IN THE MATTER OF the Utilities Commission Act, S.B.C. 1980, c. 60, as amended

and

IN THE MATTER OF Complaints against British Columbia Hydro and Power Authority and its Proposed 230 kV Transmission Line from Dunsmuir to Gold River

PUBLIC INQUIRY

REPORT AND RECOMMENDATIONS

July 26, 1989

July 26, 1989

TO THE BRITISH COLUMBIA UTILITIES COMMISSION

Pursuant to Section 93(2) of the Utilities Commission Act and Commission Order No. G-35-89, an Inquiry was conducted into the complaints by customers of British Columbia Hydro and Power Authority in the Courtenay area regarding possible health effects, if any, from the proposed 230 kV transmission line from Dunsmuir to Gold River. As part of the Inquiry public hearings were held in Courtenay from July 11 to 14, 1989 and the Report is based substantially on the information presented there.

I submit the Report and Recommendations.

Respectfully,

Original signed by:
JOHN G. McINTYRE,
Chairman and Inquiry Officer
British Columbia Utilities Commission

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APPEARANCES

Participant	Representing
K.C. MACKENZIE, Q.C. C.L. FORTH C.W.J. BOATMAN JEFF BARKER PAT BEAVEN PAUL WONG	British Columbia Hydro and Power Authority ("B.C. Hydro")
ANTONIO SASTRE LINDA ERDREICH	Environmental Research Information Inc. ("ERI"), on behalf of B.C. Hydro
R.J. BAUMAN HUGH WHALEN BOB CHAMBERS REID MURPHY DON VOKEY	Canadian Pacific Forest Products Limited ("CPFP")
R.J. GATHERCOLE J.E. VANCE ANDREW A MARINO DARLENE KAVKA	The Comox Valley Rerouting Committee
ANN EDWARDS	MLA - Kootenay - Opposition Energy Critic
BOB SKELLY	Member of Parliament - Comox/Alberni
JOHN MARTON, PH.D.	Himself
ELIZABETH SHANNON	Herself
RICHARD DACK	Himself
CLIFFORD THATE	Himself
KATHY BURNS	Merville Environmental Committee
MONICA TERFLOTH	Herself
PEGGY CARSWELL	Regional District of Comox-Strathcona
CHRIS HILLIAR	Himself
RUSS COLMAN	Himself
DARCY MILLER	Himself
MIKE HOGAN	Himself

APPEARANCES
(cont'd)

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BRIAN MUNROE	Himself
DICK BIRNEY	Himself
TERRI LANGHORN	Herself
MR. & MRS. BERGER	Themselves
MR. GENZ	Himself
MS. GUINETTE	Herself
LOUISE SCHNURCH	Herself
NINA WOOD	Herself
JACQUIE SANDIFORD	Herself
RICHARD JOINER	Himself
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WAYNE WHITE	School District #71 - Courtenay
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1.0 BACKGROUND

In 1947 and subsequently in the period 1957 to 1961, British Columbia Hydro and Power Authority ("B.C. Hydro") acquired, by succession, a right-of-way ("ROW") from the Dunsmuir substation near Qualicum, British Columbia, to the John Hart station near Campbell River, British Columbia for the purposes of constructing and maintaining transmission lines. Over the years, three 138 kilovolts ("kV") transmission lines were built on the ROW. There is sufficient room on the ROW for the proposed 230 kV transmission line, however, clearing of timber and other site preparation tasks were required (Exhibit 14, Tab 2).

Canadian Pacific Forest Products Limited ("CPFP") owns and operates an existing bleach kraft pulp mill at Gold River, British Columbia, on the west central coast of Vancouver Island with water access to the Pacific Ocean. The mill produces some 700 tonnes of pulp per day and employs 480 persons. The mill site is about 13 kilometres from the Village of Gold River.

CPFP, together with a number of international newspaper publishers and others, formed a partnership known as "Gold River Newsprint Limited Partnership". The partnership has recently constructed a new chemithermo mechanical pulp mill and a new newsprint mill on the site at a projected capital cost of some $323 million. Completion of that project is imminent (T 546-7).

The newsprint mill is scheduled to commence production on September 1, 1989, for shipments in October, 1989. Electrical energy is required by August 15, 1989 to meet the break-in, production and shipment schedules. There is no allowance in the schedule for delay. CPFP will incur unrecoverable out-of-pocket costs of $115,000 per day for each day that electricity is delayed beyond August 15, 1989. The figure includes no amount for lost profit. There are 125 direct jobs and some 250 support jobs associated with the new mill (T 546-551).

1.1 The Commitment for Power

The existing single-circuit 138 kV line to Gold River from Campbell River can provide a maximum of 40 megawatts ("MW") of power. The expanded plant requires an additional 90 MW (Exhibit 22, p. 3). The new 230 kV line will provide the additional power.

B.C. Hydro conducted a feasibility study in 1987 to determine how additional power could be provided to the proposed plant expansion. The study concluded that a new 230 kV powerline was required, and B.C. Hydro committed to provide the power by about July 31, 1989.

With the full support of the Government of British Columbia and B.C. Hydro, CPFP decided to proceed with the expansion project. The Premier of the Province publicly announced the project in September 1987. Construction began in the fall of 1987, on a "fast track" approach (Exhibit 22, p. 2). The production of the mill is fully contracted, and commitments have been made to purchasers, some or all of whom may have permitted existing supply contracts to expire in anticipation of the new production from the Gold River mill.

1.2 Review Process of the Proposed New Powerline

For its part, B.C. Hydro followed its normal review process as part of its pre-construction plan. Discussions were concluded with CPFP in September, 1987. B.C. Hydro promptly communicated with the appropriate Federal and Provincial Government resource agencies seeking necessary government approvals, as well as Regional Districts, Municipalities and others advising of the proposed construction. A letter, September 16, 1987, was forwarded to 19 separate resource agencies and interest groups. It described the proposed line and the route, and invited comments and suggestions from all parties concerned.

