

Hans Karow
Coalition to Reduce Electropollution (CORE)
S2 / C 49
RR # 1
3075 Hayman Road
Naramata, BC, V0H 1N0

Mr. Robert J. Pellatt
Commission Secretary
British Columbia Utilities Commission
Sixth Floor, 900 Howe Street, Box 250
Vancouver, BC, V6Z 2N3

Without Prejudice

June 18, 2007

Dear Mr. Pellatt,

Re: FortisBC Inc. - Certificate of Public Convenience and Necessity (CPCN) for the Naramata Substation & Transmission Line Project No. 3698458
<http://www.bcuc.com/ApplicationView.aspx?ApplicationId=150>

1. Please accept my **Evidence # 32** for reference into subject hearing process:

**Electromagnetic Fields & Cancers:
Children at risk with residential and school exposure to EMFs.**

by Dr. Magda Havas, presented at Hydro One Workshop on EMFs, Markham Ontario, June 16, 2004

Source: http://www.stop-emf.ca/hydroone/PresentationEMFHydro_files/frame.htm

This presentation clearly shows that there are biological effects **far below** the present WHO/ICNIRP/Health Canada EMF exposure guidelines and/or recommendations!

2. I kindly ask your office staff to have all slides printed out and posted to the BCUC's subject project link.
3. For intervenors with little knowledge about EMF I strongly recommend to have a brief look at Dr. Havas presentation, especially slide 12 by clicking in the left bar on "**Exposure Guidelines vs Effects**" which will directly lead to slide 12. This slide explains why FortisBC likes the still present WHO/ICNIRP EMF Exposure Standards and to comply to those. Would the guidelines be lower in the 2 - 10 milliGauss range, FortisBC would not be able/allowed to build new substations and transmission lines close to residential and public building areas! This must be addressed in the hearing's issue
4. Project compliance with the WHO and ICNIRP EMF standards,

Respectfully submitted,

Hans Karow, CORE

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Epidemiological Studies: threshold magnetic field?

Epidemiological Studies: dose-response?

**Schuz et al. 2001:
Childhood Leukemia**



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Magda Havas, B.Sc., Ph.D.

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Abstract:

We now have more than 20 years of scientific research from around the world showing adverse health effects associated with exposure to electromagnetic fields from our use of electricity. Both children and adults are affected although children appear to be more sensitive. The epidemiological studies from Wertheimer and Leeper (1979) to the most recent meta-analysis dealing with **childhood leukemia** and **residential exposure** to electromagnetic fields are presented. There is a consistent 2- to 4-fold increased risk of **children developing leukemia** when they are exposed to **magnetic fields exceeding 2 to 4 mG** in their homes. The **bedroom** seems to be the most critical environment and children **under the age of 6** are particularly vulnerable. Evidence of a **dose/response** relationship, commonly used in chemical toxicology, is evident. Studies of occupational exposure to electromagnetic fields report an increased incidence of **adult leukemia, brain tumors, and breast cancer** at levels at or **above 2 mG**, and an increased risk of **miscarriages above 16 mG**. These studies in combination with laboratory studies lend credence to the concept that extremely low frequency **electromagnetic fields are harmful to human health** at levels to which we are currently exposed in the **home**, at **school**, and in the **workplace**. Federally we need better standards to protect public health. Buffer zones around high voltage power lines are needed to minimize human exposure. **Magnetic field at the edge of the right-of-way should not exceed 2 mG during peak power consumption. Also, mitigation should be in place to minimize ground currents.**

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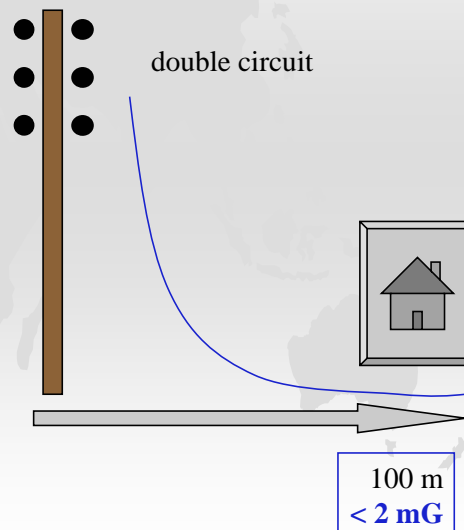
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Epidemiological Studies: *threshold magnetic field?*

