

Hans Karow  
Coalition to Reduce Electropollution (CORE)  
M2 /C14  
1215 Poplar Grove Road  
PENTICTON, BC, V2A 8T6  
E-mail: [hkarow@shaw.ca](mailto:hkarow@shaw.ca)

Mr. Robert J. Pellatt  
Commission Secretary  
B.C. Utilities Commission  
900 Howe Street, Box 250  
Vancouver, BC V6Z 2N3

February 15, 2006

Dear Mr. Pellatt,

Re: **FortisBC Inc. Order No. G-114-05 / Project No. 3698407CPCN Application for Nk'Mip Substation & Osoyoos Transmission Line**  
<http://www.bcuc.com/ApplicationView.aspx?ApplicationId=93>

1. Please accept this and the attachment as my Evidence # 37, another follow up with regards of property devaluation issue.
2. The attached article

***“Do You Want Your Children Playing under Those Things? The Continuing Controversy about High Voltage Electromagnetic Fields, Human Health, and Real Property Values”*** by Thomas A. Jaconetty

clearly indicates as well that property devaluation is associated with proximity of power lines. Fortis has not provided a fair response, how residential properties may be affected by the proposed project (BCUC IR#1, Q9.7 and Fortis A9.7, page 20; Wonch/White Q6/A6 and Appendix A6.)

3. Permission was received to submit the attached article as evidence into the hearing from the author, Mr. Thomas A. Jaconetty (via e-mail, dated February 14, 2006) and from the International Association of Assessing Officers (IAAO) as the publisher of the attached article in the *Assessment Journal* (see attached release).

\*\*\*\*\*

Respectfully submitted,

Hans Karow

## **Do you want your children playing under those things?: The continuing controversy about high voltage electromagnetic fields, human health, and real property values**

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### **Abstract:**

*The issue of whether high voltage transmission and power wires, and their associated electromagnetic fields, adversely affect human health and real property values has been the subject of controversy for many years. As a result, a significant body of literature on the subject has developed. The purpose of this article is to investigate the relevant market studies, public perception, medical and scientific research, and developing case law and to consider the implications for real property valuations, eminent domain and condemnation cases, and real property tax appeals.*

### **Full Text:**

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### **[Headnote]**

Abstract

Inconclusive medical and market research on the impact of high voltage power lines on property values has resulted in complex interrelationships among subjective belief, objective data, and behavior.

### Introduction

The issue of whether high voltage transmission and power wires, and their associated electromagnetic fields, adversely affect human health and real property values has been the subject of controversy for many years. As a result, a significant body of literature on the subject has developed (Kinnard 1990; Kinnard and Dickey 1995; Jaconetty 1996).

The purpose of this article is to investigate the relevant market studies, public perception, medical and scientific research, and developing case law and to consider the implications for real property valuations, eminent domain

and condemnation cases, and real property tax appeals.

## Market Studies

An early analysis of 791 residences in seventeen Hartford, Connecticut, subdivisions in the late 1960s found that "sale prices did not vary perceptibly with closeness to a tower line right-of-way" (Kinnard 1967). A mid-1980s study of Wisconsin rural property also indicated virtually no adverse impact (Solom 1985). Similarly, a 1986-91 review of forty-six parcels in Michigan concluded, "[A] strong relationship between sales prices of recreational acreage and private disclosure of a power transmission line cannot be clearly established." Either value is "not being influenced or [it is not] readily measurable" (Rigdon 1991). One contemporaneous commentator said, "[U]t does not appear that the public recognizes a substantial detriment to value due to proximity of power lines" (Beasley 1991).

However, there have been several other noteworthy studies. One estimated a valuation loss of only 2-3 percent for properties in very close proximity to such lines (Colwell and Foley 1979; Colwell 1990). Another suggested a loss of about 10 percent (DeLaney and Timmons 1992). So did a 1993 review of 100 Houston residential properties that abutted a power line corridor, which found that there was a measurable loss of value relative to non-abutting peer properties (Bolton and Sick 1999; Bolton 1994). A late 1994 California matched-sales analysis showed that vacant lot values were adversely affected by 18-53.8 percent (Bolton and Sick 1999, 336).