Recipients of the solicitation included the City of Courtenay and the Village of Cumberland. Each responded with approval provided the line was constructed in the existing ROW corridor. The Regional District of Comox-Strathcona did not respond. None of those responding raised health concerns or any possible risk from Electromagnetic Field ("EMF") exposure (Exhibit 14, Tab 2; T 450-451).

1.3 The Awakening of Complaints

The new 230 kV line was included in B.C. Hydro's Resource Plan submitted to the B.C. Utilities Commission ("the Commission") on April 20, 1988. While the Commission did not have any special concerns at that time, by letter dated September 29, 1988, the Commission requested a synopsis of the results of the environmental inter-ministerial review. There is no record of a formal response from B.C. Hydro.

B.C. Hydro first received formal notice of health concerns relating to EMF exposure from Dr. John Marton of Courtenay, B.C. by letter dated March 16, 1988. Part of his property occupies the entire width of the transmission line ROW, and his home is 55 meters from the edge of the ROW. Some out-buildings are closer. He was provided information by B.C. Hydro about scientific studies related to the possibility of EMF risks. By the time of his letter, Dr. Marton had concluded that he was personally unwilling to accept the possibility of health risks for his family from the new powerlines. Correspondence and related contact continued between Dr. Marton and senior B.C. Hydro personnel through to November 1988, without results satisfactory to Dr. Marton. On February 5, 1989 he wrote to the Provincial Ombudsman. After discussing the matter with Commission staff, the Ombudsman elected to defer the handling of this and other similar complaints to the Commission.

In early February 1989, Mrs. Darlene Kavka and her husband were visited by a B.C. Hydro employee who advised them (amongst others over whose property

rights-of-way existed) of the need to clear standing trees from the ROW over a portion of their property. A dispute arose over the claim for compensation for loss of the trees and other damage and a complaint was filed by them with the Commission on February 8, 1989. The complaint also raised the health concern relating to EMF exposure. A copy of the complaint was provided to B.C. Hydro and it responded through the Commission on April 27, 1989.

After filing of the complaint, Mrs. Kavka became extremely active in raising public awareness regarding the EMF issue. Thereafter, the Commission began receiving increasing numbers of written complaints from dozens of concerned citizens living near the proposed powerline in the Courtenay area expressing their concerns about EMF exposure. By copy of an April 5, 1989 letter to B.C. Hydro, the Commission received written notice from the Regional District of Comox-Strathcona requesting that the proposed 230 kV line be rerouted.

1.4 Purchase Proposal by B.C. Hydro

On May 8, 1989, there was an informal meeting in Courtenay between Mr. C.W.J. Boatman, B.C. Hydro Vice-President, Corporate and Environmental Affairs, another senior B.C. Hydro representative, Dr. Marton, Mr. and Mrs. Kavka and a lawyer representing Dr. Marton and the Kavkas. During the meeting, and reiterated the following day with representatives of the Regional District, B.C. Hydro advanced a proposal designed to allay the fears of the alarmed citizens about the possible EMF health risk (T 519-20). It proposed that it would provide EMF scientific literature directly to those living adjacent to the ROW so that the persons having the most concerns could read the information and make up their own minds about the risk. It would also provide any further information requested and would make an expert available for discussions. Also, it was proposed that if concerns persisted, B.C. Hydro would be prepared to negotiate the purchase of their properties at a fair value to be determined by independent appraisals.

Subsequently, on May 9 and 12, 1989, B.C. Hydro either delivered or mailed a letter to some 144 property owners. The letter (Exhibit 20) transmitted information about EMF and stated that the recipients had until May 31, 1989 to request B.C. Hydro to purchase their properties. B.C. Hydro subsequently confirmed (T 523) that the letter was an offer to purchase subject to an appraisal arrangement for valuation. The media highlighted the unusual proposal and it drew substantial publicity. The majority of owners to whom the offer was made were confused by it. Some 66 persons accepted the proposal by the stipulated date. The offer was construed by many as being clear evidence that B.C. Hydro recognized a possible EMF health risk. B.C. Hydro received approximately 140 responses for purchase from persons who did not receive a letter.

1.5 B.C. Utilities Commission Inquiry Order

On June 12, 1989 the Commission ordered an Inquiry to be conducted and appointed its Chairman, Mr. John G. McIntyre to conduct the Inquiry with the assistance of Commissioner W.M. Swanson, Q.C., and staff members W.J. Grant, Director of Engineering and Accounting and N.C.J. Smith, Manager, Engineering and Project Review - Electrical. The Commission Order directed the Inquiry to take place in Courtenay, B.C. commencing July 11, 1989 in a public forum. The order also directed that construction cease on a 7 km section of the line in the Courtenay area until the Commission resolved the complaints.

On June 16, 1989, an informal meeting was held in Courtenay between a number of concerned citizens and Commission personnel assisting the Inquiry Officer, to discuss aspects of public participation at the Inquiry. An air reconnaissance was also conducted over the disputed section of the line. At a later date, but prior to the Inquiry, the Inquiry Officer also viewed the area from the air.

Legal counsel and an independent expert were engaged to assist the Inquiry. The latter was Mr. Richard Gallagher of the B.C. Cancer Control Agency. He is a well known scientist and epidemiologist and is currently active in the EMF field.

The Terms of Reference of the Inquiry were:

(a) determine the need, routing and timing for the project.

(b) review the process followed with respect to the environmental assessment of the project and identify any appropriate mitigation measures.

(c) determine the levels of electric and magnetic fields associated with the new line, and assess the impact of these on the current fields created by the existing 138 kV lines.

(d) address the health related concerns as expressed by property owners impacted by the new line, respecting biological effects of the electric and magnetic fields generated by the line.

1.6 The Conduct of the Inquiry

The Inquiry was held in Courtenay, B.C. commencing on Tuesday evening, July 11, 1989, and continued over the ensuing three days, including another evening session on Wednesday. Pre-arranged public information sessions were held during the morning and afternoon preceding the Inquiry. A public resource room adjacent to the hearing room was made available and included copies of information related to the Inquiry. Attendance by the public varied between 125 to 180, and it was clear that there was deep concern in the community over the EMF health issue.

