

The New Power lines

A major concern for Tsawwassen Residents

Introduction

This document, which will be available on line at www.trahvol.com, presents a number of not widely known but very important facts about the potential dangers of installing in Tsawwassen a 230 KVolt power line overhead on steel poles rather than underground. BC Transmission Corporation (BCTC) (Ref. Delta Optimist) states that E.M.F. levels will range from 15 to 149 milligauss.

Note: Milligauss is the measure of EMF or magnetic field radiation used in Canada and the US. In Britain and Europe the microtesla (ut), a larger unit is used. The equivalency is $1\text{ut}=10\text{ mg}$. Throughout this document the “ut” will be used because the British and Europeans report their data in “ut” and most of the literature references cited are in those units.

Several routes were brought forward by residents for the new power line One involved crossing First Nations land, and was rejected by the TFN. A proposal to route the lines via Deltaport was rejected by the BCUC as being put forward to late. It would have saved \$22M versus the proposed overhead route through the heart of Tsawwassen. Options considered by the BCUC for the Tsawwassen transit were steel poles or underground installation via an unsafe and destructive 70’ wide open trench surface excavation. The BCUC chose to order overhead lines on the existing right of way. Residents, last year proposed a safe underground installation via Horizontal Directional Drilling (HDD). The cost of the HDD proposal (~\$24 million) was deemed too high by Minister Neufeld even though BCTC was willing to spend \$24M on the unsafe open trench proposal. BCTC’s proposed surface excavation would have damaged many properties, would emit 22 times the EMF of the present lines and would still leave overhead lines in place indefinitely. The HDD underground proposal would have been non-destructive and safe, emitting virtually no EMF and having no potential to block school exits or create disruptions to the community during a catastrophe.

Steel Poles throughout the Tsawwassen transit.

This option is unacceptable. Magnetic radiation from (overhead) 230 Kvolt power lines can have a number of undesirable (and sometimes fatal) effects.

Located on or very close the right of way for the Tsawwassen power line are:

- (a) High School (1300 students and staff)**
- (b) Care home (Kinsmen) 100 residents plus 100 staff**

- (c) Three churches, one of which has a child care program (estimated population 100)
- (d) Family residences, 137 of which in fact whose yards and homes the right of way infringes upon. (Estimated population 550)
- (e) Many other homes immediately adjacent to the right of way.

Thus we have approximately 2150 people living dangerously close to this 230 Kvolt line. Over the next 60 years (the life of the line) tens of thousands of people will be affected.

There are no “official limits” in Canada with respect to EMF’s carried by power lines. If ever there was a case for adopting the “Precautionary Principle” it is this one. The precautionary principle in this case means either moving the power line out of Tsawwassen or burying them safely. It is my understanding that at one stage the BC Government did adopt the precautionary principle and then abandoned it. We are left with the reality of 230 Kvolt power line running within feet of a high school, nursing home, churches, residences and daycare centres.

The Tsawwassen project was reviewed by Health Canada (Appendix 1) and the Federal – Provincial – Territorial Radiation Protection Committee – Canada. (Appendix 2) Both groups approved the project.

The current literature does not, in my opinion, support the view of Health Canada Scientists, that the VITR project (i.e. Tsawwassen Power Line) is not a public health risk.

The extensive review articles published in 2001 by Prof. D.L. Henshaw and co workers at Bristol University, was one of the first scientific papers to deal broadly with the issue of power lines and human health. It is a detailed review article covering all known risks to health of high corona voltage power lines as of 2001.

Corona Ion Effects are described, beginning in Document 1, para 1.1. These corona ions, (molecules of ionized oxygen and nitrogen) acquire + charges from the magnetic radiation and are attracted to particles floating in the atmosphere. We should be concerned, in this connection with the doubling of the port size at Tsawwassen. It will, presumably, double the number of ships and transport trucks, and therefore double the number of diesel particulates available for formation of + charged particulate. These can drift for several kilometres (much further than corona ions); (6 - 7 kilometres versus about 600 metres). Light (small) diesel particulate are among the most carcinogenic substances known.

