.		Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412090079	11	8	Lease registered on title	Infrastructure located on property.	Possible crossing with Zur-Ban, Moffat Lake Explorations Ltd., Bank of Commerece, Stanley Reef Resources Ltd., HydroOne, and Paladin Petroleum Corporation.	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412090072	PT 11	7	Lease registered on title	Infrastructure located on property.	Possible crossing with Elliott's Land Services Ltd., and HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412100033	11	5	No other easements on title	Infrastructure located on property.	Possible crossing with HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412130017	PT 11	4	No other easements on title	Infrastructure located on property.		Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412130012	PT 11	4	No other easements on title	Infrastructure located on property.	Possible crossing with HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412140004	10	1	Lease registered on title	Infrastructure located on property.	Possible crossing with Bell Telephone Company.	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412140018	PT 10	1	No other easements on title	Infrastructure located on property.	Railroad. Possible crossing with Tuckersmith Communications Co-Operative Ltd.	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412140006	PT 10	1	No other easements on title	Infrastructure located on property.	Possible crossing with Tuckersmith Communications Co-Operative Ltd. and HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412760004	PT 25	1	Lease registered on title	Infrastructure located on property.	Possible crossing with Mikal Oil Co. Ltd., E.V. McCollum & Co., Norman Fitgerald, Milton Resources Ltd., Tuckersmith Communications Co-Operative Ltd., and HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412810081	26	2	No other easements on title	Infrastructure located on property.	Possible crossing with HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412810103	PT 26	4	No other easements on title	Infrastructure located on property.	Possible crossing with HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property

412770009	14	7	No other easements on title	Infrastructure located on property.		Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412770010	13	7	No other easements on title	Infrastructure located on property.	Possible crossing with HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412770012	PT 11	7	No other easements on title	Infrastructure located on property.	Possible crossing with HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412980030	PT 5	4	No other easements on title	Infrastructure located on property.	Possible crossing with HydroOne	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property
412980006	PT 5	1	No other easements on title	Infrastructure located on property.	Railroad	Yes	Yes	Temporary and Permanent	Permanent 33' wide Easement, Temporary Construction Easement across property

Adjacent land owner table

PIN	LOT	CON	Ease on Title	Nature of Impact	Crossing Type	On-Going Negotations	Adjacent LO
Adjacent to 412160020	10	9	No other easements on title	Infrastructure located within right of way	Possible crossing with Tuckersmith Communications Co-Operative Ltd.	No	Yes
Adjacent to 412100028	11	6	No other easements on title	Infrastructure located within right of way		No	Yes
Adjacent to 412130032	11&12	3	Lease registered on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412130033	11	3	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	Yes	Yes
Adjacent to 412130045	11	2	No other easements on title	Infrastructure located within right of way		No	Yes
Adjacent to 412810068	26	1 LRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412760027	24&25	2 LRS	No other easements on title	Infrastructure located within right of way		No	Yes
Adjacent to 412810091	26&27	3 LRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412800037	26	5 LRS	No other easements on title	Infrastructure located within right of way		No	Yes
Adjacent to 412770005	25	5 LRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412770011	12	7 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412770014	10	7 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	Yes	Yes
Adjacent to 412770015	9	7 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes

Adjacent to 412790100	9	6 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with Tuckersmith Communications Co-Operative Ltd. and HydroOne	No	Yes
Adjacent to 412790100	9	6 HRS	No other easements on title	Infrastructure located within right of way		No	Yes
Adjacent to 412790099	8	6 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412790129	7	6 HRS	No other easements on title	Infrastructure located within right of way		No	Yes
Adjacent to 412790128	7	6 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412790097	6	6 HRS	Lease registered on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412780010	5	6 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412780005	5	5 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes
Adjacent to 412980032	5	4 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	Yes	Yes
Adjacent to 412980031	5	4 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	Yes	Yes
Adjacent to 412790084	6	4 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with HydroOne	Yes	Yes
Adjacent to 412790083	6	3 HRS	No other easements on title	Infrastructure located within right of way	Possible crossing with Tuckersmith Communications Co-Operative Ltd. and HydroOne	No	Yes
Adjacent to 412980005	5	1&2 HRS	Easement on title	Infrastructure located within right of way	Possible crossing with Ontario Natural Gas Storage and Pipelines Ltd. and HydroOne	No	Yes
Adjacent to 412980004	5	1 HRS	Lease registered on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes

Adjacent to 412970021	6	1 HRS	Lease registered on title	Infrastructure located within right of way	Possible crossing with HydroOne	No	Yes

Schedule 4

Bluewater Transmission Line - Record of Consultation

PIN	Date	General Notes
412970021	November 21, 2011	Spoke with landowner about the transmission line, our offer, changes in the project. Landowner has agreed to meet in 2 - 3 weeks.
	October 1, 2012	Spoke with landowner about a study taking place on the property. Landowner shared access details.
412970022	November 21, 2011	Spoke with landowner about the transmission line, our offer, changes in the project. Landowner has agreed to meet in 2 - 3 weeks.
	July 3, 2012	Met with landowner to deliver a package.
	July 31, 2012	Sent a letter addressing community concerns gathered at the Bluewater Open House and during consultation meetings since May 2012.
412980005	January 5, 2012	Met with landowner and discussed transmission line and agreement. Landowner was concerned about the effect it might have on their home. Landowner would like to review the agreement.
	February 7, 2012	Spoke with landowner about the transmission line and options for the landowners property. Landowner was unsure about the offer.
	February 25, 2012	Met with landowner and discussed the transmission line and associated infrastructure. Landowner is still unsure.
	March 21, 2012	Met with landowner to discuss the agreement. Landowner is concerned about damage to trees.
	April 11, 2012	Spoke to landowner to schedule a meeting for the following week.
	April 16, 2012	Spoke to landowner who is too busy and is not available to meet. Landowner will contact us with their availability.
	April 23, 2012	Met with landowner to present agreement. Landowner felt the developer had addressed their concerns but was still undecided. Landowner would like to continue considering their options.
	June 3, 2012	Met with landowner to discuss the their property and the transmission line. Landowner would prefer if the transmission line was planned elsewhere. We discussed various scenarios on the property. Landowner is unsure and would like to discuss with family members.
	June 18, 2012	Met with landowner to discuss transmission line and associate infrastructure. Landowner has concerns about health effects and is still undecided but will continue to consider the agreement.
	July 5, 2012	Met with family member of landowner to deliver information package.
	July 24, 2012	Spoke with landowner to discuss transmission line infrastructure and agreement. Landowner is concerned about where the transmission line will be placed.
	July 31, 2012	Spoke with landowner who was not interested in discussing the transmission line further. We also discussed associated studies.
	August 1, 2012	Met with landowner and discussed the agreement. Landowner is undecided and did not want to comment further without discussing with family members.
	November 15, 2012	Met with landowner and discussed the transmission line. Landowners have concerns about health issues and requested a follow up next week.
	November 19, 2012	Met with landowner and discussed transmission line and agreement. Landowner would like to review an agreement.
412970231	October 18, 2011	Met with landowner to discuss transmission line and agreement. Landowner is opposed to wind power and will not participate. Landowner is concerned about aesthetics, and politics.
	January 15, 2012	Landowner is very opposed and not interested in participating.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412790083	October 19, 2011	Met with landowner and discussed the transmission line and agreement. Landowner was positive but will need to consult family members. Landowner would like to review the agreement.
	July 5, 2012	Met with landowner to deliver a package and discussed the transmission line and agreement. Landowner is open to considering the offer but will need to consult family members.
	July 5, 2012	Met with landowners and discussed transmission line and agreement. They are undecided but would like to review the agreement.
	July 16, 2012	Spoke to family member and confirmed the property has changed ownership.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412980025	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412790084	October 18, 2011	Met with landowner to discuss transmission line and agreement. Landowners are receptive to the offer and would like to review the agreement.
	November 7, 2011	Follow-up with landowner to schedule a presentation of the agreement. Landowners are not able to meet at this time.
	July 3, 2012	Spoke to landowner regarding the transmission line and agreement. They are interested in reviewing the agreement and was concerned about potential tree loss.
	July 3, 2012	Met with landowner to deliver a package. They are interested in participating.
	July 17, 2012	Spoke to landowner to discuss transmission infrastructure. They are still interested in participating.
	July 21, 2012	Met with landowners and presented the agreement. They are concerned about potential tree damage and are reluctant.
	July 23, 2012	Spoke with landowner and set a meeting time.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	October 9, 2012	Met with landowner and discussed agreement. Landowner would like a follow-up later in the week and will let us know their availability.
	October 29, 2012	Met with landowners and discussed transmission line and agreement. Landowners requested further information related to aesthetics.
	November 7, 2012	Spoke with landowner and scheduled a follow-up meeting. Landowner is open to participation.

	November 9, 2012	Met with landowners who are still undecided, would like to continue reviewing the agreement and would like to consult a lawyer.
	November 23, 2012	Met with landowners and provided information about some of their concerns.
412790086	March 20, 2012	Met with landowners to discuss access for studies, the transmission line and agreement. They would like to review the agreement.
	April 25, 2012	Spoke with landowners who were concerned about delicate infrastructure on the property.
	July 4, 2012	Met with landowner to drop off information package. Landowner was open to the project.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	September 27, 2012	Spoke with landowner about studies taking place on the property. Landowner shared preferences in regards to access.
412980030	February 25, 2012	Spoke with family member of landowner and discussed transmission line and agreement. I was directed to speak with the landowner directly and was provided with contact details.
	April 12, 2012	Spoke with landowner and discussed transmission line and agreement. Landowner informed me that another landowner of this property wished to discuss with me as well.
	April 17, 2012	Spoke with landowner regarding the transmission line, the agreement and access for studies. Landowner granted access and would like to review the agreement.
	May 11, 2012	Spoke to landowner about concerns they had in relation to the transmission line. We set a meeting time to follow up.
	May 16, 2012	Met with landowners to review agreement. They decided to sign.
	July 3, 2012	Met with landowner to deliver information package. Landowner in interested in learning details about the transmission line.
	July 17, 2012	Spoke with associate of landowners regarding studies on the property and discussed concerns about the study.
	July 19, 2012	Met with associate of landowners to discuss study on the property. Discussed the study in depth with associate who agreed to allow study to take place.
	July 23, 2012	Spoke with family member of landowner and discussed transmission line and agreement. I was directed to speak with the landowner directly and was provided with contact details.
	July 31, 2012	Spoke with landowner and discussed transmission line and agreement. Landowner informed me that another landowner of this property wished to discuss with me as well.
	September 28, 2012	Spoke to landowner about a study occurring on the property. Landowner shared details about accessing the property and requested a follow-up next week.
	October 2, 2012	Met with landowners and discussed transmission line and agreement. Landowners would like to be as informed as possible about project and asked for some further information.
	October 15, 2012	Met with landowner to discuss studies on the property.
412980031	March 8, 2012	Spoke to landowner about the transmission line and agreement. Landowner was not interested in discussing and ended the conversation immediately.
	July 3, 2012	Met with landowner to drop off information package. Landowner refused package.
	July 11, 2012	Spoke to landowner about transmission line. Landowner is concerned about safety and the potential effect on their residence. Landowner is open to considering another part of the property for the line.
	July 20, 2012	Spoke with landowner about the transmission line. Landowner is open to only certain types of infrastructure and would like to review a lease if this is an option. The landowner would also like to know more detailed information about the transmission line.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	October 12, 2012	Spoke with landowner regarding the transmission line. Landowner is concerned about aesthetics and agreed to meet for a follow-up next week.
	October 17, 2012	Met with landowner and discussed the agreement. Landowner is concerned about aesthetics and potential effects to trees on the property.
	November 13, 2012	Spoke with landowner about transmission line and agreement. Landowners concerns remain unchanged and is not interested in participating.
412980032	April 19, 2012	Met with landowner and discussed transmission line and agreement. Landowner is open to reviewing an agreement although is concerned about tree damage.
	May 8, 2012	Met with landowner and briefly discussed the agreement. We will schedule a follow-up meeting in the next couple days.
	May 16, 2012	Met with landowner and discussed the agreement. Landowner is concerned about potential tree loss and feels this is a big barrier.
	May 24, 2012	Met with landowner to follow-up on concerns. Landowner had mixed emotions about the developers response to their concerns. Landowner was open to meeting the following week to discuss further.
	May 30, 2012	Met with landowner to discuss agreement and concerns related to potential tree loss. Landowner is still open to participating.
	June 5, 2012	Spoke to landowner who requested more time to consider the offer.
	June 12, 2012	Spoke to landowner to follow-up on previous discussion. Landowner is concern about community opinion and is unsure about participation.
	June 13, 2012	Spoke to landowner who was not interested in discussing at this time.
	June 14, 2012	Spoke to landowner who was more open to discussing participation. Discussed public meeting with landowner.
	June 27, 2012	Spoke to landowner about the agreement and discussed some of the community comments the landowner had heard. We agreed to follow up in a couple of weeks.
	July 16, 2012	Spoke to the landowner about possible participation and existing concerns with it.
	July 25, 2012	Met with landowner to discuss remaining concerns. Landowner is not positive about participating.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 21, 2012	Met with landowner who has not changed opinion on participating.
	August 28, 2012	Spoke with landowner who was not able to discuss at the time.
	September 6, 2012	Met landowner and discussed agreement. Landowner is concerned about potential tree loss.
	September 18, 2012	Met with landowner and discussed transmission line route. Landowner requested a follow-up at a later date.
	November 8, 2012	Met with landowner and discussed transmission line and agreement. Landowner is undecided and politically opposed.
412790095	February 25, 2012	Met with landowners and discussed transmission line, agreement and project. Landowners would like to review an agreement. Landowners are concerned about potential effect on property and compensation.
	May 1, 2012	Met with landowners and discussed transmission line and agreement. Landowners concerns remain unchanged and but more specific.

	May 11, 2012	Spoke with landowners about agreement. Landowners were not interested in discussing in any detail but requested a follow-up at a later date.
	June 9, 2012	Met with landowners and presented agreement. Landowners are concerned about placement of infrastructure.
	June 13, 2012	Met with landowner who was not interested in discussing the transmission line or agreement any further. Landowner prefers correspondence by email.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412780005	February 25, 2012	Met with landowners and discussed transmission line, agreement and project. Landowners would like to review an agreement. Landowners are concerned about potential effect on property and compensation.
	May 1, 2012	Met with landowners and discussed transmission line and agreement. Landowners concerns remain unchanged and but more specific.
	May 11, 2012	Spoke with landowners about agreement. Landowners were not interested in discussing in any detail but requested a follow-up at a later date.
	June 9, 2012	Met with landowners and presented agreement. Landowners are concerned about placement of infrastructure.
	June 13, 2012	Met with landowner who was not interested in discussing the transmission line or agreement any further. Landowner prefers correspondence by email.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	September 5, 2012	Left message with a family member to schedule a follow-up.
412790096	February 25, 2012	Met with landowners and discussed transmission line, agreement and project. Landowners would like to review an agreement. Landowners are concerned about potential effect on property and compensation.
	May 1, 2012	Met with landowners and discussed transmission line and agreement. Landowners concerns remain unchanged and but more specific.
	May 11, 2012	Spoke with landowners about agreement. Landowners were not interested in discussing in any detail but requested a follow-up at a later date.
	June 9, 2012	Met with landowners and presented agreement. Landowners are concerned about placement of infrastructure.
	June 13, 2012	Met with landowner who was not interested in discussing the transmission line or agreement any further. Landowner prefers correspondence by email.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412790097	February 25, 2012	Met with landowners and discussed transmission line, agreement and project. Landowners would like to review an agreement. Landowners are concerned about potential effect on property and compensation.
	May 1, 2012	Met with landowners and discussed transmission line and agreement. Landowners concerns remain unchanged and but more specific.
	May 11, 2012	Spoke with landowners about agreement. Landowners were not interested in discussing in any detail but requested a follow-up at a later date.
	June 9, 2012	Met with landowners and presented agreement. Landowners are concerned about placement of infrastructure.
	June 13, 2012	Met with landowner who was not interested in discussing the transmission line or agreement any further. Landowner prefers correspondence by email.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412780010	February 25, 2012	Met with landowners and discussed transmission line, agreement and project. Landowners would like to review an agreement. Landowners are concerned about potential effect on property and compensation.
	May 1, 2012	Met with landowners and discussed transmission line and agreement. Landowners concerns remain unchanged and but more specific.
	May 11, 2012	Spoke with landowners about agreement. Landowners were not interested in discussing in any detail but requested a follow-up at a later date.
	June 9, 2012	Met with landowners and presented agreement. Landowners are concerned about placement of infrastructure.
	June 13, 2012	Met with landowner who was not interested in discussing the transmission line or agreement any further. Landowner prefers correspondence by email.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412780016	February 25, 2012	Met with landowners and discussed transmission line, agreement and project. Landowners would like to review an agreement. Landowners are concerned about potential effect on property and compensation.
	May 1, 2012	Met with landowners and discussed transmission line and agreement. Landowners concerns remain unchanged and but more specific.
	May 11, 2012	Spoke with landowners about agreement. Landowners were not interested in discussing in any detail but requested a follow-up at a later date.
	June 9, 2012	Met with landowners and presented agreement. Landowners are concerned about placement of infrastructure.
	June 13, 2012	Met with landowner who was not interested in discussing the transmission line or agreement any further. Landowner prefers correspondence by email.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412770026	February 25, 2012	Met with landowners and discussed transmission line, agreement and project. Landowners would like to review an agreement. Landowners are concerned about potential effect on property and compensation.
	May 1, 2012	Met with landowners and discussed transmission line and agreement. Landowners concerns remain unchanged and but more specific.
	May 11, 2012	Spoke with landowners about agreement. Landowners were not interested in discussing in any detail but requested a follow-up at a later date.
	June 9, 2012	Met with landowners and presented agreement. Landowners are concerned about placement of infrastructure.
	June 13, 2012	Met with landowner who was not interested in discussing the transmission line or agreement any further. Landowner prefers correspondence by email.
	July 31, 2012	Letter sent to landowner addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412790129	July 6, 2012	Met with landowner and discussed transmission line and agreement. Landowner has reservations but is open to discussion.
	July 21, 2012	Met with landowner and discussed transmission line and agreement. Landowner had concerns about the agreement.

	July 31, 2012	Letter sent to landowner addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	October 12, 2012	Met landowner briefly and arranged a follow up for later in the week.
	October 16, 2012	Met with landowner and discussed transmission line and agreement. Landowner had concerns about the placement of the infrastructure.
	December 4, 2012	Met with landowner and presented agreement. Landowner would like to continue reviewing the document and requested a follow-up at a later date.
	December 6, 2012	Spoke to landowner and scheduled a follow-up for the next day.
	December 7, 2012	Met with landowner who decided to sign the agreement.
412790128	June 22, 2012	Met with landowner and discussed transmission line and agreement. Landowners are open to considering participation.
	June 26, 2012	Met with landowners and discussed transmission line, agreement and wind project. Landowners are interested in hearing more about the project.
	June 28, 2012	Met with landowners and discuss their concerns. Set a tentative appointment to present the agreement in the coming weeks.
	July 18, 2012	Met with landowner and scheduled an agreement presentation for the next day.
	July 19, 2012	Met with landowners and presented the agreement. They decided to sign the agreement.
	July 31, 2012	Letter sent to landowner addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	September 26, 2012	Met with landowner and discussed studies taking place on the property. Landowner granted permission.
412770017	February 25, 2012	Met with landowners and discussed transmission line, agreement and project. Landowners would like to review an agreement. Landowners are concerned about potential effect on property and compensation.
	May 1, 2012	Met with landowners and discussed transmission line and agreement. Landowners concerns remain unchanged and but more specific.
	May 11, 2012	Spoke with landowners about agreement. Landowners were not interested in discussing in any detail but requested a follow-up at a later date.
	June 9, 2012	Met with landowners and presented agreement. Landowners are concerned about placement of infrastructure.
	June 13, 2012	Met with landowner who was not interested in discussing the transmission line or agreement any further. Landowner prefers correspondence by email.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412790100	November 10, 2011	Met with landowners and discussed transmission line and agreement. Landowners are concerned about compensation and would like more information about the project.
	November 29, 2011	Met with landowner who would like to review an agreement.
	January 6, 2012	Met with landowner and discussed transmission route. Landowner is concerned about placement of the infrastructure and potential effects on the property. Landowner is open to further discussion.
	January 18, 2012	Met with landowner and discussed transmission line. Landowner is concerned about potential health effects.
	February 25, 2012	Met with landowner who was not open to discussion at the time.
	March 15, 2012	Met with landowners and discussed their concerns. They are concerned about potential health effects information on this was provided.
	March 20, 2012	Met with landowners and discussed the transmission line. Their concerns are unchanged which will be addressed more in depth at subsequent appointments.
	May 1, 2012	Spoke with landowners and set a tentative appointment to meet with them and discuss their concerns in greater detail.
	May 9, 2012	Met with landowners and discussed transmission line and agreement. Landowners have several concerns which were discussed at length.
	June 13, 2012	Met with landowners and discussed transmission line. They are opposed and their concerns are unchanged.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 30, 2012	Spoke to landowner who's concerns are unchanged. Landowner is opposed.
412790099	June 22, 2012	Met with landowner and discussed transmission line and agreement. Landowners are aware of project and concerned about community opinion.
	June 26, 2012	Met landowner who was not able to speak in depth. Recommended returning at a later date.
	June 29, 2012	Met landowner and discussed agreement and concerns. Set a follow-up appointment to review the agreement.
	July 18, 2012	Met landowners who are concerned about community opinions. Landowners are open to considering participation.
	July 20, 2012	Met with landowners to deliver agreement and discussed community opinion. Landowners requested further time to continue reviewing and considering the agreement.
	July 25, 2012	Met with landowners and discussed transmission line. Landowners are concerned about potential effect on trees.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 3, 2012	Met with landowner and discussed their potential participation and concerns. Landowner requested a follow-up at a later date.
	August 21, 2012	Met with landowners who are interested in participating.
	September 19, 2012	Spoke with landowners and scheduled a meeting for a later date.
	September 21, 2012	Met with landowners and presented agreement. Landowners decided to sign the agreement.
412770016	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412790101	October 27, 2011	Met with landowner and discussed transmission line and agreement. Landowner requested additional information and is concerned about the opinions of the community.
	December 8, 2011	Correspondence from landowner requesting an agreement for review and a follow-up meeting. Meeting set for the following week.
	December 16, 2011	Met with landowners and presented agreement. Landowners decided to sign the agreement.
	June 29, 2012	Dropped off some information with a family member of the landowners.
	July 4, 2012	Met with landowner and dropped off an information package. Landowner had questions about an the transmission line route.
	July 6, 2012	Met with landowner to discuss transmission line route. Landowner would like to review the agreement.
	July 7, 2012	Spoke with landowner who had a request regarding the agreement.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 21, 2012	Spoke with landowner to schedule a follow-up.
	August 23, 2012	Met with landowner and reviewed agreement. After some discussion landowner signed the agreement.
	October 18, 2012	Met with landowner and discussed compensation and studies taking place on the property.
412770015	October 21, 2011	Met with landowners and discussed transmission line and agreement. Landowners would like to review an agreement.
	November 8, 2011	Met with landowner and presented agreement. Landowner would like to continue reviewing agreement.
	November 23, 2011	Spoke with landowners about the agreement. Landowners had questions about compensation.

	December 1, 2011	Met with family member of landowner. Landowner was unavailable.
	December 2, 2011	Met with landowner and discussed agreement. Landowner requested a follow-up at a later date.
	December 12, 2011	Met with landowner and discussed possible participation in the project. Landowner is interested in opinion of neighbor.
	January 6, 2012	Met with landowner and discussed agreement. Landowner requested a follow-up at a later date.
	January 24, 2012	Met with landowner and discussed transmission line. Landowner is concerned about the opinions of neighbors.
	February 27, 2012	Spoke with family member. Landowner is unavailable at this time.
	March 9, 2012	Met with landowner and discussed potential participation. Landowners are concerned about opinion of neighbors.
	June 22, 2012	Met with landowner and discussed the agreement. Landowner has reservations.
	June 29, 2012	Met with landowner and delivered an information package. Landowner has concerns about the Ontario power grid.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	November 5, 2012	Met with landowner and discussed several concerns. Landowner is not interested in participation.
412790102	October 21, 2011	Met with landowners and discussed transmission line and agreement. Landowners would like to review an agreement.
	November 8, 2011	Met with landowner and presented agreement. Landowner would like to continue reviewing agreement.
	November 23, 2011	Spoke with landowners about the agreement. Landowners had questions about compensation.
	December 1, 2011	Met with family member of landowner. Landowner was unavailable.
	December 2, 2011	Met with landowner and discussed agreement. Landowner requested a follow-up at a later date.
	December 12, 2011	Met with landowner and discussed possible participation in the project. Landowner is interested in opinion of neighbor.
	January 6, 2012	Met with landowner and discussed agreement. Landowner requested a follow-up at a later date.
	January 24, 2012	Met with landowner and discussed transmission line. Landowner is concerned about the opinions of neighbors.
	February 27, 2012	Spoke with family member. Landowner is unavailable at this time.
	March 9, 2012	Met with landowner and discussed potential participation. Landowners are concerned about opinion of neighbors.
	June 22, 2012	Met with landowner and discussed the agreement. Landowner has reservations.
	June 29, 2012	Met with landowner and delivered an information package. Landowner has concerns about the Ontario power system.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	November 5, 2012	Met with landowner and discussed several concerns. Landowner is not interested in participation.
412770014	June 13, 2012	Met with landowners and discussed transmission line route and agreement.
	June 18, 2012	Spoke to landowner and set a follow up meeting.
	June 21, 2012	Met with landowner and discussed transmission line route. Landowner requested more information.
	June 29, 2012	Delivered and information package to family member of landowner.
	July 7, 2012	Met with landowner and discussed transmission line and related topics.
	July 30, 2012	Met with landowners and discussed transmission line. Landowners would prefer a different route.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	October 26, 2012	Met with landowner and discussed transmission line. Landowner are concerned about the potential effect on their property.
	November 13, 2012	Met with landowners and discussed their concerns. Information that was previously requested was provided.
	November 28, 2012	Let with landowners and discussed transmission line. Landowners are concerned about potential effect on trees.
	December 4, 2012	Met with landowners and discussed transmission line. Landowners are concerned about potential health issues and the route of the line.
	December 12, 2012	Met with landowner and discussed transmission line route. Set a follow-up appointment for the following week.
	December 20, 2012	Met with landowner and discussed their concerns about possible health effects and the transmission line route.
	January 3, 2013	Spoke with landowner regarding studies on the property.
	January 9, 2013	Spoke with landowner and discussed studies on the property and the project.
	January 14, 2013	Spoke to landowner about studies taking place on the property and the transmission line route.
412790104	December 8, 2011	Met with landowner and discussed transmission line and agreement. Landowner is not supportive.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 16, 2012	Met with landowner and discussed transmission line and agreement. Landowner is strongly opposed.
412770012	October 27, 2011	Met with landowner and discussed transmission line and agreement. Landowner requested additional information and is concerned about the opinions of the community.
	December 16, 2011	Met with landowner and presented agreement. Landowner had a request and is positive about participation.
	February 8, 2012	Met landowner to follow up on previous discussion. Landowner is open to further discussion.
	March 9, 2012	Met wit landowner and discussed agreement. Landowner would like to continue reviewing the agreement.
	March 19, 2012	Met with landowner who decided to sign the agreement.
	June 29, 2012	Delivered information package to landowners.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	September 26, 2012	Met with landowners and discussed transmission line. They have concerns about the route of the line.
412790105	November 1, 2011	Met with landowners and discussed transmission line and agreement. Landowners are open to hearing more and we set a follow-up for a later date.
	November 10, 2011	Met with landowner and discussed agreement. Landowner is interested in discussing further.
	November 29, 2011	Met with landowner and discussed transmission line and agreement. Landowner is concerned about the placement of the infrastructure.
	January 5, 2012	Met with landowner and discussed transmission line. Landowner would like more information on engineering.
	January 11, 2012	Spoke to landowner and forwarded answers to questions from previous meeting. Follow-up scheduled for the next week.
	January 25, 2012	Met with landowner to discuss transmission line and agreement. Landowner had concerns about potential effect on the property.
	February 9, 2012	Met with landowner and discussed agreement and followed up on concerns from previous meeting. I provided further information as well.
	March 15, 2012	Met with landowner and discussed transmission line route. Landowner is not interested in participating.
	June 13, 2012	Met with landowner who is not interested in participating. Landowner is concerned about the placement of the infrastructure in the future.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412770011	November 10, 2011	Met with landowners and discussed transmission line and agreement. Landowners are concerned about compensation and would like more information about the project.
	November 29, 2011	Met with landowner who would like to review an agreement.
	January 6, 2012	Met with landowner and discussed transmission route. Landowner is concerned about placement of the infrastructure and potential effects on the property. Landowner is open to further discussion.
	January 18, 2012	Met with landowner and discussed transmission line. Landowner is concerned about potential health effects.