2.0 ELECTROMAGNETIC FIELDS AND HEALTH

During the past few years there has been an increasing concern in society that electric and magnetic fields generated from 50 Hz (in Europe) and 60 Hz alternating current might cause adverse health effects. Public concern has tended to focus on high voltage power transmission lines, perhaps because of their high visibility. It should be emphasized, however, that electric distribution wiring carrying electric power into individual homes generate electric and magnetic fields similar in character to those of high voltage transmission lines, although the field intensity levels are lower. In addition, individual electrical appliances within the home, such as blenders, hair dryers, electric blankets, vacuum cleaners, can openers, and food processors also generate significant levels of magnetic fields while they are in use. Thus the cumulative "body burden" of exposure to electric or magnetic fields is a result of the influence of several factors over and above that attributable to high voltage power transmission lines. In fact, probably the strongest single source of magnetic field exposure to which the average Canadian householder is likely to be exposed, comes not from appliances or transmission lines, but from use of electric blankets and heated water beds. Thus the health issues surrounding B.C. Hydro's proposed 230 kV transmission line must be examined in the context of overall human exposure and health effects as well as the particular exposure resulting from the powerline.

Alternating Current Electric Fields

Voltage on any wire produces an electric field in the area surrounding the wire. The intensity of the electric field surrounding a power transmission line at a given point is measured by the magniture and direction of the force that would be experienced by a unit charge placed in the field at that point. The field intensity is expressed in volts per metre or kilovolts per metre. The electric field generated by any line becomes progressively and rapidly weaker as distance from the line increases. Irregular ground or the presence of objects

such as trees, vegetation or houses greatly distorts the electric field at or near ground level. Beneath tall vegetation or inside buildings or homes, the electric field from a transmission line passing nearby is considerably reduced because these objects provide a shielding effect.

When human beings are situated within an electric field, currents and voltages are induced within the body, and these vary with field strength and field frequency, and are quite weak. Scientists currently disagree as to whether these small currents and voltages induced by external electric fields alter biological processes in a deleterious way.

Alternating Current Magnetic Fields

Magnetic fields are produced from electric current flowing in a conductor or wire. The strength of the magnetic field or magnetic flux density is measured by the lines of force per unit area. Measurements are usually expressed in teslas (T) or gauss (G) (10,000 G = 1T). Magnetic fields are present around transmission lines, but are also produced by functioning electrical appliances such as electric drills and food processors. In the case of appliances, the fields may be quite strong in the immediate vicinity of the device and fall off quite rapidly with distance. Similarly with transmission lines, the fields rapidly decline in strength with increasing distance from the line. Unlike electrical fields, 60 Hz magnetic fields penetrate most objects including houses and humans.

2.1 Health Effects - General

The scientific literature on long-term health effects of electric and magnetic fields has been assessed together with the evidence presented by Dr. Andrew Marino, of the Louisiana State University Medical Center and that presented by Drs. Linda Erdreich and Antonio Sastre of Environmental Research Information Inc. ("ERI") of New York City. The ERI approach has

been to evaluate the studies conducted to date in an overall way, paying close attention to the "weight of evidence" in each particular area. It is recognized that even scientific work of the highest standard is usually not without some weak points. On the other hand, it is clear that certain studies have been conducted more carefully than others, in that better control was exercised over outside variables which could alter the possible association between electric or magnetic fields and resultant health effects. More weight is assigned to these latter studies by ERI.

Epidemiological studies on EMF are considered more difficult to carry out than laboratory studies since in a laboratory setting it is possible for the investigators to physically control many of the variables or confounders, other than the electric and magnetic fields, which might influence the detection or magnitude of health risk. Thus, in a study of the effect of magnetic field on rats, the diet, water consumption, hours of daylight, atmospheric conditions, cage size and other details of the rats' existence which might predispose toward detecting or not detecting an association with fields can be controlled. In the case of epidemiological investigations designed to detect associations between electromagnetic fields and human health, such control over possible confounders is not possible.

It is very difficult to actually prove or demonstrate a cause-effect relationship in science, particularly in epidemiological studies. Thus scientists deal in probabilities rather than certainties, and criteria such as replicability of studies and consistency of results become important in evaluating results.

2.2 Inquiry Evidence

Counsel for B.C. Hydro stated that B.C. Hydro did not wish to be adversarial in the Inquiry. B.C. Hydro adopted the position that the study of biological effects of electromagnetic fields is a new area and results are not conclusive or consistent.

In his opening, B.C. Hydro's counsel stated that most work to date does not suggest adverse health effects from EMF, but that there is some doubt.

> "Most of the studies to date support the conclusion that EMF, particularly at the levels involved here, do not present a risk to health. But there are some studies that do suggest an association, and those studies should not be dismissed."
>
> "So, Mr. Chairman, B.C. Hydro cannot give an unqualified assurance or a definite statement that there is no health risk involved in EMF. More scientific research needs to be done.
>
> All that B.C. Hydro can do is to retain qualified and independent experts to provide their best judgement on the evidence to date and to be guided by their advice." (T 20-21)

Dr. Erdreich and Dr. Sastre

Formal B.C. Hydro testimony opened with Dr. Erdreich specifying the criteria used by scientists to evaluate the probability of an association actually being a cause-effect relationship.

These are:

(a) **Strength of the Association**

The measure of the association between an agent and subsequent disease should be strong. This gives confidence that the association is real and not a result of chance or confounding by other factors.

(b) **Dose-Response Relationship**

An increase in dosage or exposure to an agent should result in more severe health effects or more individuals becoming diseased.

(c) **Lack of Temporal Ambiguity**

There should be good evidence that the exposure occurred before the disease, and the lag-time between exposure and development of the disease should be consistent with what we know about such illnesses.