It is noted here that a number of serious psychological effects have been associated with power line radiation. These are discussed in detail in Document 1, the Henshaw etal report.

Document 2 is a review of the data up to 2005, with special reference to childhood leukaemia

Conclusion

The scientific literature pertaining to high voltage overhead power lines (>120 Kv) leads me to conclude that close contact with such installations is dangerous to human health. I see no reason to put the health of several thousand people at risk, when it is perfectly obvious that the only reasons for doing so in the Tsawwassen situation is to save some money.

**Bruce D Owen, PhD
Professor Emeritus
University British Columbia**

Document 1

Summary of a paper published in *Medical Hypotheses*: Does our electricity distribution system pose a serious risk to public health?

D.L. Henshaw, 2002, 59 No.1, 39-51

Note: This summary published in 2002 has been largely superseded by the more recent [California Health Department Report](#)

Preface

The research literature reveals that for some illnesses there is a degree of consistency in the evidence suggesting adverse health effects of living near high voltage power lines. The evidence comes from two principal sources: (i) the body of epidemiological studies and (ii) a risk analysis based on increased exposure to air pollution near power lines.

The following areas can be considered:

1. Electric field effects

In the case of illnesses associated with air pollution, risk analyses can be performed based on the increased probability of lung deposition of inhaled pollutant aerosols that have been electrically charged by power line corona ions compared with uncharged aerosols.

1.1 Corona ion effects

1.1.1 Childhood leukemia

The attached reference list cites a number of papers where childhood leukemia has been associated with traffic density and motor vehicle pollution. Corona ions are assumed to be effective at increasing exposure to air pollution up to 300 meters downwind of power lines, in the prevailing south westerly wind direction (Fews 1999a). A 30% increase in exposure has been assumed. The proportion of the population living within 300 meters of 132, 275 and 400 V power lines is assumed to be 2.9%. The number of excess cases of childhood leukemia is therefore given by $600 \times 2.9\% \times 0.3 \times 0.5 = 2.6$ cases or approximately 3 cases. However, the non-downwind quadrants near power lines might also be affected by corona ion effects. To reflect this uncertainty the table provides the range of the possible number of cases from both magnetic field and corona ion effects.

Approximately 3 cases annually

1.1.2 Lung cancer

Erren (1996) reviewed five studies where lung cancer has been associated with EMF exposure. This included the UK study by McDowall (1996). Here, the author considered cancer incidence in East Anglia, in populations living up to 50 m from electrical installations, mainly substations, although he did not specify which were fed by overhead power lines. Within 15 m of an installation, elevated SMRs were seen for lung cancer, all leukemias, other

lymphatic neoplasms and all respiratory disease. Only the result for lung cancer was statistically significant (odds ratio = 2.15, 95% CI = 1.18 – 3.61) and this was mainly driven by an effect in women. The odds ratios for lung cancer showed a consistent gradient of increasing excess mortality with proximity to the line, but at distances greater than 15 m these were not statistically significant.

Lung cancer is known to be associated with air pollution with increased risks in the range 1.3 to 2.5 (Katsouyanni & Pershagen 1997). Corona ions emitted from high voltage powerlines increase the charge state of pollutant aerosol particles in the air. Aerosols in the size range 20 to 200 nm are of special interest, especially those containing PAHs such as benzo[a]pyrene. There is evidence that in this size range the effect of single charges on aerosols is sufficient to increase the deposition of inhaled aerosols in the tracheobronchial lung region by a factor of 2 to 3 (Cohen *et al* 1998).