	March 15, 2012	Met with landowner who was not open to discussion at the time.
	March 20, 2012	Met with landowners and discussed their concerns. They are concerned about potential health effects information on this was provided.
	May 1, 2012	Met with landowners and discussed the transmission line. Their concerns are unchanged which will be addressed more in depth at subsequent appointments.
	May 8, 2012	Spoke with landowners and set a tentative appointment to meet with them and discuss their concerns in greater detail.
	June 13, 2012	Met with landowners and discussed transmission line and agreement. Landowners have several concerns which were discussed at length.
	July 31, 2012	Met with landowners and discussed transmission line. They are opposed and their concerns are unchanged.
	August 30, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412790106	October 21, 2011	Met with landowners and discussed transmission line and agreement. Landowners would like to review an agreement.
	November 8, 2011	Met with landowner and presented agreement. Landowner would like to continue reviewing agreement.
	November 23, 2011	Spoke with landowners about the agreement. Landowners had questions about compensation.
	December 1, 2011	Met with family member of landowner. Landowner was unavailable.
	December 2, 2011	Met with landowner and discussed agreement. Landowner requested a follow-up at a later date.
	December 12, 2011	Met with landowner and discussed possible participation in the project. Landowner is interested in opinion of neighbor.
	January 6, 2012	Met with landowner and discussed agreement. Landowner requested a follow-up at a later date.
	January 24, 2012	Met with landowner and discussed transmission line. Landowner is concerned about the opinions of neighbors.
	February 27, 2012	Spoke with family member. Landowner is unavailable at this time.
	March 9, 2012	Met with landowner and discussed potential participation. Landowners are concerned about opinion of neighbors.
	June 22, 2012	Met with landowner and discussed the agreement. Landowner has reservations.
	June 29, 2012	Met with landowner and delivered an information package. Landowner has concerns about the Ontario power grid.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	November 5, 2012	Met with landowner and discussed several concerns. Landowner is not interested in participation.
412770010	October 27, 2011	Met with landowner and discussed transmission line and agreement. Landowner requested additional information and is concerned about the opinions of the community.
	December 16, 2011	Met with landowner and presented agreement. Landowner had a request and is positive about participation.
	January 4, 2012	Met with landowner and discussed agreement. Landowner is concerned about community opinion.
	January 13, 2012	Met with landowner and discussed concerns and possible participation.
	January 23, 2012	Met with landowner and discussed concerns and possible participation. Landowner would like to continue considering offer.
	January 31, 2012	Spoke to landowner who still has reservations. Landowner requested a follow-up at a later date.
	February 2, 2012	Met with landowners who decided to sign the agreement.
	June 29, 2012	Delivered information package to landowners.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	September 26, 2012	Met with landowners and discussed transmission line. They have concerns about the route of the line.
412770009	October 27, 2011	Met with landowner and discussed transmission line and agreement. Landowner requested additional information and is concerned about the opinions of the community.
	December 16, 2011	Met with landowner and presented agreement. Landowner had a request and is positive about participation.
	January 4, 2012	Met with landowner and discussed agreement. Landowner is concerned about community opinion.
	January 13, 2012	Met with landowner and discussed concerns and possible participation.
	January 23, 2012	Met with landowner and discussed concerns and possible participation. Landowner would like to continue considering offer.
	January 31, 2012	Spoke to landowner who still has reservations. Landowner requested a follow-up at a later date.
	February 2, 2012	Met with landowners who decided to sign the agreement.
	June 29, 2012	Delivered information package to landowners.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 17, 2012	Met with landowners and discussed transmission line. Landowners have concerns over proximity of the line to homes.
	September 26, 2012	Met with landowners and discussed transmission line. They have concerns about the route of the line.
412800037	October 20, 2011	Met with landowner and discussed transmission line and agreement. Landowner would like to review an agreement.
	November 6, 2011	Spoke with landowner and set a follow-up appointment for the next day.
	November 7, 2011	Met with landowner and presented agreement. Landowners would like to have the agreement reviewed by a lawyer.
	December 12, 2011	Spoke with landowner about the agreement which is still under legal review.
	January 6, 2012	Met with landowner who is waiting for legal response. Landowner requested a follow-up at a later date.
	February 11, 2012	Met with landowner and discussed transmission line. Landowner is concerned about health issues.
	June 13, 2012	Met with landowners and discussed transmission line. Landowners have concerns about potential effects on farming.
	June 21, 2012	Met with landowner and provided information that follows up on concerns from our last visit.
	July 10, 2012	Left phone message to discuss follow-up meeting.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 29, 2012	Left message for landowner that we would like to provide them with further answers to their questions.
	August 30, 2012	spoke to landowner regarding a nearby study and project timeline.
412770005	November 2, 2011	Met with landowner and discussed transmission line and agreement. Landowner is opposed to project and all wind power.
	November 18, 2011	Spoke with landowner who is not interested in participating.
	May 16, 2012	Met with landowner and discussed property access. Landowner did not consent and is unhappy about the transmission route.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412810103	October 22, 2011	Met with landowner and discussed transmission line and agreement. Follow-up set for the following day.
	October 23, 2011	Met with landowner and discussed transmission line and agreement. Landowner would like to review an agreement.
	November 9, 2011	Met with landowner and presented agreement. Landowners decided to sign.
	July 5, 2012	Met with landowners and dropped off and information package.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412760053	March 19, 2012	Met with landowner and discussed transmission line and agreement. Landowner is concerned about health effects. Landowner would like to review and agreement.
	May 11, 2012	Met with landowner and reviewed agreement. Landowner is concerned about health effects and possible effect on property. Landowner would like to continue to review the agreement.
	June 9, 2012	Met with landowner and discussed agreement. Landowner will be attending the upcoming public meeting.
	July 7, 2012	Met with landowner and discussed concerns. Landowner has requested further information.

	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412810091	October 21, 2011	Met with landowner and discussed transmission line and agreement. Landowner would like to review and agreement.
	November 3, 2011	Met with landowner who was not able to speak at length but provided landowner with and agreement. Set a follow-up meeting for a later date.
	November 7, 2011	Met with landowner to follow up on previous meeting. Landowner is interested to attend the public meeting and has concerns about community opinion.
	December 2, 2011	Met with landowner and discussed transmission line and agreement. Landowner is not supportive.
	December 12, 2011	Met with landowner and discussed agreement. Landowner had a request.
	January 13, 2012	Met with landowner who is still not interested in participation at this time.
	April 19, 2012	Met with landowner and discussed agreement. Landowner is still reviewing the agreement.
	May 11, 2012	Met with landowner and discussed agreement. Landowner has concerns about some wording in the agreement and was not available to speak at length. Landowner requested a follow-up meeting.
	May 18, 2012	Met with landowner to follow up on previous discussion. We addressed their concerns and landowner was receptive. Landowner would like to continue reviewing the agreement.
	May 25, 2012	Met with landowner who was not able to speak in depth at the time. Follow-up scheduled at a later date.
	June 6, 2012	Met with landowner and discussed agreement. Landowner is satisfied with our attempts to address his concerns. Follow-up scheduled for a later date.
	June 12, 2012	Met with landowner and discussed participation in the project. Landowner is concerned about community opinions and has reservations.
	June 22, 2012	Met with landowner and discussed agreement. Landowner has reservations but is still considering participation.
	June 29, 2012	Delivered Information package to landowner.
	July 17, 2012	Met with landowner and discussed participation in the project.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	September 10, 2012	Met with landowner who is not supportive of project or agreement.
412760040	January 17, 2012	Met with landowner and discussed transmission line and agreement. Landowner would like to review the agreement.
	February 11, 2012	Met with landowner and presented agreement. Landowner is concerned about potential effect on trees.
	March 8, 2012	Met with landowner and discussed agreement. Follow-up scheduled at a later date.
	April 19, 2012	Met with landowner and discussed participation in the project. Landowner has reservations and would like to attend public meeting.
	June 13, 2012	Met with landowner and discussed transmission line. Landowner is concerned about the location of the infrastructure.
	July 4, 2012	Delivered information package to landowner.
	July 5, 2012	Met landowner and discussed participation in the project. Landowners are not supportive.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 16, 2012	Met landowner and discussed transmission line. Landowner is concerned about aesthetics.
	August 29, 2012	Met with landowner and discussed transmission line and easement. Landowner would like to discuss with family.
	September 4, 2012	Met with landowner and discussed agreement. Landowner requested follow-up at a later date.
	September 25, 2012	Met with landowners and presented agreement. Landowners are open to participation and would like to review the agreement further.
	October 9, 2012	Met with landowner and discussed agreement. Landowner is concerned about health effects.
	November 6, 2012	Met with landowner and discussed participation. Landowner has decided against it at this time.
412810081	October 22, 2011	Met with landowner and discussed transmission line and agreement. Landowner would like to review the agreement.
	November 10, 2011	Met with landowner and presented agreement. Landowner would like to review agreement further and attend upcoming public meeting.
	December 2, 2011	Met with landowner discussed agreement. Landowner is open to participation.
	January 14, 2012	Met with landowner and discussed participation. Landowner would like to continue considering.
	February 6, 2012	Met with landowner and discussed agreement. Landowners is not interested in participation at this time.
	May 9, 2012	Met with landowner and discussed infrastructure. Follow-up meeting scheduled.
	May 12, 2012	Met with landowner and discussed transmission line. Landowner is still considering participation.
	May 15, 2012	Spoke with landowner and rescheduled follow-up meeting.
	May 16, 2012	Spoke to landowner and set a follow
	June 7, 2012	Spoke to landowner and discussed the location of our meeting.
	June 8, 2012	Spoke to landowner and discussed transmission line and agreement. Follow up set for next week .
	June 13, 2012	Met with landowner and discussed participation. Landowner Is open to it but would like to go to the public meeting.
	June 18, 2012	Met with landowner and presented agreement. Landowner is considering participation.
	June 22, 2012	Met with landowners who decided to sign the agreement.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412760027	October 21, 2011	Met with landowners and discussed transmission line and agreement. Landowners would like to review an agreement.
	November 8, 2011	Met with landowner and presented agreement. Landowner would like to continue reviewing agreement.
	November 23, 2011	Spoke with landowners about the agreement. Landowners had questions about compensation.
	December 1, 2011	Met with family member of landowner. Landowner was unavailable.
	December 2, 2011	Met with landowner and discussed agreement. Landowner requested a follow-up at a later date.
	December 12, 2011	Met with landowner and discussed possible participation in the project. Landowner is interested in opinion of neighbor.
	January 6, 2012	Met with landowner and discussed agreement. Landowner requested a follow-up at a later date.
	January 24, 2012	Met with landowner and discussed transmission line. Landowner is concerned about the opinions of neighbors.
	February 27, 2012	Spoke with family member. Landowner is unavailable at this time.
	March 9, 2012	Met with landowner and discussed potential participation. Landowners are concerned about opinion of neighbors.
	June 22, 2012	Met with landowner and discussed the agreement. Landowner has reservations.
	June 29, 2012	Met with landowner and delivered an information package. Landowner has concerns about the Ontario power grid.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	November 5, 2012	Met with landowner and discussed several concerns. Landowner is not interested in participation.
412810068	June 29, 2012	Information package was delivered to landowner.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412760004	October 20, 2011	Met with landowners and discussed transmission line and agreement. Landowners are interested in engineering and would like more information.
	November 9, 2011	Met landowners and presented agreement. Landowners would like to review agreement further.

	November 30, 2011	Met with landowners who decided to sign the agreement.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412140006	October 20, 2011	Met with landowner and discussed transmission line and agreement. Landowner is concerned about possible effect on property, aesthetics, and compensation. Landowner would like to review the agreement.
	November 10, 2011	Set agreement presentation for the following week.
	November 17, 2011	Met with landowner and presented the agreement. Landowner is not concerned about the transmission line and would like more information about construction.
	December 1, 2011	Met with landowner and discussed transmission line and upcoming public meeting. Follow-up scheduled for a later date.
	January 15, 2012	Met with landowner and discussed agreement. Landowner had a request.
	January 24, 2012	Met with landowner and discussed agreement. Follow-up appointment set for a later date.
	February 26, 2012	Met with landowner and discussed participation. Follow-up at a later date.
	March 19, 2012	Met with landowners and discussed participation in the project. Landowners would like to continue reviewing agreement.
	March 21, 2012	Met with landowners who decided to sign the agreement.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412130136	May 3, 2012	Met with landowner and discussed transmission line and agreement. Landowner is not supportive of project.
	July 5, 2012	Delivered information package to landowner. Landowner is still not interested in participation.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412140004	October 20, 2011	Met with landowner and discussed transmission line and agreement. Landowner is concerned about possible effect on property, aesthetics, and compensation. Landowner would like to review the agreement.
	November 10, 2011	Set agreement presentation for the following week.
	November 17, 2011	Met with landowner and presented the agreement. Landowner is no longer concerned about the transmission line and would like more information about construction.
	December 1, 2011	Met with landowner and discussed transmission line and upcoming public meeting. Follow-up scheduled for a later date.
	January 15, 2012	Met with landowner and discussed agreement. Landowner had a request which will be considered.
	January 24, 2012	Met with landowner and discussed agreement. Follow-up appointment set for a later date.
	February 26, 2012	Met with landowner and discussed participation. Follow-up at a later date.
	March 19, 2012	Met with landowners and discussed participation in the project. Landowners would like to continue reviewing agreement.
	March 21, 2012	Met with landowners who decided to sign the agreement.
	July 5, 2012	Delivered an information package to landowner.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412130045	April 27, 2012	Met with landowners and discussed transmission line and agreement. Landowners are open to a follow-up at a later date.
	May 14, 2012	Met with landowner and discussed transmission line. Landowner is concerned about the transmission route.
	May 24, 2012	Met with landowner and discussed participation. Landowner is neutral.
	June 4, 2012	Met with landowner and discussed transmission line. Landowner is not supportive.
	June 6, 2012	Met with landowner and discussed transmission line. Follow-up set for a later date.
	June 26, 2012	Met with landowner and discussed transmission line. Landowners are concerned about the opinion of family members.
	June 29, 2012	Delivered and information package to landowners.
	July 23, 2012	Met with landowners and discussed transmission route. Landowners are not in favor at this time.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 31, 2012	Met landowner and discussed transmission line and agreement. Landowners are not comfortable with the route but are open to discussion.
	September 17, 2012	Met landowners and discussed transmission line. Landowners are open to a follow-up.
	October 18, 2012	Met with landowner and discussed transmission line. Landowners have ongoing concerns about route but are open to discussion.
	October 22, 2012	Met with landowners and discussed their concerns. Landowners are concerned about the route.
	November 13, 2012	Met landowners and discussed their concerns. Landowners are not prepared to participate with the current agreement but are open to a follow-up.
412130032	June 29, 2012	Met with landowners and discussed transmission line and agreement. Landowners are interested in engineering and would like more information.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 13, 2012	Met with family member for landowner. Landowners unavailable at the this time.
	August 14, 2012	Met with landowner and discussed transmission line and agreement. Landowner is concerned about opinions of neighbors.
	September 13, 2012	Spoke with family member of landowner. Landowner is unavailable at this time. Set a follow-up for the next day.
	September 14, 2012	Met with landowners and discussed transmission line and agreement. Landowners are open to a follow-up meeting.
	October 10, 2012	Met with landowner and discussed transmission line and agreement. Landowner would like more time to consider the offer.
	November 12, 2012	Met with landowner who decided to sign the agreement.
412130033	April 25, 2012	Met with landowners and discussed transmission line and agreement. Landowners are concerned about potential effect on trees and health effects.
	July 4, 2012	Delivered information package to landowner. Landowners are divided in their opinions.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 13, 2012	Met with landowners and discussed transmission line and route. Landowners are concerned about potential effect on the property. Provided landowners with further information.
	August 20, 2012	Met with landowner and discussed transmission line. Landowner is open to a follow-up meeting.
	September 10, 2012	Met with landowner and discussed agreement and transmission line. Landowners would like to schedule an agreement presentation.
	September 11, 2012	Met with landowner and presented agreement. Landowners are concerned about trees.
	September 25, 2012	Met with landowners and reviewed their concerns. Landowner would like to discuss further with family.
	October 16, 2012	Met with landowners and discussed transmission line and agreement. Landowner had a request.
	November 26, 2012	Met landowners who's concerns remain the same despite our attempts to address them. They are open to follow-up visits.
412150056	October 25, 2011	Met with landowner and discussed transmission line and agreement. Landowner is concerned about the engineering, compensation and wind speeds.
	November 2, 2011	Met with landowner and discussed transmission line and agreement. Landowner is concerned about location of the infrastructure. Landowners would like to review the agreement.
	November 18, 2011	Met with landowner and presented agreement. Landowner is positive and would like to discuss further with neighbors.

	December 1, 2011	Met with landowner to discuss transmission line and upcoming public meeting.
	January 15, 2012	Met with landowners and discussed the agreement. Landowners decided to sign the agreement.
	February 9, 2012	Met with landowner to follow-up and discuss project.
	July 3, 2012	Delivered an information package to landowner. Landowner had questions about studies on the property.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	September 26, 2012	Met with landowner and discussed project progress. Landowner had concerns about studies taking place on the property.
412130017	March 27, 2012	Met with landowners and discussed transmission line and agreement. Landowners would like to review an agreement.
	April 25, 2012	Met landowners and set agreement presentation.
	April 27, 2012	Met landowners and presented agreement. Landowners decided to sign the agreement.
	July 3, 2012	Delivered information package to landowners.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412130012	April 25, 2012	Met with landowners family member. Family member will discuss with landowner.
	May 15, 2012	Met with landowner and discussed transmission line and agreement. Set and appointment to present the agreement.
	May 17, 2012	Met with landowners and presented the agreement. Landowner decided to sign the agreement.
	June 29, 2012	Spoke to landowners family member who requested I return at a later date.
	July 16, 2012	Met with landowner to follow-up. Landowner is happy with compensation.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412150032	October 20, 2011	Met with landowner and discussed transmission line and agreement. Landowner is concerned about timing of the project and aesthetics.
	October 25, 2011	Met with landowners and discussed transmission line and agreement. Landowners are concerned about possible effects on the property.
	November 3, 2011	Met with landowners and presented agreement. Landowners had some questions and would like to discuss further.
	November 4, 2011	Met with landowners to discuss further. Landowners decided to sign the agreement.
	May 1, 2012	Met with landowner and discussed location of the infrastructure. Landowners are satisfied with our communication.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412100033	January 23, 2012	Met with landowner and discussed transmission line and agreement. Landowner would like to review agreement.
	February 6, 2012	Met with landowner and presented agreement. Landowner would like to review further.
	February 27, 2012	Met with landowner who decided to sign the agreement.
	July 5, 2012	Met with landowner and delivered an information package.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412150031	October 17, 2011	Met with landowner and discussed transmission line and agreement. Landowner is concerned about location of infrastructure. Landowner is open to more information and would like to review agreement.
	October 31, 2011	Met with landowner who was not able to discuss in detail at the time but set a follow-up for the next day.
	November 1, 2011	Met with landowner and presented agreement. Landowner would like to discuss with family members and get legal review.
	November 14, 2011	Left phone message to schedule a follow-up.
	November 21, 2011	Spoke with landowners who is awaiting legal response. Landowner had concerns about potential effect on trees and transmission line.
	November 24, 2011	Left a phone message with landowner to follow up on concerns.
	November 30, 2011	Met with landowner and discussed transmission line. Landowners concerns remain unchanged. Landowner had questions about the transmission line.
	December 12, 2011	Met with landowner and discussed transmission line. Landowner is concerned about potential effects on property.
	December 22, 2011	Met with landowner to discuss participation in the project. Landowner is still considering our offer. Landowner is open to follow-up in the future.
	January 10, 2012	Left phone message to follow-up on previous discussion.
	January 16, 2012	Spoke with landowner who is concerned about potential effects on property.
	May 14, 2012	Met with landowners to discuss concerns. Proposed various ways to address their issues.
	May 26, 2012	Spoke with landowner briefly and set a follow-up for later in the week.
	May 28, 2012	Met with landowner and discussed agreement. Landowner is open to a follow-up.
	July 3, 2012	Delivered information package to landowner.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 14, 2012	Met with landowner and discussed transmission line and agreement. Landowner is concerned about potential effects on property.
	August 16, 2012	Left phone message to follow-up.
	August 21, 2012	Met with landowner and discussed agreement. Landowners concerns remain unchanged.
	August 23, 2012	Spoke with landowner and about concerns. Landowner is open to follow-up.
	September 7, 2012	Spoke with landowner to follow-up on concerns. Landowner would like to meet in person.
	September 25, 2012	Spoke with landowner and discussed agreement. Landowner is not interested in participating at this time but is open to further contact.
412150030	November 3, 2011	Met with manager of property. Discussed transmission line and agreement. Manager will review and forward agreement to landowner when prepared.
	November 9, 2011	Set a follow-up appointment with property manager.
	November 14, 2011	Met with property manager to present agreement. Manager is concerned about engineering and would like more information to send to landowner.
	November 24, 2011	Spoke with property manager who was not able to discuss at the time.
	December 15, 2011	Met with property manager and discussed landowners feelings on transmission line and agreement. Landowner had several request which we will consider.
	May 26, 2012	Left phone message to follow-up on previous negotiations.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	September 12, 2012	Met with property manager who is concerned about compensation. Landowner is not supportive of the project but is still open to considering participation.
	January 4, 2013	Spoke with property manager about transmission line. Landowner is not interested in participation and property manager had questions about communications received.
412100028	January 13, 2012	Met with landowner and discussed transmission line and agreement. Landowner is not interested in participation.
	February 12, 2012	Met with landowners and discussed transmission line and agreement. Landowners would like family members to be involved.

	February 25, 2012	Spoke with landowner to schedule a follow-up. Landowner agreed to discussing with family members.
	May 3, 2012	Met with landowners and discussed transmission line and agreement. Landowners are concerned about location of infrastructure and community opinion.
	May 11, 2012	Spoke with landowner about agreement. Landowner is open to further discussion. Follow-up set for next week.
	May 14, 2012	Met with landowners and discussed agreement and transmission line. They would like to discuss with family further.
	May 16, 2012	Met with landowners and discussed agreement. Landowners has some requests and requested we speak with family members.
	May 22, 2012	Met with landowners and discussed agreement. Landowners are concerned about opinions of family members but are satisfied with our attempts to address their concerns. They are open to a follow-up meeting.
	May 25, 2012	Spoke with landowner about agreement. Landowner had questions about a recent meeting which were addressed. We set a follow-up date.
	May 28, 2012	Met with landowners and discussed agreement. Landowners are concerned about opinion of family members. We discussed their concerns again.
	June 6, 2012	Met with landowners and reviewed the agreement. Landowners would like to continue considering offer.
	June 18, 2012	Met with landowners and reviewed agreement again. Landowners are still considering offer.
	June 29, 2012	Met with landowners and discussed participation in the project. Landowners hope to decide soon.
	June 29, 2012	Delivered information package to landowners.
	July 6, 2012	Spoke with landowner who's concerns remain unchanged. Landowner requested a follow-up at a later date.
	July 13, 2012	Met with landowner who is not decided on participation. Follow-up at a later date.
	July 30, 2012	Met with landowner and reviewed agreement. Landowners are not yet in agreement.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
	August 13, 2012	Met with landowners and discussed agreement and project. Landowner requested a follow-up at a later date.
	August 25, 2012	Met with landowners and discussed agreement and answered questions. Landowners have decided not to participate in the project.
	September 10, 2012	Met with landowners and discussed the agreement. Landowners are now amenable to participation and requested a follow-up in the future.
	December 3, 2012	Met with landowners and discussed agreement and transmission line. Landowners are concerned about possible effects on the property. The landowners decided to sign the agreement.
412150003	October 13, 2011	Met with landowner and discussed transmission line and agreement. Landowners are concerned about engineering and public input.
	October 17, 2011	Met with landowners to deliver agreement and discussed community opinion. Landowner requested a meeting on a different date.
	November 10, 2011	Met with landowners to deliver agreement and discussed community opinion. Landowners requested further time to continue reviewing and considering the agreement. Landowner is not supportive.
	November 21, 2011	Met with landowner and discussed transmission line. Landowner is not supportive.
	February 14, 2012	Landowner has concerns regarding the project. Addressed concerns during meeting.
	February 25, 2012	Met with landowner to discuss terms of the agreement and project. Landowner had concerns regarding project, addressed during meeting.
	April 27, 2012	Met with landowner to discuss terms of the agreement and project.
	May 3, 2012	Landowner expressed concerns regarding the project, addressed concerns during meeting. Landowner will review the agreement and follow up with questions.
	May 16, 2012	Met with landowner to discuss terms of the agreement and project. Landowner has concerns regarding project, addressed concerns during meeting.
	June 29, 2012	Delivered an information package to landowner. Content with additional information.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412090072	January 18, 2012	Met with landowner to discuss agreement and project.
	January 31, 2012	Contacted landowner to organize meeting to discuss agreement and project.
	February 6, 2012	Met with landowner to discuss terms of the agreement. Landowner had concerns regarding the project, addressed concerns during meeting.
	February 20, 2012	Met with landowner to discuss agreement and project. Landowner expressed some concerns over terms in the agreement.
	February 28, 2012	Met with landowner to discuss terms of the agreement and project. Landowner unavailable for a lengthy meeting.
	March 7, 2012	Met with landowner to discuss terms of the agreement and project.
	March 7, 2012	Landowner has concerns over terms in the agreement. Addressed all concerns during meeting.
	April 2, 2012	Met with landowner to discuss terms of the agreement and project.
	April 5, 2012	Met with landowner to discuss terms of the agreement. Landowners are content with the terms of the agreement.
	July 3, 2012	Delivered an information package to landowner.
	July 17, 2012	Met with landowner to discuss project permitting process.
	July 28, 2012	Met with landowner to discuss project permitting process.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412160050	October 20, 2011	Landowner was content to discuss the agreement and project. Has concerns over construction process and compensation. Addressed all concerns during meeting.
	November 17, 2011	Met with landowner to discuss terms of the agreement. Landowners are content with the terms of the agreement.
	November 24, 2011	Met with landowner to discuss terms of the agreement and project.
	November 28, 2011	Met with landowner to schedule a meeting to review terms of the agreement.
	December 1, 2011	Met with landowner to discuss project.
	January 12, 2012	Met with landowner to discuss terms of the agreement. Landowners are content with the terms of the agreement.
	July 3, 2012	Delivered an information package to landowner. Landowner supportive of project.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412090079	January 6, 2012	Met with landowner to discuss terms of the agreement and project.
	January 9, 2012	Met with landowner to discuss terms of the agreement. Landowners are content with the terms of the agreement.
	June 29, 2012	Delivered an information package to landowner. Landowner supportive of project.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412160031	February 6, 2012	Met with landowner to discuss terms of the agreement and project.
	April 2, 2012	Met with landowner to discuss terms of the agreement.
	July 3, 2012	Delivered an information package to landowner.

	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412090051	April 11, 2012	Met with landowner to discuss agreement. Landowner content with their terms.
	May 26, 2012	Met with landowner to discuss agreement and project.
	May 28, 2012	Met with landowner to discuss agreement. Content with terms.
	June 29, 2012	Delivered an information package to landowner. Landowner supportive of project.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.
412160020	November 29, 2011	Met with landowner to discuss terms of the agreement and project.
	November 30, 2011	Landowner had no concerns regarding the agreement or proposed transmission line.
	December 9, 2011	Met with landowner to discuss terms of the agreement. Landowners are content with the terms of the agreement.
	June 29, 2012	Delivered an information package to landowner. Landowner supportive of project.
	July 31, 2012	Letter sent addressing concerns gathered from the community at the Bluewater Open House and during consultation meetings since May 2012.

Schedule 5

July 31, 2012

Landowner Name
Landowner Address

Re:

Dear Sir and Madam:

NextEra Energy Canada, ULC (NextEra) is pursuing the development of an overhead transmission line in the Municipalities of Bluewater and Huron East, ON associated with the proposed Bluewater Wind Energy Centre in the Municipality of Bluewater. Members of the community have expressed concern about stray voltage from this new transmission line and potential effects on their dairy and agricultural businesses. NextEra takes its responsibility to protect neighbours and local industry very seriously and intends to continue to communicate with the community throughout this process. We have attempted to address concerns regarding stray voltage within this letter.

Transmission vs. Distribution

Transmission lines take high-voltage power from generators (such as wind farms) and transmit the power to various substations on the electric system. These lines enable the efficient transmission of large amounts of power over long distances, minimizing the amount of power lost during transportation. Once at a distribution substation, the power is converted to a lower voltage for use by the distribution system. Distribution lines take this lower-voltage power from distribution substations and distribute it to homes and businesses. The addition of a transmission line does not have a direct effect on the power being distributed to local communities through the distribution system.

What is stray voltage?

Stray voltage can result from the normal delivery and/or use of electricity - usually smaller than 10 volts - that may be present between two conductive surfaces. Stray voltage is related to power system faults and is generally not considered hazardous. Wind turbines are not the root of the problem, but the addition of this or any other generation source may expose faults in that system. All types of generation, including wind generation, must fully comply with utility requirements to ensure that the electricity they supply is compliant with grid standards.

Much has been researched and written about stray voltage and the importance of minimizing its potential impact in order to protect animals and nearby dairy operations. Literature and research findings on the impact of stray voltage on farm operations helped to shape the Ontario Energy Board (OEB) Distribution System Code which defines stray voltage, discusses off-farm and on-farm sources, and provides a set of guidelines for local distribution companies should a landowner raise a concern over potential stray voltage. These are mandatory requirements of all local distribution companies, like Hydro One in your neighbourhood.

Proposed transmission line

The proposed transmission line in Bluewater and Huron East is not connected to the distribution system and thus, should not impact stray voltage at your farms or your neighbours' farms. Regardless, NextEra is committed to working with local landowners as well as regulatory bodies throughout the development of this line to ensure that the proposed infrastructure will not negatively affect local agriculture or dairy businesses in any manner. NextEra will (in collaboration with HONI) test for stray voltage prior to transmission line construction if desired by a nearby landowner. Mitigation strategies will be provided should stray voltage be attributed to our transmission line once in operation. An example of a proven mitigation strategy which could be utilized is the installation of a neutral 'decoupling' device at the affected recipient's service transformer to help control the localized voltages. Approved testing procedures for stray voltage can be found in Appendix H of the OEB Distribution System Code located at www.ontarioenergyboard.ca/OEB.

How is NextEra minimizing the risk of stray voltage?

NextEra Energy Canada will adopt industry best practices at all times to minimize the risk of stray voltage and ensure our projects are built and maintained within acceptable levels as prescribed by the local safety code. We are actively meeting with landowners to discuss our development and are conducting feasibility analyses to determine a viable transmission line route. Concurrently, NextEra developers and engineers are working with transmission experts, local engineers, and Hydro One in their capacity as the local distribution company to ensure that the line would be properly constructed and operated in accordance with all applicable electrical codes.

In Ontario, stray voltage and other potential issues arising from the development and operation of an electrical line are overseen by many regulatory agencies including the Ontario Energy Board (OEB), North American Electric Reliability Council (NERC), the Independent Electricity System Operator (IESO), and the Electrical Safety Authority. Each entity sets requirements which a distribution or transmission company must adhere to when developing and operating infrastructure. It is important to note that within Ontario, the OEB distinguishes between a transmitter and a distributor of electricity. A Transmitter provides service to large customers (over 50 kilovolts), while a distributor provides service to smaller customers, such as homes, farms and retail stores. NextEra's proposed transmission line falls under the transmitter category and would be required to adhere to the OEB requirements of the transmission system, as opposed to the requirements of the distribution system.

NextEra is committed to working with the community as this project progresses and we welcome your thoughts and comments. Attached for your reference are two items: A) Fact Sheet from Hydro one discussing what stray voltage is, its causes, and what you should do if you think you have a stray voltage problem; and B) Appendix H to the Ontario Energy Board Distribution

System Code – Farm Stray Voltage Distributor Investigation Procedure which provides a detailed description of how a distributor tests for stray voltage. More information including research on stray voltage is available and can be provided upon request. Should you have questions or wish to further discuss, please do not hesitate to contact NextEra at 519-318-0237 or email me at Derek.dudek@nee.com.