An extensive evaluation of 12,907 residential real estate transactions in Vancouver, British Columbia, from 1985 through 1991 established "an undeniable drop in value ... [of] 6.3 percent ... due to proximity and visual impact" (Bolton and Sick 1999, 334, citing Hamilton and Schwann). Research in Portland, Oregon, published in 1996, indicated a 0-10 percent reduction in value for single family residential property, but greater negative effects on intensively managed agricultural property and on rural vacation home developments (Bolton and Sick 1999, 334-35). In 1997, the Lower Colorado River Authority commissioned a study to evaluate the influence of transmission lines in and around Georgetown, Texas. More than 100 real estate transactions, covering eight different residential subdivisions and vacant parcels, were considered. On balance, it concluded that "an electric transmission line easement has less than a 10% impact on price" (Bolton and Sick 1999, 336).

Considering all of the market evidence, a value loss of less than 10 percent may be a reasonable expectation for residential properties. The negative impact is possibly greater for other types of properties.

## Public Perception

A survey of St. Louis, Missouri, real estate brokers in 1995 revealed that 54 percent believed electromagnetic fields "very negatively affected" property values. Another 23.8 percent believed the impact was "somewhat negative" (Bolton and Sick 1999, 335). An earlier evaluation concluded that residential real estate appraisers without any experience in appraising properties near high-voltage transmission wires often estimated a larger price reduction than did more experienced appraisers (DeLaney and Timmons 1992).

It has become axiomatic that once something is labeled as potentially carcinogenic, it is almost impossible to dislodge subjective fear from the public mind. For example, one poll suggests that about 23 percent of the American public perceive a serious cancer risk from electromagnetic power wires (Dateline 1996). In fact, modern technology may pose a double-edged sword: ever-accelerating progress, accompanied by increasing public paranoia (ABC Special Report 1996; Moore 1997).

A general fear of an enhanced cancer risk can indeed decrease real property values regardless of whether or not that risk actually exists. The result may be short-lived but nonetheless apparent.

The most well-documented example of this phenomenon occurred in two suburban towns outside of Edmonton, Alberta, Canada, in the mid- to late 1980s. Relying on scientific studies that were later proven to be epidemiologically incorrect, public announcements triggered psychological trauma and marketplace panic,

which caused a measurable reduction in real property values in the area (Guidotti and Ambercrombie 1994; Guidotti and Jacobs 1993; Guidotti 1991-92). Another analogous situation, according to several commentators, was the infamous Love Canal, New York, evacuation (Love Canal 1980; Wildavsky 1995, 146; Mazur 1998, 142-61).

Market analyses from Shelby and Memphis Counties in Tennessee also confirm that when public awareness of a possible health risk increases, most people believe market values will decline. This remains true even if the marketplace sales do not objectively support such a trend (Kung and Seagle 1992, 400).

What conclusion should be drawn from these studies? At a minimum, real estate professionals and the general public believe that real property values will decline if a causal link is reasonably proposed between serious health risks and the electromagnetic fields produced by high-voltage wires. To the extent this fear becomes embedded in the public mind, it will matter little whether such beliefs, or the alleged causal connection, eventually are proven or dispelled scientifically.

### Medical and Scientific Research

The primary sparks igniting this scientific debate were the Denver studies covering 1950-73 and 1976-83 (Pool 1990; Zuckerman 1987). They indicated an increased risk of childhood cancers, especially leukemia, lymphomas, and nervous system tumors, due to exposure to electromagnetic transmission wires.

Other research was undertaken in the Scandinavian countries. Although a Finnish report suggested that electromagnetic fields did not form a major health risk for children, a Danish case study confirmed a positive association with all types of childhood cancers. Similarly, Swedish findings confirmed a correlation between magnetic fields and increased probability of childhood cancers but could not find a causal connection with central nervous system tumors or childhood lymphoma. However, another study did link occupational electromagnetic exposure to certain adult cancers (Parisi 1995). In critiquing eight other studies, another Finnish survey offered this summary:

[F]our of six studies on overall cancer risk in children found some indication of an increased risk and two did not. Four of five studies on nervous system tumors, five of seven on leukemia, and all four studies on lymphoma, using various exposure assessment methods, reported increase in risk. One study on nervous system tumors and two studies on leukemia detected no evidence of increased risk. (Parisi 1995, 34)

These health issues have also been raised in the context of other types of energy transmission. Studies from World War II through 1953 by the United States Navy disclosed an increased likelihood of serious medical conditions among radar personnel. Included were internal bleeding, leukemia, cataracts, headaches, brain tumors, heart and liver disorders, blood abnormalities, and various cancers (Blake-- Levitt 1997, reprinted in Richter 1999). Clinical findings from Warsaw, Poland, published in the 1980s produced similar evidence of lymphomas, melanomas, leukemia, brain tumors, high blood pressure, brain damage, and immune system disorders (Blake-Levitt 1997, 7). Also, test animals exposed to radar waves have experienced malignant endocrine gland tumors and benign adrenal gland disorders (Blake-Levitt 1997, 7-8).

