

# Health concerns related to the construction of a high-voltage power line in Tsawwassen, British Columbia

**Petition:** No. 259

**Issue(s):** Environmental assessment, federal provincial relations, human health/environmental health, and other

**Petitioner(s):** John R. Bulloch and Dr. Bruce D. Owen

**Date Received:** 27 June 2008

**Status:** Completed

**Summary:** The petitioners are concerned about the potential health impacts that the construction of a high-voltage power line in a densely populated area of Tsawwassen, British Columbia could cause to people living near the power lines. The petitioners present summaries of studies related to electromagnetic effects on human health, and would like to know, among other things, who has the authority to halt the construction of the power line. In addition, the petitioners ask questions related to health concerns raised during the environmental assessment of the power line project.

**Federal Departments Responsible for Reply:** [Environment Canada](#), [Fisheries and Oceans Canada](#), [Health Canada](#)

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## Petition

### A PETITION

### TO THE AUDITOR GENERAL

### OF CANADA

CONCERNING A 230,000 VOLT POWER LINE  
BEING CONSTRUCTED IN A DENSELY POPULATED  
AREA OF TSAWWASSEN, BRITISH COLUMBIA

*[Original signed by Dr. B.D. Owen and John Bulloch]*

Dr. B.D. Owen

John Bulloch, CD

Professor Emeritus

Tsawwassen Resident

University of British Columbia

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To the Auditor General of Canada

With great respect we ask that:

Given the evidence published in peer-reviewed scientific journals that shock effects, direct radiation effects and corona ion effects can cause fatal illnesses in people living near high voltage power lines

and

Given the fact that the power line in question is within a few meters of a high school, two churches, several hundred residences, and is a 230,000 volt line

and

Given the fact that there was no site visit by any Health Canada personnel qualified to pass judgment on the risks to health involved, and there was no consultation with Health Canada by BCTC.

and

Given the fact that burying the power line would eliminate all of the potential hazards:

We respectfully request that the responsible Federal Authorities enter into discussion with British Columbia authorities in order to compel the British Columbia Transmission Corporation to halt construction of the 3.7 km Tsawwassen Transit power line until all health issues have been resolved.

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### Introduction

This petition presents a number of 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) states that E.M.F. levels will range from 15 to 149 milligauss. 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 **1uT=10 mG.** Throughout the document the uT will be used because the British and Europeans report their data in T or uT and many of the literature references cited herein are in those units.

Several routes were considered for the new power line. One involved crossing First Nations land, and was rejected. Another involved environmentally sensitive land and was also rejected. **The next proposal was to follow the existing right of way with underground installation via surface excavation or underground installation via tunnel. The cost of the tunnel was deemed too high.** Surface excavation would damage many properties and was therefore unacceptable. The remaining choice was above ground on steel poles and this was the option chosen. This is unacceptable. **Magnetic radiation from (overhead) 230 Kvolt power lines can have a number of undesirable (and possibly fatal) effects. This fact is the reason for this appeal to the Auditor General of Canada.**

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

- (a) High School (1300 students and staff)
- (b) Nursing 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 infringe on the right of way. (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 could be affected. The total population of Tsawwassen is approximately 22,000.

**The scientific literature does not support the view of Health Canada Scientists that the VITR project (i.e. Tsawwassen Power Line) is not a public health risk.(see: Role of Health Canada )**

The extensive review article, 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 voltage power lines as of 2001.

**Corona Ion Effects** are described in the Henshaw paper. Corona ions, (molecules of ionized oxygen and nitrogen) acquire + charges from electrical radiation and are attracted to particulates floating in the atmosphere. We should be concerned, in this connection, with the doubling of the port capacity 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 particulates. These can drift for several kilometres (much further than corona ions alone); (6 – 7 kilometres versus about 600 metres). Light (small) diesel particulates are among the most carcinogenic substances known. Adding to the problem is the fact that low grade bunker-type fuel is used while the ships are in port.

Given the above situation, we are very concerned about **CORONA IONS**. Prevailing wind directions (W and NW) from the two ports (Deltaport and BC Ferries) will cause a flow of carcinogenic particulates directly towards the power line, where ionization of air (oxygen and nitrogen) is occurring to produce corona ions carrying a positive charge. These combine with a + charged particulate that, if inhaled, will adhere to lung or other tissue. Interestingly these particulates are usually found in the area where most lung cancers begin.

**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**

**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 power lines 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 power lines, 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 power lines is taken to be  $4.6\% \times 6 \times 10^7$  people =  $2.76 \times 10^6$  people. A 30% increase in risk downwind compared with upwind of power lines 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 power lines 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 power lines 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 power lines 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 power lines. 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 power lines 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  $\mu\text{T}$ .