(d) **Consistency**

Results from different types of studies should generally agree. Consistency increases confidence that the associations found are of a cause and effect nature.

(e) **Biological Plausibility**

The associations found, particularly in epidemiological investigations, should be consistent with what is known about biological mechanisms as elucidated by the basic or laboratory sciences.

(f) **Specificity of the Association**

An association of a specific exposure with a corresponding specific disease outcome increases the probability that a cause-effect relationship is present.

The more of these six criteria that are fulfilled within a body of evidence relating an exposure to a disease, the stronger the evidence favouring a causal association (T 27-29).

Dr. Erdreich also commented on the process by which she and Dr. Sastre evaluated the scientific literature on EMF as described in her prepared evidence given in Exhibit 3.

> "...to evaluate whether, collectively, these studies support a conclusion that magnetic field exposure is causally associated with increased cancer risk, with adverse reproductive effects, or adverse effects on general health."

In response to questioning concerning her opinion on the probability of health effects resulting from EMF as evidenced in the epidemiological literature, Dr. Erdreich stated that her interpretation of the relevant literature on distribution and transmission lines did not support a conclusion that they are a factor in causing human disease (T 32-33).

Dr. Sastre was careful to specify that the effects of EMF at 60 Hz were the only effects which were of concern in the matter of the 230 kV transmission line. He felt that no adverse effects on human health had yet been demonstrated for EMF. He stated:

> "...we need to distinguish between effects and adverse effects in the areas of endocrinology, to the extent that they have been examined, effects on the central nervous system, on reproduction, and on prostheses that could be related to either the initiation or promotion of cancer. We find that there are no effects that are consistent with an adverse effect on the health of an intact organism. And that would be the conclusion that I would reach at this point." (T 32)

Dr. Sastre and Dr. Erdreich were questioned as to whether they had addressed all the studies completed on EMF. Dr. Erdreich replied that all studies were screened for relevance (to 230 kV and 60 Hz electromagnetic fields) before being evaluated (T 34). Dr. Sastre indicated he followed similar criteria for relevance of studies before evaluating them in his prepared evidence (T 35).

Under cross-examination Dr. Erdreich was asked whether the proposed B.C. Hydro 230 kV powerline was safe. She responded:

> " 'Safe' is a very broad term. I'm providing information that says from my reading of the data there is no indication of potential health risks of concern. 'Safe' becomes a value judgement." (T 62)

On further cross-examination, Dr. Erdreich clarified the different types of epidemiological studies and how closely cause-effect relationships could be inferred from them (T 65-68).

(a) **Correlation Studies** are used to generate hypotheses but in general do not infer causation. She advised:

> "Epidemiologists collect vital statistics and look at variations over place and time. Now, in just the collection of birth rates and infant mortality rates and death rates by cause is epidemiology. And you can correlate these rates with events. And it just describes what's happening with these rates with different events."

(b) **Proportionate Mortality Studies** use routinely collected death certificate data and are another type of descriptive epidemiology. One example put forward was the proportion of deaths due to cancer compared to an appropriate reference population to provide a proportionate mortality ratio.

(c) **Case Control or Observational Studies** evaluate retrospectively a history of exposures to putative causal agents in subjects with and without the disease in question. These studies are more powerful than the first two types in establishing causality.

> "But the real information from epidemiology can get you a little better than an association, and that is there are different types of studies. And when you do observational epidemiology you can get associations that are, that are more indicative of causality, and the reason is the way that the study is designed.
>
> So, for example, if you do a case control study, you're really comparing cases and controls on the history of their exposure. And so, you don't really know whether more people who are exposed got the disease, but you will infer that from a case control study."

(d) **Cohort Studies** in which a group of subjects are enrolled in a study prior to exposure, and disease outcome in those subsequently exposed is compared with those not subsequently exposed. This is the type of study from which one can most readily and appropriately infer disease causation.

> "...sometimes epidemiologists are fortunate enough to be able to pull together a group of exposed people and compare them with the unexposed people to see if one group has more disease than the other. And we don't have too many of these studies in the residential EMF. But these give you a better, a chance of demonstrating an association than with just the descriptive epidemiology."

Under cross-examination Dr. Erdreich also noted the necessity for replication of results in scientific studies. Replication helps get around the shortcomings of any single study (T 73). Under specific cross-examination concerning a study by Wertheimer and Leeper (in 1979), Dr. Erdreich stated that the authors believed they had shown an association between high current residential wiring configuration and childhood leukemia but that her assessment of the paper was that such an association was not demonstrated. Further, Dr. Erdreich did not feel that a later study conducted by Dr. D. Savitz (1986) designed to be a better study than that of Wertheimer and Leeper confirmed the results found in that earlier study (T 96).

Dr. Erdreich also does not agree with the Scientific Advisory Panel of the New York State Power Lines Project when they stated in their final report (July 1, 1987):

> "Even before the study by Savitz was undertaken, available information indicated that children living near power transmission facilities or in homes with elevated magnetic field might be at increased risk of cancer. However, so many methodological and theoretical concerns were raised against these studies that the findings had to be considered highly uncertain. The study by Savitz confirms the results of the previous studies to some extent and adds to the credibility of the hypothesis that exposure to extemely-low-frequency magnetic fields might be a cause of childhood cancer. It is important to bear

> in mind, however, that research in basic sciences has not revealed any mechanisms that could explain the role of the magnetic fields in the origin of cancer."

Under cross-examination Dr. Sastre suggested that science evaluates "risk" rather than "safety" with regard to a given environmental agent (T 149). Dr. Sastre's opinion of the new 230 kV power transmission line was that it posed no risk to human health (T 149).

Dr. Sastre also presented a lengthy explanation delineating the difference between a stressor and a stress reaction. The medical community agrees that a stressor provokes a reaction which involves brain and hormone pathways, including an increase in cortisol, release of catecholamines, and release by the adrenals of epinephrine and norepinephrine. Of necessity, without these actual physical parameters, a reaction cannot be called a stress reaction to some outside factor. Stressors can be defined as acute or chronic. Dr. Sastre maintained that there is no qualitative difference between an acute and a chronic stressor. An acute stressor becomes chronic through prolonged exposure (T 155-156).