- **Wertheimer & Leeper 1979, USA**
 - wire codes
 - leukemia, lymphoma, brain tumors
 - leukemia **OR 3.0** (1.8-5.0, 95% CI)
 - high CC, **~2.5 mG**
- **Savitz et al. 1988, USA**
 - **2.2 mG**, leukemia **OR 2.8** (0.9-8.3, 95% CI)
- **Feychting & Ahlbom 1993, Sweden**
 - **≥ 2 mG**, leukemia **OR 2.7** (1.0-6.3, 95% CI)
- **Ahlbom et al. 2000, Meta-analysis**
 - **≥ 4 mG**, leukemia **OR 2** (1.27-3.13, 95% CI)



NOTE: OR refers to the Odds Ratio and indicates the magnitude of risk; CI = 95% confidence interval

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Epidemiological Studies: *dose-response*?

- *Feychting & Ahlbom* 1993, **Sweden**, childhood leukemia
 - ≥ 2 mG, **2.7-fold** increase [OR 2.7; 1.0-6.3 95% CI]
 - ≥ 3 mG, **3.8-fold** increase [OR 3.8; 1.4-9.3 95% CI]
- *Gorham* 1992, **USA**, childhood leukemia
 - **1 mG**: lowest cancer incidence
 - **2 mG**: **3-fold** increase
 - **3 mG**: **4-fold** increase
- *Olsen* 1992, **Denmark**, childhood leukemia & brain tumors
 - **4 mG**: **5-fold** increase

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Schuz et al. 2001: Childhood Leukemia in Germany (514 cases and 1301 controls, former West Germany)

Odds Ratio (95% CI)	< 1 mG (ref)	1 - <2 mG	2 - <4 mG	> 4 mG
24-h Median Bedroom Acute Leukemia	1	1.15 (0.65-3.67)	1.16 (0.43-3.11)	5.81 (0.78-43.2)
Night-time (10pm -6 am) Acute Leukemia	1	1.42 (0.9-2.23)	2.53 (0.86-7.46)	5.53 * (1.15-26.6)
Night-time ALL	1	1.48 (0.92-2.36)	2.49 (0.80-7.73)	6.19 * (1.29-29.7)
Night-time < 4 years old	1	1.74 (0.95-3.19)	2.75 (0.60-12.7)	14.9 * (1.2-185)

Night-time All German Studies	1	1.33 (0.90-1.97)	2.40 * (1.07-5.37)	4.28 * (1.25-14.7)
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Dose-response relationship



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Childhood Leukemia: *age & risk?*

- *Feychting and Ahlbom 1993: Sweden*
 - **All Ages (0-15): ≥ 2 mG, OR 3.1***, 95% CI (1.1-8.6)
 - **Ages 5-9: ≥ 2 mG, OR 5.7***, 95% CI (1.0-26)
- *Green et al. 1999: Canada (Toronto, York, Peel, Durham in Ontario)*
 - **OR 4.5*** of childhood leukemia (**all ages, 0-14**)
 - **<6 years old** greater risk than **6-14 year olds**.
- *Schuz et al. 2001: Germany, night-time exposure*
 - **all ages: ≥ 2 mG, OR 3.2***, (1.33-7.8)
 - **<4 years old** greater risk: **≥ 2 mG, OR 4.5***, (1.2-16.7)

* = statistically significant ($P \leq 0.05\%$)

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Occupational Exposure of **Father** & Childhood Cancers:

Feychting et al. 2000 (Sweden)