Yours truly,

Derek Dudek
NextEra Energy Canada, ULC

World Health Organization

What are electromagnetic fields?

Definitions and sources

Electric fields are created by differences in voltage: the higher the voltage, the stronger will be the resultant field. **Magnetic fields** are created when electric current flows: the greater the current, the stronger the magnetic field. An electric field will exist even when there is no current flowing. If current does flow, the strength of the magnetic field will vary with power consumption but the electric field strength will be constant.
(Extract from **Electromagnetic fields** published by the WHO Regional Office for Europe in 1999 (Local authorities, health and environment briefing pamphlet series; 32).

Natural sources of electromagnetic fields

Electromagnetic fields are present everywhere in our environment but are invisible to the human eye. Electric fields are produced by the local build-up of electric charges in the atmosphere associated with thunderstorms. The earth's magnetic field causes a compass needle to orient in a North-South direction and is used by birds and fish for navigation.

Human-made sources of electromagnetic fields

Besides natural sources the electromagnetic spectrum also includes fields generated by human-made sources: X-rays are employed to diagnose a broken limb after a sport accident. The electricity that comes out of every power socket has associated low frequency electromagnetic fields. And various kinds of higher frequency radiowaves are used to transmit information – whether via TV antennas, radio stations or mobile phone base stations.

The basics of wavelength and frequency

What makes the various forms of electromagnetic fields so different?
One of the main characteristics which defines an electromagnetic field (EMF) is its frequency or its corresponding wavelength. Fields of different frequencies interact with the body in different ways. One can imagine electromagnetic waves as series of very regular waves that travel at an enormous speed, the speed of light. The frequency simply describes the number of oscillations or cycles per second, while the term wavelength describes the distance between one wave and the next. Hence wavelength and frequency are inseparably intertwined: the higher the frequency the shorter the wavelength.

A simple analogy should help to illustrate the concept: Tie a long rope to a door handle and keep hold of the free end. Moving it up and then down slowly will generate a single big wave; more rapid motion will generate a whole series of small waves. The length of the rope remains constant, therefore, the more waves you generate (higher frequency) the smaller will be the distance between them (shorter wavelength).

What is the difference between non-ionizing electromagnetic fields and ionising radiation?
Wavelength and frequency determine another important characteristic of electromagnetic fields: Electromagnetic waves are carried by particles called quanta. Quanta of higher frequency (shorter wavelength) waves carry more energy than lower frequency (longer wavelength) fields. Some electromagnetic waves carry so much energy per quantum that they have the ability to break bonds between molecules. In the electromagnetic spectrum, gamma rays given off by radioactive materials, cosmic rays and X-rays carry this property and are called 'ionizing radiation'. Fields whose quanta are insufficient to break molecular bonds are called 'non-ionizing radiation'. Man-made sources of electromagnetic fields that form a major part of industrialized life - electricity, microwaves and radiofrequency fields – are found at the relatively long wavelength and low frequency end of the electromagnetic spectrum and their quanta are unable to break chemical bonds.

Electromagnetic fields at low frequencies

Electric fields exist whenever a positive or negative electrical charge is present. They exert forces on other charges within the field. The strength of the electric field is measured in volts per metre (V/m). Any electrical wire that is charged will produce an associated electric field. This field exists even when there is no current flowing. The higher the voltage, the stronger the electric field at a given distance from the wire.

Electric fields are strongest close to a charge or charged conductor, and their strength rapidly diminishes with distance from it. Conductors such as metal shield them very effectively. Other materials, such as building materials and trees, provide some shielding capability. Therefore, the electric fields from power lines outside the house are reduced by walls, buildings, and trees. When power lines are buried in the ground, the electric fields at the surface are hardly detectable.

Magnetic fields arise from the motion of electric charges. The strength of the magnetic field is measured in amperes per meter (A/m); more commonly in electromagnetic field research, scientists specify a related quantity, the flux density (in microtesla, μT) instead. In contrast to electric fields, a magnetic field is only produced once a device is switched on and current flows. The higher the current, the greater the strength of the magnetic field.

Like electric fields, magnetic fields are strongest close to their origin and rapidly decrease at greater distances from the source. Magnetic fields are not blocked by common materials such as the walls of buildings.

Electric fields	**Magnetic fields**
1. Electric fields arise from voltage. 2. Their strength is measured in Volts per metre (V/m) 3. An electric field can be present even when a device is switched off. 4. Field strength decreases with distance from the source. 5. Most building materials shield electric fields to some extent.	1. Magnetic fields arise from current flows. 2. Their strength is measured in amperes per meter (A/m). Commonly, EMF investigators use a related measure, flux density (in microtesla (μT) or millitesla (mT) instead. 3. Magnetic fields exist as soon as a device is switched on and current flows. 4. Field strength decreases with distance from the source. 5. Magnetic fields are not attenuated by most materials.

Electric fields
Plugging a wire into an outlet creates electric fields in the air surrounding the appliance. The higher the voltage the stronger the field produced. Since the voltage can exist even when no current is flowing, the appliance does not have to be turned on for an electric field to exist in the room surrounding it.

Magnetic fields
Magnetic fields are created only when the electric current flows. Magnetic fields and electric fields then exist together in the room environment. The greater the current the stronger the magnetic field. High voltages are used for the transmission and distribution of electricity whereas relatively low voltages are used in the home. The voltages used by power transmission equipment vary little from day to day, currents through a transmission line vary with power consumption.

Electric fields around the wire to an appliance only cease to exist when the appliance is unplugged or switched off at the wall. They will still exist around the cable behind the wall.

How do static fields differ from time-varying fields?
A static field does not vary over time. A direct current (DC) is an electric current flowing in one direction only. In any battery-powered appliance the current flows from the battery to the appliance and then back to the battery. It will create a static magnetic field. The earth's magnetic field is also a static field. So is the magnetic field around a bar magnet which can be visualized by observing the pattern that is formed when iron filings are sprinkled around it.

In contrast, time-varying electromagnetic fields are produced by alternating currents (AC). Alternating currents reverse their direction

at regular intervals. In most European countries electricity changes direction with a frequency of 50 cycles per second or 50 Hertz. Equally, the associated electromagnetic field changes its orientation 50 times every second. North American electricity has a frequency of 60 Hertz.

What are the main sources of low, intermediate and high frequency fields?

The time-varying electromagnetic fields produced by electrical appliances are an example of **extremely low frequency (ELF) fields.** ELF fields generally have frequencies up to 300 Hz. Other technologies produce **intermediate frequency (IF) fields** with frequencies from 300 Hz to 10 MHz and **radiofrequency (RF) fields** with frequencies of 10 MHz to 300 GHz. The effects of electromagnetic fields on the human body depend not only on their field level but on their frequency and energy. Our electricity power supply and all appliances using electricity are the main sources of ELF fields; computer screens, anti-theft devices and security systems are the main sources of IF fields; and radio, television, radar and cellular telephone antennas, and microwave ovens are the main sources of RF fields. These fields induce currents within the human body, which if sufficient can produce a range of effects such as heating and electrical shock, depending on their amplitude and frequency range. (However, to produce such effects, the fields outside the body would have to be very strong, far stronger than present in normal environments.)

Electromagnetic fields at high frequencies

Mobile telephones, television and radio transmitters and radar produce RF fields. These fields are used to transmit information over long distances and form the basis of telecommunications as well as radio and television broadcasting all over the world. Microwaves are RF fields at high frequencies in the GHz range. In microwaves ovens, we use them to quickly heat food.

At radio frequencies, electric and magnetic fields are closely interrelated and we typically measure their levels as power densities in watts per square metre (W/m^2).

Key points:

1. The electromagnetic spectrum encompasses both natural and human-made sources of electromagnetic fields.
2. Frequency and wavelength characterise an electromagnetic field. In an electromagnetic wave, these two characteristics are directly related to each other: the higher the frequency the shorter the wavelength.
3. Ionizing radiation such as X-ray and gamma-rays consists of photons which carry sufficient energy to break molecular bonds. Photons of electromagnetic waves at power and radio frequencies have much lower energy that do not have this ability.
4. Electric fields exist whenever charge is present and are measured in volts per metre (V/m). Magnetic fields arise from current flow. Their flux densities are measured in microtesla (μT) or millitesla (mT).
5. At radio and microwave frequencies, electric and magnetic fields are considered together as the two components of an electromagnetic wave. Power density, measured in watts per square metre (W/m^2), describes the intensity of these fields.
6. Low frequency and high frequency electromagnetic waves affect the human body in different ways.
7. Electrical power supplies and appliances are the most common sources of low frequency electric and magnetic fields in our living environment. Everyday sources of radiofrequency electromagnetic fields are telecommunications, broadcasting antennas and microwave ovens.

Summary of health effects

What happens when you are exposed to electromagnetic fields?

Exposure to electromagnetic fields is not a new phenomenon. However, during the 20th century, environmental exposure to man-made electromagnetic fields has been steadily increasing as growing electricity demand, ever-advancing technologies and changes in social behaviour have created more and more artificial sources. Everyone is exposed to a complex mix of weak electric and magnetic fields, both at home and at work, from the generation and transmission of electricity, domestic appliances and industrial equipment, to telecommunications and broadcasting.

Tiny electrical currents exist in the human body due to the chemical reactions that occur as part of the normal bodily functions, even in the absence of external electric fields. For example, nerves relay signals by transmitting electric impulses. Most biochemical reactions from digestion to brain activities go along with the rearrangement of charged particles. Even the heart is electrically active - an activity that your doctor can trace with the help of an electrocardiogram.

Low-frequency electric fields influence the human body just as they influence any other material made up of charged particles. When electric fields act on conductive materials, they influence the distribution of electric charges at their surface. They cause current to flow through the body to the ground.

Low-frequency magnetic fields induce circulating currents within the human body. The strength of these currents depends on the intensity of the outside magnetic field. If sufficiently large, these currents could cause stimulation of nerves and muscles or affect other biological processes.

Both electric and magnetic fields induce voltages and currents in the body but even directly beneath a high voltage transmission line, the induced currents are very small compared to thresholds for producing shock and other electrical effects.

Heating is the main biological effect of the electromagnetic fields of radiofrequency fields. In microwave ovens this fact is employed to warm up food. The levels of radiofrequency fields to which people are normally exposed are very much lower than those needed to produce significant heating. The heating effect of radiowaves forms the underlying basis for current guidelines. Scientists are also investigating the possibility that effects below the threshold level for body heating occur as a result of long-term exposure. To date, no adverse health effects from low level, long-term exposure to radiofrequency or power frequency fields have been confirmed, but scientists are actively continuing to research this area.

Biological effects or health effects? What is a health hazard?

Biological effects are measurable responses to a stimulus or to a change in the environment. These changes are not necessarily harmful to your health. For example, listening to music, reading a book, eating an apple or playing tennis will produce a range of biological effects. Nevertheless, none of these activities is expected to cause health effects. The body has sophisticated mechanisms to adjust to the many and varied influences we encounter in our environment. Ongoing change forms a normal part of our lives. But, of course, the body does not possess adequate compensation mechanisms for all biological effects. Changes that are irreversible and stress the system for long periods of time may constitute a health hazard.

An adverse health effect causes detectable impairment of the health of the exposed individual or of his or her offspring; a biological effect, on the other hand, may or may not result in an adverse health effect.

It is not disputed that electromagnetic fields above certain levels can trigger biological effects. Experiments with healthy volunteers indicate that short-term exposure at the levels present in the environment or in the home do not cause any apparent detrimental effects. Exposures to higher levels that might be harmful are restricted by national and international guidelines. The current debate is centred on whether long-term low level exposure can evoke biological responses and influence people's well being.

Widespread concerns for health

A look at the news headlines of recent years allows some insight into the various areas of public concern. Over the course of the past decade, numerous electromagnetic field sources have become the focus of health concerns, including power lines, microwave ovens, computer and TV screens, security devices, radars and most recently mobile phones and their base stations.

The International EMF Project

In response to growing public health concerns over possible health effects from exposure to an ever increasing number and diversity of electromagnetic field sources, in 1996 the World Health Organization (WHO) launched a large, multidisciplinary research effort. The International EMF Project brings together current knowledge and available resources of key international and national agencies and scientific institutions.

Conclusions from scientific research
In the area of biological effects and medical applications of non-ionizing radiation approximately 25,000 articles have been published over the past 30 years. Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields. However, some gaps in knowledge about biological effects exist and need further research.

Effects on general health
Some members of the public have attributed a diffuse collection of symptoms to low levels of exposure to electromagnetic fields at home. Reported symptoms include headaches, anxiety, suicide and depression, nausea, fatigue and loss of libido. To date, scientific evidence does not support a link between these symptoms and exposure to electromagnetic fields. At least some of these health problems may be caused by noise or other factors in the environment, or by anxiety related to the presence of new technologies.

Effects on pregnancy outcome
Many different sources and exposures to electromagnetic fields in the living and working environment, including computer screens, water beds and electric blankets, radiofrequency welding machines, diathermy equipment and radar, have been evaluated by the WHO

and other organizations. The overall weight of evidence shows that exposure to fields at typical environmental levels does not increase the risk of any adverse outcome such as spontaneous abortions, malformations, low birth weight, and congenital diseases. There have been occasional reports of associations between health problems and presumed exposure to electromagnetic fields, such as reports of prematurity and low birth weight in children of workers in the electronics industry, but these have not been regarded by the scientific community as being necessarily caused by the field exposures (as opposed to factors such as exposure to solvents).

Cataracts
General eye irritation and cataracts have sometimes been reported in workers exposed to high levels of radiofrequency and microwave radiation, but animal studies do not support the idea that such forms of eye damage can be produced at levels that are not thermally hazardous. There is no evidence that these effects occur at levels experienced by the general public.

Electromagnetic fields and cancer
Despite many studies, the evidence for any effect remains highly controversial. However, it is clear that if electromagnetic fields do have an effect on cancer, then any increase in risk will be extremely small. The results to date contain many inconsistencies, but no large increases in risk have been found for any cancer in children or adults.

A number of epidemiological studies suggest small increases in risk of childhood leukemia with exposure to low frequency magnetic fields in the home. However, scientists have not generally concluded that these results indicate a cause-effect relation between exposure to the fields and disease (as opposed to artifacts in the study or effects unrelated to field exposure). In part, this conclusion has been reached because animal and laboratory studies fail to demonstrate any reproducible effects that are consistent with the hypothesis that fields cause or promote cancer. Large-scale studies are currently underway in several countries and may help resolve these issues.

Electromagnetic hypersensitivity and depression
Some individuals report "hypersensitivity" to electric or magnetic fields. They ask whether aches and pains, headaches, depression, lethargy, sleeping disorders, and even convulsions and epileptic seizures could be associated with electromagnetic field exposure.

There is little scientific evidence to support the idea of electromagnetic hypersensitivity. Recent Scandinavian studies found that individuals do not show consistent reactions under properly controlled conditions of electromagnetic field exposure. Nor is there any accepted biological mechanism to explain hypersensitivity. Research on this subject is difficult because many other subjective responses may be involved, apart from direct effects of fields themselves. More studies are continuing on the subject.

The focus of current and future research
Much effort is currently being directed towards the study of electromagnetic fields in relation to cancer. Studies in search for possible carcinogenic (cancer-producing) effects of power frequency fields is continuing, although at a reduced level compared to that of the late 1990's.

The long-term health effects of mobile telephone use is another topic of much current research. No obvious adverse effect of exposure to low level radiofrequency fields has been discovered. However, given public concerns regarding the safety of cellular telephones, further research aims to determine whether any less obvious effects might occur at very low exposure levels.

Key points

1. A wide range of environmental influences causes biological effects. 'Biological effect' does not equal 'health hazard'. Special research is needed to identify and measure health hazards.
2. At low frequencies, external electric and magnetic fields induce small circulating currents within the body. In virtually all ordinary environments, the levels of induced currents inside the body are too small to produce obvious effects.
3. The main effect of radiofrequency electromagnetic fields is heating of body tissues.
4. There is no doubt that short-term exposure to very high levels of electromagnetic fields can be harmful to health. Current public concern focuses on possible long-term health effects caused by exposure to electromagnetic fields at levels below those required to trigger acute biological responses.
5. WHO's International EMF Project was launched to provide scientifically sound and objective answers to public concerns about possible hazards of low level electromagnetic fields.
6. Despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health.
7. The focus of international research is the investigation of possible links between cancer and electromagnetic fields, at power line and radiofrequencies.

Progress in research

If electromagnetic fields constitute a health hazard, there will be consequences in all industrialized countries. The public demands concrete answers to the ever more pressing question, whether everyday electromagnetic fields cause adverse health effects. The media often seem to have definitive answers. However, one should judge these reports with caution and take into account that the primary interest of the media is not education. A journalist may select and report a story driven by a range of non-technical reasons: journalists compete with one another for time and space and different journals and newspapers compete for circulation numbers. Novel sensational headlines that are relevant to as many people as possible aid them in achieving these goals - bad news is not only the big news, it is often the only news we hear. The large number of studies which suggest that electromagnetic fields are harmless receive little if any coverage. Science cannot provide a guarantee of absolute safety yet but the development of research is reassuring overall.

Different types of studies are needed

A mix of studies in different research areas is essential for the evaluation of a potential adverse health effect of electromagnetic fields. Different types of studies investigate distinct aspects of the problem. Laboratory studies on cells aim to elucidate the fundamental underlying mechanisms that link electromagnetic field exposure to biological effects. They try to identify mechanisms based on molecular or cellular changes that are brought about by the electromagnetic field - such a change would provide clues to how a physical force is converted into a biological action within the body. In these studies, single cells or tissues are removed from their normal living environment which may inactivate possible compensation mechanisms.

Another type of study, involving animals, is more closely related to real life situations. These studies provide evidence that is more directly relevant to establishing safe exposure levels in humans and often employ several different field levels to investigate dose-response relationships.

Epidemiological studies or human health studies are another direct source of information on long-term effects of exposure. These studies investigate the cause and distribution of diseases in real life situations, in communities and occupational groups. Researchers try to establish if there is a statistical association between exposure to electromagnetic fields and the incidence of a specific disease or adverse health effect. However, epidemiological studies are costly. More importantly, they involve measurements on very complex human populations and are difficult to control sufficiently well to detect small effects. For these reasons, scientists evaluate all relevant evidence when deciding about potential health hazards, including epidemiology, animal, and cellular studies.

Interpretation of epidemiological studies

Epidemiological studies alone typically cannot establish a clear cause and effect relationship, mainly because they detect only statistical associations between exposure and disease, which may or may not be caused by the exposure. Imagine a hypothetical study showing a link between electromagnetic field exposure in electrical workers of the company "X-Electricity" and an increased risk of cancer. Even if a statistical association is observed, it could also be due to incomplete data on other factors in the workplace. For example, electrical workers may have been exposed to chemical solvents with the potential to cause cancer. Moreover, an observed statistical association may be due only to statistical effects, or the study itself may have suffered from some problem with its design.

Therefore, finding an association between some agent and a specific disease does not necessarily mean that the agent caused the disease. Establishing causality requires that an investigator consider many factors. The case for a cause-and-effect link is strengthened if there is a consistent and strong association between exposure and effect, a clear dose-response relationship, a credible biological explanation, support provided by relevant animal studies, and above all consistency between studies. These factors have generally been absent in studies involving electromagnetic fields and cancer. This is one of the strongest reasons why scientists have generally been reluctant to conclude that weak electromagnetic fields have health effects.

Difficulties in ruling out the possibility of very small risks

"The absence of evidence of detrimental effects does not seem to suffice in modern society. The evidence of their absence is demanded more and more instead". (Barnabas Kunsch, Austrian Research Centre Seibersdorf)

"There is no convincing evidence for an adverse health effect of electromagnetic fields" or "A cause-effect link between electromagnetic fields and cancer has not been confirmed" are typical of the conclusions that have been reached by expert committees that have examined the issue. This sounds as if science wanted to avoid giving an answer. Then why should research continue if scientists have already shown that there is no effect?

The answer is simple: Human health studies are very good at identifying large effects, such as a connection between smoking and cancer. Unfortunately, they are less able to distinguish a small effect from no effect at all. If electromagnetic fields at typical environmental levels were strong carcinogens, then it would have been easy to have shown that by now. By contrast, if low level electromagnetic fields are a weak carcinogen, or even a strong carcinogen to a small group of people in the larger population, that

would be far more difficult to demonstrate. In fact, even if a large study shows no association we can never be entirely sure that there is no relationship. The absence of an effect could mean that there really is none. But just as well it could mean that the effect is simply undetectable with our method of measurement. Therefore, negative results are generally less convincing than strong positive ones.

The most difficult situation of all, which unfortunately has developed with epidemiology studies involving electromagnetic fields, is a collection of studies with weak positive results, which however are inconsistent among each other. In that situation, scientists themselves are likely to be divided about the significance of the data. However, for the reasons explained above, most scientists and clinicians agree that any health effects of low level electromagnetic fields, if they exist at all, are likely to be very small compared to other health risks that people face in everyday life.

What's in the future?

The main aim of WHO's International EMF Project is to initiate and co-ordinate research worldwide to produce a well-founded response to public concerns. This evaluation will integrate results from cellular, animal and human health studies to allow as comprehensive a health risk assessment as possible. A holistic assessment of a variety of relevant and reliable studies will provide the most reliable answer possible about the adverse health effects, if any exist, of long term exposure to weak electromagnetic fields.

One way to illustrate the necessity of evidence from different types of experiments is a crossword. To be able to read the given crossword's solution with absolute **CERTAINTY** nine questions must be answered. Assuming we can only answer three of these, we might be able to guess the solution. However, the three given letters may also be part of a very different word. Every additional answer will increase our own confidence. In fact, science will probably never be able to answer all questions, but the more solid evidence we collect the better will be our guess at the solution.

Key points

1. Laboratory studies on cells aim to determine if there is a mechanism by which electromagnetic field exposure could cause harmful biological effects. Animal studies are essential for establishing effects in higher organisms whose physiology resembles that of humans to a degree. Epidemiological studies look for statistical associations between field exposure and the incidence of specific adverse health outcomes in humans.
2. Finding a statistical association between some agent and a specific disease does not mean that the agent caused the disease.
3. The absence of health effects could mean that there really are none; however, it could also signify that an existing effect is undetectable with present methods.
4. Results of diverse studies (cellular, animal, and epidemiology) must be considered together before drawing conclusions about possible health risks of a suspected environmental hazard. Consistent evidence from these very different types of studies increases the degree of certainty about a true effect

Typical exposure levels at home and in the environment

Electromagnetic fields at home

Background electromagnetic field levels from electricity transmission and distribution facilities
Electricity is transmitted over long distances via high voltage power lines. Transformers reduce these high voltages for local distribution to homes and businesses. Electricity transmission and distribution facilities and residential wiring and appliances account for the background level of power frequency electric and magnetic fields in the home. In homes not located near power lines this background field may be up to about 0.2 μT. Directly beneath power lines the fields are much stronger. Magnetic flux densities at ground level can range up to several μT. Electric field levels underneath power lines can be as high as 10 kV/m. However, the fields (both electric and magnetic) drop off with distance from the lines. At 50 m to 100 m distance the fields are normally at levels that are found in areas away from high voltage power lines. In addition, house walls substantially reduce the electric field levels from those found at similar locations outside the house.

Electric appliances in the household
The strongest power frequency electric fields that are ordinarily encountered in the environment exist beneath high voltage transmission lines. In contrast, the strongest magnetic fields at power frequency are normally found very close to motors and other electrical appliances, as well as in specialized equipment such as magnetic resonance scanners used for medical imaging.

Typical electric field strengths measured near household appliances

(at a distance of 30 cm)
(From: Federal Office for Radiation Safety, Germany 1999)

Electric appliance	Electric field strength (V/m)
Stereo receiver	180
Iron	120
Refrigerator	120
Mixer	100
Toaster	80
Hair dryer	80
Colour TV	60
Coffee machine	60
Vacuum cleaner	50
Electric oven	8
Light bulb	5
Guideline limit value	**5000**

Many people are surprised when they become aware of the variety of magnetic field levels found near various appliances. The field strength does not depend on how large, complex, powerful or noisy the device is. Furthermore, even between apparently similar devices, the strength of the magnetic field may vary a lot. For example, while some hair dryers are surrounded by a very strong field, others hardly produce any magnetic field at all. These differences in magnetic field strength are related to product design. The following table shows typical values for a number of electrical devices commonly found in homes and workplaces. The measurements were taken in Germany and all of the appliances operate on electricity at a frequency of 50 Hz. It should be noted that the actual exposure levels vary considerably depending on the model of appliance and distance from it.

Typical magnetic field strength of household appliances at various distances

Electric appliance	3 cm distance (µT)	30 cm distance (µT)	1 m distance (µT)
Hair dryer	**6 – 2000**	0.01 – 7	0.01 – 0.03
Electric shaver	**15 – 1500**	0.08 – 9	0.01 – 0.03
Vacuum cleaner	200 – 800	**2 – 20**	0.13 – 2

Fluorescent light	40 – 400	**0.5 – 2**	0.02 – 0.25
Microwave oven	73 – 200	**4 – 8**	0.25 – 0.6
Portable radio	16 – 56	**1**	< 0.01
Electric oven	1 – 50	**0.15 – 0.5**	0.01 – 0.04
Washing machine	0.8 – 50	**0.15 – 3**	0.01 – 0.15
Iron	8 – 30	**0.12 – 0.3**	0.01 – 0.03
Dishwasher	3.5 – 20	**0.6 – 3**	0.07 – 0.3
Computer	0.5 – 30	**< 0.01**	
Refrigerator	0.5 – 1.7	**0.01 – 0.25**	<0.01
Colour TV	2.5 - 50	0.04 – 2	**0.01 – 0.15**
With most household appliances the magnetic field strength at a distance of 30 cm is well below the guideline limit for the general public of 100 μT.			

(Source: Federal Office for Radiation Safety, Germany 1999) Normal operating distance is given in bold

The table illustrates two main points: First, the magnetic field strength around all appliances rapidly decreases the further you get away from them. Secondly, most household appliances are not operated very close to the body. At a distance of 30 cm the magnetic fields surrounding most household appliances are more than 100 times lower than the given guideline limit of 100 μT at 50 Hz (83 μT at 60 Hz) for the general public.

Television sets and computer screens

Computer screens and television sets work on similar principles. Both produce static electric fields and alternating electric and magnetic fields at various frequencies. However, screens with liquid crystal displays used in some laptop computers and desktop units do not give rise to significant electric and magnetic fields. Modern computers have conductive screens which reduce the static field from the screen to a level similar to that of the normal background in the home or workplace. At the position of operators (30 to 50 cm from the screen), alternating magnetic fields are typically below 0.7 μT in flux density (at power frequencies). Alternating electric field strengths at operator positions range from below 1 V/m up to 10 V/m.

Microwave ovens
Domestic microwave ovens operate at very high power levels. However, effective shielding reduces leakage outside the ovens to almost non-detectable levels. Furthermore microwave leakage falls very rapidly with increasing distance from the oven. Many countries have manufacturing standards that specify maximum leakage levels for new ovens; an oven that meets the manufacturing standards will not present any hazard to the consumer.

Portable telephones
Portable telephones operate at much lower intensities than mobile phones. This is because they are employed very close to their home base station, and so do not need strong fields to transmit over long distances. As a consequence, the radiofrequency fields that surround these devices are negligible.

Electromagnetic fields in the environment

Radar
Radars are used for navigation, weather forecasting, and military applications, as well as a variety of other functions. They emit pulsed microwave signals. The peak power in the pulse can be high even though the average power may be low. Many radars rotate or move up and down; this reduces the mean power density to which the public is exposed in the vicinity of radars. Even high power, non-rotating military radars limit exposures to below guideline levels at locations of public access.

Security systems
Anti-theft systems in shops use tags that are detected by electrical coils at the exits. When a purchase is made the tags are removed or permanently deactivated. The electromagnetic fields from the coils do not generally exceed exposure guideline levels. Access control systems work in the same way with the tag incorporated into a key ring or identity card. Library security systems use tags that can be deactivated when a book is borrowed and reactivated when it is returned. Metal detectors and airport security systems set up a strong magnetic field of up to 100 μT that is disturbed by the presence of a metal object. Close to the frame of the detector, magnetic field strengths may approach and occasionally exceed guideline levels. However, this does not constitute a health hazard, as will be discussed in the section on guidelines. (see Are exposures above the guidelines harmful?)

Electric trains and trams
Long-distance trains have one or more engine cars that are separate from the passenger cars. Thus passenger exposure comes mainly from the electricity supply to the train. Magnetic fields in the passenger cars of long-distance trains can be several hundred μT near the floor, with lower values (tens of μT) elsewhere in the compartment. Electric field strengths may reach 300 V/m. People living in the vicinity of railway lines may encounter magnetic fields from the overhead supply which, depending on the country, may be comparable to the fields produced by high-voltage power lines.

Motors and traction equipment of trains and trams are normally located underneath the floors of passenger cars. At floor level, magnetic field intensities may amount to tens of μT in regions of the floor just above the motor. The fields fall off quickly with distance from the floor, and exposure of the upper bodies of passengers is much lower.

TV and radio
When choosing a radio station on your stereo at home, have you ever wondered what the familiar abbreviations AM and FM stand for? Radio signals are described as amplitude-modulated (AM) or frequency-modulated (FM) depending on the way in which they carry information. AM radio signals can be used for broadcasting over very long distances whereas FM waves cover more localized areas but can give a better sound quality.

AM radio signals are transmitted via large arrays of antennas, which can be tens of metres high, on sites which are off-limits to the public. Exposures very close to antennas and feed cables can be high, but these would affect maintenance workers rather than the general public.

TV and FM radio antennas are much smaller than AM radio antennas and are mounted in arrays at the top of high towers. The towers themselves serve only as supporting structures. As exposures near the foot of these towers are below guideline limits, public access to these areas may be possible. Small local TV and radio antennas are sometimes mounted on the top of buildings; if this is the case it may be necessary to control access to the roof.

Mobile phones and their base stations
Mobile phones allow people to be within reach at all times. These low-power radiowave devices transmit and receive signals from a network of fixed low power base stations. Each base station provides coverage to a given area. Depending on the number of calls being handled, base stations may be from only a few hundred metres apart in major cities to several kilometres apart in rural areas.