Further he stated that the major variables determining the impact of a stressor on the body are the intensity and duration of the stressor. In addition it is Dr. Sastre's belief that in order to be a chronic stressor, a factor must first be shown to be an acute stressor (T 161). Dr. Sastre stated that he had seen no evidence that electric or magnetic field exposure was a stressor (T 158).

Both Dr. Erdreich and Dr. Sastre under cross-examination stated that they agreed with the Scientific Advisory Panel of the New York State Power Lines Project that no causal relationship had been demonstrated between magnetic fields and cancer (T 200).

Several members of the public expressed their concerns to the B.C. Hydro Panel. Dr. Marton, an area resident and Psychologist, asked if any studies had been done which reviewed health inventories of children living near powerlines. Dr. Erdreich stated:

> "There have been no suggestions of health effects in children that haven't been studied, except for the leukemias and cancers, and these have been studied." (T 219)

Dr. Marino

Dr. Marino, Professor of Orthopaedic Surgery, Cellular Biology and Anatomy at the Louisiana State University Medical Center gave expert testimony on behalf of the Comox Valley Rerouting Committee.

Dr. Marino described how he had calculated the changes in electric and magnetic fields that would occur from the addition by B.C. Hydro of a 230 kV transmission line to the existing three 138 kV lines. Dr. Marino suggested that the average electric field exposure for those not using electric blankets or living next to high voltage lines was 1-2 volts per metre (T 319).

Under direct examination, Dr. Marino stated that he felt the B.C. Hydro's Dunsmuir powerlines were a health risk and this opinion was based on his reading of the literature (T 320).

Dr. Marino stated that powerlines generate electric and magnetic fields off the ROW which are many times greater than the exposure to which a person not living close to powerlines is exposed to. These fields produce changes in the bodies of animals and humans. As such, he argued that they are biological stressors. Because they cause a continuing response, such fields would be chronic stressors. Dr. Marino believed that additional chronic exposure to stressors promotes disease by reducing the body's adaptive capacity (T 321-322).

Dr. Marino also stated that it is unlikely ever to have absolute proof that magnetic fields cause cancer. Rather, magnetic fields are risk factors for cancer in the same way that smoking is a risk factor for lung cancer (T 357). Dr. Marino is of the opinion also that exposing individuals involuntarily to 60 Hz electromagnetic fields from power transmission

lines such as the new 230 kV B.C. Hydro line constitutes involuntary human experimentation if permission is not provided by the affected people (T 324).

Dr. Marino differed from Drs. Erdreich and Sastre in that he felt exposure to 60 Hz electromagnetic fields was a definite risk factor for disease (T 323). Dr. Marino stated that in his view it was not honest scientific differences that were responsible for conflicting views among investigators about whether power frequency fields were risk factors for disease, but rather power company interference in studies (T 323).

When asked by the Chairman what research was worthwhile he stated it was work not funded or influenced by utilities. Dr. Marino also suggested that the views of "blue ribbon panels" convened to examine human risk from electric and magnetic fields are worthless because the members of such panels are not independent in their viewpoints, but rather are contractees, consultants or advisors to the utility industry (T 329-330).

Dr. Marino stated that the power utilities through their U.S. based research institute (Electric Power Research Institute) inappropriately specified conditions under which studies must be carried out and thus prevented a fair appraisal of the risks of 60 Hz fields in research done by scientists.

When asked what he considered to be a safe level of electric and magnetic fields, he specified that the upper limit for human habitation was an electric field of 50 V/m and a magnetic field of 1-2 mG. Dr. Marino felt that any appreciable increase above average EMF levels due to power transmission lines was reason for concern (T 397-398).

Counsel for B.C. Hydro proceeded to review with Dr. Marino, some recent work of Dr. David Savitz of the University of North Carolina. Dr. Savitz conducted an epidemiological study of childhood tumours and electric and magnetic fields in Denver and

showed an association between wiring configurations and childhood leukemia. An undated open letter (Exhibit 11), subsequent to the Denver study, quoted Dr. Savitz as saying there was no proof that magnetic fields cause cancer.

> "As indicated in the press coverage our study suggests a link between prolonged magnetic field exposure from electric powerlines near residences and risk of childhood cancer. It should be kept in mind, however, that we have not proven that magnetic fields cause cancer. Subsequent research will indicate whether we are on the right track or whether our results are in error. Thus there is a suggestion of a possible hazard which is yet to be resolved. Given these circumstances, it seems that interest or concern may be justified, but our study is not sufficiently convincing to warrant drastic action by homeowners." (T 356) (underlining added)

Because of concerns about quantifying levels of EMF exposure to health risk the Chairman asked Dr. Marino if in some circumstances householders living close to the powerlines might be getting a higher exposure from appliances, electrical devices, and wiring configurations within their homes than they get from a powerline. Dr. Marino concurred that this might be true (T 403-405).

Finally, due to the difficulties in placing empirically determined limits on the amount of electric and magnetic field that individuals should be exposed to, the Chairman expressed his concern about what B.C. residents could do on a long-term basis to ameliorate risks (T 425).

Dr. Marino answered at length suggesting that drastic steps may not be necessary and that one desirable strategy might be for individuals to reduce exposure to other disease risk factors.

> "There is a middle road position which amounts to a recognition that there is some health-impacting aspect of being chronically exposed to electromagnetic fields. But that these fields don't cause disease, that they are factors associated with disease like many other factors.
>
> So that I think that it's foolish to ignore the problem, on the other hand it's foolish to over-respond and let one physically identifiable factor overwhelm other factors that may be present in the environment."