The risk calculation takes the affected population as living within 400 metres of high voltage powerlines, downwind of the prevailing south-westerly wind. An average 15% aerosol charging by single charges is assumed to lead to a 30% increase in lung deposition of inhaled aerosols. The average male/female lung cancer rate in the UK is taken to be 74 per 100,000 per year. The number of people living within 400 m of 132, 275 and 400 kV powerlines is taken to be $4.6\% \times 6 \times 10^7$ people = 2.76×10^6 people. A 30% increase in risk downwind compared with upwind of powerlines is assumed. This yields 306 cases annually. The range quoted in the table of 250 – 400 cases annually takes into account two possibilities: (i) that on average corona ion effects may not extend to 400 m from powerlines or (ii) that a contribution to risk in those living upwind of the prevailing south-westerly wind should be included.

Approximately 250-400 cases annually

1.1.3 Other illnesses linked to air pollution

Seaton (1995) has discussed the range of illnesses associated with air pollution, especially respiratory and cardiovascular disease. If these are increased near powerlines as a result of increased lung deposition of inhaled aerosols charged by corona ions, then the number of excess cases could reach several thousand. Not all of these would be fatal.

Approximately 2,000-3,000 cases annually

1.2 Oscillation of polluted particles leading to increased deposition on the skin

Fews *et al* 1999b made experimental measurements of the increased deposition of radon decay product aerosols on model heads under high voltage powerlines outdoors. Increased deposition in the range 1.4 to 2.9 was found. It was also observed that the deposition rate of radon decay product aerosols outdoors is about 20 times higher than indoors. This is consistent with the known deposition velocity of outdoor and indoor aerosols. The practical result is that in the UK the dose rate to the basal layer of the skin outdoors arising from the plateout of radon decay products is likely to be around ten times higher than that indoors, even though the radon decay product concentration in air outdoors is very low.

The ICRP quotes an excess relative risk of non-melanoma skin cancer of around 60% per Sv (NRPB 1997). On this basis a risk analysis can be made for radiation induced skin cancer as

a result of living close to high voltage overhead powerlines. A preliminary study by Preece *et al* (1996) found a 1.6-fold increase in non-melanoma skin cancer in people living within 20 m of high voltage powerlines in south-west England (RR = 1.62, 95% CI = 1.06 – 2.47).

For the risk analysis, we take the average male/female non-melanoma skin cancer rate to be 41.6 per 100,000 per year. The exposed population consists of those living very close to the line, say within 25 m. This corresponds to 0.14% or $0.14\% \times 6 \times 10^7 = 82,500$ people. Applying the skin cancer rate and assuming a 40% increase in risk yields 14 cases annually.

Approximately 14 cases annually

2. Magnetic field effects

(i) In the case of childhood leukemia, the pooled analyses by Ahlbom *et al* (2000) and Greenland *et al* (2000) suggest an approximate doubling of leukemia risk for magnetic field exposures above 0.3/0.4 μ T.

(ii) In the case of depression and suicide, there is a body of evidence in the scientific literature showing a general consistency of increased risk in relation to magnetic field exposures. It is of interest that an increase in risk appears at a low threshold of $\sim 0.1 \mu$ T. It should be noted that to date this literature has not been well reviewed by bodies such as the US National Institute of Environmental Health Sciences (NIEHS) nor by the UK National Radiological Protection Board (NRPB).

This document makes an initial attempt to quantify the likely number of cases of ill health annually that might occur in populations living near high voltage powerlines in the UK if the level of risk indicated by the epidemiological studies and the risk analyses was to be realised. If as is implied by these estimates, several thousand cases of illness annually are associated with living near high voltage powerlines in the UK then this could be of significant public health relevance.

2.1 Childhood leukemia

Increased risk has been assumed above 0.4 μ T, effective up to 50 metres either side of 132, 275 and 400 kV powerlines. The proportion of the population living within 50 metres is estimated as 0.275%. If there are 600 cases of childhood ALL annually in the UK, this corresponds to 1.7 or approximately 2 cases only.