Mobile phone base stations are usually mounted on the tops of buildings or on towers at heights of between 15 and 50 metres. The

levels of transmissions from any particular base station are variable and depend on the number of calls and the callers' distance from the base station. Antennas emit a very narrow beam of radiowaves which spreads out almost parallel to the ground. Therefore, radiofrequency fields at ground level and in regions normally accessible to the public are many times below hazard levels. Guidelines would only be exceeded if a person were to approach to within a metre or two directly in front of the antennas. Until mobile phones became widely used, members of the public were mainly exposed to radiofrequency emissions from radio and TV stations. Even today, the phone towers themselves add little to our total exposure, as signal strengths in places of public access are normally similar to or lower than those from distant radio and TV stations.

However, the user of a mobile phone is exposed to radiofrequency fields much higher than those found in the general environment. Mobile phones are operated very close to the head. Therefore, rather than looking at the heating effect across the whole body, the distribution of absorbed energy in the head of the user must be determined. From sophisticated computer modeling and measurements using models of heads, it appears that the energy absorbed from a mobile phone is not in excess of current guidelines.

Concerns about other so-called non-thermal effects arising from exposure to mobile phone frequencies have also been raised. These include suggestions of subtle effects on cells that could have an effect on cancer development. Effects on electrically excitable tissues that may influence the function of the brain and nervous tissue have also been hypothesized. However, the overall evidence available to date does not suggest that the use of mobile phones has any detrimental effect on human health.

Magnetic fields in everyday life: are they really that high?

In recent years, national authorities in different countries have conducted many measurements to investigate electromagnetic field levels in the living environment. None of these surveys has concluded that field levels could bring about adverse health effects.

The Federal Office for Radiation Safety in Germany recently measured the daily exposure to magnetic fields of about 2000 individuals across a range of occupations and public exposures. All of them were equipped with personal dosimeters for 24 hours. The measured exposure varied widely but gave an average daily exposure of 0.10 μT. This value is a thousand times lower that the standard limit of 100 μT for the public and 200 times lower than the 500 μT exposure limit for workers. Furthermore, the exposure of people living in the centres of cities showed that there are no drastic differences in exposure between life in rural areas and life in the city. Even the exposure of people living in the vicinity of high voltage power lines differs very little from the average exposure in the population.

Key points

1. Background electromagnetic field levels in the home are mainly caused by the transmission and distribution facilities for electricity or by electrical appliances.
2. Electrical appliances differ greatly in the strength of fields they generate. Both electric and magnetic field levels decrease rapidly with distance from the appliances. In any event, fields surrounding household appliances usually are far below guideline limits.
3. At operator positions the electric and magnetic fields of television sets and computer screens are hundreds of thousands times below guideline levels.
4. Microwave ovens meeting the standards are not hazardous to health.
5. As long as close public access to radar facilities, broadcasting antennas and mobile phone base stations is restricted, exposure guideline limits for radiofrequency fields will not be exceeded.
6. The user of a mobile phone encounters field levels that are much higher than any levels in the normal living environment. However, even these increased levels do not appear to generate harmful effects.
7. Many surveys have demonstrated that exposure to electromagnetic field levels in the living environment is extremely low.

Current standards

Standards are set to protect our health and are well known for many food additives, for concentrations of chemicals in water or air pollutants. Similarly, field standards exist to limit overexposure to electromagnetic field levels present in our environment.

Who decides on guidelines?

Countries set their own national standards for exposure to electromagnetic fields. However, the majority of these national standards draw on the guidelines set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This non-governmental organization, formally recognized by WHO, evaluates scientific results from all over the world. Based on an in-depth review of the literature, ICNIRP produces guidelines recommending limits on exposure. These guidelines are reviewed periodically and updated if necessary.

Electromagnetic field levels vary with frequency in a complex way. Listing every value in every standard and at every frequency would be difficult to understand. The table below is a summary of the exposure guidelines for the three areas that have become the focus of public concern: electricity in the home, mobile phone base stations and microwave ovens. These guidelines were last updated in April 1998.

Summary of the ICNIRP exposure guidelines

	European power frequency		Mobile phone base station frequency		Microwave oven frequency
Frequency	50 Hz	50 Hz	900 MHz	1.8 GHz	2.45 GHz
	Electric field (V/m)	Magnetic field (μT)	Power density (W/m^2)	Power density (W/m^2)	Power density (W/m^2)
Public exposure limits	5 000	100	4.5	9	10
Occupational exposure limits	10 000	500	22.5	45	

ICNIRP, EMF guidelines, Health Physics 74, 494-522 (1998)

The exposure guidelines may differ by a factor of more than 100 between some former Soviet countries and Western countries. With the globalization of trade and the rapid introduction of telecommunications worldwide there is a need for universal standards. As many countries from the former Soviet Union are now considering new standards, the WHO has recently launched an initiative to harmonize exposure guidelines worldwide. Future standards will be based on the results of the WHO's International Electromagnetic Field Project.

What are guidelines based on?

An important point to make is that a guideline limit is not a precise delineation between safety and hazard. There is no one level above which exposures become hazardous to health; instead, the potential risk to human health gradually increases with higher exposure levels. Guidelines indicate that, below a given threshold, electromagnetic field exposure is safe according to scientific knowledge. However, it does not automatically follow that, above the given limit, exposure is harmful.

Nevertheless, to be able to set limits on exposure, scientific studies need to identify the threshold level at which first health effects become apparent. As humans cannot be used for experiments, guidelines critically rely on animal studies. Subtle behavioural changes in animals at low levels often precede more drastic changes in health at higher levels. Abnormal behaviour is a very sensitive indicator of a biological response and has been selected as the lowest observable adverse health effect. Guidelines recommend the prevention of electromagnetic field exposure levels, at which behavioural changes become noticeable.

This threshold level for behaviour is not equal to the guideline limit. ICNIRP applies a safety factor of 10 to derive occupational exposure limits, and a factor of 50 to obtain the guideline value for the general public. Therefore, for example, in the radiofrequency and microwave frequency ranges, the maximum levels you might experience in the environment or in your home are at least 50 times lower than the threshold level at which first behavioural changes in animals become apparent.

Why is the safety factor for occupational exposure guidelines lower than for the general public?

The occupationally exposed population consists of adults who generally experience known electromagnetic field conditions. These workers are trained to be aware of potential risk and to take appropriate precautions. By contrast, the general public consists of individuals of all ages and of varying health status. In many cases, these are unaware of their exposure to EMF. Moreover, individual members of the public cannot be expected to take precautions to minimize or avoid exposure. These are the underlying considerations for more stringent exposure restrictions for the general public than for the occupationally exposed population.

As we have seen earlier, low frequency electromagnetic fields induce currents in the human body (see What happens when you are exposed to electromagnetic fields?). But various biochemical reactions within the body itself generate currents as well. The cells or tissues will not be able to detect any induced currents below this background level. Therefore, at low frequencies, exposure guidelines ensure that the level of currents induced by an electromagnetic fields is below that of natural body currents.

The main effect of radiofrequency energy is the heating of tissue. Consequently, exposure guidelines for radiofrequency fields and microwaves are set to prevent health effects caused by localized or whole-body heating (see What happens when you are exposed to electromagnetic fields?). Compliance with the guidelines will ensure that heating effects are sufficiently small not to be harmful.

What guidelines cannot account for...

At present, speculations about potential long-term health effects cannot form the basis for the issuing of guidelines or standards. Adding up the results of all scientific studies, the overall weight of evidence does not indicate that electromagnetic fields cause long-term health effects such as cancer. National and international bodies set and update standards on the basis of the latest scientific knowledge to protect against known health effects.

Guidelines are set for the average population and cannot directly address the requirements of a minority of potentially more sensitive people. Air pollution guidelines, for example, are not based on the special needs of asthmatics. Similarly, electromagnetic field guidelines are not designed to protect people from interference with implanted medical electronic devices such as heart pacemakers. Instead, advice about exposure situations to be avoided should be sought from the manufacturers and from the clinician implanting the device.

What are typical maximum exposure levels at home and in the environment?

Some practical information will help you to relate to the international guideline values given above. In the following table you will find the most common sources of electromagnetic fields. All values are maximum levels of public exposure – your own exposure is likely to be much lower. For a closer look at field levels around individual electrical appliances, please see the section Typical exposure levels at home and in the environment.

Source	Typical maximum public exposure	
	Electric field (V/m)	Magnetic flux density (μT)
Natural fields	200	70 (Earth's magnetic field)
Mains power (in homes not close to power lines)	100	0.2
Mains power (beneath large power lines)	10 000	20

Electric trains and trams	300	50
TV and computer screens (at operator position)	10	0.7
	Typical maximum public exposure (W/m^2)	
TV and radio transmitters	0.1	
Mobile phone base stations	0.1	
Radars	0.2	
Microwave ovens	0.5	

Source: WHO Regional Office for Europe

How are guidelines put into practice and who checks on them?

The responsibility to investigate fields around power lines, mobile phone base stations or any other sources accessible to the general public lies with government agencies and local authorities. They must ensure that compliance with guidelines is maintained.

With electronic devices, the manufacturer is responsible for complying with the standard limits. However, as we have seen above, the nature of most devices ensures that the emitted fields are well below the cut-off values. Furthermore, many consumer associations carry out tests on a regular basis. In case of any particular concern or worry, contact the manufacturer directly or enquire with your local public health authority.

Are exposures above the guidelines harmful?

It is perfectly safe to eat a pot of strawberry jam up to the expiration date – but if you consume the jam any later the manufacturer cannot guarantee good food quality. Nevertheless, even a few weeks or months after the expiration date, it will usually be safe to eat the jam. Similarly, electromagnetic field guidelines ensure that, within the given exposure limit, no known adverse health effects will occur. A large safety factor is applied to the level known to cause a health consequence. Therefore, even if you experienced field strengths several times higher than the given limit value, your exposure would still be within this safety margin.

In everyday situations, most people do not experience electromagnetic fields that exceed the guideline limits. Typical exposures are far below these values. However, there are occasions where a person's exposure may, for a short period, approach or even exceed the guidelines. According to ICNIRP, radiofrequency and microwave exposures should be averaged over time to address cumulative effects. The guidelines specify a time-averaging period of six minutes and short-term exposures above the limits are acceptable.

In contrast, exposure to low frequency electric and magnetic fields is not time-averaged in the guidelines. To make things even more complicated, another factor called coupling comes into play. Coupling refers to the interaction between the electric and magnetic fields and the exposed body. This depends on the size and shape of the body, the type of tissue and the orientation of the body relative to the field. Guidelines must be conservative: ICNIRP always assumes maximum coupling of the field to the exposed individual. Thus

the guideline limits provide maximum protection. For example, even though the magnetic field values for hairdryers and electric shavers appear to exceed the recommended values, extremely weak coupling between the field and the head prevents the induction of electrical currents that could exceed guideline limits.

Key points

1. ICNIRP issues guidelines on the basis of the current scientific knowledge. Most countries draw on these international guidelines for their own national standards.
2. Standards for low frequency electromagnetic fields ensure that induced electric currents are below the normal level of background currents within the body. Standards for radiofrequency and microwaves prevent health effects caused by localized or whole body heating.
3. Guidelines do not protect against potential interference with electromedical devices.
4. Maximum exposure levels in everyday life are typically far below guideline limits.
5. Due to a large safety factor, exposure above the guideline limits is not necessarily harmful to health. Furthermore time-averaging for high frequency fields and the assumption of maximum coupling for low frequency fields introduce an additional safety margin.

Precautionary approaches

With more and more research data available, it has become increasingly unlikely that exposure to electromagnetic fields constitutes a serious health hazard, nevertheless, some uncertainty remains. The original scientific discussion about the interpretation of controversial results has shifted to become a societal as well as political issue.

The public debate over electromagnetic fields focuses on the potential detriments of electromagnetic fields but often ignores the benefits associated with electromagnetic field technology. Without electricity, society would come to a standstill. Similarly, broadcasting and telecommunications have become a simple fact of modern life. An analysis of the balance between cost and potential hazards is essential.

Protection of public health

International guidelines and national safety standards for electromagnetic fields are developed on the basis of the current scientific knowledge to ensure that the fields humans encounter are not harmful to health. To compensate uncertainties in knowledge (due, for example, to experimental errors, extrapolation from animals to humans, or statistical uncertainty), large safety factors are incorporated into the exposure limits. The guidelines are regularly reviewed and updated if necessary. It has been suggested that taking additional precautions to cope with remaining uncertainties may be a useful policy to adopt while science improves knowledge on health consequences. However, the type and extent of the cautionary policy chosen critically depends on the strength of evidence for a health risk and the scale and nature of the potential consequences. The cautionary response should be proportional to the potential risk. For more information, see the WHO Backgrounder on Cautionary Policies.

Several policies promoting caution have been developed to address concerns about public, occupational and environmental health and safety issues connected with chemical and physical agents.

What should be done while research continues?

One of the objectives of the International EMF Project is to help national authorities weigh the benefits of using electromagnetic field technologies against the possibility that a health risk might be discovered. Furthermore, the WHO will issue recommendations on protective measures, if they may be needed. It will take some years for the required research to be completed, evaluated and published. In the meantime, the World Health Organization has issued a series of recommendations:

- Strict adherence to existing national or international safety standards: such standards, based on current knowledge, are developed to protect everyone in the population with a large safety factor.
- Simple protective measures: barriers around strong electromagnetic field sources help preclude unauthorized access to areas where exposure limits may be exceeded.
- Consultation with local authorities and the public in siting new power lines or mobile phone base stations: siting decisions are often required to take into account aesthetics and public sensitivities. Open communication during the planning stages can help create public understanding and greater acceptance of a new facility.
- Communication: an effective system of health information and communication among scientists, governments, industry and the public can help raise general awareness of programmes dealing with exposure to electromagnetic fields and reduce any mistrust and fears.

For further information, see the WHO Fact Sheets on Electromagnetic Fields and Public Health

What is EMF - German, Italian & Swedish

German

- Was sind elektromagnetische Felder?
pdf, 63kb

Italian

- Cosa sono i campi elettromagnetici?
pdf, 711kb

Swedish

- Vad är elektromagnetiska falt?
pdf, 548kb

Electric and Magnetic Fields At Extremely Low Frequencies

The Issue

There are concerns that daily exposure to electric and magnetic fields (EMFs) may cause health problems. These concerns are reflected in a number of reports that have attempted to link EMF exposure to a variety of health issues, including childhood cancer.

Background

Electricity delivered through power lines plays a central role in modern society. It is used to light homes, prepare food, run computers and operate other household appliances, such as TVs and radios. In Canada, appliances that plug into a wall socket use electric power that flows back and forth at a power frequency of 60 cycles per second (60 hertz).

Every time you use electricity and electrical appliances, you are exposed to electric and magnetic fields (EMFs) at extremely low frequencies (ELF). The term "extremely low" is used to describe any frequency below 300 hertz. EMFs produced by the transmission and use of electricity belong to this category.

Electric and Magnetic Fields (EMFs)

Electric and magnetic fields are invisible forces that surround electrical equipment, power cords and wires that carry electricity, including outdoor power lines. You cannot see or feel EMFs.

Electric Fields: These are formed whenever a wire is plugged into an outlet, even when the appliance is not turned on. The higher the voltage, the stronger the electric field.

Magnetic Fields: These are formed when electric current is flowing within a device or wire. The greater the current, the stronger the magnetic field.

Electric and magnetic fields can occur separately or together. For example, when you plug the power cord for a lamp into a wall socket, it creates an electric field along the cord. When you turn the lamp on, the flow of current through the cord creates a magnetic field. Meanwhile, the electric field is still present.

The Strength of EMFs

Electric and magnetic fields are strongest when close to their source. As you move away from the source, the strength of the fields fades rapidly. This means you are

exposed to stronger electric and magnetic fields when standing close to a source (e.g., right beside a transformer box or under a high voltage power line), and you are exposed to weaker fields as you move away. When you are indoors at home, the magnetic fields from high voltage power lines and transformer boxes are weaker than those from household electrical appliances.

Canadian Exposures to EMFs at ELF

On a daily basis, most Canadians are exposed to EMFs generated by household wiring, fluorescent lighting, and any electrical appliance that plugs into the wall, including hair dryers, vacuum cleaners and toasters. In the workplace, common sources include video display terminals (computer monitors), air purifiers, photocopiers, fax machines, fluorescent lights, electric heaters and electric tools in machine shops, such as drills, power saws, lathes and welding machines.

Exposures in Canadian Homes, Schools and Offices Present No Known Health Risks

Research has shown that EMFs from electrical devices and power lines can cause weak electric currents to flow through the human body. However, these currents are much smaller than those produced naturally by your brain, nerves and heart, and arenot associated with any known health risks.

There have been many studies about the effects of exposure to electric and magnetic fields at extremely low frequencies. Scientists at Health Canada are aware that some of these studies have suggested a possible link between exposure to ELF fields and certain types of childhood cancer. The International Agency for Research on Cancer (IARC) has evaluated the scientific data and has classified ELF magnetic fields as being "possibly carcinogenic" to humans. IARC based this classification on the following:

- human health population studies showing weak evidence of an association with childhood leukemia; and
- a large database of laboratory study results showing inadequate evidence of an association with cancer in animals.

To put this into context, it is important to understand that the "possibly carcinogenic" classification is also applied to coffee, gasoline engine exhaust and pickled vegetables, and is often used for agents that require further study. In summary, when all of the studies are evaluated together, the evidence suggesting that EMFs may contribute to an increased risk of cancer is very weak.

Concerns about Electromagnetic Interference

In certain circumstances, EMFs can cause interference with electronic devices. For example, office workers may notice image movement (jitter) on their computer screens if the computer is in an area where magnetic fields are slightly elevated above background levels. Some sources that generate these slightly elevated levels are the cables that bring electrical power into an office area, and common electrical equipment, such as power transformers.

Magnetic fields that are capable of causing jitter on computer screens do not present any known risks to human health. To solve the jitter problem, simply move the computer to another part of the room where the magnetic fields are weaker.

Minimizing Your Risk

You do not need to take action regarding daily exposures to electric and magnetic fields at extremely low frequencies. There is no conclusive evidence of any harm caused by exposures at levels found in Canadian homes and schools, including those located just outside the boundaries of power line corridors.

Health Canada's Role

Health Canada, along with the World Health Organization, monitors scientific research on EMFs and human health as part of its mission to help Canadians maintain and improve their health. At present, there are no Canadian government guidelines for exposure to EMFs at ELF. Health Canada does not consider guidelines for the Canadian public necessary because the scientific evidence is not strong enough to conclude that exposures cause health problems for the public.

Some national and international organizations have published health-based exposure guidelines for EMFs at ELF. However, these guidelines are not based on a consideration of risks related to cancer. Rather, the point of the guidelines is to make sure that exposures to EMFs do not cause electric currents or fields in the body that are stronger than the ones produced naturally by the brain, nerves and heart. EMF exposures in Canadian homes, schools and offices are far below these guidelines.

Health Canada Santé Canada

Your health and safety... our priority. *Votré santé et votre sécurité... notre priorité.*

Electric and Magnetic Fields At Extremely Low Frequencies

Updated January 2010

IT'S YOUR HEALTH

Need More Info?

For further information contact:

The Consumer and Clinical Radiation Protection Bureau
Health Canada
775 Brookfield Road
Ottawa, ON K1A 1C1
Telephone: (613) 954-6699
Fax: (613) 952-7584
E-mail: CCRPB-PCRPCC@hc-sc.gc.ca
www.hc-sc.gc.ca/ahc-asc/branch-dirgen/hecs-dgsesc/psp-psp/ccrpb-bpcrpcc-eng.php

Also, see the following Fact Sheets on the World Health Organization (WHO) Web sections:
Electromagnetic Fields and Public Health: Exposure to Extremely Low Frequency Fields, at:
www.who.int/mediacentre/factsheets/fs322/en/index.html

Electromagnetic Fields and Public Health: Extremely Low Frequency(ELF), at:
www.who.int/docstore/peh-emf/publications/facts_press/efact/efs205.html

Electromagnetic Fields and Public Health: Extremely Low Frequency Fields and Cancer, at: www.who.int/docstore/peh-emf/publications/facts_press/efact/efs263.html

For more information visit the following Web sites:
The International Agency for Research on Cancer (IARC), Static and extremely low frequency (ELF) electric and magnetic fields. Report No. 80, at:
www.iop.org/EJ/abstract/0952-4746/21/3/604

IARC Carcinogen Classifications, at:
http://monographs.iarc.fr/ENG/Classification/index.php

The U.S. National Institute of Environmental Health Sciences (NIEHS), Questions and Answers about EMF at :
www.niehs.nih.gov/health/topics/agents/emf/

It's Your Health, Safety of Exposure to Electric and Magnetic Fields from Computer Monitors and Other Video Display Terminals at :
www.hc-sc.gc.ca/hl-vs/iyh-vsv/prod/monit-eng.php

For additional articles on health and safety issues go to the *It's Your Health* Web section at:
www.healthcanada.gc.ca/iyh
You can also call toll free at
1-866-225-0709
or TTY at 1-800-267-1245*

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Electromagnetic fields and other physical factors around wind power generators (pilot study)

M. Israel · P. Ivanova · M. Ivanova

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Abstract According to the 20/20/20 strategy by European Union for green energy by 2020 priority should be given to the Renewable Energy Sources. The energy generated from the wind has proven to be of interest for several reasons—wind is available, it is a cheap, and virtually inexhaustible source of energy. In this relation in the last years, many wind power stations were built all around the country. They are being located in proximity of populated areas. Their work besides the generation of electricity is connected to emission of physical factors in the environment that could be essential for human health. In order to avoid overexposure to electromagnetic fields, noise, and vibration to the general public minimal safety distance is being determined theoretically for 'worst case" conditions basing on the technical characteristics of the generators. After the mounting of installations, measurements have to be performed to determine whether the national and European safety limits for the factors of environment are being kept. The paper presents results of measurement of electromagnetic fields, additionally noise and vibration around one of the biggest wind power parks in Bulgaria. The measurements were made in the close proximity of the generators both for the personnel working conditions and for the population in the closest living areas.

Keywords Wind power generators · Environment · Electric and magnetic field · Noise · Vibrations

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1 Introduction

The purposes *"20/20/20"* of EU in the field of climate and energy are aimed at reducing carbon dioxide emissions by 20% compared with 1990 levels, increasing the share of renewables to 20%, and reducing the consumption of energy by 20%. In this respect, calls upon the member countries to introduce renewable energies in its energetic in order to reduce emissions of greenhouse gases into the atmosphere, the share of these sources should reach 20% of the production capacities of States.

In Bulgaria, one of the most popular and new installations for generating renewable energy are wind power stations. They are located near the populated areas and during their work emit electromagnetic fields (EMF), other physical factors as noise and vibration, and create unfavourable phenomena as flicker effects, interference with light and communication. In relation to the human health protection, it is necessary to assess their impact in urban areas bordering the facilities and working environment around.

In Bulgarian legislation, there is not regulated any fixed safety zone for wind power generators. Thus, a hygienic safety zone of 500 m was specified through calculations and predictions made by us as experts in the relevant area, taking into account environmental factors, mainly noise and infrasound.

2 Aim

The purpose of this study was to examine the levels of electromagnetic fields (EMF), noise and vibration, emitted by wind power generators, to evaluate the levels according to the National and European limits for exposures to

workers and general population, and to check if the preliminary set safety zone around the wind energy park is adequate.

3 Materials and methods

The object of the study is one of the largest wind energy parks along the Black Sea and nearest populated areas. It is built on the lands of four villages. At the same area, a home for adults with mental retardation is situated. They all are identified by numbers 1–5.

The wind park consists of 55 wind power generators, types Vestas V90 3 MW, with the following characteristics:

- Height of the towers: $h = 85$ m
- Height of the gondola: $h = 70$ m
- Diameter of the rotor: $D = 82$ m
- Nominal power for one generator: $P = 2{,}040$ kW on 1,800 rev/min
- Revolutions per minute of the generator: 900–1,800 rev/min
- Number of blades: 3
- Revolutions per minute of the turbine: 8.5–23.3 rev/min.

The measurements of all studied physical factors are carried out in parallel on the same points. The assessment is based on measurements of EMF, noise, vibration during the 72-hour sample period in operating conditions. Weather conditions during the measurements are as follows: air temperature: 0–5.5°C; air velocity: –5 m/s.

3.1 Electric and magnetic field strengths with power frequency

Measurements were performed in a wide frequency range from 20 to 1 kHz, covered by the measuring device and evaluated both electric and magnetic fields for the main frequency 50 Hz, and for harmonics when operating the generator. The following measuring device was used:

Type HI-3604 ("HOLADAY INDUSTRIES", USA):

- frequency range: for electric field—$f = 20$–$2{,}000$ Hz;
- frequency range for magnetic field—$f = 20$–$1{,}000$ Hz;
- uncertainty ±20%.

3.1.1 *Evaluation of the electric and magnetic field measured values around of the wind power generators (for occupational exposure)*

The measurements of the electrical field strength (EFS) and magnetic flux density (MFD) values were made near the towers of 3 generators in order to assess the possible exposure of workers in the area of wind energy park/farm. To establish maximum levels of EFS and MFD, the measurements were made in places where the cables for electricity transfer pass, at 3 levels above the ground: at 1.20, 1.50 and 1.80 m.

For assessment the exposures, we used the exposure limits for occupational exposure to power frequency electric and magnetic fields from Ordinance No. 7/1999. The Bulgarian national standard (BNS 12.1.002-78) for power frequency electric fields concerning the exposure in working environment determines maximal permissible time duration of workers' exposure depending on the measured values of only the electric field strength.

In Table 1, the ***exposure limits*** under the before mentioned regulations are presented

For frequency 50 Hz, exposure limit is 12 G (1.2 mT). For persons with active implants, the ***limit value of magnetic flux density is B = 1 G (0.1 mT).***

3.1.2 *Evaluation of the electric and magnetic field measured values around of the wind power generators (for the general population)*

Measurements of the electric field and magnetic field in the environment were made on the border of the populated areas/settlements at the same places where measurements of other physical factors were done. All measurements were made at 1.80 m above the ground.

In Bulgaria, there are no limits for extremely low frequency (ELF) fields in the living environment. In the absence of national regulations for power frequency electric and magnetic fields for the living environment, the recommendation of the EU Council Recommendation 1999/519/EC has been used for evaluation. It has adopted

Table 1 Exposure limits

Regulation	Frequency range	Electrical field strength, E (V/m)	Magnetic flux density, B (G)
Ordinance	1–100 Hz	25 kV/m	$600/f^{a}$
No. 7/1999	100–4,000 kHz	$2.10^{6}/f$ V/m	$600/f$
BNS 12.1.002-78	50 Hz	25 kV/m	–

[a] f is the frequency of electromagnetic field in Hz

the following exposure limits for general public for the frequency range:

0.025–0.8 kHz:

- *Electric field strength–250/f * (for 50 Hz, E = 5,000 V/m);*
- *Magnetic flux density–5/f (for 50 Hz, B = 100 T)*

* where *f* is the frequency of the field in kHz.

In Bulgaria, there are regulations implementing safety zones around the sites, sources of harmful emissions into the environment, Ordinance No. 7 of 25 May 1992. According to (Ordinance No. 7/1992) safety zones around power lines, open distribution systems are set as follows:

"Safety zones for the power lines with a voltage of 100 kV and above shall be determined by the projections of the final lines of the conductors at a distance:

- *power lines 110 kV–10 m;*
- *power lines 220 kV–20 m;*
- *power lines 400 kV–30 m;*
- *power lines 750 kV–60 m.*

Land on both sides under the conductors is not built up for housing or carrying out activities."

3.2 Noise

The measurements of noise levels in working and living environment were carried out by standard methods using the following device:

Sound level meter type 2230 with condenser microphone type 4155, and sound calibrator type 4231, „Brüel & Kjær":

- Frequency range—20–20,000 Hz;
- Dynamic range—(20–140) dB(*A*);
- Deviation in dB—(0.2–0.8) dB;
- Deviation of L_{eq} for 10 min measurement duration in dB(*A*)—0.1 dB(*A*);
- Uncertainty 0.3 dB(*A*);
- Deviation of $L_{Cpeak,}$dB(*C*)—0.4 dB(*C*);
- Uncertainty of $L_{Cpeak,}$dB (*C*)—0.5 dB(*C*).

3.2.1 *Evaluation of the noise levels in the working environment emitted by the wind turbines*

The measurements and assessments of the noise levels were made according to the minimum requirements for protecting workers from existing or potential risks to health and safety related to noise exposure. To assess the noise levels, the Ordinance No. 6 of 15 August 2005 was used.

In this particular case, we can not talk about "working" in noise conditions, because wind generators are virtually maintenance-free and automated. Prophylaxis, which is periodically carried out is being made when the generator is stopped, the neighboring generators are on big distance and can not generate significant noise levels.

The actual measurement of noise as required by above-mentioned ordinance for the working environment was done in conjunction with surveillance of the equipment and possible residence of farm workers in the area.

The limit values to be observed under the requirements of Ordinance No. 6/2005 (Directive 2003/10/EC, are as follows:

***The exposure limit values and action levels** are determined in respect of the daily noise expose levels and peak sound pressure as follows:*

1. *Exposure limit values: L_{ex}8 h = 87 dB(A) and p_{peak} = 200 Pa, corresponding to140 dB(C);*
2. *Upper exposure action levels: L_{ex}8 h = 85 dB(A) and p_{peak} = 140 Pa, corresponding to 137 dB(C);*
3. *Lower exposure action levels: L_{ex}8 h = 80 dB(A) and p_{peak} = 112 Pa, corresponding to 135 dB (C).*

3.2.2 *Evaluation of the noise levels in the environment associated with the operation of wind turbines*

Measurements of equivalent levels of environmental noise had been made in the closest proximity area of the four settlements and close to the home for adults with mental retardation. They were carried out during the day, evening, and night according to the requirements of Ordinance No. 6 of 26 June 2006. First, before the 72-hour samples, measurements of background noise levels were made on stopped generators.

Exposure limits values for the noise levels in different areas and structural zones in urban areas and beyond, according to (Ordinance No. 6/2006), are as follows:

Residential areas and zones–equivalent noise level (day)–55 dB; evening–50 dB and night–45 dB.

In areas of hospitals and sanatoriums–equivalent noise level day–45 dB; evening–35 dB and night–35 dB.

3.3 Vibrations

The measurements of vibrations in the working and living environment are performed using standard methods, as required by BNS ISO 2631-1, which refers to assessing the effects of vibration on the human body. The following device was used for the measurements:

Set (type 3513): vibration level meter, type 2511, filter 1621, with piezoelectric accelerometer type 4370, calibrator type 4294, „Brüel & Kjær".