> "One strategy for coping, if it's undesirable to exclude the fields from your living area, if it's impractical or impossible, one desirable strategy is to assess the other factors in your life that similarly produce or orient to a disease, and reduce those factors. There doesn't need to be an excessive reaction. There needs to be a total integrated view of the factors, reasonably suspected to predispose to a disease, and a judgement made then." (T 426) (underlining added)

Intervenor Evidence

The Merville Environmental Committee suggested that although scientific evidence on the effects of EMF is not complete, prudence dictated that it would be wise to reroute the new 230 kV powerline away from Merville. As well, they argued that more attention needs to be paid to possible EMF hazards (T 435).

Other individual residents expressed their concerns with respect to the line and their fear of potential health risks related to EMF.

Mrs. Kavka provided evidence on behalf of the Comox Valley Rerouting Committee ("the Committee"). She also supplied numerous letters and petitions expressing concern for the potential health risks of EMF from transmission lines. The Committee represents 124 families.

Mrs. Kavka provided the results of a telephone survey of health problems (Exhibit 40). The survey was not conducted in any standardized or scientific way and prompted the Chairman to remark that such information presented in that manner might be taken to be more valuable that it really is. He expressed his opinion that such material may cause an unwarranted heightening of concern (T 864).

Mrs. Kavka also provided evidence on her activities in promoting opposition to the new 230 kV line.

> "I did everything I could think of to bring it to people's attention because I thought, if I don't know what's going on, then neither do a lot of other people who are basing decisions on incomplete facts. So the first public meeting that I attended and spoke on the subject was on March 28, 1989 at the regional board office in the scheduled monthly meeting.
>
> I presented a brief at that time, and as the Commission is well aware, the regional board voted 17 to 1 that---they resolved that no future high-voltage powerlines should be placed in densely-populated residential areas within this regional district.
>
> I followed that by going to the school board where a similar registering of concern was sent to B.C. Hydro, that they felt that in light of not knowing how safe things really are, or how dangerous things really are, that the most prudent move is a move away from the people. If you want to hear, I went to every other meeting I could possibly think of. I went to the parents association meetings and there were similar resolutions from all of them in terms of submitting letters of concern to both B.C. Hydro and the Utilities Commission.
>
> I followed that by public information booths. I went to the mall and made my literature, everything that I had, available to anyone who wanted to read it. At that time I had letters prepared for both Mr. Bell and the Utilities Commission, that if people agreed, as opposed to a petition, it was a letter, that if they agreed with it the letter said to sign and mail it and to be sure to mail both because I felt the Utilities Commission should be well aware of the concerns of the public." (T 874-875)

The Chairman of the School Board testified that as a result of a submission from the Committee an addition to the Arden School was put on hold until the School Board could be assured that the environment in which students attend Arden School is safe (T 949). In response to questioning from Commission Counsel, the School Board Chairman confirmed that he was unaware that the magnetic field from the transmission lines would be approximately 0.50 mG at the school building (T 952).

2.3 Assessment

Sometimes associations between related variables have been found before a cause and effect relationship was documented. For instance, the relationship between lung cancer and cigarette smoking emerged before a biologic mechanism of action was suggested. Even today we still do not know in an absolute sense which of the many carcinogens in tobacco smoke might be responsible for lung cancer. Further, although cigarette smoke is related to lung cancer, it is also related to cancer of the larynx, kidney and bladder, as well as heart disease, bronchitis and emphysema. Thus specificity of association is absent. In addition, as Dr. Marino has pointed out, we may never demonstrate true causality in science and thus must rely on inference of biological effect from the research data.

It is clear that some results emerging from the studies conducted to date give reason for concern. For instance, the study of Wertheimer and Leeper, while imperfect in many ways, did suggest an association between childhood leukemia and exposure to potentially high current residential wiring configurations. A study conducted in Denver by Dr. David Savitz of the University of North Carolina partially confirmed the earlier study's results, although it failed to confirm a relationship between measured magnetic field and leukemia.

Although other studies to date have not replicated these results and there have been studies which have shown no association, evidence exists suggesting the possibility of an adverse effect from 60 Hz electromagnetic fields.

It is equally unwise to suggest that there is conclusive scientific evidence of an adverse effect of electromagnetic radiation. For example, most of the occupational studies indicating a relationship between EMF and workers exposed to strong electric or magnetic fields are based on simple job titles with no attempt to take a full occupational history. Since persons

working in the fields of electronics and electrical maintenance are also exposed to a number of other influences such as chemicals, the associations detected to date need further study with better control of potential confounding factors.

Further, the studies done directly relating residential exposure to high voltage transmission lines and cancer have been either ambiguous (Tomenius, 1986) or negative (McDowall, 1986).

In the area of animal experimentation there are many initial studies, usually involving high frequency energy, demonstrating adverse effects which have not been successfully replicated. Their relevance to the possible adverse effects of 60 Hz exposures has also been questioned. As well, a number of negative studies showing no effects at all have been seen in the epidemiologic and laboratory areas.

Inquiry Findings

The Inquiry finds that there is cause for concern within the scientific literature about the biological effects on humans of electromagnetic radiation. There is, however, insufficient evidence to support a presumption of an actual health risk. This conclusion holds for effects:

(a) within residential areas due to distribution wire configuration and measured magnetic field;

(b) within occupational categories due to implied exposure to EMF at work;

(c) residences close to high voltage transmission lines.

The question of whether the design or results of studies financed either by the individual power companies or by the Electric Power Research Institute are biased by such funding has been considered carefully. Each study published is open to criticism in the scientific literature and inappropriate design features or unsubstantiated conclusions would be detected quickly. In addition, since published studies must state the source of their funding, systematic attempts to distort findings would not go unnoticed or uncriticized. The blanket condemnation of such studies by Dr. Marino is rejected entirely.

More and better scientific research is necessary in both the laboratory and epidemiologic areas. Research involving human exposure must concentrate on better measurement and characterization of actual electric and magnetic field exposure. Further, ascertaining of the sources of such exposure (transmission lines, distribution lines, appliances) is also very important.

Given the current state of scientific evidence it would involve undesirable and unfounded speculation to establish any fixed standards for EMF exposure at the edge of the ROW. The evidence of any health hazard is inconclusive and the establishment of standards would create either unwarranted alarm in some people or result in a potentially false sense of security in others.