Approximately 2 cases annually

2.2 Suicide and Depression

The literature contains a number of papers associating both suicide and depression with exposure to magnetic fields, including near powerlines. Increased risk of both suicide and depression are both considered biologically plausible either by reduced production of melatonin by magnetic fields or by the magnetic field induction of electric fields in the body. A discussion may be found in Wijngaarden *et al* (2000).

The literature reveals a number of features:

1. A general consistency that both suicide and depression are associated with power frequency magnetic field exposure. Some studies also hint at an association with power frequency electric fields.

2. A threshold effect occurring at low magnetic field exposures, ~0.1 μT. Such a low threshold would embrace exposures near all types of powerlines not merely those at 132 kV and above.

3. Occupational studies appear to show lower effects than for residential studies. This would be consistent with a mechanistic effect associated with reduced melatonin production, which occurs mainly at night and therefore has a larger effect on chronically exposed populations.

(i) Suicide

The average suicide rate for males and females is taken to be 9.6 per 100,000 per year. An exposure threshold of 0.1 μT is assumed which is effective up to 150 m either side of 132, 275 and 400 kV powerlines. This embraces 1.05% of the population. The exposed population is therefore $1.05\% \times 6 \times 10^7 = 630,000$ people. Assume the risk to be doubled.

Approximately 60 cases annually

(ii) Mild depression

Again take an exposed population of 630,000 people. Some estimates suggest that 15% of the population experience an episode of mild depression each year. If there is a 40% increase in risk above 0.1 μT, this would lead to a large number of cases of mild depression associated with magnetic field exposure. The value quoted in the table of 9,000 cases annually is a conservative estimate.

Approximately 9,000 cases annually

Notes on the Table of Risks

These notes explain how the number of excess cases in each category was estimated. The proportion of the population living near powerlines has been estimated using the data for 275 kV and 400 kV given in figure 1 of UKCCS (2000). It has then been assumed that the proportion of the population living near 132 kV powerlines is a factor 1.5 greater. In each case a conservative estimate has been made of the range of effective magnetic fields.

Condition	References	Key findings/Risk assessment	Predicted excess cases annually in the UK near high voltage powerlines
Childhood leukemia	Fews <i>et al</i> , 1999	(i) <i>Corona Ion Effects</i> : Risk assessment based on increased exposure to air pollution.	2 – 8 cases
	Ahlbom <i>et al</i> , 2000		
	Greenland <i>et al</i> , 2000		
	Microwave News, Sept/Oct 2000	(ii) <i>Magnetic Fields</i> : No accepted causal mechanism for magnetic fields but an implied relative risk of 2.0 above 0.4 μT and 1.7 above 0.3 μT.	
Skin cancer	Fews <i>et al</i> , 1999b	Risk assessment based on	

	NRPB 1997	increased skin exposure to radon decay products and other agents via 50 Hz oscillation of aerosols.	14 cases
Lung cancer	McDowall, 1986	Risk assessment based on increased exposure to air pollution via corona ion effects.	250 – 400 cases
Other illnesses associated with air pollution	Katsouyanni & Pershagen, 1997		
	Seaton <i>et al</i> , 1995	Risk assessment based on increased exposure to air pollution via corona ion effects.	2,000 - 3,000 cases
Suicide and Depression	Reichmanis <i>et al</i> , 1979	Considered biologically plausible via magnetic field exposure. Apparent low threshold ~ 0.1 µT.	(i) Suicide: 60 cases
	Perry <i>et al</i> , 1981		
	Perry <i>et al</i> , 1989	40% increase in suicide in West Midlands; small increase in general depressive illnesses; 2 to 3-fold increase in severe depression and a 2 to 3.6-fold increase in suicide among electric utility workers.	(ii) Depression: Up to 9,000 cases of mild depression
	Poole <i>et al</i> , 1993		
	Savitz <i>et al</i> , 1994		
	Verkasalo <i>et al</i> , 1997		
	Beale <i>et al</i> , 1997		
	van Wijngaarden <i>et al</i> , 2000		