- Frequency range—2–14,000 Hz;
- Dynamic range—(0–1,000) m/s^2;

- Irregularity for the frequency ranges 0.3 and 3 Hz; 0.100 m/s^2—(1.5–2.5)%.

3.3.1 *Assessment of the whole-body vibrations for working environment*

The measurements of vibration transmitted to the whole body were carried out near the 3 towers of generators, on the very foundation of the tower. This measurement was carried out once in terms of checking the quality of construction of the towers and the need to reduce vibrations to an absolute minimum, which can not lead to hazardous situations, associated with the rotation of the blades at high wind velocities. Measured vibration acceleration values are defined as an integral quantity–daily exposure for an 8-hour workday A (8 h), in parameter vibration acceleration ($\times 10^{-3}$ m/s^2), as required by Ordinance No. 9 of 12 February 2010.

***The daily exposure limit value** for whole-body vibrations determined over 8 h as required by Ordinance No. 3/ 2005 shall not exceed 1.15 m/s^2; as the daily exposure action level is 0.5 m/s^2.*

3.3.2 *Assessment of the whole-body vibrations for living environment*

Measurements of vibrations at four locations (close to the four villages) and to the home for adults with mental retardation were performed only once to demonstrate the absence of vibration from the operation of wind park in residential areas. The method used for measurements is according to Ordinance No. 9 of 12 February 2010. Assessment of measured values is made for the "worst case"–permanent vibrations during the night.

4 Results

4.1 Electrical and magnetic fields

The results of measurements of electric field strength and magnetic flux density in the close proximity of wind generators are presented in Table 2.

The results of measurements of electric field strength and magnetic flux density in the closest points of populated areas are presented in Table 3.

4.2 Noise

The results of measurements of the equivalent noise levels close to the wind turbines are presented in the following Table 4.

The results of measurements of the equivalent noise levels near urban areas are presented in the following Table 5.

4.3 Vibrations

The results of measurements made on the foundations of the wind turbines at a distance $L = 3$ m from the towers for occupational exposure are presented in the following Table 6:

Table 2 Electric and magnetic field values close to the wind generators

No	Place of measurement	HI 3604	
		E (V/m)	B (mG)
1.	Wind generator G21		
1.1.	At 3 m from the tower, maximal value	1.44	0.133
1.2.	At 2 m from the tower, above cable channel 33 kV		
	at 20 cm from ground level	1.44	0.179
	at 120 cm from ground level	1.44	0.151
	at 180 cm from ground level	1.44	0.136
2.	Wind generator G17		
2.1	At 3 m from the tower, above cable channel 33 kV		
	at 20 cm from ground level	1.44	0.225
	at 120 cm from ground level	1.44	0.180
	at 180 cm from ground level	1.44	0.153
3.	Wind generator G10		
3.1	At 2 m from the tower, above cable channel 33 kV		
	at 20 cm from ground level	1.44	0.168
	at 120 cm from ground level	1.44	0.153
	at 180 cm from ground level	1.44	0.139

Table 3 Electric and magnetic field values close to the populated areas

No	Place of measurement	HI 3604	
		E (V/m)	*B* (mG)
1.	Closest point of village 2 (generators No. G8 and G9)		
	Close to the nearest buildings of the village	18.38[a]	0.135
2.	Closest point of village 1 (generators No. G46 and G49)		
	Close to the nearest buildings of the village	2.82	0.133
3.	On the road to the village 1, power line 110 kV		
	under the power line—maximal value	3,780	2.690
	On 10 m from the projection of the last conductor	1,100	0.448
4.	Closest point of village 3 (generators No. G13, G34, and G35)	1.48	0.133
5.	Closest point of village 4 (generators No. G53, G54, and G55)	1.44	0.160
6.	Home for adults with mental retardation, (Closest wind generators G34 and G35), by the fence	1.68	0.133

[a] On distance 30 m from power line

Table 4 Equivalent noise levels close to the wind generators

No	Place of measurements	Measured noise levels		Lower exposure action levels	
		($L_{eqv.}$) dB (*A*)	*L*, dB (*C*)	Exposure limit values, dB (*A*)	*L*, dB (*C*)
Measurements in the area of wind generators					
1	Wind generator G 21 on distance $L \approx 3$ m	51.3	99.5	80	135
2	Wind generator G 17 on distance $L \approx 3$ m	48.8	96.9	80	135
3	Wind generator G 10 on distance $L \approx 3$ m	45.0	95.1	80	135

Table 5 Equivalent noise levels close to the populated areas

No	Place of measurement	Measured noise levels ($L_{eqv.}$), dB (*A*)			Limit value, dB (*A*)		
		Day	Evening	Night	Day	Evening	Night
1	Village 1	41.8	39.6	37.5	55	50	45
	(closest wind generators No. G46 and G49)	40.1	40.4	38.9			
		38.9	38.5	37.2			
2	Village 2	33.3	40.0	32.5	55	50	45
	(closest wind generators No. G8 and G9)	44.3	43.9	33.1			
		43.2	43.5	32.8			
3	Village 3	37.6	37.6	36.3	55	50	45
	(closest wind generators No. G13, G34, 35)	38.1	39.3	37.1			
		37.4	38.7	36.8			
4	Home for adults with mental retardation	39.8	34.1	34.2	45	35	35
	(closest wind generators No. G34 and G35)	40.6	34.5	34.4			
		40.1	33.8	33.9			
5	Village 4	42.7	37.9	36.3	55	50	45
	(closest wind generators No. G53, G54, and G55)	43.0	38.6	37.9			
		42.1	38.2	37.5			

Table 6 Whole-body vibration values close to the wind generators

No	Place of measurement (foundation)	Vibrations parameter Vibration acceleration values $\times 10^{-3}$ m/s^2	RMS values of the vibrations in octave frequency bands with geometrical mean frequencies in Hz							Vibration values 10^{-3} m/s^2	Day exposure A (8 h) $\times 10^{-3}$ m/s^2
			1	2	4	8	16	31.5	63		
1	Wind generator G10	x	0.50	0.65	0.67	0.72	1.17	2.22	1.92	3.41	4.78
		y	0.20	0.78	0.73	1.80	4.10	4.00	4.50	7.58	10.61
		z	0.18	0.67	0.72	1.25	3.85	2.50	3.47	5.97	5.97
2	Wind generator G17	x	0.39	0.44	0.44	0.70	1.80	1.52	3.22	4.12	5.77
		y	0.21	0.48	1.10	2.10	2.58	2.67	5.34	6.94	9.72
		z	0.15	0.45	0.50	0.69	1.16	1.63	2.33	3.22	3.22
3	Wind generator G21	x	0.19	0.46	0.49	1.03	1.71	1.73	3.88	4.75	6.65
		y	0.27	0.56	0.99	1.29	2.69	1.95	6.16	7.21	10.09
		z	0.00	0.12	0.35	0.52	0.50	0.81	1.43	1.83	1.83

Table 7 Whole-body vibration values close to the residential areas

No	Place of measurement (Foundation)	Vibrations parameter Vibration acceleration values $\times 10^{-3}$ m/s^2	RMS values of the vibrations in octave frequency bands with geometrical mean frequencies in Hz						
			1	2	4	8	16	31.5	63
1	Village 1 (closest wind generators No. G46 and G49)	x	0.19	0.15	0.20	0.23	0.20	0.35	0.54
		y	0.00	0.32	0.44	0.56	0.44	0.49	0.58
		z	0.00	0.00	0.00	0.00	0.00	0.18	0.52
2	Village 2 (closest wind generators No. G8 and G9)	x	0.22	0.29	0.33	0.39	0.36	0.32	0.67
		y	0.18	0.50	0.90	0.70	0.64	0.90	0.88
		z	0.29	0.32	0.21	0.17	0.21	0.19	0.53
3	Village 3 (closest wind generators No. G13, G34, G35)	x	0.19	0.46	0.49	1.03	1.71	1.73	3.88
		y	0.27	0.56	0.99	1.29	2.40	2.14	6.16
		z	0.00	0.12	0.35	0.52	0.49	1.75	1.43
4	Home for adults with mental retardation (closest wind generators No. G34 and G35)	x	0.12	0.15	0.10	0.00	0.00	0.00	0.29
		y	0.00	0.40	0.39	0.44	0.58	0.49	0.50
		z	0.00	0.20	0.46	0.29	0.21	0.21	0.29
5	Village 4 (closest wind generators No. G53, G54, and G55)	x	0.34	0.48	0.67	0.55	0.69	0.52	0.64
		y	0.37	0.73	1.73	1.97	2.92	2.17	2.60
		z	0.00	0.30	0.64	1.40	1.85	1.10	1.07
	Limit value		11.00	7.80	5.50	5.50	11.00	22.00	44.00

The results of measurements of whole-body vibration in the area of the closest buildings within the residential area of the villages are presented in the following Table 7.

5 Discussion

5.1 Electric and magnetic fields with power frequency

Turbine generators themselves are sources of electric and magnetic field, but electric field values are generally very low (electric field strengths do not exceed 100–200 V/m). Such levels are common in buildings and homes.

Magnetic flux densities depend on the consumption of electricity and they can not be determined precisely by calculation. However, data from measurements in the vicinity of hydro turbine generators in Bulgaria (Israel et al. 2001, 2008) show that magnetic flux density may reach up to $B = 1$ G, which is a warning value and presents risk for persons with active implants, but it does not create risk to people with normal health. The same limit has been adopted in the WHO recommendations for the general public.

Besides the power frequency, electrical and magnetic fields, wind turbines and generators create also EMF with higher frequencies: harmonics to the main (power)

frequency up to 2 kHz. Measurement results shown in Table 2 show that the electric and magnetic field values close to the wind generator towers are well below the current exposure limits in the country, according to Ordinance No. 7/1999, and BNS 12.1.002-78. The values of electric and magnetic field under the power line 110 kV located near the wind park are within the limits, according to Ordinance No. 7/1999, and do not pose risk to workers in the park.

The safety zone around the power line (10 m) is kept and there are not facilities, construction sites, or other places of residence of people.

Therefore, there are very low levels of EMF compared with the EU recommendations for residential areas, as well.

5.2 Noise

As it is seen from the results presented in Table 4, the measured values of equivalent noise level in the vicinity of the wind power generators do not exceed the limits for the daily level of noise exposure for an 8-hour working day, according to Ordinance No. 6/2005 for working environment. The same applies to the peak sound pressure in the vicinity of wind power generators, where the measured values also do not exceed the limits for the daily level of noise exposure for an 8-h day. Even more, the measured values of equivalent noise level are below the limit values for living environment, according to Ordinance No. 6/2006 (for the daily measured levels), which means that agricultural workers coming across the area of wind energy park are in safety concerning noise influence, even if they consider them as general public, not workers.

Results presented in Table 5 show that equivalent noise levels on the territory of the villages and the home for adults with mental retardation do not exceed the limit values for environmental noise as required by Ordinance No. 6/2006, for all assessments: for day, evening, and night.

The evaluation of the equivalent noise level close to the home for adults was made on the basis of limits for hospitals and sanatoriums, while for villages–for residential areas and territories.

5.3 Vibrations

The values of the whole-body vibrations do not exceed the daily exposure limit value set for 8-hour period–0.5 m/s^2, according to Ordinance No. 3/2005 for the three measured generators. The measured values and their comparison to the limit values set in the Ordinance No. 9/2010 are presented in Table 6 The measured values are approximately zero, within the measurement uncertainty, and are much lower than the limits presented by frequency bands.

RMS values of the acceleration in octave frequency bands in the investigated areas do not exceed the values in Table 4 of Annex to Ordinance No. 3/2005.

6 Conclusion

The overall conclusion that can be drawn from the measurements and assessments is that the wind farm/park is built in accordance with requirements to prevent values of electromagnetic fields and other physical factors: noise and vibrations above the limits both for workers maintaining or passing around and also for the population living in close proximity to the generators.

Electromagnetic fields are not emitted on the operation of wind turbines or they are so small that they are insignificant compared to the values to be found in other measurements in residential areas and homes. The measured values are much below the national exposure limits, and of the European Council recommendations.

Noise in urban areas is the only physical factor that can be significant in exposure and risk assessment to the people near wind generators. The results of the noise levels meet the requirements of Bulgarian legislation for day, evening, and night, when compared with background measurements, and it appears that the difference is only 1–3 dB above the background levels.

The requirements for hygiene safety zone around the park have been defined on the noise and infrasound calculations, and the results show that they are met: the measured values of noise in residential areas are within the limit values for the general public. Wind turbines emit noise levels at work that are within the limits according to Bulgarian legislation.

There is also no need of taking additional precautionary measures to reduce the noise influencing workers carrying out maintenance of the equipment, passing through the area, or engaged in agricultural activities.

Vibrations from the operation of generators in urban areas have values close to zero, which indicates the absence of this factor in the operation of generators.

Concerning the possible effects of the studied physical factors on workers in wind park, it can be said that all requirements of the national legislation are met, once again pointing out that wind turbines are not serviced during the work. Even for agricultural workers performing activities near the wind park, all legal requirements for physical factors values are met, even for the general public.

In conclusion the studied wind power park complies with the requirements of the national and European legislation for human protection from physical factors–electric and magnetic fields up to 1 kHz, noise, vibration, and do

not create risk for both workers in the area of the park and the general population living in the nearest villages.

References

BNS 12.1.002-78: labor protection. Electrical fields from power frequency currents at voltage 400 kV and more. General requirements for safety

Bulgarian National Standard (BNS) ISO 2631-1: mechanical vibration and shock–Evaluation of human exposure to whole-body vibration. General requirements

Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz), 1999/519/EC

Directive 2003/10/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise)

Israel M, Ivanova M, Vatsov M et al (2001) Power frequency electric and magnetic fields in hydroelectric stations. In: Proceeding of the Eastern European regional meeting and workshop "measurements and criteria for standard harmonization in the field of EMF exposure" and WHO EMF standards harmonization meeting, Varna, Bulgaria, 28 April–3 May, pp. 193–197

Israel M, Zaryabova M, Ivanova M, Shalamanova T, Ivanova P (2008) Risk of electromagnetic human exposure in Bulgaria and policy for its limitation. J Public Health, vol. 2, NCPHP, Sofia

Ordinance No. 7/1992 for hygienic requirements for health protection of the urban environment (State Gazette 46/1992)

Ordinance No. 7/1999 for the minimal requirements for providing healthy and safety work conditions on working places and on use of the working equipment (State Gazette, No. 88/1999)

Ordinance No. 3/2005 for the minimal requirements for providing health and safety of workers on risks, connected to exposure to vibration (State Gazette No. 40, 2005)

Ordinance No. 6/2005 for the minimal requirements for providing health and safety of workers on risks, connected to exposure to noise (State Gazette No. 70, 2005)

Ordinance No. 6/2006 for the indicators of noise in the environment, accounting the degree of discomfort during the different parts of 24-hours, limit values of the noise indicators in the environment, methods for assessment of the noise indicators and of the harmful effects on the general publics health (State Gazette No. 58, 2006)

Ordinance No. 9/2010 for the maximal permissible values of the vibrations in the living premises (State Gazette 17/2010)

APPENDIX H

Farm Stray Voltage
Distributor Investigation Procedure

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TABLE OF CONTENTS

GLOSSARY OF SYMBOLS

I_{LB}	load box current
Ip	transformer primary current (on the source side of the ground connection)
R_{source}	source resistance
Vcc	animal contact voltage (measured across a 500 Ohm shunt resistor) between two animal contact points
VccD	distributor contribution to animal contact voltage
Vcc_{fsv}	highest steady state value of animal contact voltage measured during the Farm Stray Voltage Test
Vcc_{full}	animal contact voltage during the Distributor Contribution Test measured with the farm power “off” and the load box set at maximum load
Vcc_{half}	animal contact voltage during the Distributor Contribution Test measured with the farm power “off” and the load box set at one-half load
Vcc_{off}	animal contact voltage during the Distributor Contribution Test measured with the farm power “off” and the load box “off”
V_{LB}	voltage at load box connection to secondary system
Voc	open circuit voltage (measured without a shunt resistor) between two animal contact points
Vp	voltage from the primary neutral at the transformer to a reference ground rod
Vp_{fsv}	value for the primary neutral to reference ground rod voltage corresponding to the highest measured steady state value of animal contact voltage measured during the Farm Stray Voltage Test (Vcc_{fsv})
Vp_{full}	value of the primary neutral to reference ground rod voltage measured during the Distributor Contribution Test with the farm power “off” and the load box set at maximum load
Vp_{half}	value of the primary neutral to reference ground rod voltage measured during the Distributor Contribution Test with the farm power “off” and the load box set at one-half load
Vp_{off}	value of the primary neutral to reference ground rod voltage measured during the Distributor Contribution Test with the farm power “off” and the load box “off”
Vpri	nominal primary phase conductor voltage to neutral conductor voltage
Vps	voltage drop from the primary neutral conductor at the location of the connection for Vp to the secondary neutral conductor at the location of the connection for Vs
Vs	voltage from the secondary neutral in the service panel serving the animal contact area to the reference ground rod

H.1 APPLICATION AND SCOPE

This investigation procedure shall be followed by distributors in accordance with section 4.7 of the Code. This investigation procedure focuses on the measurement of farm stray voltage at animal contact locations and on the measurement of contributions to ACC/ACV from the distributor's distribution system.

A distributor shall ensure that any investigator acting on the distributor's behalf in conducting an investigation under section 4.7 of the Code and this Appendix complies with all of the requirements of this Appendix.

H.2 DEFINITIONS

In this Appendix:

"ACC/ACV Threshold" means the ACC or ACV value specified in section 4.7.3 of the Code;

"Animal Contact Test" means the test described in section H.5.1.1;

"animal contact point" means an object or surface an animal can contact physically, such as the pavement, a metal stall stanchion, a metal object in a barn or milking parlour, a water bowl or trough, water in a bowl or trough, or earth;

"animal contact location" means a location where an animal can contact two animal contact points at the same time;

"current" means Alternating Current current, root mean square;

"Distributor Contribution Test" means the test described in section H.5.2.1;

"Distributor Contribution Calculations" means the procedure described in section H.5.2.2;

"Distributor Contribution Confirmation Test & Calculations" means the test and procedure described in section H.5.3.1;

"Distributor Contribution Threshold" means the contribution by a distribution system to ACC or ACV as specified in section 4.7.4 of the Code;

"Farm Stray Voltage Test" means the test described in section H.5.1.2;

"Final Farm Stray Voltage Test" means the test described in section H.5.3.2.

"investigator" means a person responsible for investigating, analyzing and determining the appropriate means of remediating farm stray voltage situations on a distributor's behalf for the purposes of meeting the distributor's obligations under section 4.7 of the Code;

"resistance" means the property of hindering the flow of current in an electric circuit;

"root mean square" ("rms") means the square root of the arithmetic mean (i.e., the average) of the squares of a set of values;

"shunt resistor" means a physical resistor (or combination of resistors) used to simulate the combined resistance of an animal's body and the resistance between the animal's body and the animal contact points;

"source resistance" means the resistance in a circuit excluding the combined resistance of the animal's body and the resistance between the animal's body and the animal contact points;

"steady state" means the value of a voltage after all transients have decayed to a negligible value. For an alternating quantity, the root-mean-square value in the steady state does not vary with time; and

"voltage" means Alternating Current voltage, root mean square.

H.3 SAFETY

(1) A distributor shall ensure that the investigation procedures set out in this Appendix are executed by persons qualified under the *Occupational Health and Safety Act* (Ontario).

(2) If an investigator reasonably believes that a significant or immediate electrical safety hazard is posed by conditions at the site of an investigation, the investigator may suspend the execution of the investigation procedure until the hazard is rectified. The investigator shall promptly report any hazard to life or property to the Electrical Safety Authority.

(3) An investigator may suspend testing if the presence of animals, in any area where electrical equipment or wiring is examined or electrical measurements are taken, creates a potential hazard to the distributor's personnel.

(4) An investigator shall identify and note the locations of electric fences and other electrified animal control devices in accordance with section H.4.6(1).

H.4 EQUIPMENT AND OTHER REQUIREMENTS

H.4.1 Measuring and Recording Devices

An investigator shall ensure that equipment used for the measurement and/or recording of voltage, current, and resistance meets the criteria specified below:

(1) **Resolution and Accuracy** - The accuracy and resolution of any instrument used to measure or record animal contact voltage shall limit the error to five percent or less at one volt.

(2) **Voltage Measurement** - Instruments used to measure animal contact voltage shall be capable of separating and independently measuring alternating current (AC) and direct current (DC) voltages. These instruments shall have a minimum internal impedance of ten thousand Ohms and shall measure the true voltage.

(3) **Current Measurement** - A clamp-on ammeter, a digital multi-meter with clamp-on device or an in-line ammeter shall be used to measure current. Such instruments shall have a nominal accuracy of five percent or less, shall be capable of separating and independently measuring alternating current (AC) and direct current (DC) and shall measure the true current.

(4) **Resistance Measurement** – The resistance of a resistor shall be measured using either a volt ohmmeter or a digital multi-meter. Resolution shall be to the level of one Ohm or less when measuring a resistance of less than one thousand Ohms. Accuracy shall be within plus or minus five Ohms for a five hundred Ohm resistance**.**

(5) **Calibration of Measuring Instruments** - All measuring instruments shall be calibrated as to resolution and accuracy annually or according to the manufacturer's recommended calibration schedule, whichever is more frequent. Calibration certification shall be obtained from either:

a) the instrument manufacturer; or

b) a laboratory currently certified as meeting all applicable Institute of Electrical and Electronic Engineers, International Organization for Standards standards, or other recognized standards.

(6) **Field Check** - Before each site investigation, measuring devices shall be field-checked by comparing measurements with those taken using a second calibrated instrument.

(7) **Digital Recording Devices** - Recording devices, including monitoring systems which combine measuring and recording functions in a single instrument, shall have the levels of resolution and accuracy described under section H.4.1(1), shall have averaging capability and shall be capable of storing data recorded over measurement intervals of one to ten seconds for up to seventy-two consecutive hours. Digital recording devices, which have deviation settings, shall permit the deviation setting to be set so as to meet these resolution, accuracy and capability requirements. Digital recording devices shall be able to log the

time and date of all data recorded and shall have their internal clocks synchronized.

H.4.2 Load Box

An investigator shall ensure that the load box meets the criteria specified below:

(1) Volts - A load box shall be a primarily non-inductive nominal two hundred forty volt, resistance heating type load.

(2) Power - Testing shall be accomplished with a dual element 9/18 or 12.5/25 kW load box.

(3) Split-Load - A load box shall be capable of operating at two or more load settings, including approximately fifty percent and one hundred percent of the load box's rated total load.

H.4.3 Other Equipment

An investigator shall use the following equipment, as required, in conducting an investigation under this Appendix:

(1) A steel portable ground rod at least 1.0 m in length and 1.5 cm in diameter, sharpened at one end to ease insertion into the earth. The rod must be equipped with a terminal that permits a stainless steel hose clamp or alligator clip to be connected to the rod and must be marked at a point 50 cm from the sharpened rod end (the target depth of insertion).

(2) Two 50 m reels of insulated #14, #16 or #18 stranded wire. Equip one end of each roll of wire with a stainless steel hose clamp or an alligator clip of suitable size to connect to the ground rod. Equip the other end with a banana plug capable of connecting to the measuring instruments used.

(3) One 50 m reel of insulated #14, #16 or #18 twisted, shielded pair stranded wire. At one end, equip one wire with a stainless steel hose clamp and the other wire with an alligator clip of suitable size to connect to the copper plate. At the other end equip each wire with a banana plug capable of connecting to the digital recording device used.

(4) A copper plate with a regular shape (square, rectangular or round) and a base area measuring at least 100 cm^2. The plate must be clean prior to each use.

(5) One weight of at least 10 kg (used in combination with the copper plate referred to in (3) above.

(6) Wire brush.

(7) Paper towels.

(8) Salt water solution.

(9) Pocket calculator.

(10) One five hundred Ohm (+/- 2%) shunt resistor or equivalent combination of resistors.

(11) Two ten thousand Ohm (+/- 2%) shunt resistors or equivalent combination of resistors.

H.4.4 Test Scheduling

An investigator shall schedule any tests, both as to time and duration, in consultation with the livestock farm customer to ensure that the test time and/or other conditions are consistent with those during or in which animal performance or behaviour has indicated that farm stray voltage may be affecting farm operations.

H.4.5 Investigation Sequence

An investigator shall carry out an investigation as follows:

Phase 1 Procedure

1. Animal Contact Test
2. Farm Stray Voltage Test

Phase 2 Procedure

1. Distributor Contribution Test
2. Distributor Contribution Calculations

Phase 3 Procedure

1. Distributor Contribution Confirmation Test & Calculations
2. Final Farm Stray Voltage Test

H.4.6 Documentation

The following documentation shall be prepared and retained by a distributor in accordance with 4.7.7 of the Code:

(1) Sketch or line drawing of the farm on which are located, at a minimum:

a) Distribution transformer(s);

b) Distributor’s phase and neutral conductors (indicating size and type);

c) Farm buildings;

d) Secondary electrical service panels;

e) Existing grounding electrodes;

f) Animal contact locations tested (using the identification numbers indicated on Form 1);

g) Remote reference ground rod used for testing purposes;

h) Primary and secondary neutral locations used in conjunction with the remote reference ground rod used for testing purposes;

i) Electric fences and other electrified animal control devices;

j) Water bowls; and

k) Well.

(2) All information specified in the Forms set out in this Appendix. The Forms shall be in the format set out in this Appendix, and may be completed by hand or in electronic format.

(3) All data recorded using digital recording devices, downloaded in electronic format.

H.4.7 Investigation Report

(1) An investigator shall prepare a written report that complies with section H.4.7(2) and that sets out the results and findings of any investigation conducted under section 4.7 of the Code and this Appendix.

(2) The written report shall contain, as a minimum, the following information: the name of the distributor; the name of the investigator; information on how and to whom inquiries about the investigation should be addressed; the date the livestock farm customer's complaint was received by the distributor; the date of the distributor's or investigator's initial site visit; the date the investigation was initiated; the date the investigation was concluded; a summary and explanation of the test results in plain language; and a brief description in plain language of any remediation measures taken or planned. Copies of all information specified in the Forms set out in this Appendix shall be attached to the report.

(3) The distributor shall promptly provide copies of the report and the recorded measurement data in both paper and electronic format to the livestock farm customer.

H.5 INVESTIGATION PROCEDURE

This section H.5 refers to measurements for ACV. An investigator shall determine ACC on the basis of the ACV measurements using Ohm's Law (current = voltage/resistance).

H.5.1 Phase 1 Procedure

An investigator shall conduct the Phase 1 Procedure set out in and in accordance with sections H.5.1.1 and H.5.1.2 to determine whether the ACC/ACV Threshold is met.

H.5.1.1 Animal Contact Test

(1) Purpose – The Animal Contact Test will identify the locations, if any, at which farm stray voltage may be present. Information collected in this test shall be used to determine the locations used for the Farm Stray Voltage Test.

(2) Selection of Animal Contact Locations - Animal contact locations, including those where animal contact points can be contacted by low resistance body parts (e.g. muzzle, hoof, and udder), shall be selected in consultation with the livestock farm customer.

(3) Test Preparation - Where possible and with the permission of the livestock farm customer, turn off all farm loads with the exception of one consistent load (e.g. a hairdryer) in order to eliminate the potential impact of farm load variability on measurements taken at different animal contact locations.

(4) Animal Contact Point Preparation

a) Where an animal contact point is the floor or earth surface, the measuring device shall be connected to a copper plate, which shall make a high quality conductive contact with the floor or earth surface. The floor or earth surface beneath and around the copper plate shall be clear of debris that may add excess resistance. If the floor is concrete, the copper plate shall be placed where the surface is flat and, if needed, cleaned using water and a wire brush.

For each animal contact location tested, calculated source resistance (R_{source}) should be 500 Ohms or less. If high quality conductive contact with the floor or earth cannot be made using the procedure described above, the following procedures shall be followed:

- Floor contact - Place a paper towel or similar material soaked in salt water solution between the copper plate and the floor. Place a weight of not less than ten kilograms on the plate. This weight shall be applied evenly across the plate and not to the adjacent concrete or earth. Place the plate a minimum distance of thirty centimetres or twelve inches from any metal equipment making contact with the floor or earth.

- Earth contact – Locate a flat surface, remove any debris and add water to the area to ensure sufficient dampness if necessary.

b) Where an animal contact point involves a metal surface, corrosion shall be removed from the area where a test lead is used to contact the metal.

(5) Data Documented – For each animal contact location:

a) Record the open circuit voltage (without a shunt resistor) between animal contact points: Voc

b) Record, within ten seconds of recording the open circuit voltage, the ACV between animal contact points with a five hundred Ohm nominal shunt resistor placed across the meter inputs: Vcc

c) Calculate and note the source resistance: R_{source}

(6) Data Records – An investigator shall record the results of and other information relating to the Animal Contact Test using Form 1 of this Appendix.

H.5.1.2 Farm Stray Voltage Test

(1) Purpose - The purpose of this test is to determine the highest level of farm stray voltage at the location(s) identified in the Animal Contact Test.

(2) Reference Ground Rod Setup - A portable ground rod shall be inserted 0.5 m into the earth, located as follows:

- at least 15 m (or 50 feet) from the ground rod under test;
- well away from any well casing present;
- not closer than 7.5 m (or 25 feet) from the centerline of a primary electrical conductor right-of-way;
- not closer than 30 m (or 100 feet) from the edge of a transmission line right-of-way; and
- when practicable, at least 7.5 m (or 25 feet) from the nearest underground conductive electrical equipment of any type and at a distance equal to three to four times the buried depth of any metallic structure connected to the service entrance neutral.

(3) Digital Recording Device Setup - A digital recording device shall be used to measure and record data in accordance with section H.5.1.2(6). The device shall be prepared as follows:

- connect one lead to the reference ground rod. Use a second wire to extend the other lead to the ground wire connecting the neutral to the ground rod at the service entrance serving the area under investigation.
- install a 10,000 Ohm resistor across the input leads and note the reading. Install a second 10,000 Ohm resistor (in series) across the input leads and note whether the reading decreases by more than 10%. Where the reading decreases by more than 10%, the reference ground rod shall be

moved to another location to reduce the resistance. When a good connection to earth has been established, remove both resistors from the digital recording device.