It should be emphasized that calculations of levels of magnetic fields expected at houses along the powerline ROW, after installation of the 230 kV line, are generally quite low. In some cases, fields from transmission lines have lower readings than those from distribution wires.

B.C. Hydro has done little research in the area of studies of electromagnetic fields and their health effects. To date, B.C. Hydro has not attempted to engage itself in any way in human health research. The company has a large body of workers who presumably have over the years been exposed to relatively heavy doses of electric and magnetic field energy. Entering

these exposed individuals into studies such as the joint Ontario and Quebec Hydro occupational study could help answer the questions which have prompted this Inquiry. Additionally, contracting with recognized investigators to devise studies and utilize such resources might be another way for B.C. Hydro to be pro-active in approach, although ideally funding should be at arms-length.

Moreover, the lack of coordination between government agencies, utilities and scientific organizations in their approach to this problem in Canada is evident. A Health and Welfare Canada committee was set up to review the problem in 1986. No recommendations have yet been published, particularly with regard to the nature of the scientific study necessary to investigate the problem. In the meantime, it was estimated that some $100 million has been spent worldwide without conclusive results. Dr. Marino put it quite succinctly:

> "...I would estimate that since funding began with the Gan study in '72 or so, as near as I can tell, somewhere around $100 million has been spent, $100 million. Now, in that $100 million, Mr. Chairman, has produced not one study, not one study that is going to be useful to you to make a decision..." (T 424)

It would seem appropriate that funding for some well focused studies might come from utilities, perhaps through the Canadian Electrical Association ("CEA"). In order to ensure that funding is perceived to be at arms-length, perhaps the CEA could have studies financed and managed through Health and Welfare Canada, which has a section which routinely funds medical studies. The Medical Research Council would be another body that might be able to help in this area.

It should also be noted that there is some research going on in this country to evaluate potential health effects of electromagnetic radiation. A large cooperative study of occupational exposure in workers at Hydro Quebec, Ontario Hydro and Electricitie de France is being conducted by investigators at McGill University. A study to examine childhood

leukemia in relation to residential exposure to electric and magnetic fields has also been proposed. This study will involve investigators from the Cancer Control Agency of B.C. and McGill University and will be conducted in major cities across Canada.

It would not be appropriate to complete an assessment of the complaints respecting the proposed transmission line without reflecting on the elevated concern of the residents. Much documentary and other information had been made available to them on the subject and it cannot be denied that people have the right to draw their own conclusions. Fear, however, can be preyed upon by activism which can fuel anxiety by the unscientific association of information purported to be fact. The evidence given by Mrs. Kavka (a particular example is the telephone survey regarding various illnesses [Exhibit 41]) and the inferences of many other individuals alleging an association between various illnesses and the powerlines are indicative of concern as opposed to proven cause-effect relationships. The issue of EMF and its potential biological effects must be addressed by scientific studies. Accordingly, while the concern of the people is genuine, that concern in itself should not be used to draw serious conclusions which have high socio-economic effects. People's motives vary and in this case there may well be motives for the actions of a few which transcend the EMF issue.

Finally, with respect to the proposed expansion of Arden School it is recommended that the School Board be advised that the Commission sees no reason to delay expansion as a result of EMF concerns. Magnetic field readings at the school are very low and will remain very low after completion of the 230 kV line. The only meaningful EMF influence at the school comes from the local distribution lines and internal school wiring. These influences would exist at any school.

3.0 SUPPLY ALTERNATIVES

As explained in Section 1, the $323 million Gold River mill expansion to be powered by the proposed 230 kV transmission line is scheduled to commence operations by September 1, 1989 (Exhibit 22). This requires that the new source of power be available by August 14, 1989. The power requirements of the mill are in the order of 90 MW (T 547) and this quantity cannot be accommodated by the existing 40 MW single circuit 138 kV line.

The supply alternatives available are:

(a) construction of a new 230 kV line on the existing ROW between Dunsmuir and Gold River substations as currently planned.

(b) construction of a new 230 kV line on the selected ROW, but undergrounding the segments through the Courtenay, Cumberland and Merville areas.

(c) construction of a new 230 kV line on a new ROW (to be selected) which is routed around the communities of Courtenay, Cumberland and Merville.

(d) rerouting the three existing 138 kV lines together with (c) above.

(e) development or dedication of a generation source of adequate capacity for the new load closer to the load site.

The feasibility and ramifications of these options are rationalized in the sections which follow.

3.1 Near-Term Solution

In prepared testimony (Exhibit 22, p. 3) CPFP indicated that "The new mills can be operated at marginally less than capacity but not at levels which negate the necessity for B.C. Hydro's new 230 kV line." With this statement in mind, the only near term solutions are either the construction of the proposed 230 kV line on the selected ROW, or supply from an existing generation source of adequate capacity.

B.C. Hydro's planning for the existing CPFP mill provides for a back-up supply from a standby gas turbine generating plant located in the Port Hardy area. This plant has a rated capacity of 99.7 MW which is more than adequate to supply the mill load. However, B.C. Hydro's Project Manager, Mr. J. Barker testified that this gas turbine plant is not designed for continuous base loading and that if such were attempted, apart from the operating problems that would ensue, the fuel costs of approximately $100,000 per day would be prohibitive when compared to the electricity costs with the proposed line extension (T 723).

Therefore, it can be concluded that the only feasible short-term solution is the continuation of construction on the presently selected ROW.

3.2 Long-Term Solution

The following possibilities exist if a longer term solution should become necessary:

(a) line rerouting could be considered, especially in the event that a common corridor with the proposed Island Highway shows merit.

(b) co-generation or supply from a private power producer.

(c) undergrounding.

Testimony submitted by several participants recommended that a route away from developed areas be obtained in view of the severe concerns surrounding the EMF emissions and the possibility of associated health hazards.