Key References

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Skin cancer

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Document 2

STUDY OF CHILDHOOD LEUKAEMIA NEAR POWERLINES PUBLISHED IN THE BRITISH MEDICAL JOURNAL

by Draper G., Vincent T., Kroll M.E. and Swanson J.,

Friday 3rd June 2005

BMJ 2005;330;1290-doi:10.1136/bmj.330.7503.1290

‘Findings of higher childhood leukemia up to 600 metres from powerlines greatly extends findings from previous international studies, including those in the UK’, says Bristol Professor

The findings by Dr Gerald Draper and colleagues of increased rates of childhood leukemia up to 600 metres from high voltage powerlines in the UK, published in the British Medical Journal today, greatly extends previous findings from a pooled analysis of international studies which included the results of a previous UK study.

Denis Henshaw, Professor of Human Radiation Effects at the University of Bristol said today:

“These latest findings not only strengthen further the evidence that children living in proximity to high voltage powerlines are at increased risk of childhood leukemia, but in finding effects up to 600 metres away, they invoke electric field corona ion effects as a possible causal mechanism. The fact that this study has looked at the birth address is particularly important because the initial damage that may lead to leukemia is thought to occur *in-utero*.”

While the number of excess cases of the disease in children living near powerlines may be around 5 per year, this may be the tip of the iceberg: (i) in terms of the extent to which both the magnetic fields and electric fields associated with the electricity supply may be a factor in the incidence of childhood leukemia, and (ii) in terms of the many other illnesses also associated with magnetic fields such as adult leukemia, adult brain cancer, miscarriage and depression.

A particularly important finding from Dr Draper's work is the increase in childhood leukemia up to 600 metres from powerlines, well beyond the range of powerline magnetic fields. In order to understand this finding we need to consider the separate effects of the magnetic fields and electric fields associated with powerlines.

For the magnetic fields, studies in human populations have shown that such fields are capable of disrupting the night-time production of the important hormone melatonin in the pineal gland. Melatonin is a particularly powerful antioxidant which acts as a natural anti-cancer agent in the body. Studies have shown the hormone to be highly protective of oxidative damage to human blood cells - the sort of damage that could lead to leukemia

FULL DETAILS

However, powerline electric fields act differently. The intense electric field on the surface of powerline cables is sufficient to ionise the air, producing so-called corona ions. This process is the cause of the characteristic buzzing or crackling of powerlines. Corona ions are small electrically-charged particles which, when emitted from powerlines attach themselves to particles of air pollution, making these particles more likely to be trapped in the lung when inhaled. In this way people living near powerlines may be exposed to increased levels of air pollution. Crucially, corona ions can be carried several hundred metres from powerlines by the wind, so effects may be felt much further away than for magnetic fields. FULL DETAILS

Professor Henshaw said:

“In principle, corona ion effects could well explain the profile of increased incidence of childhood leukemia up to 600 metres from powerlines”.

Professor Henshaw is available for interview on: 0117 9260353; 0777 3356442; email d.l.henshaw@bristol.ac.uk or the University Press Office 0117 3317276

More information on the research in Professor Henshaw's team may be found on their website: <http://www.electric-fields.bris.ac.uk>. The work of Professor Henshaw's team is funded by CHILDREN with LEUKAEMIA, Britain's largest charity devoted to understanding the causes and prevention of childhood leukemia.

Notes for Editors

1. Corona ions

Corona ions are routinely emitted from high voltage powerlines, especially in wet conditions outdoors. In the 1950s, corona ions effects were measured up to 7 kilometres from powerlines both in the UK and in Germany. In today's conditions, we have measured corona ions up to 7 kilometres from a high voltage powerline near Glastonbury, Somerset. We have previously estimated that on average corona ion effects, significant to adversely affect human health, extend to 400 metres from powerlines. In this regard, the findings by Dr Draper of increased childhood leukemia up to 600 m from powerlines in clearly significant.