(4) Selection of Animal Contact Locations - The animal contact location at which the highest animal contact voltage reading was measured in the Animal Contact Test shall be used for the purposes of this test. Additional animal contact locations may also be tested simultaneously.

(5) Animal Contact Point Preparation – The procedure set out in section H.5.1.1(4) shall be applied.

(6) Measurement Interval - The measurement interval over which true rms values are averaged during recording shall not exceed ten seconds.

(7) Data Recorded -

a) Voltage from the primary neutral at the transformer to the reference ground rod: Vp.

b) Voltage from the secondary neutral in the service panel serving the animal contact area (note: where a watering device is involved, the service panel to which the water line is bonded shall be used) to the reference ground rod: Vs

c) Voltage drop from the primary neutral conductor at the location of the connection for Vp to the secondary neutral conductor at the location of the connection for Vs: Vps

d) Voltage across a five hundred Ohm resistor at the high ACV points as selected in accordance with section H.5.1.2(4): Vcc

(8) Test Duration and Continuity – Data shall be recorded over a period of not less than forty-eight consecutive hours. The test shall be repeated unless data is recorded without interruption for a minimum of twenty-four consecutive hours. The test shall also be repeated if testing is interrupted for more than twenty minutes during any twelve hour period.

(9) Data Records - An investigator shall record the results of and other information relating to the Farm Stray Voltage Test using Form 2 of this Appendix. A plot of the required measurements versus time may be substituted for or included with a completed Form 2. All recorded data shall be downloaded and retained with the other records of the investigation.

(10) Interpretation – Compare the ACV (Vcc) values noted on Form 2 to the ACC/ACV Threshold. An investigator shall carry out the Phase 2 Procedure if the ACC/ACV Threshold is met. If the ACC/ACV Threshold is not met, the investigation shall be terminated.

H.5.2 Phase 2 Procedure

An investigator shall conduct the Phase 2 Procedure set out in and in accordance with sections H.5.2.1 and H.5.2.2 to determine whether the Distributor Contribution Threshold is met.

H.5.2.1 Distributor Contribution Test

(1) Purpose - The Distributor Contribution Test is used to determine whether and the extent to which the distribution system contributes to farm stray voltage at animal contact locations.

(2) Application – This test shall be carried out at each point where a livestock farm customer's farm is connected to the distribution system at a distribution transformer.

(3) Time of Test - This test shall be performed at the same time of day as the times of highest ACV found in the Farm Stray Voltage Test.

(4) Preparation - Before commencing the test, measure the secondary neutral current with the farm completely de-energized. The secondary neutral current should be very low. If the current is high, this indicates some 120 volt load is energized. Investigate and de-energize as required.

(5) Data Documented

a) Eight data points shall be documented as follows:

1. Note nominal primary phase conductor voltage to neutral conductor voltage: Vpri
2. Measure load box current: I_{LB}
3. Measure voltage at load box connection to secondary system: V_{LB} (~240V)
4. Calculate transformer primary current (on the source side of the ground connection): Ip
5. Measure animal contact voltage at the same points used in the Farm Stray Voltage Test (not shown on Figure 1): Vcc
6. Measure voltage from primary neutral at the transformer to remote reference ground rod: Vp
7. Measure voltage from secondary neutral in the service panel serving the area of the animal contact to remote reference ground rod: Vs
8. Measure voltage from primary neutral at the transformer to secondary neutral at the service panel serving the area of animal contact: Vps

Figure 1 – Distributor Contribution Test

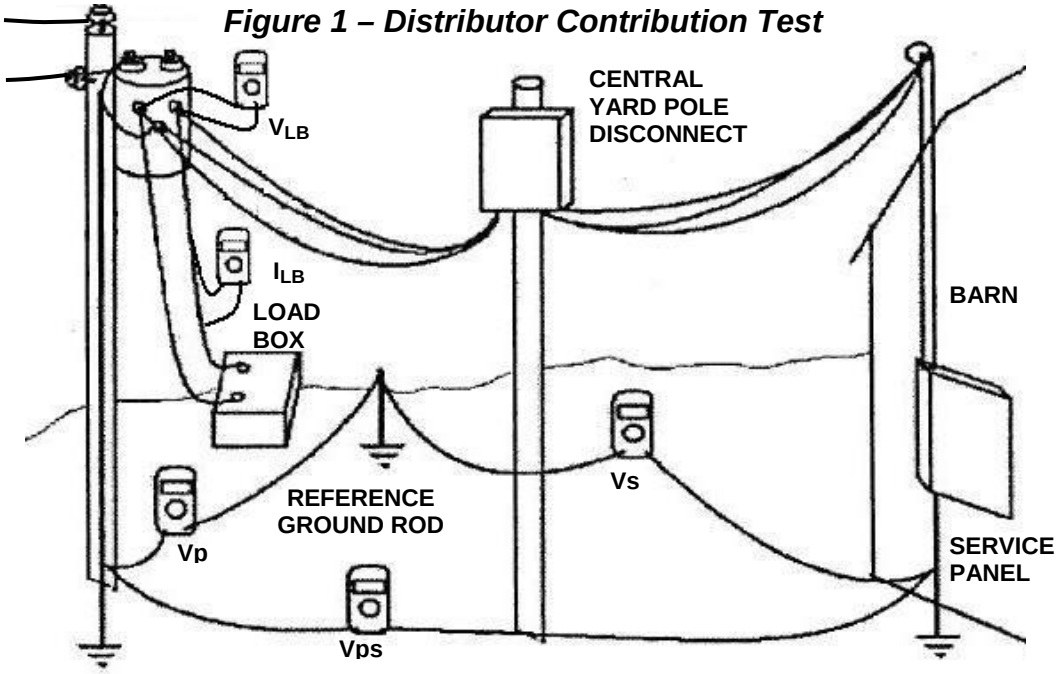

Figure 1 illustrates the measurement locations indicated above. Figure 2 illustrates the appropriate meter arrangement.

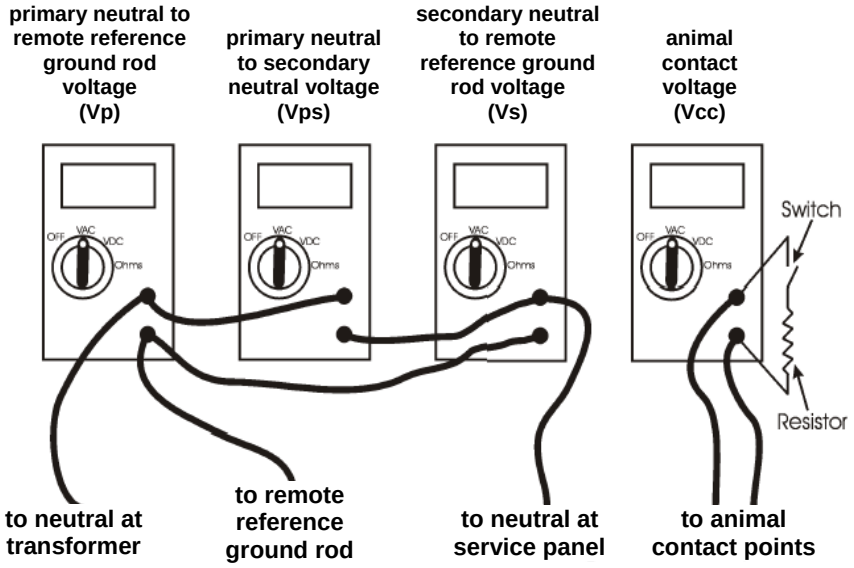

Figure 2 – Meter Arrangement for Distributor Contribution Test

(6) Conducting the Test - Attach the load box to the 240 Volt secondary side of the transformer. For single phase services, conduct Steps 1 through 5 listed below. For three phase services, conduct Step 1 and Step 2 listed below for each

phase, or conduct Steps 1 through 5 listed below for one phase only. Each test must be conducted for at least two minutes, with the highest readings observed during the interval recorded on Form 3.

a) Step 1: Load box de-energized; farm energized.

b) Step 2: Load box de-energized; farm de-energized.

c) Step 3: Load box energized at half load; farm de-energized.

d) Step 4: Load box energized to full load; farm de-energized.

e) Step 5: Load box energized to full load; farm energized.

(7) Data Records - An investigator shall record the results of and other information relating to the Distributor Contribution Test using Form 3 of this Appendix.

H.5.2.2 Distributor Contribution Calculations

(1) Purpose – The purpose of this procedure is to calculate the contribution of the distributor's distribution system to farm stray voltage.

(2) Data Analysis

a) Determine from the Farm Stray Voltage Test data the highest measured steady state value of ACV (Vcc_{fsv}) and the corresponding measured value for the primary neutral to reference ground rod voltage (Vp_{fsv}). Record these values on Form 4 at Step 1.

b) The primary neutral to remote reference ground rod voltage (Vp_{off}) and the ACV (Vcc_{off}) measured during the Distributor Contribution Test with the farm power "off" and the load box "off" shall be recorded on Form 4 at Step 2.

c) The primary neutral to remote reference ground voltage (Vp_{half}) and the animal contact voltage (Vcc_{half}) measured during the Distributor Contribution Test with the farm power "off" and the load box set at one-half (1/2) load shall be recorded on Form 4 at Step 3.

d) The primary neutral to remote reference ground voltage (Vp_{full}) and the animal contact voltage (Vcc_{full}) measured during the Distributor Contribution Test with the farm power "off" and the load box set at maximum load shall be recorded on Form 4 at Step 4.

(3) For Single Phase Farms - The contribution of the distributor's distribution system to ACV (VccD) shall be determined using the following formula:

$$VccD = \frac{Vp_{fsv} - Vp_{half}}{Vp_{full} - Vp_{half}} \times (Vcc_{full} - Vcc_{half}) + Vcc_{half}$$

(4) For Three Phase Farms - The contribution of the distributor's distribution system to ACV (VccD) for farms with three phase balanced load service is the measured ACV recorded in Step 2 of the Distributor Contribution Test (see H.5.2.1(6); i.e. with the load box de-energized and the farm de-energized) and recorded on Form 4 as Vcc_{off}.

(5) Interpretation – Compare the VccD value (from either (3) or (4) above as appropriate) to the Distributor Contribution Threshold.

(6) Data Records – An investigator shall record the results of and other information relating to the distributor contribution calculations using Form 4 of this Appendix.

H.5.3 Phase 3 Procedure

Where the Distributor Contribution Threshold has been met, an investigator shall conduct the Phase 3 Procedure set out in and in accordance with sections H.5.3.1 and H.5.3.2 to confirm whether remediation activities taken by the distributor have resulted in the contribution of the distributor's distribution system to farm stray voltage decreasing to a level that is below the Distributor Contribution Threshold; and to determine the impact of distributor remediation activities on ACC/ACV.

H.5.3.1 Distributor Contribution Confirmation Test & Calculations

(1) Purpose – The purpose of this procedure is to confirm whether the remediation activities carried out by a distributor have resulted in the contribution of the distributor's distribution system to farm stray voltage decreasing to a level that is below the Distributor Contribution Threshold.

(2) Procedure - The investigator shall repeat the Distributor Contribution Test and shall for that purpose make measurements at the same locations as used for the original Distributor Contribution Test. The investigator shall repeat the distributor contribution calculations in accordance with section H.5.2.2.

(3) Data Records - An investigator shall record the results of and other information relating to the distributor contribution confirmation test and calculations using Form 5 of this Appendix.

H.5.3.2 Final Farm Stray Voltage Test

(1) Purpose – The purpose of this test is to determine the impact of a distributor's remediation activities on farm stray voltage.

(2) Procedure - An investigator shall repeat the Farm Stray Voltage Test, other than in relation to section H.5.1.2(10), and shall for that purpose make measurements at the same animal contact locations used for purposes of the original Farm Stray Voltage Test.

(3) Data Records - An investigator shall record the results of and other information relating to the final Farm Stray Voltage Test using Form 6 of this Appendix. A plot of the required measurements versus time may be substituted for or included with a completed Form 6. All recorded data shall be downloaded and retained with the records of the investigation.

FORMS

FORM 1

ANIMAL CONTACT TEST

Customer Name: _____ Date: _____

Farm Location: _____ File No: (if applicable): _____

INSTRUCTIONS

1. The information provided by the Animal Contact Location Identification Number, and corresponding description, and by the farm sketch(es) shall be sufficient to allow a third party to locate the animal contact locations and identify the animal contact points noted on the Animal Contact Test Data Record.

2. Voltage measurements shall be made using one instrument to ensure consistency. The second measurement required for each animal contact location shall be taken immediately after the first measurement has been recorded. Comments related to the measurement process shall be recorded on the Animal Contact Test Comments sheet.

3. Calculate R_{source} as follows:

$$R_{source} = \frac{V_{oc} - V_{cc}}{V_{cc}} \times R_{shunt}$$

where R_{shunt} = 500 Ohms

4. R_{source} should be less than 500 Ohms, ideally closer to 250 Ohms. Where R_{source} is greater than 500 Ohms, clean animal contact points and add salt water solution to the contact area.

FORM 1 (continued)

ANIMAL CONTACT TEST DATA RECORD

Animal Contact Location ID #	Description of Location & Animal Contact Points	Voltage w/o Shunt Resistor	Voltage w/Shunt Resistor	Source Resistance
		V_{oc}	V_{cc}	R_{source}
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

APPENDIX H
FARM STRAY VOLTAGE DISTRIBUTOR INVESTIGATION PROCEDURE

Animal Contact Location ID #	Description of Location & Animal Contact Points	Voltage w/o Shunt Resistor	Voltage w/Shunt Resistor	Source Resistance
		V_{oc}	V_{cc}	R_{source}
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

FORM 1 (concluded)

ANIMAL CONTACT TEST COMMENTS

Animal Contact Location ID #	Comment
1	
2	
3	
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10	

Animal Contact Location ID #	Comment
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12	
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20	

APPENDIX H
FARM STRAY VOLTAGE DISTRIBUTOR INVESTIGATION PROCEDURE

FORM 2

FARM STRAY VOLTAGE TEST

Customer Name: _____ Date: _____

Farm Location: _____ File No: (if applicable): _____

Start Date/Time: _____ Stop Date/Time: _____

Animal Contact Location Identification No: _____

FARM STRAY VOLTAGE TEST DATA

Hour	Time Highest Steady State Vcc Recorded in Hour	Readings at the time (Hour:Min) noted at left:				Estimated Time During Hour Vcc Exceeds ACC/ACV Threshold
		Animal Contact Voltage Across Shunt Resistor	Primary Neutral to Reference Ground Rod Voltage	Secondary Neutral to Reference Ground Rod Voltage	Primary Neutral to Secondary Neutral Voltage	
	Hour:Min	Vcc	Vp	Vs	Vps	Min
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APPENDIX H
FARM STRAY VOLTAGE DISTRIBUTOR INVESTIGATION PROCEDURE

Hour	Time Highest Steady State Vcc Recorded in Hour	Readings at the time (Hour:Min) noted at left:				Estimated Time During Hour Vcc Exceeds ACC/ACV Threshold
		Animal Contact Voltage Across Shunt Resistor	Primary Neutral to Reference Ground Rod Voltage	Secondary Neutral to Reference Ground Rod Voltage	Primary Neutral to Secondary Neutral Voltage	
	Hour:Min	Vcc	Vp	Vs	Vps	Min
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APPENDIX H
FARM STRAY VOLTAGE DISTRIBUTOR INVESTIGATION PROCEDURE

Hour	Time Highest Steady State Vcc Recorded in Hour	Readings at the time (Hour:Min) noted at left:				Estimated Time During Hour Vcc Exceeds ACC/ACV Threshold
		Animal Contact Voltage Across Shunt Resistor	Primary Neutral to Reference Ground Rod Voltage	Secondary Neutral to Reference Ground Rod Voltage	Primary Neutral to Secondary Neutral Voltage	
	Hour:Min	Vcc	Vp	Vs	Vps	Min
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						

FORM 3

DISTRIBUTOR CONTRIBUTION TEST DATA

Customer Name: _____ Date: _____

Farm Location: _____ File No: (if applicable): _____

1. Initial measurements and calculations with farm service de-energized:

Primary Nominal Voltage Phase to Neutral (Vpri):_____V (e.g. 8kV)

Load Box Current (I_{LB}): Half Load_____ A Full Load _____A

Load Box Voltage (V_{LB}): Half Load_____ V Full Load _____V

Transformer Primary Current (I_p): _____

where:

$$I_p = \frac{I_{LB} \times V_{LB}}{V_{pri}}$$

Note: Ip is measured on the source side of the ground connection.

2. Distributor Contribution Test Measurements

		Step 1	Step 2	Step 3	Step 4	Step 5
Setting	Farm	ON	OFF	OFF	OFF	ON
	Load Box	OFF	OFF	HALF	FULL	FULL
Enter Start Time:						
Item		Record Highest Value Measured Over Minimum 2 minute Test Duration				
Vcc (V)						
Vp (V)						
Vs (V)						
Vps (V)						

FORM 3 (concluded)

NOTE ON DISTRIBUTOR CONTRIBUTION TEST

1. With all farm power disconnected, there are no sources for neutral-to-earth voltage to be produced on the farm. The voltages measured at all locations should be approximately the same (FARM OFF, LOAD BOX OFF). There may be a difference of a few tenths of a volt in some situations. Assuming the primary (distributor) and secondary (farm) neutral conductors are bonded at the transformer, any voltage measured with the farm power off is most likely due to an off-farm source. The source may be voltage drop on the primary neutral, or it can be a ground fault at a neighbouring property in the area.
2. If a farm is supplied with a single-phase multi-grounded utility distribution line, the 240 volt load test should result in at least a slight increase in voltage when the load is applied (Farm OFF, Load Box FULL). A large increase in neutral-to-earth voltage during the 240 volt load test indicates the primary neutral circuit resistance may need to be reduced.

APPENDIX H
FARM STRAY VOLTAGE DISTRIBUTOR INVESTIGATION PROCEDURE

FORM 4

DISTRIBUTOR CONTRIBUTION CALCULATION

Customer Name: _____ Date: _____

Farm Location: _____ File No: (if applicable): _____

Farm Service Type: Three Phase ☐ Single Phase ☐

Step 1: Enter the highest value of animal contact voltage recorded during the Farm Stray Voltage test on Form 2 (Vcc_{fsv}) and the corresponding primary to reference ground voltage (Vp_{fsv}).

Vcc_{fsv}: _____V Vp_{fsv}: _____V

Step 2: Enter the value of animal contact voltage and corresponding primary to reference ground voltage that was present during the Distributor Contribution Test with the farm power off and the load box off.

Vcc_{off}: _____V Vp_{off}: _____V

Step 3: Enter the value of animal contact voltage and corresponding primary to reference ground voltage that was present during the Distributor Contribution Test with the farm power off and the load box set at half load.

Vcc_{half}:_____V Vp_{half}: _____V

Step 4: Enter the value of animal contact voltage and corresponding primary to reference ground voltage that was present during the Distributor Contribution Test with the farm power off and the load box set at maximum load.

Vcc_{full}:_____V Vp_{full}: _____V

Distributor Contribution to ACC/ACV (VccD)

Calculated VccD for farms with single phase service:_____V

$$VccD = \frac{Vp_{fsv} - Vp_{half}}{Vp_{full} - Vp_{half}} \times (Vcc_{full} - Vcc_{half}) + Vcc_{half}$$

Measured VccD (VccD = Vcc_{off}) for farms with three phase service:_____V

FORM 5

DISTRIBUTOR CONTRIBUTION CONFIRMATION TEST AND CALCULATIONS

Test Data

Customer Name: _____ Date: _____

Farm Location: _____ File No: (if applicable): _____

1. Initial measurements and calculations with farm service de-energized:

Primary Nominal Voltage Phase to Neutral (Vpri):_____V (e.g. 8kV)

Load Box Current (I_{LB}): Half Load_____ A Full Load _____A

Load Box Voltage (V_{LB}): Half Load_____ V Full Load _____V

Transformer Primary Current (I_p): _____

where:

$$I_p = \frac{I_{LB} \times V_{LB}}{V_{pri}}$$

Note: Ip is measured on the source side of the ground connection.

2. Load box measurements

		Step 1	Step 2	Step 3	Step 4	Step 5
Setting	Farm	ON	OFF	OFF	OFF	ON
	Load Box	OFF	OFF	HALF	FULL	FULL
Enter Start Time:						
Item		Record Highest Value Measured Over Minimum 2 minute Test Duration				
Vcc (V)						
Vp (V)						
Vs (V)						
Vps (V)						

FORM 5 (concluded)

DISTRIBUTOR CONTRIBUTION CONFIRMATION TEST AND CALCULATIONS

Calculations

Customer Name: _____ Date: _____

Farm Location: _____ File No: (if applicable): _____

Farm Service Type: Three Phase ☐ Single Phase ☐

Step 1: Enter the highest value of animal contact voltage recorded during the Farm Stray Voltage Test on Form 2 (Vcc_{fsv}) and the corresponding primary to reference ground voltage (Vp_{fsv}).

Vcc_{fsv}: _____V Vp_{fsv}: _____V

Step 2: Enter the value of animal contact voltage and corresponding primary to reference ground voltage that was present during the Distributor Contribution Test with the farm power off and the load box off.

Vcc_{off}: _____V Vp_{off}: _____V

Step 3: Enter the value of animal contact voltage and corresponding primary to reference ground voltage that was present during the Distributor Contribution Test with the farm power off and the load box set at half load.

Vcc_{half}:_____V Vp_{half}: _____V

Step 4: Enter the value of animal contact voltage and corresponding primary to reference ground voltage that was present during the Distributor Contribution Test with the farm power off and the load box set at maximum load.

Vcc_{full}:_____V Vp_{full}: _____V

Distributor Contribution to ACC/ACV (VccD)

Calculated VccD for farms with single phase service:_____V

$$VccD = \frac{Vp_{fsv} - Vp_{half}}{Vp_{full} - Vp_{half}} \times (Vcc_{full} - Vcc_{half}) + Vcc_{half}$$

Measured VccD (VccD = Vcc_{off}) for farms with three phase service:_____V

FORM 6

FINAL FARM STRAY VOLTAGE TEST

Customer Name: _____ Date: _____

Farm Location: _____ File No: (if applicable): _____

Start Date/Time: _____ Stop Date/Time: _____

Animal Contact Location Identification No: _____

FINAL FARM STRAY VOLTAGE TEST DATA

Hour	Time Highest Steady State Vcc Recorded in Hour	Readings at the time (Hour:Min) noted at left:				Estimated Time During Hour Vcc Exceeds ACC/ACV Threshold
		Animal Contact Voltage Across Shunt Resistor	Primary Neutral to Reference Ground Rod Voltage	Secondary Neutral to Reference Ground Rod Voltage	Primary Neutral to Secondary Neutral Voltage	
	Hour:Min	Vcc	Vp	Vs	Vps	Min
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APPENDIX H
FARM STRAY VOLTAGE DISTRIBUTOR INVESTIGATION PROCEDURE

Hour	Time Highest Steady State Vcc Recorded in Hour	Readings at the time (Hour:Min) noted at left:				Estimated Time During Hour Vcc Exceeds ACC/ACV Threshold
		Animal Contact Voltage Across Shunt Resistor	Primary Neutral to Reference Ground Rod Voltage	Secondary Neutral to Reference Ground Rod Voltage	Primary Neutral to Secondary Neutral Voltage	
	Hour:Min	Vcc	Vp	Vs	Vps	Min
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APPENDIX H
FARM STRAY VOLTAGE DISTRIBUTOR INVESTIGATION PROCEDURE

Hour	Time Highest Steady State Vcc Recorded in Hour	Readings at the time (Hour:Min) noted at left:				Estimated Time During Hour Vcc Exceeds ACC/ACV Threshold
		Animal Contact Voltage Across Shunt Resistor	Primary Neutral to Reference Ground Rod Voltage	Secondary Neutral to Reference Ground Rod Voltage	Primary Neutral to Secondary Neutral Voltage	
	Hour:Min	Vcc	Vp	Vs	Vps	Min
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Stray *Voltage*

What is Stray Voltage?

Varying amounts of low-level voltage often exist between the earth and electrically-grounded farm equipment such as metal stabling, feeders, or milk pipelines. Usually, these voltage levels present no harm to animals. However, if an animal touches a grounded metal object where these low voltages are found, a small electric current may pass through the animal. The voltage that causes this small current is known as "animal contact voltage," "stray voltage" or "tingle voltage."

Reported symptoms for dairy cows include:

- Reluctance to enter milking parlour
- Reduced water or feed intake
- Nervous or aggressive behaviour
- Uneven and incomplete milkout
- Increased somatic count
- Lowered milk production

These symptoms can also be the result of other non-electrical farm factors such as disease, poor nutrition, unsanitary conditions or milking equipment problems. Farmers should consider and investigate all possibilities, including stray voltage, when attempting to resolve these symptoms.

What causes Stray Voltage?

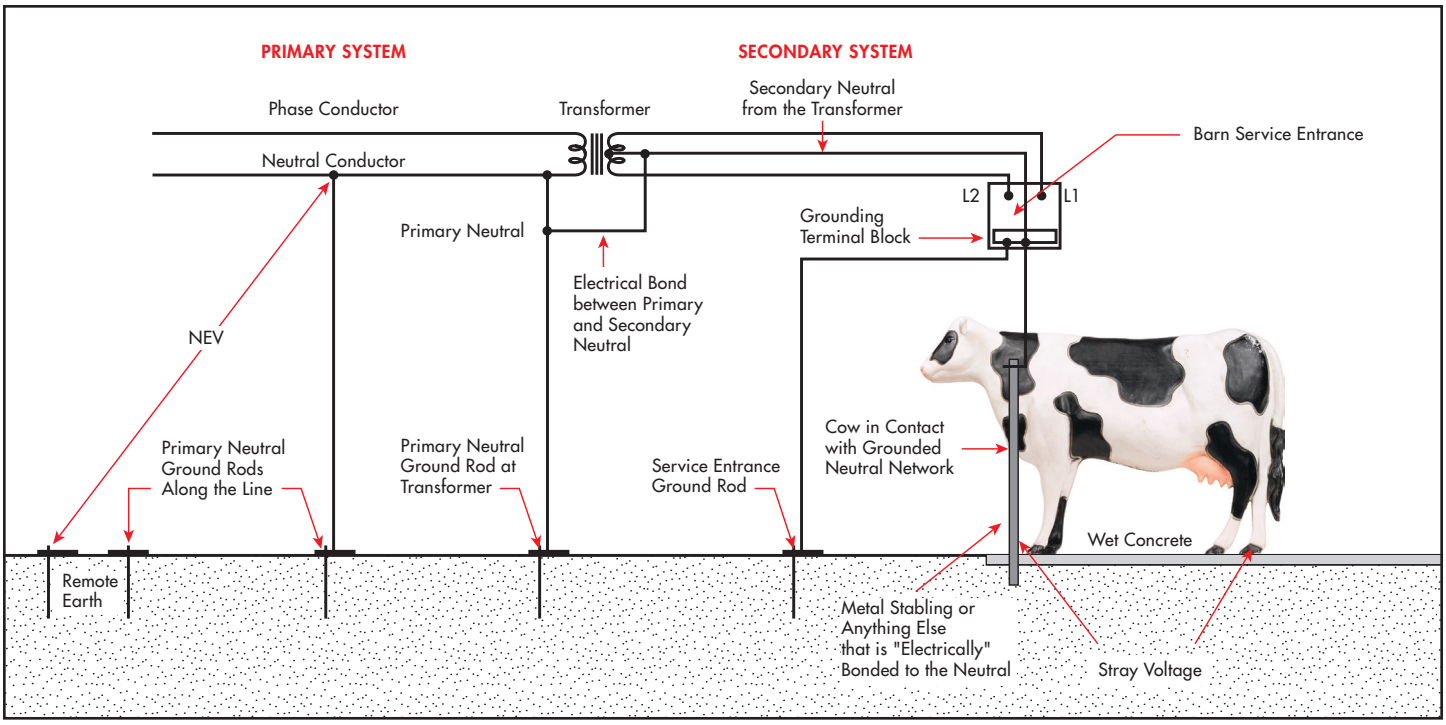
Stray voltage can be produced by a wide variety of off-farm and on-farm sources.

Off-farm sources:

In a properly functioning electrical distribution system, some voltage will always exist between the neutral system (ground conductors) and the earth. The level of this neutral-to-earth voltage (NEV) can change on a daily or seasonal basis, depending on changes in electrical loading, environmental conditions and other factors. For safety reasons, Hydro One's neutral system is connected to a farm's grounding system. While this bond protects people and animals from shocks caused by faulty electrical equipment and lightning strikes, it can also result in a stray voltage equal to a fraction of the NEV appearing on grounded farm equipment, such as feeders, waterers, metal stabling, metal grates and milk pipelines.

On-the-farm sources:

Poor or faulty farm wiring, improper grounding, unbalanced farm system loading, defective equipment or voltages from telephone lines or gas pipelines are all possible sources of stray voltage.



If you think you have a Stray Voltage problem

Call our Customer Communications Centre at 1-888-664-9376 (Monday to Friday, 7:30 a.m. to 8 p.m.). Your local field business centre will call you within five business days to arrange an appointment.

1. **First Site Visit:** We'll meet with you at your property to perform pre-test inspections, conduct a site layout and carry out an animal contact test.

2. **Second Site Visit:** Five to ten business days after the first site visit, we will return to your property and install a farm stray voltage recording device.

3. **Third Site Visit:** Two to three business days after the second site visit, we'll remove the recording device and analyze the recorded data. We'll discuss the results of the testing with you at this time.

4. **The Ontario Energy Board (OEB) has specified that voltage levels of less than 1.0 volt to be of no concern.** If the measured threshold falls below this level, the investigation will conclude. Nevertheless, if you choose to purchase a stray voltage filter from us, we'll install it at no cost.

5. **If the stray voltage measured is above 1.0 volt,** we'll do further OEB-defined testing during a fourth site visit to determine whether corrective measures need to be taken by us.

6. **Final Site Visit:** If corrective measures were implemented by us, we'll return to your property to conduct final testing to see whether any additional corrective measures need to be taken by us.

For more information, go to www.HydroOneNetworks.com/strayvoltage

For additional information on the effects of stray voltage on livestock, see the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) website, www.omafra.gov.on.ca/english/livestock/dairy/facts/strayvol.htm

hydro one
Partners in Powerful Communities

NEXTera ENERGY RESOURCES

A Leader in Clean Energy

NextEra Energy Resources stands out as a leader in producing electricity from clean and renewable resources and is among the nation's most disciplined competitive power generators. Our company derives approximately 95 percent of its electricity from clean or renewable fuels such as wind, natural gas, solar, hydroelectric and nuclear power plants in operation across North America. Our success reflects the solid business practices of our parent company, NextEra Energy, Inc., one of the nation's leading clean energy companies.