Tests on human subjects circa 1975 showed alterations on electroencephalograms due to microwave and radio-frequency power exposure (Blake-Levitt 1997, 8). In the 1980s, more Warsaw research detected accelerated development of animal skin cancer resulting from microwave radiation (Szmigielski et al. 1982; Szmigielski et al. 1988; Blake-Levitt 1997, 7). There is some evidence from Australia, Germany, Norway, and Sweden that there may be a medical relationship between cellular transmissions and headaches, cancers, and changes in blood pressure and sleep patterns in humans (20/20 1999).

Cellular and microwave exposure has been shown to increase DNA single- and double-strand breaks in rats (Lai and Singh 1995; Blake-Levitt 1997, 7). A similar correlation between low-level microwave radiation and melanoma growth in mice has been clinically verified (Santini et al. 1988). Exposure of mice to high-intensity

electromagnetic fields causes renal disease, lympholastic lymphoma, and nonlympholastic lymphoma, as well as some central nervous system disorders, dehydration, wounds, and localized infections (Repacholi et al. 1997; Blake-Levitt 1997, 7). The implications for humans to be drawn from this body of research remain uncertain at this time.

Nevertheless, by the mid- to late 1990s, learned scientific opinion remained divided on the potential health hazard of electromagnetic fields. A professional organization of American physicists, the Council of the American Physical Society, declared in 1995 that "the conjectures relating cancer to power line fields have not been scientifically substantiated." The council has also been asserted on various occasions that any claimed cancer connection "should be extremely difficult to detect because of small, if any, magnitude"; that there is "a truly small or non-existent risk"; and that "when power frequency fields are actually measured, the correlation vanishes" (Bolton and Sick 1999, 333; Lusvardi 2000, 190). Lusvardi also asserts that the maximum energy field within a power line right-of-way usually generates levels "50 times less than the level naturally found in the human body" and up to "500 to 2500 times less" as one moves ten meters away and then to the edge of the right-of-way (Lusvardi 2000). In addition, in 1997, the United States Academy of Sciences, through the National Research Council, affirmed that "no conclusive and consistent evidence shows that exposure to residential electric and magnetic fields produces cancer, adverse neurobehavioral effects or reproductive and developmental effects" (Bolton and Sick 1999, 333).

However, in 1994, a British group of epidemiologists-the Advisory Group on Non-Ionizing Radiation (AGNIR)-had reached conflicting conclusions. It said:

... [S]tudies do not establish that exposure to electromagnetic fields is a cause of cancer but taken together, they do provide some evidence to suggest that the possibility exists in the case of childhood leukemia. (Bolton and Sick 1999, 333)

In June 1998, the United States National Institute of Environmental Health Services did, in fact, classify electromagnetic fields as a group 2B human carcinogen, indicating that they may be "possibly carcinogenic to humans" (Bolton and Sick 1999, 334).

The conclusion? Serious health questions abound. No single professional organization, researcher, or scientist has been able to put the issue to rest. There remains a clinical, epidemiological, and medical basis for doubt, despite protests to the contrary.

#### Developing Case Law

Many people would agree with the observation made by the California Supreme Court more than forty years ago: "No reasonably prudent person should be expected to purchase land ... without giving heed ... to the possible effects of the hazard" presented by a 220,000-volt transmission line. It is too "commonly known to be disputed" that such is "inherently dangerous" (Pacific Gas Co. v. W H. Hunt's Estate Co.). The Sixth Circuit Federal Court of Appeals echoed these sentiments on two separate occasions involving power lines operated by the Tennessee Valley Authority. In 1959 it observed:

[T]he apprehension of injuries to person or property ... is founded in practical experience and may be taken into consideration in so far as the lines and towers affect the market value of the land. (Hicks v. United States)

Again almost ten years later, the court opined that "certain segments of the buying public" may "remain apprehensive of the high voltage wires." Consequently, purchasers "might be unwilling to pay as much for the property as they otherwise would." It matters not that scientific studies may show that these structures are objectively "safe" (United States ex rel. TVA v. Easement and Right of Way).