	Odds Ratio (95% CI)		
	Magnetic Flux Density (mG)		
	1.3-2.1	1.3-2.9	≥ 3
Total cancer	1.0 (0.8-1.3)	1.0 (0.8-1.2)	1.1 (0.8-1.5)
Leukemia	1.6 (1.0-2.5) *	1.4 (0.9-2.2)	2.0 (1.1-3.5) *
CNS	0.8 (0.5-1.2)	0.8 (0.6-1.2)	0.5 (0.3-1.0)
Lymphoma	1.4 (0.6-3.3)	1.3 (0.6-3.1)	0.9 (0.2-3.4)
Kidney	1.1 (0.4-2.8)	1.1 (0.4-2.7)	1.7 (0.5-5.7)
Neuroblastoma	1.8 (0.6-5.3)	1.5 (0.5-4.6)	1.0 (0.2-5.7)

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Occupational Exposure of **Mother** & Childhood Cancers:

Feychting et al. 2000 (Sweden)

	Odds Ratio (95% CI)		
	Magnetic Flux Density (mG)		
	1.2-1.8	1.2-2.5	≥ 2.6
Total Cancer	0.9 (0.7-1.2)	0.9 (0.7-1.2)	1.1 (0.7-1.7)
Leukemia	1.1 (0.7-1.8)	1.1 (0.7-1.7)	1.2 (0.5-2.4)
CNS	0.8 (0.4-1.3)	0.8 (0.5-1.4)	1.1 (0.5-2.4)
Lymphoma	0.4 (0.1-1.3)	0.4 (0.1-1.2)	0.4 (0.1-3.4)
Kidney	1.7 (0.5-5.6)	1.7 (0.5-5.5)	1.0 (0.1-8.7)
Neuroblastoma	2.6 (0.5-12.8)	2.8 (0.6-13.3)	3.9 (0.5-27.4)

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Wartenberg 2001: *Residential EMF Exposure and Childhood Leukemia: Meta-Analysis & Population Attributable Risk* (Bioelectromagnetics 5:S86-S104)

Meta-Analysis: (19 studies examined) **statistical method designed to summarize and simplify a complex set of study results.**

“ . . .many people believe there are no data to support an association between residential magnetic field exposure and childhood leukemia. To the contrary, the data strongly and relatively consistently support such an association, although the estimated magnitude of the risk is moderate.”

*“ If one chooses to use these **summary estimates*** for interpretation, given the widespread exposure to magnetic fields they suggest perhaps as much as a 15-25% increase in the childhood leukemia rate, which is a large and important public health impact.”*

***Wire code:** RR 1.4 \geq OHCC, 28% exposure assessment

***Measurements:** RR 1.1 per 1 mG

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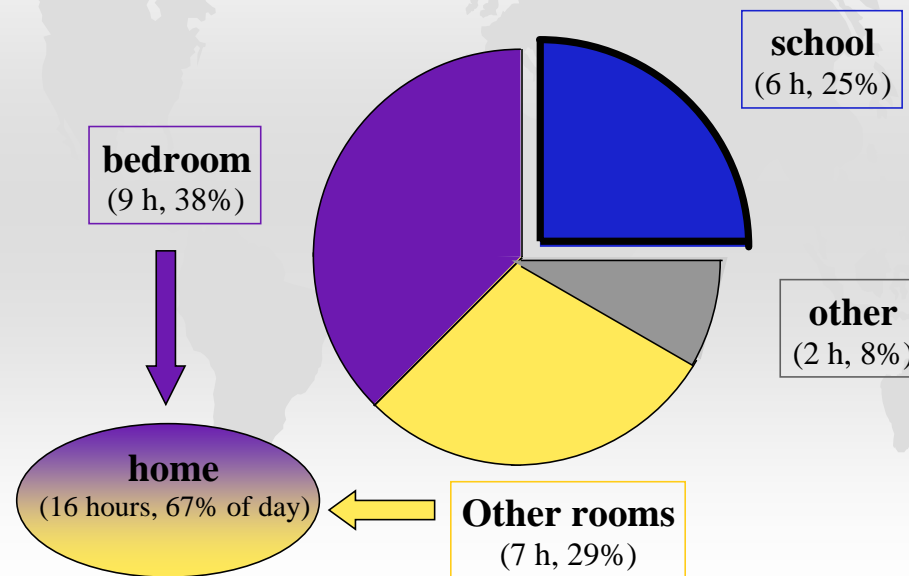
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Time Allocation: School Age Children