Principal publications:

- Fews, A.P., Henshaw, D.L., Wilding, R.J. and Keitch, P.A. Corona ions from powerlines and increased exposure to pollutant aerosols. *International Journal of Radiation Biology*, 75(12), 1523-1531, (1999). – technical report of corona ion emission from high voltage powerlines in the UK
- Henshaw, D. L., 2002. Does our electricity distribution system pose a serious risk to public health? *Medical Hypotheses*, 59(1), 39-51 - see discussion of corona ions on pages 43 - 46.
- Fews, A. P., Wilding, R. J., Keitch, P. A., Holden, N. K. and Henshaw, D. L., 2002. Modification of atmospheric DC fields by space charge from high-voltage power lines. *Atmospheric Research*, 63, 271-289 - further detailed technical report of corona ion emission from high voltage powerlines in the UK
- National Radiological Protection Board (NRPB, 2004). Particle Deposition in the Vicinity of Power Lines and Possible Effects on Health Documents of the NRPB, 15, No. 1. Chilton, UK. HMSO, London ISBN 0-85951-531-1. – NRPB (now HPA) report on corona ions

2. Other background information

In Autumn 2000, a pooled analysis of international studies on electric and magnetic fields (Emfs) and childhood leukemia, led by Professor Ahlbom of the Karolinska Institute in Sweden, which included the results of a study in the UK, was published in the *British Journal of Cancer* in 2000 (Vol. 83, pp 692-698). The study showed that children exposed to magnetic fields above a level of 0.4 microtesla were at twice the risk of contracting the disease. While this level of exposure is above average levels found in the home, it is well below levels found near high voltage powerlines where values can reach several microtesla or even tens of microtesla. The Ahlbom study has since led the International Agency for Research on Cancer (IARC) to classify magnetic fields as a possible carcinogen and the World Health Organisation to call an international meeting to discuss the issue of introducing precautionary measures against exposure to Emfs associated with the electricity supply. Last year, the then Public Health Minister, Melanie Johnson, set up a Stakeholder Advisory Group on Emfs (SAGE) to examine the issue of precaution against EMF exposures in the UK.

The International Agency for Research on Cancer (IARC) Report on magnetic fields was published in: *IARC Monographs of the Evaluation of Carcinogenic Risks to Humans*, 2002. Non-Ionizing Radiation, Part 1: Static and Extremely Low-Frequency (ELF) Electric and Magnetic Fields. Volume 80, 19-26 June 2001, IARC Press, 150 Cours Albert Thomas, F-69372 Lyon Cedex 08, France.

In June 2002, a major report on EMF health effects from the California Health Department found increased risk of childhood leukemia, adult leukemia, adult brain cancer and miscarriage. This report may be accessed at:
<http://www.dhs.ca.gov/ehib/emf/RiskEvaluation/riskeval.html>

Childhood leukemia is a mercifully rare disease, which constitutes about one third of approximately 1400 cases of childhood cancer per year. The number of cases associated

specifically with powerlines is small in absolute terms but the number associated with the electricity supply generally is not known. Childhood leukemia is a biologically diverse disease and is likely to arise by several aetiological pathways. A number of factors are associated with the disease, such as infections, background radiation, magnetic fields, air pollution and paternal pre-conceptual exposure to hydrocarbons.

Appendix 1

**Comments by the Electromagnetics Division
Consumer & Clinical Radiation Protection Bureau, Health Canada
On
The VITR Project Application Report
EMF Health Impact Assessment**

Documents Reviewed:

1. Application for Environmental Assessment Certificate (*BCEAA*) and Environmental Screening (*CEAA*), Vancouver Island Transmission Reinforcement (VITR) Project.
 2. Chapter 6.13 Socio-Economic Environment.
 3. Chapter 6.14 Public Health
 4. Appendix I Electromagnetic Fields Reports.
 5. Exponent, Inc. Vancouver Island Transmission Reinforcement Project - Health Effects of Electric and Magnetic Fields: A Review of the Current Status of Knowledge (part of Appendix I).
 6. Addendum to Application for Environmental Assessment Certificate (*BCEAA*) and Environmental Screening (*CEAA*) - Vancouver Island Transmission Reinforcement Project.
 7. Scientific literature cited by the proponent and the concerned citizens.
1. Comments from the public regarding health concerns.