Thus, subjective fear in the marketplace may become more important than so-called objective scientific data. State courts are divided on the admissibility of the subjective fear of danger. A few (Alabama, Illinois, and

West Virginia) find such testimony necessarily subjective and therefore inadmissible. At least nine states admit the existence of fear if that fear is said to have some reasonable basis (Connecticut, Georgia, Kentucky, Maryland, Nebraska, New Jersey, Tennessee, Texas, and Utah). Another thirteen or so jurisdictions hold that evidence of fear is admissible with a simple showing that the fear exists (Arkansas, California, Indiana, Iowa, Kansas, Louisiana, North Carolina, Ohio, Oklahoma, South Dakota, Virginia, Washington, and the Sixth Circuit). (See *Willsey v. Kansas Power Co.*, *San Diego Gas and Electric Co. v. Daley*, *Ryan v. Kansas Power and Light Co.*, and *Florida Power and Light v. Jennings*.)

There is an older body of Illinois case law, in particular, that adopts the most conservative and restrictive viewpoint by denying admissibility. Even so, one Illinois Supreme Court decision did leave the door partially open when it implied that fear of danger could be considered where the source of alleged danger was in "close proximity to buildings or habitants" or the highest and best use of the property was for 11 residential or factory purposes." (See *Illinois Power Corp. v. Talbott*, on the danger of electricity, fire, and lightning from transmission wires and towers; *Illinois Power and Light Co. v. Peterson*, on tower and transmission lines; *Illinois Power Co. v. Wieland*, on an unsightly structure that offends sensibilities; *Central Illinois Public Service Co. v. Lee*, on H-pole structures with guy wires; and *Central Light Co. v. Nierstheimer*, on power lines. The quotation is taken from *Trunkline Gas Co. v. O'Bryan*.)

Several more recent decisions have specifically addressed the impact of electromagnetic fields on the marketplace, often in the context of eminent domain and condemnation proceedings. In 1987, the Florida Supreme Court observed that "a certain amount of fear and healthy wariness ... strikes us as eminently reasonable." It permitted evidence of marketplace fear to be admitted "without independent proof of reasonableness" (*Florida Power and Light Co. v. Jennings*). This decision echoed an earlier approach of the Ninth Circuit Federal Court of Appeals in the context of the loading and unloading of munition ships in Hawaii. The question for the ninth circuit simply was whether this fear will "affect the actions of knowledgeable and prudent sellers and purchasers" (*United States v. 760.807 Acres of Land*).

One year after the Florida decision, the California appellate court allowed evidence of the "calculated diminution" of present market value caused by public fear of electromagnetic radiation (*San Diego Gas and Electric Co. v. Daley*).

The Kansas Supreme Court followed suit in 1991, saying that "any loss of market value proven with a reasonable degree of probability should be compensated" (*Ryan v. Kansas Power and Light Co.*).

New York decisions are in accord. Those courts require that a nexus be established between "the market value diminution of the property" and the "particular fear" (*Jones v. Power Authority of the State of New York*, *Criscuola v. Power Authority of the State of New York*, *Zappavigna v. State of New York and Power Authority of the State of New York*). That principle has spawned a recent spate of lawsuits in New York against cellular telephone companies and Amtrak, as well as several inverse condemnation actions (*Bolton and Sick* 1999, 335; *Rikon* 1996).

The marketplace fear theory is not without its limitations. First, the United States Supreme Court (*Daubert v. Merrill Dow Pharmaceuticals, Inc.*, *General Electric Co. v. Joiner*, *Kuhmo Tire Co. Ltd. v. Carmichael*) and the Seventh Circuit Federal Court of Appeals (*Target Marketing Publishing Inc. v. ADVO, Inc.*; *Minasian v. Standard Chartered Bank, PLC*, *Rosen v. Ciba-Geigy Corp.*; and *Lester v. Resolution Trust Corp.*), for example, have both signaled their distaste and impatience with so-called "junk science." It is becoming increasingly clear that all is not fair, relevant, material, probative, demonstrably provable, reliable, and admissible under the rubric of science (*Hoyt and Aalberts* 2001; *Schweihls and Reilly* 2000; *Reeg and Bebaut* 1997; *Hoyt and Aalberts* 1997).

Next, courts and tribunals have shown some conservatism in application of these principles. California will not extend marketplace fear as an element of damages in inverse condemnation cases when the power line was already in existence (*San Diego Gas and Electric Co. v. Superior Court*; *Bolton and Sick* 1999, 339). The

Illinois Property Tax Appeal Board has rejected pleas based on "proximity to high tension electrical wires" where the subject is actually assessed at a value per square foot lower than values per square foot generated by sales of comparable properties nearby. (See, for example, *Schiavone v. DuPage County Board of Review*.) Nor will it consider relief when taxpayers fail to produce any market value evidence. (See *Louis Garcia*, for proximity to oil tanks and wells; *Vlastimil John Surak*, for high voltage wires and railroad tracks; and *William Miller* for noxious odors.)