Demonstrating Expertise in Wind Energy

One of NextEra Energy Resources' competitive advantages is in wind energy development. While North America's power demands continue to grow, so does interest in clean, renewable and affordable wind energy. NextEra Energy Resources is helping develop wind energy facilities and is the North American leader in wind energy generation.

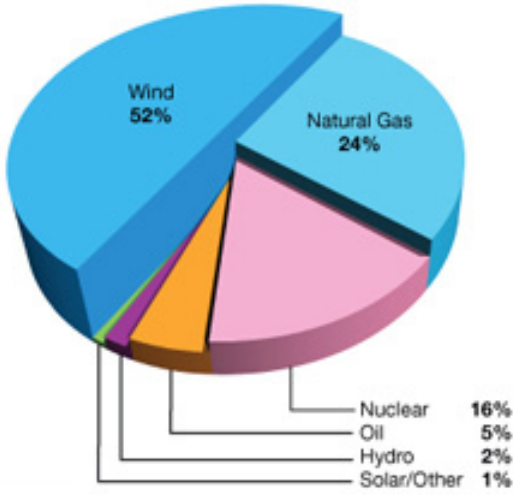
Wind energy is especially attractive now because of the following:

- **Quick to market.** The time it takes to construct a wind energy center is relatively short — from groundbreaking to commercial operation in six to nine months.
- **Low and competitive price.** The cost of wind has decreased significantly. This cost is competitive with other forms of power generation. In addition, there is no fuel cost volatility.
- **Environmental benefits.** Wind-generated power produces no air or water emissions, creates no solid waste by-products and does not deplete natural resources such as coal, oil or gas.
- **Portfolio diversity.** Utilities and other energy businesses that add wind generation to their portfolios help diversify the nation's energy supply while meeting customers' electricity preferences.
- **Regulatory initiatives.** Some states have instituted regulatory initiatives that encourage clean energy production, and wind energy can help meet those requirements.
- **Customer choice.** More customers are requesting the option of purchasing clean renewable energy, such as wind, to meet their electricity needs.

Wind development is an even better option when NextEra Energy Resources is involved. We offer numerous advantages over other companies, including: our financial strength; our proven ability to deliver; our world-class expertise in development, construction and operations; and our strong community focus.

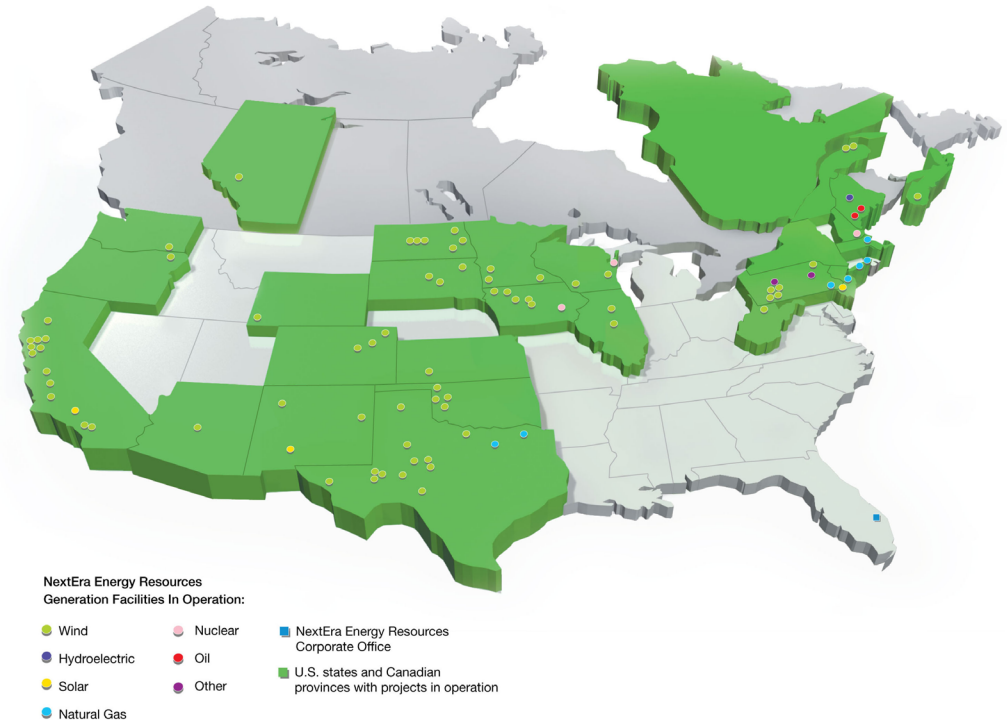
A Diversified Portfolio at NextEra Energy Resources

Total Net Megawatts: 16,781
Updated Jan. 31, 2012



NextEra Energy Resources Generation Facilities

As of 01/31/12



Building Partnerships Across North America

It takes more than environmental leadership to be successful in our business. It takes customers that are committed to a clean environment and renewable energy to purchase the electricity produced from wind energy centers. NextEra Energy Resources is building strong partnerships with companies across North America that are buying wind-generated electricity to provide to residential and commercial markets throughout their service areas. Many electric utilities, cooperatives and municipalities have joined with our company in providing clean, renewable wind power.

Generating Clean Energy Through a Growing Renewable Energy Portfolio

NextEra Energy Resources has a portfolio of facilities, totaling more than 16,700 net megawatts of generating capacity with a presence in 23 states and three provinces in Canada. In addition to our wind energy centers, we also develop and operate other clean energy resources.

Natural gas. We have incorporated the cleanest burning fossil fuel into our portfolio with natural gas facilities currently in five states. Often we install combined-cycle technology, which uses waste heat to drive an additional power generator for increased energy efficiency and lower emissions than conventional fossil-fueled units.

Nuclear energy. NextEra Energy Resources added clean nuclear energy into the fuel mix through a majority interest in the Seabrook Station in New Hampshire, a 70 percent interest in the Duane Arnold Energy Center in Iowa, and full ownership of Point Beach Nuclear Plant in Wisconsin. Nuclear power plants produce virtually no air emissions during operation, and our facilities have excellent safety records and are focused on reliable operation.

Other energy sources. NextEra Energy Resources is a leading producer of hydroelectric power in Maine, totaling approximately 360 megawatts of renewable energy. Our company is also the largest U.S. generator of solar energy through operations at the Solar Electric Generating Systems (SEGS) in California's Mojave Desert. In all, the company operates an unprecedented 320 megawatts, with ownership of approximately 158 megawatts of solar generation.

Operating in Harmony with the Environment

NextEra Energy Resources promotes the generation of clean energy through the use of clean-burning fuels and renewable resources. We also incorporate environmental stewardship into the design, construction, operation and maintenance of our facilities. Through our commitment, we are working to ensure that the growing demand for power is met in the most environmentally responsible manner.

For more information, please visit www.NextEraEnergyResources.com

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act*, 1998, S.O. 1998, c.15, Schedule B;

AND IN THE MATTER OF an application by Varna Wind Inc. for an order or orders pursuant to section 92 of the Ontario Energy Board Act, 1998 granting leave to construct transmission facilities in the Municipalities of Bluewater and Huron East.

VARNA WIND RESPONSES TO GROUP INTERROGATORIES

Group IR 1:

Varna Wind, Inc. (the "Applicant") is a special purpose vehicle established for the development, construction and operation of the Bluewater Wind Energy Centre (BWEC).

(a) For this specific project, why is the Applicant incorporated under the laws of New Brunswick and not Ontario?

(b) Is this following the intent of the Provincial Government mandate?

ANSWER 1(a):

The Applicant's corporate structure was described in detail in the application. The jurisdiction of incorporation is not relevant to the proceeding.

ANSWER 1(b):

In Procedural Order No. 1, the OEB stated that the "Ontario government's renewable energy policy" is out of the scope of the Board's jurisdiction in this proceeding. The question is therefore not relevant to this proceeding.

The copy of the easement agreement submitted by the Applicant, as reviewed by the group, records an address in United States (Florida) for signing authority to bind the corporation. In the Open House sheets, provided under Exhibit G Tab 1 Schedule 3, the Applicant boasts that

> ***"Over the next 20 years, we estimate the project will contribute:***
> ***$166 million in corporate income tax***

$10 million in property tax revenue to Huron County
$21 million in landowner payments"

(c) Is the Applicant implying that they will be paying income tax on these wind turbines of 8.3 million dollars a year on this project alone to the Province of Ontario?

ANSWER 1(c):

It should be noted that the excerpt above from Exhibit G, Tab 1, Schedule 3 was provided to the public as part of consultation materials that discussed the economic impact of the project over the next 20 years. The figures provided were averages, based on assumptions with information known at the time the materials were published (i.e. industrial mill rates, corporate tax rates).

The question is not relevant to this proceeding. However, over the next 20 years, in aggregate, the Applicant will be paying $166 MM in combined provincial and federal income taxes.

(d) Is the Applicant implying that they will be paying $500,000.00 a year to Huron County on this project? How is this annual payment of $500,000.00 being allocated between the Municipalities of Bluewater and Huron East?

ANSWER 1(d):

The question is not relevant to this proceeding. However, using the current industrial mill rate, and publicly available methodology for calculating property taxes for wind projects (MPAC), annual property taxation is estimated to be approximately $103K. 53% of that amount is allocated to the Province to support education. 26% is allocated to Huron County and the remaining 21% is allocated to the Municipality of Bluewater. The portion of the Facility located in Huron East is in the Municipal Right of Way and not subject to property tax assessment.

(e) Is the Applicant implying that they will be paying $1,050,000.00 a year to landowners for the 37 turbines, or $28,378.38 per turbine per year?

ANSWER 1(e):

The question is not relevant to this proceeding. However, for the Board's information, the Applicant provided this information as an average over the next 20 years. Actual compensation to individual landowners will vary and is confidential.

(f) With the profits the Applicant reports, how can a small property owner along the proposed transmission line challenge anything against a company of this stature?

ANSWER 1(f):

This leave to construct proceeding provides opportunities for all affected parties to participate in accordance with the OEB's practice and procedures.

Group IR 2:

No comment.

Group IR 3:

The Applicant is seeking approval to construct and operate a transmission facility.
The Applicant has been awarded a 20-year power purchase agreement.
It is understood that the Wind Turbine contracts are also for a 20 year agreement.

(a) Why do all of the Option Agreements for the transmission line include for perpetuity?

(b) If others have an option to renegotiate, why are the property owners on the transmission line not given equal opportunity?

(c) When the turbines are obsolete or on the termination of the 20 year contract, if the Applicant does not renew the wind turbine contracts, exactly what is the Applicant's decommissioning plan?

(d) Does the decommissioning include the transmission line?

(e) What funding agreement does the Applicant have set up with the municipalities for the decommissioning?

(f) The world is paved with good intentions, but what are the guarantees from the Applicant that the decommissioning expenses are not left to the taxpayer?

ANSWER:

(a) As is industry standard practice, transmission easements in Ontario are typically negotiated and granted in perpetuity.

(b) It is standard industry practice for linear infrastructure easements, including transmission easements, to be paid for in a one-time payment at commencement and to continue in perpetuity. The turbines are mechanical and so they have a wear factor and a given life expectancy.

(c) Please refer to the "Final Decommissioning Plan Report – Bluewater Wind Energy Centre" (the "Decommissioning Plan"), dated as of June, 2012 and included as part of the Varna Wind, Inc. Renewable Energy Approval application submission on June 26, 2012.
The Report is available at www.
Nexteraenergycanada.com/pdf/bluewater/Decommissioning_2012_06_26.pdf.

(d) Yes, the Decommissioning Plan submitted as part of the Renewable Energy Approval application submission includes the transmission line.

(e) Decommissioning requirements are addressed by the Ministry of Environment through the Renewable Energy Approval process. This process ensures that the Applicant has created and will adhere to a sufficient Decommissioning Plan and sets forth specific decommissioning requirements within the Applicant's REA. As such, no further agreement is currently set up with the municipalities.

(f) As mentioned in 3(e), the Applicant is subject to decommissioning requirements dictated by the MOE through the Renewable Energy Approval process. The Applicant must adhere to these requirements to be in compliance with its REA.

Group IR 4:

The applicant states that they will be increasing the amount of renewable energy generation being added to the provincial grid. We disagree. It is understood that when there is excess hydro, whenever there is wind and the turbines are turning, then the other source of green/renewable energy that of water at Niagara Falls has to be turned off or exported. The cheap green/renewable energy is turned off for the very expensive wind energy. So, at the end of the day, the same amount of green/renewable energy has been generated except for a lot more money which all of the people of the province of Ontario have to directly pay for via their hydro bills. We note there was an increase in the hydro bills effective January 1, 2013 to accommodate more renewable energy.

(a) Is the energy from wind turbines actually increasing the total green/renewable energy being used in Ontario?

We understand that the stats from HONI support that there is no real increase in any green/renewable energy from wind turbines. The nonrenewable energy generators need warm up time so cannot be turned on and off whenever the winds happen to blow and produce unpredictable quantities of power. Great idea if wind energy could replace nonrenewable energy or if the energy could be stored, i.e. Hydrogen production.
The economic slowdown, the restarting of the last nuclear phase, etc. have left the Province of Ontario with excess hydro at present and for the future. The excess hydro that is produced by the turbines could possibly be beneficial if it could be stored.

(b) Is the Applicant only taking their profits or is Applicant working on technology to improve the system?

(c) If so, exactly what are they doing?

ANSWER 4 (a,b,c):

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding.

In response to the specific questions enumerated in the Interrogatory, the Applicant advises as follows:

(a) All energy produced from the Bluewater Wind Energy Centre is delivered to the IESO controlled-grid. The IESO operates the grid in accordance with the Market Rules.

(b) The Applicant meets all requirements of the IESO Market Rules with respect to dispatch obligations, including those aimed at maintaining operability and reliability.

(c) See response to IR 4(b).

Group IR 5:

The Applicant states that the location of the facility was determined by a strong interest expressed by local landowners. We very, very, very strongly disagree.

We agree that for more than a year the Applicant has been relentlessly trying to get all the properties signed, on both sides of Centennial Road and Hensall Road, the route determined by the Applicant.

The Applicant strongly suggested to us that the line was going through, on the route that the Applicant choose, no matter what. The landowners were told that they had a choose to sign the agreement and receive some money or the person on the other side of the road would get the money. Some landowners have stated that they signed because they felt they had no choice. It must be said that the properties, the Applicant has been able to get easement contracts on, are on properties where the owner does not reside on the property. One individual signed all of his properties except for the property where he personally resides. When the same person heard that the proposed route would in fact also be going by their home the local newspaper carried the story. The Huron Expositor, on Wednesday November 14, 2012, in the article headed "Tuckersmith family angry transmission lines to be 70 feet from their house" and the article states"We feel we have been deliberately deceived all along as at first they promised that they would never go by in front of our house...."

When Hydro One put up the new distribution line in 2004 on Hensall Road, Hydro One bent over backwards trying to accommodate all of our concerns, the environment, to keep the good farm land, etc. Hydro One worked with each and every landowner to ensure the least amount of impact for everyone.

Unfortunately, our personal experience with the Applicant has been extremely negative and eventually it got to the point that a number of the landowners felt that they had no choice but to ask the Applicant to stay off their property.

The group, in Tuckersmith Township, was started by us the land owners in response to the Applicant's tactics. In Tuckersmith Township, from the total of about 43 properties or so that the Applicant tried to sign, we believe from the pre-filed evidence that maybe 18% signed.

(a) Is it the policy of the government to force the transmission line on any one person?

(b) We ask the Applicant to support their statement that the location was determined by the interest expressed by local landowners?

(c) Why was the Applicant trying to sign contracts for both sides of the road?

(d) The Applicant was aware that HONI would not allow their posts to be within 50 feet of the existing posts. Why was the Applicant trying to sign properties on the same side of the existing HONI posts with the contract only allowing for a 33 foot easement?

ANSWER 5 (a):

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding.

In response to the specific questions enumerated in the Interrogatory, the Applicant advises as follows:

(a) The OEB's authority with respect to siting transmission facilities is addressed in Part VI of the *OEB Act, 1998*.

ANSWER 5 (b):

During the development of the route, a great deal of information was reviewed and analyzed in order to narrow down the best possible choice for a transmission route that would, not only serve the intended purpose, but that would also best serve the interests of the community as a whole. Some of the factors that are considered include:

- Public and social
  - Tree and vegetation removal on residential property
  - Distance to parks, schools, trails, and public facilities.
  - Distance to homes and businesses
- Environmental

  - Archaeologically significant areas
  - Wild life areas and protected wetlands
  - Endangered species
- Cultural
  - Impact to existing utilities
  - Agricultural and dairy operations
  - Tree and vegetation removal on non-residential property
- Engineering and construction
  - Sound engineering and construction principles (safety/reliability)
  - Engineering demands (size/type of structures, spans, soil type, etc.)
  - Cost and delivery schedules

In addition to these factors, interest by local landowners was also considered. For example, early in the development process a route was proposed whereby the line would be partially constructed along the back-side of privately owned property. This proposal would have had the effect of moving a portion of the route off of the county ROW and into a more discrete location. There was very little land owner interest in this particular proposal and because of the low level of interest, the route was modified.

Furthermore, land owners expressed interest in a number of other items, including, but not limited to, preserving trees, maintaining safe distances from residential homes, and in maintaining the safety of livestock. All of these land owner interests have been taken into account and had the effect of either route modification and/or engineering design modification. Landowner support is also reflected in the fact that all Directly Affected Land Owners have entered into agreements with the Applicant.

ANSWER 5 (c):

As a part of the transmission route development process, the applicant sought to maximize options along the route for location of the line in order to provide the best available location while accounting for the potential for obstacles. For example, the applicant attempted to work with the owners of existing infrastructure to co-locate facilities where possible. Doing so not only serves the intended purpose of the transmission line, but the interests of the community as a whole.

ANSWER 5 (d):

See Answer 5(c).

Group IR 6:

It is understood that the application to the MOE on June 26, 2012, has not been completed. We appreciated the individual notification to each property owner for the OEB hearings, information, deadlines, etc.

(a) Why were the property owners not notified of the deadlines for submissions to the MOE?

ANSWER 6 (a):

The Applicant complied with all elements of O.Reg 359/09 (*Environmental Protection Act)* including the notification requirements in Section 17 as prescribed by the Ministry of Environment. The Renewable Energy Application for the Bluewater Wind Energy Centre was filed on June 26th, 2012 and deemed complete on August 31st, 2012.

As per MOE requirements, notices were provided in local newspapers and mailed to all landowners within 550m of the 'Project Location' as defined in O.Reg. 359/09. Included in that notice were instructions on how to participate in the Environmental Registry public comment period (30 days) which ended on September 30, 2012.

Group IR 7:

The Applicant is applying pursuant to Sections 92 and 97 of the OEB Act.

ANSWER: Confirmed.

Group IR 8:

List of Exhibits from the Applicant's pre-filed evidence.

Group IR 9:

Authorized reps for the purpose of serving documents.

Group IR 10:

Step up voltage from 34.5kV to 115kV.

Group IR 11:

Located in Huron County.

(a) Could the Applicant please provide a map large enough so we can read all of the details?

ANSWER:

Please see the maps provided in response to Board Staff's IR. No. 3.

Group IR 12:

The Applicant states that the BWEC and the Facility encompasses approximately 10,000 acres of privately owned land parcels, of which only 630 acres constitute the potential disturbance area for construction.

(a) Could the Applicant please provide the evidence and documentation to fully support these figures?

The Applicant states that the land is predominantly cash-crop agriculture. It however fails to mention the very high concentration of dairy farms along Centennial Road. The dairy cow being the most sensitive to ground currents should definitely be considered in this application.

(b) Is the Applicant willing to take full responsibility for any ground current pollution?

ANSWER 12(a):

A map of the project location is at Exhibit B/Tab 2/Schedule2.

ANSWER 12(b):

See the Applicant's response to Board Staff IR No. 7.

Group IR 13:

The components of the Facility.

(a) Will the proposed transmission line ever exceed the maximum 115kV?

ANSWER:

The transmission line will operate in accordance within the requirements of the System Impact Assessment, which provides the following with respect to voltages:

(4) The connection applicant shall ensure that the 115 kV equipment is capable of continuously operating between 113 kV and 127 kV. Protective

relaying must be set to ensure that the transmission equipment remains in-service for voltages between 94% of the minimum continuous value and 105% of the maximum continuous value specified in Appendix 4 of the Market Rules.

(b) Why is this entire transmission line not being buried?

ANSWER:

The Applicant's and the industry's standard practice is to put 115kV transmission lines overhead. This standard is based on many considerations including, but not limited to, considerations related to construction, maintenance, operations, impact on land, and cost.

Group IR 14:

37 GE 1.62 MW wind turbines will be constructed on a reinforced concrete foundation.

(a) What guarantees do we have that the only hydro going through this proposed transmission line will be from these 37 wind turbines?

(b) Could the Applicant please advise of any Potential Build Out of the transmission line?

ANSWER 14 (a,b)

(a) The Facility is only being used to connect the Bluewater Wind Energy Centre, which produces renewable power. See also Response to Board Staff Interrogatory 14(b).

(b) The Applicant has no plans to expand the transmission line. See also Response to Board Staff Interrogatory 14 (b).

Group IR 15:

Need for the Project
We feel that the mandate is not being met by wind turbines.

The article in the National Post dated Nov. 11, 2012 states that on Oct. 28, 2012 it was the windiest day of the year. The Ontario Wind farms were producing approx. 1450 megawatts, about 85% of wind capacity. Ontario was exporting almost that exact amount. At 3:00PM on Oct. 28, 2012 the wind was generating 1432 megawatts at a mandated rate of 13.5 cents per kw/h and exporting 1507 megawatts at less than 3 cents per kw/h. At 4:00PM on Oct. 28, 2012 it was producing 1450 megawatts from wind and Ontario was exporting 1425 megawatts at the same 80% discount.

On the windiest day of the year, Ontario exported all of the wind energy at a substantial cost to

each and every Ontario citizen. The wind energy is not being added to the Provincial Grid and therefore we feel the project does not meet the need of renewable energy government mandate.

In the high energy demand summer months, wind routinely operates under 10% capacity. Wind is an unreliable source of energy at peak demands. Nuclear and coal hydro generation can not be shut off and started up every time the wind picks up or the wind slows down. We feel that wind energy should not be considered as all green because of all the good farmland being forever removed from agriculture. Using the numbers in the Applicant's application, every turbine removes about 4 acres of green space, which is not collecting sun energy via plants.

John Miner in the London Free Press dated Nov. 1, 2012, suggested that there are already 1,200 turbines in Ontario. This calculates that there are already 4,800 acres of farm land forever lost.

(a) Could the Applicant please show us how does this project add renewable energy to Ontario's grid if it is all being exported?

(b) How much credit is the Applicant giving for all the green spaced that is being lost forever?

(c) How will the Applicant deal with the carbon credits to the property owners?

ANSWER 15 (a,b,c):

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertion and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding.

In response to the specific questions enumerated in the Interrogatory, the Applicant advises as follows:

(a) Please see response to Group IR 4(a).

(b) In Procedural Order No. 1 the OEB stated that "land-use issues" are out of the scope of the Board's jurisdiction in this proceeding. The question is therefore not relevant to this proceeding. However, for the Board's information, wind turbines occupy only a small fraction of the land they are sited on. As such, farming and grazing may continue undisturbed. A turbine, in a typical wind farm, including foundation and access roads will use 1.0 – 1.5% of a 40 hectare (approximately 99 acres) farm parcel.

(c) In Procedural Order No. 1 the OEB stated that "environmental issues…and other issues concerning the Ontario Power Authority's feed in tariff program" are out of the scope of the Board's jurisdiction in this proceeding. The policy and contractual issues relating to carbon credits are therefore not relevant to this proceeding. However, for the Board's information, all environmental attributes related to renewable energy power generation belong to the OPA.

Group IRs 16, 17 & 18:

Project Planning

(a) Why is the Applicant in such a hurry to push this project through?

(b) If the Applicant continues to rush this project through, what responsibility will the Applicant take if the Federal Health Study finds negative health affects?

ANSWER 16, 17, 18 (a,b):

(a) The Applicant is proceeding at a pace that is appropriate for the project as well as to meet the goals and timelines of the Ontario FIT program.

(b) The Applicant is not proceeding at an inappropriate pace for the project. In Ontario, wind projects are regulated under the Green Energy Act, specifically under the Ontario Renewable Energy Approval (REA) Regulation (O. Reg. 359/09, as amended by O. Reg. 521/10). The project will operate in compliance with all provincial regulations.

Group IRs 19, 20, 21 & 22:

Project Details

The Applicant states that a mono-pole configuration has been chosen for the Transmission Line.

(a) Why did the Applicant choose 25 metre poles rather than higher poles to mitigate electric magnetic fields?

ANSWER:

The transmission line is designed to meet or exceed all applicable codes, rules and regulation.

(b) How will this power line affect someone with an autoimmune disease? Will this group member have to give up his/her home in order to maintain health?

ANSWER:

In Procedural Order No. 1, the Board stated that "issues related to matters of health" are out of scope in this proceeding. However, for the information of the Board, Health Canada stated that it does not consider that any precautionary measures are necessary for daily exposures to EMF at extremely low frequencies because the scientific literature shows no conclusive evidence that exposures cause health problems for the public.

(c) Why does the Applicant include in the Easement Contract offered to the property owners that it may includes lattice or truss towers or structures?

ANSWER:

It is standard industry practice to include these options in easement contracts in order to provide sufficient flexibility in final engineering design.

(d) Do the drawings include a ground rod at every post? Where does this stray voltage go? Is not the private landowners property being polluted with ground current? What compensation is the Applicant offering to the property owners for same?

ANSWER:

The grounding study is not yet finalized. A ground rod may or may not be installed at every pole. With regard to stray voltage and ground current, see the Applicant's response to Board Staff's IR No. 7(b) and 7(c).

(e) Is the Applicant putting in a buried conductor along the entire line to minimize ground current pollution? If not, why not?

ANSWER:

A buried grounded wire, also known as a counterpoise, may be installed along a portion of the route. This buried ground wire may be installed to reduce the fault current on the overhead ground wire. This will be addressed in final engineering design. Factors to be taken into account include the size of the ground grid of the substations, and the soil parameters under the substations. .

(f) Is the cost of ground current pollution not the responsibility of the Applicant rather then the innocent property owners?

ANSWER:

See the Applicant's response to Board Staff's IR No. 7(b) and 7(c).

(g) Has the Applicant considered burying the transmission line? Why or why not?

ANSWER:

See the applicant's response to question 13(b).

Group IRs 23, 24, 25, 26 & 27:

Design specifications and operational data.

We have concerns about the location and the staffing of the operation and maintenance (O&M) facility. Specifics are not provided. It is too open ended.

(a) Could the Applicant please provide more specifics on the O&M facility?

ANSWER:

It is the Applicant's preference to use an existing building in proximity to the BWEC for the O&M facility. The Operations team has commenced looking for an appropriate building, but has not concluded their search yet. If no suitable location can be found, a new building will need to be constructed. It is the Applicant's plan to share whatever O&M building is secured for the BWEC with one of the Applicant's other wind projects in the area.

If a new building is required, it would be approximately 50' x 100' and include offices, storage space and a shop with an enclosed inventory space. This inventory enclosure would be secured with 8 foot chain link fence with locked entrances and the entire building would be properly illuminated according to applicable by-laws and codes. Adequate parking for employees and visitors would also be provided.

Group IR 28:

The Applicant states that "The Corridor land rights have been acquired for the construction of the Facility...."

(a) What Corridor land rights did the Applicant acquire?

(b) Did the Applicant acquire all Municipal rights-of-way?

(c) Is the Applicant not being presumptuous here?

ANSWER Interrogatories 28 (a, b, c):

(a) The Transmission Line route is comprised of a corridor that includes private lands and the ROW located within an area along Centennial and Hensall Roads; starting at the site of the of the Collector Substation and ending at the Point of Interconnect, the Seaforth TS. The Applicant has acquired all land rights with respect to the Corridor. See Table A of the Application (Ex.F/Tab 1/Schedule 1, p. 2 of 8)

(b) Within this Corridor, the Applicant has considered the options available to it with respect to the potential use of municipal ROW on either side of the roads. As part of the development process, the applicant will negotiate a road use agreement which will address access to the

Municipal rights-of-way.

(c) The Applicant is not being presumptuous.

Group IR 29:

Option Agreement – The Transmission Easement Agreement

We strongly urge the OEB under Section 97 of the Ontario Energy Board Act to decline the Applicant's application for approval of the easement agreement.

The Applicant states that all affected landowners were offered one or two standard form transmission easement option agreements. This is not correct.

(a) Why did the Applicant not provide an option agreement for each property?

Transmission Easements were not offered for all properties, along the proposed route. Some affected landowner's only exposure to the easement agreement was when they were shown a copy of the easement agreement by a neighbour, and now in the copy of "Varna wind Inc.'s Application and pre-filed evidence."

(b) Could the Applicant please explain why they offer the same for a tract of land 10 metre by 30 metre (300 sq. metres) as for a tract of land 10 metre by 1,000 metre (10,000 sq. metres)?

Within the group this contract was shown to four different lawyers, all to get the same advice "DON'T SIGN IT".
The Transmission Easement Agreement the Applicant is seeking approval for, reads more like a purchase agreement wrote up to circumvent local severance and zoning bylaws. A Lease Agreement has a time frame and this agreement calls for perpetuity. This agreement grants zero rights to the Grantor, making it a purchase agreement and not an easement agreement. The Grantor (current land owner) would still have the tax liability, agrees to not permitting vegetation, not granting any person right of way, without getting written permission of Grantee (the Applicant) in each instance. Essentially signing such an agreement would cut off access to the rest of the property. The Grantor must disclose all financial information pertaining to the property only to agree to a gag order as it pertains to the Applicant. No where in the agreement does it say that the Grantor has any rights to the property, but because it is described as an easement, the Grantor is still held in a position of liability.

(c) The written overrides anything promised verbally. If the farmer is not allowed to grow vegetation, it begs the question who than will assume responsibility for weed and vegetation control?

(d) With the gag order, what guarantee is there that the easement agreement signed by the property owner is the one approved by the OEB?

(e) Why does the General Easement Agreement include the entire property rather than the required 10 metre strip?