(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  $\sim 0.1 \mu\text{T}$ . 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 power lines 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 power lines in the UK then this could be of significant public health relevance.

### 2.1 Childhood leukemia

Increased risk has been assumed above 0.4  $\mu\text{T}$ , effective up to 50 metres either side of 132, 275 and 400 kV power lines. 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 power lines. 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 occurs at low magnetic field exposures,  $\sim 0.1 \mu\text{T}$ . Such a low threshold would embrace exposures near all types of power lines 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  $0.1 \mu\text{T}$  is assumed which is effective up to 150 m either side of 132, 275 and 400 kV power lines. 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  $0.1 \mu\text{T}$ , 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 power lines 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 power lines 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 power lines
Childhood leukemia	Fews <i>et al</i> , 1999 Ahlbom <i>et al</i> , 2000 Greenland <i>et al</i> , 2000 Microwave News, Sept/Oct 2000	(i) <i>Corona Ion Effects</i> : Risk assessment based on increased exposure to air pollution.  (ii) <i>Magnetic Fields</i> : No accepted causal mechanism for magnetic fields but an	2 – 8 cases

		implied relative risk of 2.0 above 0.4 $\mu\text{T}$ and 1.7 above 0.3 $\mu\text{T}$ .	
<b>Skin cancer</b>	Fews <i>et al</i> , 1999b NRPB 1997	Risk assessment based on increased skin exposure to radon decay products and other agents via 50 Hz oscillation of aerosols.	<b>14 cases</b>
<b>Lung cancer</b>	McDowall, 1986 Katsouyanni & Pershagen, 1997	Risk assessment based on increased exposure to air pollution via corona ion effects.	<b>250 – 400 cases</b>
<b>Other illnesses associated with air pollution</b>	Seaton <i>et al</i> , 1995	Risk assessment based on increased exposure to air pollution via corona ion effects.	<b>2,000 - 3,000 cases</b>
<b>Suicide and Depression</b>	Reichmanis <i>et al</i> , 1979 Perry <i>et al</i> , 1981 Perry <i>et al</i> , 1989 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> ,	Considered biologically plausible via magnetic field exposure. Apparent low threshold $\sim 0.1 \mu\text{T}$ .  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.	<b>(i) Suicide:</b> <b>60 cases</b>  <b>(ii) Depression:</b> <b>Up to 9,000 cases of mild depression</b>

### Key References

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### Skin cancer

1. Fews A P, Henshaw D L, Keitch P A, Close J J and Wilding R J, 1999b. Increased exposure to pollutant aerosols under high voltage power lines. *International Journal of Radiation Biology*, **75**(12), 1505-1521.

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### Increased exposure to air pollution near power lines

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## Air pollution

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## 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 power lines 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 power lines 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 power lines 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 power lines 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 power lines, well beyond the range of power line magnetic fields. In order to understand this finding we need to consider the separate effects of **the magnetic fields** and **electric fields** associated with power lines.

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 power line cables is sufficient to ionise the air, producing so-called corona ions. This process is the cause of the characteristic buzzing or crackling of power lines. Corona ions are small electrically-charged particles which, when emitted from power lines 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 power lines may be exposed to increased levels of air pollution. Crucially, corona ions can be carried several hundred metres from power lines 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 power lines”.

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

### Principal publications:

- Fews, A.P., Henshaw, D.L., Wilding, R.J. and Keitch, P.A. Corona ions from power lines 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 power lines 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.

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 power lines 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 power lines 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.

**Note: An executive summary of the California Report is appended. (see below)**

- Fewes, 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 power lines 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.

[Information withheld]

### **The role of Health Canada in the decision to build the Tsawwassen transit of the power line above ground**

The question/answer interview presented below involved Ms. Debbie McBride, a newspaper columnist in Tsawwassen, and [name and position withheld] with Health Canada in Ottawa.

**Q1) Why did Health Canada only address the issue of electromagnetic fields (EMF) when there are other health issues that dovetail with this? Such as the interference with implanted medical devices and the Corona Effect. We know that a blueberry farmer along the Vancouver Island Transmission Reinforcement project (VITR) has been compensated for having to run his blueberry bushes at a cross angle to prevent electric shocks. We have also learned that people with metal fences are being told they need to ground them if they run parallel to the line also due to shock. I would like to know if a study by Health Canada was done on those factors and also if Children's playground equipment was included in any study? If not why not?**