General Comments:

The original and amended VITR documents have been reviewed by scientific staff at Health Canada. Overall, both documents contain sufficiently detailed information on the project design and prospective electric and magnetic field (EMF) strengths, both within and adjacent to the right-of-way (ROW), to permit an evaluation of the possible human

health impacts from the proposed VITR Project. The original application document was also found to provide an accurate overview of most recent studies on EMF and health, reflecting the current state of knowledge on the subject.

When reviewing the original and amended application documents, it should be pointed out that Health Canada scientists have read and considered all the scientific information submitted by both the proponent and the concerned parties. In addition, Health Canada staff has considered a large amount of additional peer-reviewed scientific literature, international expert panel reports and exposure standards. At present, it is Health Canada's position that there is no compelling scientific evidence that EMF in living and school environments, regardless of locations from power transmission lines, cause ill health such as cancer. This position is consistent with the overall opinions from most national and international scientific bodies.

Based on the estimated electric and magnetic field intensities beneath and adjacent to the proposed 238 kV transmission line through Tsawwassen, no adverse human health effects would be anticipated. Furthermore, it should be noted that the estimated EMF levels through Tsawwassen would be well within science-based international EMF exposure guidelines, which have been established from a number of reviews of scientific studies conducted on biological organisms, including humans, animals and cell systems.

International EMF exposure guidelines include recommendations by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE), and are to be distinguished from several municipal and/or state guidelines, which are based on socio-political considerations. It was noted by Health Canada staff that the VITR project application and addendum did not address the application of the precautionary principle (PP). While no health effects are anticipated from the proposed 238 kV transmission line, Health Canada encourages the application of the PP. Although not part of the environmental assessment requirement, it would be helpful to explain how the PP may be applied to the VITR project to reduce public concern. The PP covers a variety of measures ranging from monitoring scientific developments and providing public information to stronger approaches, such as changes to the design of power lines to reduce magnetic fields. The PP is not intended to serve as a basis for lowering exposure limits, as it would undermine science-based exposure guidelines (www.who.int/docstore/pehemf/publications/facts_press/EMF-Precaution.htm). The application of the PP with respect to power-frequency EMF should involve low-cost or no-cost measures, where feasible, but should not involve lowering exposures at all cost.

In conclusion, it is the opinion of Health Canada scientists that the VITR project and addendum do not pose a public health risk with respect to EMF exposure from the proposed transmission lines.

Specific comments:

Chapter 0 Page liii (towards the end of the document), in the list of abbreviations. ELF should have been "Extremely Low Frequency," and not "Electric Field Effects."

Chapter 6.13 Socio-Economic Environment, Section 6.13.3.7 Radio Interference Noise. Although this does not have anything to do with Health Canada, there is reference to "the Department of Communication (DOC) at Industry Canada." The proper reference should be "the former Federal Department of Communication (DOC), which is now part of Industry Canada."

Chapter 6.14 Public Health, Section 6.14.3.2 Electromagnetic Fields, p. 6-339. Line 6. The reference to “measured magnetic field levels” should be “measured electric field levels,” corresponding to Figures D1-D5 in Wong 2006a, Appendix I.

Chapter 6.14 Public Health, Section 6.14.5.2. Change in Electromagnetic Fields, Table 6.14-25, p. 6-373. On 1 April 2005, the National Radiological Protection Board merged with the Health Protection Agency of the United Kingdom forming its new Radiation Protection Division. Therefore, reference to the National Radiological Protection Board (NRPB) of Great Britain should be “The UK Health Protection Agency (HPA).”