(f) Why is there no mention in the contracts for any compensation for the very serious and harmful issues of soil compaction and soil disturbance?

(g) Why is there no mention in the contracts for any compensation for the destruction of wind breaks?

Paragraph !2 of Easement must be deleted because it is a chill on future challenges.

(h) Is the Applicant willing to delete this paragraph 12?

Paragraph 5.2 of the General Provisions states that "Each Party waives all right to trial by jury and specifically agrees that trial of suits or causes of action arising out of this agreement shall be to the Court."

(i) Could the Applicant please explain why this provision is necessary in the agreement?

ANSWER 29:

The preamble to this Interrogatory (and its sub-parts) contain a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding. This applies to all sub-parts of 29; (a) through (i).

However, for the Board's information, the Applicant will attempt to answer the questions.

ANSWER 29 (a):

The Applicant's agent went door to door during the initial landowner outreach efforts in October 2011 to determine interest in participating in the Facility. An easement agreement was only presented to landowners if, and when, it was felt that a commercial agreement could be reached and they so requested one. Otherwise, a sample agreement was used by the agent during discussion and negotiation to allow the landowner to review the language and understand the offer.

ANSWER 29 (b):

Compensation arrangements are not within the scope of this proceeding and are confidential in nature.

ANSWER 29 (c):

The Applicant is responsible for all aspects of the operation and maintenance of the Facility, including weed and vegetation control along the transmission line.

ANSWER 29 (d):

Section 97 of the OEB Act provides that an applicant for leave to construct transmission facilities must satisfy the Board "that it has offered or will offer to each owner of land affected by the approved route or location an agreement in a form approved by the Board."

ANSWER 29 (e):

The general easement agreement includes a description of the entire property so to properly identify the land where the 10 metre strip is located. A surveyed description of the 10 metre strip will be inserted into the general easement agreement after the final engineering design is complete.

ANSWER 29 (f):

The general easement agreement crop compensation terms describe where crop damage can be reasonably demonstrated to have been caused by the applicants activity, the applicant shall pay for the damage. This covers soil compaction and disturbance.

ANSWER 29 (g):

During the initial phase of development process of the transmission route, it was found that there were few, if any, purpose built "windbreaks" (i.e., a plantation usually made up of one or more rows of trees or shrubs planted in such a manner as to provide shelter from the wind and to protect soil from erosion) that interfered with proposed routes. Further, efforts were made to avoid areas were naturally occurring "windbreaks" were located. As a result, the vast majority of the transmission route is located along a corridor where, few if any, "windbreaks" are located. Because of this, no compensation for "wind breaks" was offered.

ANSWER 29 (h):

The Applicant is not willing to delete paragraph 12. This is a standard clause in a commercial contract that encourages parties to be reasonable and settle any differences that may arise in an efficient and cost effective manner.

ANSWER 29 (i):

This clause is standard practice in commercial contracts so that if there is a contractual dispute the more timely and cost effective method of trial by Court rather than a jury is available to the parties.

Group IR 30:

The Corridor will have a typical width of 10 meters.

The Applicant states that "Poles placed within the Municipal rights-of-way will be located to minimize impact to landowners ....."

(a) Why did the Applicant advise one landowner that if they did not sign then there would be 4 or 5 poles on his front lawn but if they signed then there would only be 1 or 2 poles?

(b) Why did the Applicant advise another landowner that if they signed then they would have 1 or 2 poles in the front but if they did not sign then they would

have more posts and possibly even one on the driveway?

The Applicant states that they may need temporary construction easements. This was not mentioned to any of the property owners. When the large equipment is in the field it compacts the soil. The wetter it is the more it compacts. Compaction is a major cause in the reduction in yields and it can take years and years to overcome.

(c) Have any of these temporary construction easements been negotiated with any property owners?

ANSWER to interrogatories 30(a, b):

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding.

In response to the specific questions enumerated in the Interrogatory, the Applicant advises as follows:

There are a number of factors to consider when determining how many poles may be placed within a given area; some of which include pole size, wire size, pole spacing, terrain, environmental features, etc. For the purpose of answering this question, we will assume that the terrain is flat (which it is along most of the transmission route) and that the transmission line is designed so that a minimum amount of poles are built within a given area.

The number of poles within a given area is partly dependent on the space available to accommodate wire sway. With wider area for sway, poles may be spaced further apart. Where space for wire sway is limited, for example within the Municipal right of way, and in the absence of easements, poles must be closer together to avoid wire sway over private property. If the applicant is restricted to the right of way, poles will be spaced to avoid wire. sway into air space over private land. However, if the land owner signs an easement with the applicant, the wire will be allowed to sway over their property. In this case, it is possible to engineer the transmission line with greater space between poles; hence, fewer poles will be required.

In no case will poles be built in a driveway or currently existing farm entrance.

ANSWER to (c):

(c) The transmission easement agreements contain temporary construction rights.

<u>Group IR 31:</u>

The Applicant states that they had extensive discussions with all of the landowners. This is not correct. Is the Applicant referring to the two mandatory public meetings?

The group are the landowners. We feel the Applicant tried to divide and conquer. There were

no meetings between the group and the Applicant. We feel that the Applicant used intimidation and many of us felt bullied by the Applicant to the point that we had no choice but to ask the Applicant to stay off our property. On this subject, we could write pages and pages of what we feel were threats made by the Applicant.

At the mandatory public meeting the Applicant's project Team Leaders boasted about their company but did not provide honest, consistent answers to our concerns/questions. They provided no facts, no pertinent information, but we we perceived as simple Applicant's self promotion.

The Applicant followed the mandated procedures but from our experience they had no intention of deviating from their original plans. They did not address the expressed concerns of those directly affected along the proposed transmission route. Requested written information was not provided by the Applicant.

(a) Does the Applicant feel that they accomplished what they intended?

ANSWER 31 (a):

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding.

In response to the specific question enumerated in the Interrogatory, the Applicant advises as follows:

(a) The Applicant's stakeholder consultation activities exceeded all legal requirements, as was the Applicant's intention.

Group IR 32:

Construction within the Corridor.

The Applicant states that they will need temporary pull sites typically 30 m X 30 m.
Again, this was not mentioned to any of the property owners that we are aware of.
Municipal right of ways are only 20 m wide.

(a) Does the Applicant plan to perform this within the Municipal-rights-of-way?

The Hensall Road is a major route for farmers with their tractors and wagons from Seaforth to Hensall as there are 3 Grain Elevators in Hensall.

(b) How will the Applicant take into consideration these farmers?

(c) Is the Applicant aware of the many inconveniences of any road closures and what are they willing to do about it?

ANSWER:

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding.

In response to the specific questions enumerated in the Interrogatory, the Applicant advises as follows:

a) Where private easement has not been secured (temporary or otherwise), the Applicant will use the Municipal right-of-way.
b) The Road-Use-Agreement that is under negotiation with the County and the Municipalities will include Transportation Management Plans specific to the road-use within each jurisdiction. It is anticipated that this will contain notification procedures if, and when, any section of road needs to be closed for any length of time.
c) Please refer to 32 b).

Group IR 33:

The Applicant states there will be approximately 12 Km of the transmission line located in the Municipal rights-of-way. The reference to Exhibit D, Tab 1, Schedule 2 does not provide Km.

(a) Could the Applicant please provide a map to scale that we can read all of the details.

ANSWER:

Please see the Applicant's response to Board Staff's Interrogatory No. 3.

Group IR 34:

Interconnection Easement Option for the Breaker

(a) Is this the contract with the farm owner option to sell for the plus 7 digit dollar amount for just over one acre of land by the railway tracks opposite the Seaforth Hydro Station?

ANSWER 34 (a):

(a) Compensation arrangements are not within the scope of this proceeding.

Group IR 35:

Option to purchase for the Substation

(a) Is this the one located near the wind turbines?

(b) Why was this located on Centennial Road versus some other road?

ANSWER 35:

a) Yes.
b) Based on preliminary design engineering, environmental constraints, efficiency, land available for use and proposed point of interconnection, this was the optimal location for the substations for the BWEC.

Group IR 36:

The Applicant states that care will be taken during detailed design to place the poles in the most accessible, upland areas available.

(a) Exactly who determines this? If an employee or contractor paid by the Applicant, is this not a conflict of interest?

(b) Who determines this excessive land disturbance?

ANSWER:

(a) Pole locations are determined by consultant engineer with input from biologists, archeologists, land agents, construction contractors among other team members.

(b) All team members seek to avoid excessive land disturbance.

Group IR 37:

Provides a table of property required for the proposed Facility, the transmission line route.

For over a year the Applicant relentlessly tried to sign both sides of the road along both Centennial and Hensall Roads, which are located about 90 properties. It is noted that there are 16 properties signed plus HONI and 28 not signed. It is noted that the bulk of the properties signed are located west of London Road (Hwy. 4) in the Township of Bluewater.

(a) Could the Applicant please provide a more current Table if there were any changes?

ANSWER:

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this

proceeding.

In response to the specific questions enumerated in the Interrogatory, the Applicant advises as follows:

The table provided is the current version.

Group IR 38:

N/A

Group IR 39:

Alternatives Considered

(a) Exactly what were the alternatives considered?

ANSWER:

See the Applicant's response to Board Staff's Interrogatory No. 6.

Group IR 40:

The Applicant states that they employed a range of criteria in selecting the route.

We assume that the Applicant's referral to stakeholders are the Property Owners.

(a) Could the Applicant please state exactly, who they consider the "stakeholders"?

Public information meetings are a great public relations gesture but the Applicant's style did nothing to deal with the issues brought forward by the individuals most affected by the Applicant's plans. Self promotion of the Applicant at a public information meeting does little for the people that actually have to deal with the Applicant. The proposed route was predetermined before any public meetings and it just became a strategy to promote the Applicant's route.

We feel that the Applicant should have considered the following:

i. The proposed line goes right past Huron Centennial School. The playground for the elementary school children could be 25 Metres from their proposed 115kV high voltage transmission line. When the Applicant was asked about this concern, they advised us that the school uses hydro too.

The Health Canada pamphlet "It's Your Health" dated January 2010 addressing EMF states, "....Scientists at Health Canada are aware that some of these studies have suggested a possible link between exposure to ELF fields and certain types of childhood cancer. The International Agency for Research on Cancer (IARC) has evaluated the scientific data and has classified

ELF magnetic fields as being "possibly carcinogenic to humans."

(b) Does the Applicant think that we are wrong in being concerned about our children's health?

ii. There are a number of houses along the proposed route that are extremely close to the road. These homes and the trailer park, will have an even greater Electronic Magnetic Field (EMF) exposure than the rest of us. The 2010 Health Canada pamphlet, as referred to by the Applicant, indicates the EMF when indoors is weaker than electrical appliances. EMF is a factor of distance. Who stays within 2 feet of their appliances 24/7? Who locks themselves indoors especially when you reside out in the country? The transmission line does operate 24/7. Increasing the sources of EMF we assume affects health. Denial does not mean it does not exist. Refusal to acknowledge EMF by the Applicant does not maintain our health.

(c) Is exposure to EMF cumulative since a resident will be directly under the transmission line more frequently the closer it is to their home?

(d) What guidelines does the Applicant use for maintaining a minimal distance between the transmission lines and a home?

ANSWER:

Electrical clearance required by Ontario Electrical Safety Authority.

iii. The Applicant has not taken into account the many livestock businesses on the proposed route. The Applicant proposed to build and maintain to the standards in place as livestock prescribed by the Distribution System Code & Electrical Safety Authority. We strongly feel that this is not good enough. HONI has not been able to eliminate stray voltage. So increasing the amount of transmission lines is likely to increase the probability of stray voltage. There are a number of livestock farms on the proposed route. Animals, especially dairy cows, are very sensitive to any stray voltage, even less then one volt can affect cattle. From what we understand, the Applicant will take no responsibility for any stray voltage. When deciding on the route, the Applicant did not take into consideration that there were 4 dairies within a 2 km stretch on Centennial Road. This is the highest concentration of dairy cattle within the Township of Tuckersmith.

In the newspaper "Ontario Farmer" dated Tuesday December 25, 2012, in the article headed "Stray voltage: still the sickness few want to talk about" it states that stray voltage affects production and in some cases even kills animals. The issue of stray voltage is so complex and difficult to understand that the general public just looks the other way. We are asking the OEB to please take the problem of stray voltage seriously.
In the newspaper "Rural Voice" dated January 2013, in the article headed "Dancing cows spell trouble" it states that stray voltage is not only restricted to cattle but also affects pigs and other animals. It also states that a private member's bill was introduced in 2006 in the Ontario Legislature addressing ground current and it made it to second reading but was lost in

the shuffle once parliament ended it's session.
We have had personal experience with stray voltage and it is real. Our personal experiences are consistent with concerns raised in the newspaper articles.

(e) What will the Applicant provide to those farmers whose livelihood is dependent on the animals or the dairy cows?

(f) Exactly what is the Applicant's position on this very important issue of stray voltage?

(g) Exactly what responsibility is the Applicant willing to take for any complaints on stray voltage?

(h) Will these additional transmission lines interfere with any other electronic devices used in their proximity?, i.e. Cell phone, computer, radio, etc.

iv. The Applicant states that they took the route with the least number of residences. We disagree. The Applicant is rumoured to have had at least three proposed routes. We were told by the Applicant that the Centennial and Hensall Road is the only route. If the Applicant had completed their due diligence, should they not have come up with several routes and also shown some flexibility in the route?

In the report, the Applicant claims that they considered the other roads in the study area between the Staffa Road to the south and the Mill Road to the north and choose Centennial Road as the best road for the route. We challenge them to find any other direct roads running east west between the Staffa Road and the Mill Road. Centennial Road is the only road.

(i) Exactly what other routes did the applicant consider?

v. There are many beautiful mature trees along the proposed transmission line, they are normally found on the opposite side of the road of the existing HONI distribution lines. All of those hundreds of trees are now being threatened by the Applicant's proposed route on placing the transmission line on the opposite side of the road.

The many mature trees in front of the homes provide privacy, shade, wind break, atmosphere, country setting, in touch with nature, etc. Removal of these trees would take years to grow back and devalue our homes and properties. Also, the beauty of these trees is enjoyed by anyone who travels these roads. This is the county atmosphere that the Applicant wants to rob from society and replace it with high voltage poles and lines.

(j) Would the Applicant please explain how they plan to deal with this issue

(k) What proposals is the Applicant considering to minimize the determent to the visual effects.

Property values are affected by visual affects and by actual and perceived affects of a transmission line even if located on the Municipal -right-of-way.

(l) Could the Applicant please advise how they intend to compensate for same?

ANSWERS:

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding.

In response to the specific questions enumerated in the Interrogatory, the Applicant advises as follows:

ANSWER 40 (a):

The Applicant uses the term 'stakeholders' in the broadest sense of interpretation. It refers to all of the agencies, local governments, aboriginal communities, local residents, landowners, regulators and any other interested parties that have expressed their interest to the Applicant.

ANSWER 40 (b):

See the Applicant's response to Group of Intervenors' Interrogatory Nos. 16, 17, 18 (b).

ANSWER 40 (c):

See the Applicant's response to Group of Intervenors' Interrogatory Nos. 16, 17, 18 (b).

ANSWER 40 (d):

Answer: The Applicant follows the Canadian Standards Association guidelines imposed by the Ontario Electrical Safety Authority.

ANSWER 40 (e):

See the Applicant's response to Board Staff's Interrogatory No. 7.

ANSWER 40 (f):

See the Applicant's response to Board Staff's Interrogatory No. 7.

ANSWER 40 (g):

See the Applicant's response to Board Staff's Interrogatory No. 7.

ANSWER 40 (h):

No.

ANSWER 40 (i):

See the Applicant's response to Board Staff's Interrogatory No. 6.

ANSWER 40 (j):

The Applicant is designing the Facility to minimize impact to trees. Where tree removal is

necessary, it is anticipated that the Road Use Agreement will contain requirements for mitigation.

ANSWER 40 (k):

The Applicant is designing and will construct this Facility in accordance with all applicable laws and regulations.

ANSWER 40 (l):

Compensation is not an issue in this proceeding.

Group IR 41:

Selection Process – through consultations.

(a) Could the Applicant please provide the exact consultations they are referring to?

(b) In this paragraph does stakeholders mean the MOE?

(c) We understand, that the Applicant is saying, that the Applicant together with the MOE determined the route. Is this correct?

(d) If not, could the Applicant provide the exact details of any consultations before the route was determined with any other stakeholders?

We believe the Applicant had consultations with the MOE in order to meet the mandatory REA approval. It appears to us that the Applicant has glazed over all of the other mandatory approvals to give the appearance that they had community involvement. We as a group feel we are the victims of this public relations exercise to enhance the Applicant's proposal. The message we the group got from the Applicant, is that the line is coming and the property owners have no recourse.

(e) We ask the applicant what they consider is consulting or engaging the property owners?

ANSWERS:

The preamble to the Interrogatory contains a number of assertions and arguments. The Applicant does not accept the accuracy or relevance of those assertions and arguments. Nor does the Applicant concede that any of those assertions and arguments constitutes evidence in this proceeding.

In response to the specific questions enumerated in the Interrogatory, the Applicant advises as follows:

ANSWER 41 (a)

The Applicant provided detailed information regarding consultations in the LTC filing at Exhibit G, Tab 1, Schedule 1.

ANSWER 41 (b)

The Applicant uses the term 'stakeholders' in the broadest sense of interpretation. It refers to all of the agencies, local governments, aboriginal communities, local residents, landowners, regulators and any other interested parties that have expressed their interest to the Applicant.

ANSWER 41 (c)

No. The Applicant consulted widely with agencies, including the MOE, MNR, MTCS, local Conservation Authority, local landowners, HONI, the IESO, etc. as outlined in the Consultation Report. However, the Applicant determined the final route for submission to the OEB.

ANSWER 41 (d)

The Applicant refers the Intervenor to the Consultation Report filed as part of the REA.

ANSWER 41 (e)

There are specific consultation and engagement requirements set out in Section 16 and 17 of O.Reg 359/09 under the Environmental Protection Act for Renewable Energy Facilities in Ontario. These are the minimum standards for consultation and engagement in the Province of Ontario. In addition, the Ontario Energy Board provides clear direction regarding notification in the Leave to Construct process. The Applicant has exceeded these requirements as noted in the Final Consultation Report for the BWEC available online at www.nexteraenergycanada.com/bluewater.

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Group IR 42:

The transmission line is 23 Km from the proposed substation to the Seaforth TS.

Group IR 43:

Choosing the route.

The Applicant states that the back routes were disqualified due to unacceptable environmental impacts OR disinterested landowners.

- ***(a) We ask for evidence to support the Applicant's statement.***
- ***(b) The group are the disinterested landowners. How can the Applicant suggest***

that the current route has landowner approval?

The Applicant states that there were several other roads considered but they were disqualified due to higher concentration of residences, large amounts of pre-existing infrastructure in the right-of-way or unacceptable environmental impacts.

(c) Exactly what other roads were considered?

(d) Was the major distribution line on the Hensall Road not considered?

(e) There is another wind turbine project from the Township of Bluewater also headed towards Seaforth. Why is that one on a different road only ONE road over the Hensall Road?

(f) Why can they not all be put on one line?

We are being exposed to another transmission line the very next road to Hensall Road. All along Lake Huron's west coast wind turbine projects are being proposed. A 500kv transmission line is already present running north south along all these wind turbine projects.

(g) If wind energy is as efficient as the proponents would have us believe, why do they not use this line to collect the energy from the turbines and direct the saved power from the Bruce towards Milton?

(h) Why are we polluting the country side with transmission lines?

(i) Why is our expertise not being used to do the renewable energy initiative right the first time rather than rushing these projects to completion?

We find this so very frustrating.

ANSWER 43 (a)

For a discussion of alternatives, see the Applicant's response to Board Staff's Interrogatory No. 6.

ANSWER 43 (b)

See the Applicant's response to Group of Intervenors' Interrogatory 5(b).

ANSWER 43 (c)

See the Applicant's response to Board Staff's Interrogatory 6.

ANSWER 43 (d)

For a discussion of route alternatives the Applicant considered, see the Applicant's response to Board Staff's Interrogatory 6.

ANSWER 43 (e)

As discussed in its application and in response to Board Staff Interrogatory No. 6, the Applicant reviewed a number of routes and determined that this was the best route.

ANSWER 43 (f)

Collocation of transmission facilities are affected by a number of factors, including but not limited to engineering requirements, safety concerns, proprietary issues, commercial issues, timing, aesthetics, maintenance issues, and regulatory requirements.

ANSWER 43 (g)

The contribution of generation from different sources is not an issue in or relevant to this proceeding.

ANSWER 43 (h)

This question is beyond the scope of this proceeding.

ANSWER 43 (i)

This question is beyond the scope of this proceeding.

Group IR 44:

Closing paragraph – transmission route.

Group IR 45:

After choosing the route they are now forced to deal with the obstacles.

Group IR 46:

8.5 km has no hydro structures in the municipal-right-of-way.

Group IR 47:

14.5 km has hydro structures in the municipal-right-of-way.

Do we understand this correctly, that it took the Applicant 4 months to determine that they can not co-locate on HONI's poles?

Are not HONI's distribution lines under 50Kv and the Applicant's 115Kv?
The Applicant could very easily not boost their line from 34.5Kv to 115Kv.

We ask the Applicant to provide one example in Canada that co-locates transmission lines and distribution lines.

ANSWER:

The Applicant pursued the option of collocation of its lines on HONI's poles as discussed in Paragraph 47 of the Application in good faith. HONI declined as described in Paragraph 47.

The Applicant is aware of at least one transmission line in Ontario that is collocated with a distribution line.

Group IR 48:

The Applicant states that the negotiations continue with the remaining landowners.

(a) We the group are the property owners. We are unaware of any negotiations.

Group IR 49:

The Applicant proposes to construct 11.5 km of the transmission lines on private easements.

Group IR 50:

The Applicant states that they continue to engage with Adjacent Landowners, community residents, the Municipalities and HONI.

(a) Exactly, which continuing engagements is the Applicant referring to?

ANSWER:

As noted the Applicant's response to Board Staff's Interrogatory No 5, the Applicant is still in negotiations with the local municipalities regarding Road Use Agreements. The Applicant continues to meet with any landowner in the area that expresses a concern, question or interest in an update. The Applicant attends local Council meetings to provide updates.

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act*, 1998, S.O. 1998, c.15, Schedule B;

AND IN THE MATTER OF an application by Varna Wind Inc. for an order or orders pursuant to section 92 of the Ontario Energy Board Act, 1998 granting leave to construct transmission facilities in the Municipalities of Bluewater and Huron East.

VARNA WIND RESPONSES TO HONI INTERROGATORIES

HONI Interrogatory 1:

Hydro One will likely require access to properties of its distribution customers which may lie behind NextEra's high voltage line, to, among other things, provide a new connection, upgrade or expand existing service, maintain or repair its assets or restore power. This would require that Hydro One route its line across the road and undertake a "perpendicular crossing" of NextEra assets and share the right of way. To physically accommodate this access, a variety of scenarios are anticipated, such as

- ***Hydro One installing underground assets,***
- ***NextEra installing a new pole mid-span at Hydro One's request to accommodate a specific road crossing,***
- ***Hydro One attaching its distribution lines to either an existing or new (i.e., higher, if needed) NextEra pole, as a tenant in a joint use arrangement.***

These different types of configurations could drive higher costs that Hydro One would not have otherwise incurred in the absence of NextEra's adjacent facilities.

a) Does NextEra believe that these higher costs are in the interest of provincial ratepayers, and that provincial ratepayers should therefore bear the incremental costs via a Board-approved mechanism?

b) Does NextEra believe that the higher costs of such arrangements should be borne by customers of the electricity distributor – in this case Hydro One?

c) Does NextEra agree that Hydro One should be required to bear only those "base" costs that it would normally have incurred in the absence of NextEra's assets, and that NextEra should bear any incremental costs that Hydro One may incur over and above those "base" costs?

d) What principles and methodology would NextEra suggest for allocating the higher costs between itself and Hydro One in cases such as the above?

e) Given that Hydro One (or other distributors) may incur those higher costs well into the future, and that NextEra possesses a long-term contract and proposes to install long-life assets for this project, what should be the duration of such cost sharing, and why?

ANSWER:

The Interrogatory posits a number of scenarios relating to potential future uses of distribution infrastructure and requests the Applicant's position on a number of questions that may arise from those scenarios. In its decision granting Leave to Construct the Grand Renewable Wind transmission facility, the Board stated the following with respect to the relevance of the impact of a proposed transmission facility on current and future uses of existing distribution infrastructure:

"In its assessment of impacts on prices, reliability and quality of electricity service the Board considers it appropriate that GRWLP [the proponent] be responsible to pay for any direct impacts its Project causes to the quality or reliability of the electricity service provided by HCHI's [the distributor] existing system. HCHI has made claims that both its current and future use of its system will (or may) be negatively impacted. In the context of the current proceeding, the Board does not consider it appropriate that GRWLP be held responsible for any alteration that HCHI may have to make to its future plans. This consideration would be beyond the scope of this proceeding and is not supported by any governing planning framework." (Emphasis added). (Decision and Order granting Leave to Construct to Grand Renewable Wind Farm (EB-2011-0063), December 8, 2011, at p. 11).

The questions are therefore not relevant to this proceeding.

HONI Interrogatory 3:

Please provide the service requirements that NextEra is obliged to follow, or should be obliged to follow, for the following:

a) Time to have service crews on site once requested (e.g., for emergency response, or to allow the distributor to restore power or repair assets as a result of storm damage)?

ANSWER 3(a):

Standard response time to the site is 30 minutes during normal working hours if crews are already onsite. During non-working hours the "on call" personnel will be dispatched and the response time will depend on road conditions, time of day and location of the problem.

b) The Notice period that NextEra requires prior to establishing work protection or other necessary operating arrangements to enable Hydro One to safely undertake planned or unplanned work in close electrical proximity to NextEra assets, when needed?

ANSWER 3(b):

NextEra Energy is currently working with Hydro One to develop protocols and procedures for operations and maintenance of the facility. We plan to have the protocols and procedures finalized prior to the scheduled energization of the project on 18 October 2013.

c) Other service obligations that NextEra may need to undertake as an occupant of road allowance in proximity to Hydro One, to ensure the safety of the public and of work crews of both companies during emergency restoration or other work?

ANSWER 3(c):

NextEra Energy is currently working with Hydro One to develop protocols and procedures for operations and maintenance of the facility and collection/distribution system. The NextEra Transmission and Substation Group met with Hydro One on 28 February 2013 to work out more detail of these agreements. We plan to have the protocols and procedures finalized prior to the scheduled energization of the project on 18 October 2013.

(d) Has NextEra begun to develop any protocols for working with Hydro One in such cases, and when does NextEra expect such protocols to be in place?

ANSWER 3(d):

Please see response to Hydro One 3(b).

HONI Interrogatory 4:

What is NextEra's process for notifying Hydro One of its plans for building lines and circuits that require Hydro One's involvement, to allow the timely development of agreements addressing logistical and cost arrangements, such as those discussed above?

Answer:

The Applicant has been working with, and will continue to work with HONI's Distribution Business Development team regarding issues related to HONI's distribution system. HONI has a process in place with respect to notification. The Applicant will follow that process.

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act*, 1998, S.O. 1998, c.15, Schedule B;

AND IN THE MATTER OF an application by Varna Wind Inc. for an order or orders pursuant to section 92 of the Ontario Energy Board Act, 1998 granting leave to construct transmission facilities in the Municipalities of Bluewater and Huron East.

VARNA WIND RESPONSES TO OLDFIELD INTERROGATORIES

Oldfield Interrogatory d:

d) In an emergency situation, how long would the wait time be for qualified service to correct safety hazards caused by downed wires from storms or accidents? (Our area is familiar with exceptionally good service from Hydro One.)

ANSWER (d):

Please see response to HONI IR 3(a).

Olfield Interrogatory e:

e) Further to previous question, would there be an emergency telephone number available to the public and will there be assurance in writing of timely emergency service and what recourse is there if respond times and quality of repair were not acceptable -who would we contact – Next Era, OEB?

ANSWER (e):

Yes. There will be a 24 hour hotline for the project available to the public to contact NextEra.

Oldfield Interrogatory f:

f) How does Next Era monitor the safety of the line and who are they accountable to regarding records of regular maintenance?

ANSWER (f):

NextEra Energy will monitor the health of the system 24/7 from a number of locations including locally at the Operations and Maintenance building during working hours and from NextEra's central Fleet Performance and Diagnostic Center (FPDC) and Energy Resource Control Center (ERCC).

Oldfield Interrogatory g:

g) Because Next Era easement agreements are "lifetime" with provision for the sale at any time, of all of their infrastructure (poles, lines and easement properties) how does the OEB ensure that a new company purchasing these assets, would be bound to the same terms or rules with respect to service, reliability and safety issues?

ANSWER (g):

Any approval granted by the Board, including an order granting leave to construct a transmission facility may only be transferred with the approval of the Board (see: OEB Act, 1998, s. 19).

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act*, 1998, S.O. 1998, c.15, Schedule B;

AND IN THE MATTER OF an application by Varna Wind Inc. for an order or orders pursuant to section 92 of the Ontario Energy Board Act, 1998 granting leave to construct transmission facilities in the Municipalities of Bluewater and Huron East.

VARNA WIND RESPONSES TO RITZEMA INTERROGATORIES

Ritzema Interrogatory 1:

At Exhibit F/Tab 1/Schedule 1/Paragraph 29, the Applicant states:

"The Applicant has acquired land rights to private lands needed for the Transmission Line." At Exhibit F/Tab 1/Schedule 1/Paragraph 31, the Applicant states:

"The Applicant has had extensive discussions regarding the Transmission Line and the Transmission Easement with all of the landowners along the Corridor, including Adjacent Landowners."

(a) As the Pin, Lot and Concession numbers on the map at Exhibit D/Tab1/Schedule 2 cannot be distinguish, please refer to the maps attached as Exhibit 1 to this Interrogatory and confirm whether or not the highlighted property owned by the Ritzema's will be directly affected by this project.

(b) If it is confirmed that the Ritzema property will be directly affected, please clarify to what extent it will be affected:

- ***(i) Will there be infrastructure located on the property?***
- ***(ii) Will construction easements be necessary on the property?***
- ***(iii) Will easements be necessary upon project completion to gain entry for access to infrastructure on an ongoing basis?***

Answers IR 1:

(a) The highlighted property in the map is not directly affected by this project.
(b) See answer to IR 1.