A1. Health Canada's role in the Vancouver Island Transmission Reinforcement project (VITR project) was to provide advice, under Section 12(3) of the Canadian Environmental Assessment Act (CEAA), to Environment Canada on the potential health issues related to EMF exposure. Health Canada's scientific advice was referred to the Electromagnetics Division, Consumer and Clinical Protection Bureau, Product Safety Programme which provided the response on possible human health effects from exposure to EMFs. I am not aware of any Health Canada studies in the areas specified in the enquiry. The corona ions issue is speculative and actual studies and research with respect to health impacts haven't been done. {NOT TRUE}

**Q2) I've noticed that all the environmental application was all done on British Columbia Transmission Corporation (BCTC) Stationary. Where is Health Canada's request and application as in independent body of study?**

A2. As noted in A1, Health Canada participated in the joint Federal-Provincial environmental assessment review of the VITR project as a Federal Authority, providing specialist advice in accordance with s12(3) of CEAA to the Responsible Authorities. Health Canada participated in the CEAA review at the request of Environment Canada, a Responsible Authority. It is not required in CEAA reviews for a Federal Authority to file a request to participate. The invitation from a Responsible Authority is sufficient. Health Canada was not invited to participate in the separate BCUC process and did not participate.

**Q3) Was the site visit done in Tsawwassen, by whom and when?**

A3. Health Canada did not participate in any site visits in Tsawwassen and cannot respond to this question.

**Q4) Why was the study period so short?**

A4. Health Canada is not in a position to answer this question since it did not conduct any studies specific to this project.

**Q5) Why is the use of the Precautionary Principle encouraged but with low cost or no cost solutions?**

A5. The Precautionary Principle (PP) is a public policy approach for risk management of *possible but unproven* adverse health effects. The extent of PP practices range from monitoring scientific developments and providing information to lowering exposure limits. When considering precautionary measures, they should be proportional to the level of risk and its associated uncertainty, the severity of the health outcome, and the level of societal benefit. In the context of extremely-low-frequency electric and magnetic fields, such as those from power lines, health risks to the public from such exposures have not been established. It is, therefore, the opinion of Health Canada that any precautionary measures applied to power lines should only involve low cost or no cost options.

**Q6) Who is the person who did the studies here before the project was approved?**

A6. Health Canada is not in a position to answer this question since it did not conduct any studies specific to this project.

**Q7) Health Canada signed off on the project yet there is no name attached. Who signed off on it?**

A7. Carl Alleyne, BC Regional Environmental Assessment Coordinator, represented Health Canada during the *Canadian Environmental Assessment Act* (CEAA) review of the VITR project. Expert advice on the potential health impacts due to EMF exposure was provided by the Electromagnetics Division of the Product Safety

Programme. This advice was conveyed through the BC Regional EA Coordinator. Note: Mr. Alleyne is located in Burnaby.

**Q8) The WHO EMF project is referred to yet [name withheld] had been discredited by [name withheld] own committee before this study was completed. When we get the names of the scientists involved in this study I would like to know if they were aware of it.**

A8. All activities conducted by the WHO International EMF Project are based on sound science. Any conclusions and recommendations about health risk are those of a committee of experts convened for this purpose. WHO staff, including [name withheld], are only the secretariat for these meetings.

**Q9) Is Health Canada willing to put in a stop work order until a properly signed study is completed?**

A9. Health Canada does not have any legislative authority or decision-making power to stop the project. Its role was to provide specialist advice to the Responsible Authorities under CEAA.

Best Regards,

[Name and information withheld]

1. The next two documents are, in our opinion out of date, and contain mainly unhelpful, generalized, statements. **The failure to have a site visit to a project of this size, which will place a 230 kilovolt power line over the heads of more than 2000 people, is inexcusable.**

2. What are the standards? Do you have any regulations concerning maximum voltages in overhead power lines? Why could you not force the BC government to bury this line. That was the original plan, we understand, but it was changed because of cost considerations.

## **HEALTH CANADA'S POSITION STATEMENT FOR THE GENERAL PUBLIC:**

**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.

8. 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](http://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.

**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.

### FINAL COMMENTS:

It seems unreasonable to us that, in both these documents (and many others like them) the Government or the proponent can claim no harm proven as an excuse for undertaking no mitigating action. The independent researcher, often university based, is forced to spend additional time and limited resources trying to provide the additional “proof” demanded. **Why cannot the Provincial government do the research, or at least finance it? These demands for “additional proof” can go on forever.**

There is absolutely no excuse for the situation in Tsawwassen at present. The knowledge that 230,000 volt power lines cause harm has been in the science literature for years. It is time for the BC government to provide mitigation, either by **burying the power line or moving it.**

### Specific Questions

Given the overhead installation of this power line, who would have the authority to demand that construction be halted until health concerns, particularly those that are life threatening have been addressed?