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“Cancer Clusters” in Schools & EMFs

- New York City, NY ('90-92)
 - 3 cases **leukemia**, 10 mG, moved kindergarten
- Mesa, Arizona ('92)
 - **brain cancer**, 50 mG, lighting, rewired
- California ('90 to '92)
 - Santa Barbara, 6 cases **lymphomas & leukemias**, 5X, TL + substation
 - San Francisco, 22 **cancers** (staff), PL + transformer
 - Fresno, **cancer cluster** (teachers), HVTL

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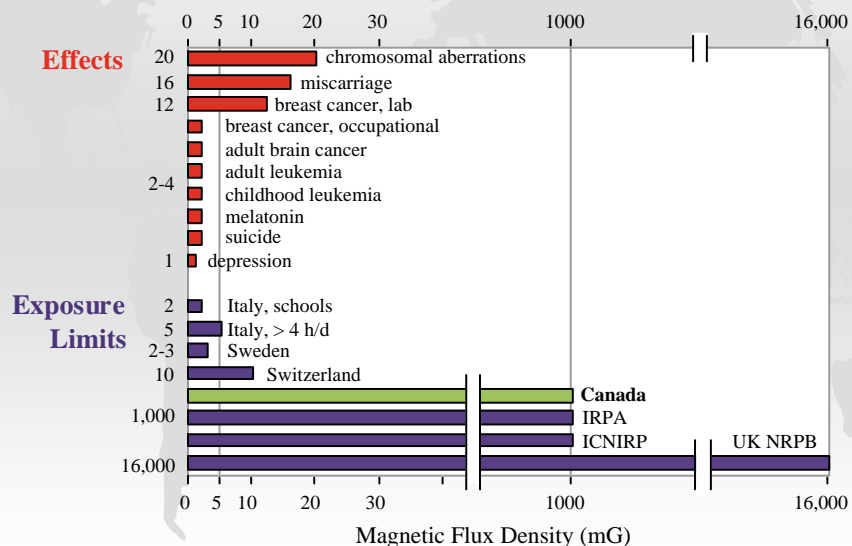
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Exposure Guidelines vs Effects

Extremely Low Frequency Magnetic Fields



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EMF Policy/Guidelines

- **Swedish National Energy Administration, Department of Electrical Safety**
 - magnetic fields in **schools, daycare centres** and **playgrounds** should not exceed **2-3 mG**
- **National Institute of Environmental Health Sciences (NIEHS) 1998**
 - classified EMF (power frequency) as "**possible carcinogen**"
 - advocate "**Prudent Avoidance**"
- **International Radiation Protection Association (IRPA): power frequency**
 - should not exceed **1000 mG** for 24-hour period.

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Recent Decision in California PG&E 230 kV transmission line

- 1 California PUC **Administrative Law Judge** ruled favorably on a new 230 kV transmission line.
- 1 She has not only required PG&E to **underground the line** but
 - To bury it up to 12 feet (**6 extra**) to reduce EMFs
 - To use a field-canceling **triangular duct** arrangement
 - To **spend more** than the required **4%** of the budget (\$12 B) to do so.
- 1 She has opened a new state-wide **Order Instituting Investigation (OII)** to evaluate the last decade of EMF studies.

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Conclusions:

Childhood Cancer & Power Frequency Magnetic Field Exposure

1. **Magnetic fields** (extremely low frequency): **“possible carcinogen”** (NIEHS, 1998)
2. **2-4 mG threshold** level associated with childhood leukemia (home)
3. **Other cancers** (nervous system tumors & lymphomas) possible
4. **Younger children** at greater risk than older children
5. **Night-time** exposure important
6. **Parental exposure** to electromagnetic fields may be important
7. **School environment** contributes to daily exposure
8. **Guidelines inadequate** to protect public health: range is 2-3 mG (Sweden) to 1,000 mG (IRPA)
9. **Prudent avoidance**: establish buffer zone around high voltage power lines that does not exceed 2 mG during peak energy use.
10. **Minimize ground currents** associated with power delivery.

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