Exponent Document, Section 4.7, page 43, line 37. Reference to the National Radiological Protection Board (NRPB) of Great Britain should be “The UK Health Protection Agency (HPA).” This is to be consistent with a similar reference on page 24. Addendum document. The tables and graphs regarding electric and magnetic fields should be improved for better understanding (Tables 4 & 5, Figures A25, B25, C25 and D26).

September 6, 2006

Appendix 2

POSITION STATEMENT FOR THE GENERAL PUBLIC ON THE HEALTH EFFECTS OF POWER-FREQUENCY (60 Hz) ELECTRIC AND MAGNETIC FIELDS

1. Electric and magnetic fields (Emfs) are produced by the generation, transmission, distribution and use of electrical energy at power frequencies (60 Hz in Canada). People are exposed to these fields while in close proximity to power lines and other electrical facilities, as well as electrical wiring, equipment and appliances in homes, schools and workplaces.

2. Studies to investigate the health effects of these fields have taken place around the world for more than thirty years. These studies include laboratory research into effects on cells and animals, as well as epidemiological (human health) studies looking at possible associations between exposures and diseases in the population. Short- and long-term scientific investigations have been conducted and are continuing.

3. Laboratory research has shown that power-frequency Emfs can interact with biological systems; however, results to date have not provided conclusive evidence that these fields cause adverse health effects, such as cancer. Epidemiological studies have not established an association between exposure to power-frequency Emfs and the development of cancer in adults. The evidence associating cancer in children with exposure to power-frequency Emfs remains inconclusive.

4. After a recent evaluation of the scientific data, the International Agency for Research on Cancer classified extremely-low-frequency (ELF) magnetic fields as "possibly carcinogenic to humans" based on studies of childhood cancer

(<http://monographs.iarc.fr>). "Possibly carcinogenic to humans" is a classification used to denote an agent for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence for carcinogenicity in experimental animals. In the case of ELF fields, the evidence is not strong enough to conclude that they definitely cause cancer in children. More studies are needed to draw firm conclusions.

5. Immediate biological effects can result from direct exposure but only at field strength levels well above those typically found in living environments. Peripheral nerve and muscle stimulation can be caused by intense magnetic fields and hair stimulation by intense electric fields. Minor shocks may be caused by touching poorly-grounded, conducting (metallic) objects located under some high voltage lines, as a result of electrical charge induced by high intensity electric or magnetic fields.

6. Based on the available scientific evidence to date, the Federal Provincial Territorial Radiation Protection Committee (FPTRPC) concludes that adverse health effects from exposure to power-frequency Emfs, at levels normally encountered in homes, schools and offices, have not been established. Protection of the public against acute effects such as minor shocks, that may occur from contact with conducting objects under high voltage power lines, can be achieved through awareness initiatives undertaken by the electrical power industry.

7. There have been increasing requests from concerned citizens that the precautionary principle (PP) be used in a number of areas, including exposure to Emfs. It should be noted that the extent of PP covers a variety of measures ranging from moderate methods such as monitoring scientific developments and providing information, through participation in the process of acquiring new knowledge by carrying out research, to stronger measures such as lowering exposure limits. Since there is no conclusive evidence that exposure to Emfs at levels normally found in Canadian living and working environments is harmful, FPTRPC is of the opinion that moderate measures and participation in the process of acquiring new knowledge are sufficient. These types of activity are consistent with the Canadian government framework on precaution.

8. The FPTRPC will continue to monitor scientific research relating to the health effects of power-frequency Emfs and will reassess its position periodically as new information becomes available.

Notes:

(a) This Position Statement replaces the previous Position Statement (first released by the FPTRPC in November 1998 and updated in October 2002).

(b) This Position Statement is not intended to provide direction on health and safety aspects of electromagnetic interference by Emfs with medical electronic devices, including cardiac pacemakers. Electromagnetic interference with such devices requires different considerations from those used in the evaluation of human health effects.