Who has the authority to order construction halted?

Who would be held responsible for deaths attributed to the power lines?

Why did Health Canada refuse to acknowledge recent findings from published scientific literature?

Why does Health Canada refuse to establish EMF limits for long term exposure?

Why was there no site visit for a project of this dimension?

Why was the issue of corona ionization not addressed particularly in the light of the increased pollution from both Delta Port and ferry traffic?

Considering residents live within 10 meters of these lines, why was the danger of induced voltage not taken into account?

### Contact Information

*[Original signed by Dr. B.D. Owen and John R. Bulloch]*

Dr. B.D. Owen

John R Bulloch

Professor Emeritus

Tsawwassen Resident

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## Minister's Response: Environment Canada

9 December 2008

Dr. B.D. Owen  
Professor Emeritus  
University of British Columbia  
313 – 1359 56th Street  
Delta BC V4L 2P3

Mr. John R. Bulloch  
1680 53A Street  
Delta BC V4M 3G4

Dear Dr. Owen and Mr. Bulloch:

I am writing to provide Environment Canada's response to your Environmental Petition No. 259, pursuant to section 22 of the *Auditor General Act*, regarding a 230,000-volt power line being constructed in Tsawwassen, British Columbia. Your petition was received in the Department on 11 July.

The second question you raise falls under the responsibility of my department.

Question: Who has the authority to order construction halted?

Response: Environment Canada issued a disposal at sea permit for the Vancouver Island Transmission Reinforcement Project in November 2007. The permit, which was issued pursuant to the *Canadian Environmental Protection Act, 1999*, authorizes the loading and disposal of approved dredge material from the project at a designated site. Environment Canada's enforcement authority pertains to these loading and disposal-at-sea activities, to ensure compliance with conditions identified in the permit. It does not include matters related to the construction of the overhead power line.

I understand that the Ministers of Health and Fisheries and Oceans will be responding separately to issues that fall under the mandates of their departments.

I appreciate this opportunity to respond to your petition and trust that you will find this information useful.

Sincerely,

*[Original signed by Jim Prentice, Minister of the Environment]*

The Honourable Jim Prentice, P.C., Q.C., M.P.

c.c.: The Honourable Leona Aglukkaq, P.C., M.P.

The Honourable Gail Shea, P.C., M.P.

Mr. Scott Vaughan, Commissioner of the Environment and Sustainable Development

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# Minister's Response: Fisheries and Oceans Canada

October 23, 2008

Dr. B.D. Owen  
Professor Emeritus  
University of British Columbia  
#313, 1359 – 56th Street  
Delta, British Columbia  
V4L 2P3

Mr. John R. Bulloch  
1580 – 53A Street  
Delta, British Columbia  
V4L 2L6

Dear Dr. Owen and Mr. Bulloch,

I am writing in response to your Environmental Petition No. 259 to the Commissioner of the Environment and Sustainable Development, entitled “Concerning a 230,000 volt power line being constructed in a densely populated area of Tsawwassen, British Columbia”.

The questions you have posed in the petition are outside the mandate, jurisdiction, and expertise of Fisheries and Oceans Canada (DFO).

The involvement of DFO in the Vancouver Island Transmission Reinforcement project was based on the need for the issuance of authorizations under section 32 and subsection 35(2) of the *Fisheries Act*, for the installation of the submarine cable across the Strait of Georgia. DFO participated in an environmental assessment under the *Canadian Environmental Assessment Act*. A conclusion that the proposed project is not likely to cause significant environmental effects was reached on June 25, 2007.

The Commissioner has also referred the petition to my honourable colleagues, the Minister of the Environment and the Minister of Health, who will provide responses on matters within their mandates.

Sincerely,

*[Original signed by Loyola Hearn, Minister of Fisheries and Oceans]*

Loyola Hearn, P.C.

c.c.: The Honourable John Baird, P.C.

The Honourable Tony Clement, P.C..

Mr. Scott Vaughan, Commissioner of the Environment and Sustainable Development

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# Minister's Response: Health Canada

22 October 2008

Dr. B.D. Owen  
Professor Emeritus  
University of British Columbia

#313-1359 56 Street  
Delta, British Columbia V4L 2A6

Mr. John R. Bulloch  
1680 53A Street  
Delta, British Columbia V4L 3G4

Dear Dr. Owen and Mr. Bulloch:

This is in response to your environmental petition No. 259 of July 11, 2008, addressed to the Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you put forth your concerns about the 230,000 volt power line being constructed in a densely populated area of Tsawwassen, British Columbia.