Third, the Fifth Circuit Federal Court of Appeals recognized in 1996 that high voltage wires may "create in the general public fears which make the property less desirable and thus diminish the market value of the property." Although that fear could be considered, it may be "too speculative and conjectural to be submitted" to the trier of fact as a separate item of damages (*Bolton and Sick* 1999, 340; *United States v. 14.38 Acres of Land*; *United States v. Robinson*).

Trends in modern case law consider the question as one of common sense. Several courts have focused on what a reasonably prudent person could be expected to believe and do. This view emphasizes the very nature of the power lines, general public apprehension, practical experience, and a healthy wariness for that which is inherently dangerous. Thus, courts generally are becoming more flexible and admitting testimony of subjective fear in the marketplace.

#### Implications for Determination of Fair Market Value in Eminent Domain and Condemnation Cases and for Adjudicating Property Tax Appeals

One commentator has succinctly stated:

Real estate professionals continue to conclude that power lines are bad for property values. On the case law front, there is continuing support for the admissibility of expert appraisal evidence based on "fear in the marketplace," but there is growing criticism of testimony deemed to be "junk science." (*Bolton and Sick* 2000)

Next, appraisal is an art and a behavioral science. There is danger in presuming or assuming anything. Even the existence of marketplace fear must be proven. One must always go to the market for data.

Illinois courts, for example, have a long history of rejecting speculative valuations for real property. (See, for example, *State of Illinois v. Illinois Central Railroad, Chicago and Alton Railway Co. v. Staley, Illinois Central Railroad v. City of Chicago, People ex rel. Carr v. Stewart, Dept. of Public Works v. Foreman State Trust and Savings Bank*. See also *Trunkline Gas Co. v. O Bryan*, and the cases cited therein, and *Application of Rosewell*.) Decisions from the District of Columbia, Maine, Oregon, Pennsylvania, New Mexico, and Washington sound similar cautions. (For discussion of several of the Illinois and the other jurisdiction cases, see *Jaconetty* 1993.)

Finally, there are definitive questions to be answered. First, do electromagnetic fields generated by high-voltage towers and wires adversely influence real property values? On a subjective level, most people believe that they should, do, and will. On an objective level, they may not, or, if they do, it is likely that they affect residential property values only minimally.

Second, is there a medical or scientific basis for the claims of adverse human health effects? Possibly, maybe even probably, depending on which studies, scientific organizations, or researchers appear to have the most compelling data at any given point in time. In the public mind, the threat is very real. Adding to this threat is the nature of the inherently dangerous equipment involved. Regardless of the state of the scientific and medical proof, the general public consensus is that serious health risks exist. There is fear in the marketplace.

Third, is there a direct causal link between either the very existence of the towers and wires (and the alleged human health risks) and real property values? Many (including real estate professionals) believe, or want to believe, so. However, has anyone conclusively and accurately proven, measured, or quantified it?

For real estate appraisers, bank loan officers, assessing officials, researchers, prospective purchasers, condemning authorities, property owners, tax courts, and tribunals, several factual inquiries may be relevant. Were the towers and wires always present or recently constructed? What actual market data exist? Is there a demonstrable difference in sales prices for the properties in the shadow of, adjacent to, or near the electromagnetic fields when compared with other properties more distant? Are there resales? What do those data suggest? Is there a difference in the level of appreciation in property values depending on the distance of real property from the source of the electromagnetic radiation? Is there actual evidence of fear in the marketplace? How has it been manifested? What best establishes the market-subject, peer and comparable sales, or resales? If there is an impact on real property values, how does one accurately measure or quantify it? Does medical and scientific evidence matter at all or only what people believe? Is perception more important than reality?

This article raises many questions. The most compelling may simply be, "Would you want your children playing in the backyard every day under those things?" If your answer is "no," is that conclusion based on what has been proven or what you believe?

Real property valuation systems and appeal processes, as well as the typical case law involving eminent domain and condemnation, are fundamentally market based. They reflect complex interrelationships among subjective belief, objective data, and behavior. Only further market-based and scientific research on this subject can hope to provide more definitive answers to such a complex, emotional issue.

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**[Author note]**

Thomas A. Jaconetty, Esq.

**[Author note]**

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**INTERNATIONAL ASSOCIATION OF ASSESSING OFFICERS**  
**314 W 10 St**  
**Kansas City, Missouri 64105-1616**  
**816/701-8100**  
**Fax 816/701-8149**  
**www.iaao.org**

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