I am pleased to provide you with the enclosed Health Canada response to your petition.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,

*[Original signed by Tony Clement, Minister of Health and Minister for the Federal Economic Development Initiative for Northern Ontario]*

Tony Clement

Enclosure

c.c. Mr. Scott Vaughan, CESD

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**Health Canada Response to  
Environmental Petition No. 259 filed by Dr. B.D. Owen and  
Mr. John Bullock under Section 22 of the Auditor General Act  
Received July 11, 2008**

**Concerning a 230,000 volt power line being constructed in a densely populated area of Tsawwassen,  
British Columbia**

**November 8, 2008**

Minister of Health and the Minister for the Federal Economic  
Development Initiative for Northern Ontario

1. *Given the overhead installation of this power line, who would have the authority to demand that construction be halted until the health concerns, particularly those that are life threatening have been addressed?*
2. *Who has the authority to order construction halted?*

**Answer to Questions 1 and 2:**

Regulations for the design, construction and safe operation of power lines and transmission towers are the responsibility of provincial/territorial authorities.

Health Canada's role in the Canadian environmental assessment (CEA) review process for this project was to evaluate whether there was any potential for human health effects resulting from exposure to electric and magnetic fields (EMFs) from the Vancouver Island Transmission Reinforcement (VITR) project. Health Canada scientists used the information supplied to them by the CEA office and provided their opinion based on their knowledge and experience in the area of EMF health effects. This knowledge comes from years of continual review of the scientific literature, participation in scientific organizations and societies, and their own in-house studies.

Health Canada scientists take the issue of human exposure to extremely low frequency (ELF) EMFs seriously and form their opinion with the utmost care and respect for the rights of all Canadians.

3. *Who would be held responsible for deaths attributed to the power lines?*

Regulations for the design, construction and safe operation of power lines and transmission towers are the responsibility of provincial or territorial authorities.

4. *Why did Health Canada refuse to acknowledge recent findings from published scientific literature?*

All studies, including recent ones, are reviewed by Health Canada scientific staff either as participants in standard-setting bodies and international scientific meetings, as academic or peer reviewers for publications, or as part of a continuous program of literature surveillance.

A weight-of-evidence approach is employed when assessing the possible health risks of power line EMFs. This takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), but also the quality of those studies. Poorly conducted studies (e.g. incomplete dosimetry or inadequate control samples) receive relatively little weight, while properly conducted studies (e.g. all controls included, appropriate statistics, complete dosimetry) will receive more weight.

5. *Why does Health Canada refuse to establish EMF limits for long term exposure?*

It is Health Canada's opinion that the scientific evidence is not sufficiently strong to support a science-based ELF EMF exposure guideline. Nevertheless, Health Canada is in agreement with the position of the World Health Organization (WHO) in that the application of precautionary measures with respect to ELF EMFs should be considered to reduce human exposures where feasible, but should not include the arbitrary lowering of exposure limits. (Please note that limits do exist for acute exposures, although at levels not normally encountered except in certain occupational settings).

6. *Why was there no site visit for a project of this dimension?*

The Electromagnetics Division of the Consumer and Clinical Radiation Protection Bureau of Health Canada was requested to provide expert opinions on the VITR environmental assessment with respect to human exposure of EMFs only. The information provided to them by the CEA coordinator was of sufficient detail to carry out this task. A site visit was unnecessary and would not have provided any additional information on the effects of human exposure to EMFs.

7. *Why was the issue of corona ionization not addressed particularly in the light of the increased pollution from both Delta Port and Ferry Traffic?*

The Corona Ions Effect is a hypothesis put forward by a scientist at the UK Bristol University Human Radiation Effects Group to try to explain the weak statistical associations between EMF exposure and childhood leukemia found in a number of epidemiological studies. The hypothesis suggests that electric fields from high voltage power lines may influence the behaviour of airborne particles (air pollution or radioactive

decay products from radon gas) making them more likely to adhere to human skin or lung tissue. The hypothesis has to date not been supported by experimental studies and has been considered by a number of expert review panels as being an unlikely contributor to the increased risk ratios encountered in the previously mentioned epidemiological studies. As such, it does not form a biological basis upon which to establish science-based human exposure limits.

8. *Considering residents live within 10 metres of these lines, why was the danger of induced voltage not taken into account?*

If, by induced voltage, the petitioners mean the energization of ungrounded metallic objects in the presence of a strong electric field, prevention of electric shock from touching a metallic object energized by induction falls under provincially enforced electrical safety codes. Such regulations for the design, construction and operation of power lines and transmission towers are the responsibility of provincial or territorial authorities.

**Date issued:**

2008-10-21