Rerouting was also recommended in view of the planned Vancouver Island natural gas pipeline project which is proposed to be routed along the same transmission line corridor. Arguments advanced suggested that such intensive use of this corridor would be an unreasonable imposition on the residents whose properties are already impacted by the transmission lines. Some residents also expressed concerns about the possible hazards that could be precipitated by gas pipeline leaks if transmission lines and gas pipelines are installed in the same corridor located in a residential area. These concerns are based on the possibility that, in this area, the ROW will be used by the pipeline project. This has not been established. If this were to be the case, B.C. Hydro is correct in stating that the pipeline project proponents would need to negotiate on underground easement with property owners.

B.C. Hydro testified that rerouting of the existing 138 kV lines and the proposed 230 kV line would incur costs of approximately $650,000 per km for the 20 or 26 km rerouting "alternatives" (Exhibits 14 and 15) and would delay the project by 18 to 24 months, depending on the difficulties encountered in acquisition of new rights-of-way. In addition, an alternative route could encounter unknown environmental and social problems. Rerouting the 230 kV line only was estimated to cost $200,000 per km (T 462).

Testimony by CPFP representatives indicated that installation of new facilities to provide adequate local generation is not economically comparable to a supply from B.C. Hydro. However, in view of the current provincial interest in developing non-utility generation, there may be opportunities in the future for CPFP to curtail the B.C. Hydro supply in favour of generation from independent producers. This can have implications for the timing of the future upgrade of the existing 138 kV lines in the Courtenay/Comox area.

The possibility of undergrounding the transmission lines in residential areas was raised during the Inquiry. While current science has indicated that undergrounding powerlines could drastically reduce EMF emissions, the associated costs can amount to as much as 20 times the cost of the overhead alternative (T 606). A preliminary cost estimate for undergrounding the 7 km section in dispute in the Courtenay area is $14,000,000 (Exhibit 36). This Report does not support such measures for the transmission line under consideration.

3.3 Discussion

It became evident during the course of the Inquiry that B.C. Hydro followed its normal process for obtaining external approval for construction of the new 230 kV transmission line. CPFP also received assurance from B.C. Hydro that their expansion planning and mill construction could proceed because power could be supplied in the timeframe required. This action, on the part of B.C. Hydro, was done in good faith, since their canvassing of the various approving agencies attracted no serious environmental, socio-economic, or health concerns.

The majority of intervenors at the Inquiry continued to press for a rerouting of the proposed line, as well as the three existing 138 kV lines, around residential areas. Serious concerns for health risks from the EMF emissions were cited as reasons for this request.

Given all the prevailing circumstances, it would be unjust to enforce a line rerouting at this time since B.C. Hydro and the mill had followed all the appropriate procedures for project implementation in the timeframe needed. An order to reroute, at short notice, could only be justified if evidence were presented to demonstrate a potential health risk. Since this was not evident during the Inquiry, a decision on a new route is not appropriate at this time.

Another factor in this matter, is the selection of a feasible alternative route. Exhibit 15, which was presented in testimony, shows what may be termed "map routes". Those are essentially lines on a map (T 497, 498), since no detailed surveys had been conducted by B.C. Hydro to identify a feasible alignment. This should not be construed as a criticism of B.C. Hydro, because the time available from the date of the Commission staff's information request did not allow for a meaningful evaluation of alternative routes.

4.0 RECOMMENDATIONS

These recommendations flow from the literature review, the evidence of Drs. Marino, Sastre and Erdreich with respect to risks related to EMF from Extra Low Frequency ("ELF") powerlines, and the evidence of the concerned citizens and B.C. Hydro regarding the events that have transpired between them in the past year. This matter has become an intense emotional strain for those residents located in close proximity to the proposed line. It is unfortunate that the evidence with respect to EMF health risks is not conclusive. The moderate statements of Dr. Savitz, at times reasonably paralleled by Dr. Marino, that there is no need for public alarm are of only limited comfort to those who cannot be definitively assured that there is no meaningful risk.

The question of magnetic fields from high voltage transmission lines is but one part of a larger issue related to the use of electricity in every day life. Electric distribution lines, household wiring and electric appliances create the greatest preponderance of EMF radiation. A June 1989 report by scientists from Carnegie Mellon University to the U.S. Congressional Office of Technological Assessment espouses "prudent avoidance" practices that can be taken by everyone. The proposed prudent approach to limiting exposure to EMF includes, for example, the avoidance of continuous close contact with magnetic fields from items such as electric blankets and alarm clocks. Those researchers propose that electric blankets be used only to heat the bed before retiring, or disposed of altogether, and that the alarm clock in the bedroom be moved further away from the bed. An extension of the views of these researchers could be that some may view it as "prudent avoidance" that young children be discouraged from continuous play on the ROW itself. Since magnetic fields fall off sharply with distance from the sources, simple actions could substantially reduce overall exposure to such fields.

It must be recognized that the magnetic fields from the proposed high voltage transmission lines in the Courtenay corridor would emit magnetic fields which also fall off rapidly with distance. The calculated magnetic fields from the transmission lines at the residences located along the corridor indicate that the magnetic fields from the powerlines are not substantially different from the ambient magnetic fields caused by household wiring and appliances (Exhibit 14, Tabs 9 and 11). In some cases the EMF impact from distribution lines can be considered more significant than that of the transmission lines due to the location of the ROW.

It is important that the EMF health risks from both transmission lines and other sources be determined. The Commission must not gloss over this issue as a result of the inconclusive nature of the current scientific literature. The matter deserves attention and coordinated scientific study. In this regard there is much work ongoing throughout the world including the Carnegie Mellon Report, an EMF report from Health and Welfare Canada expected later this year, proposed research by Dr. Savitz to be sponsored by the State of California, a research study to be undertaken by the B.C. Cancer Control Agency and others, including work by Ontario Hydro, Quebec Hydro and Electricitie de France.

4.1 Rerouting Issue

Based on the Inquiry findings of Sections 2 and 3 of this Report, the current evidence does not support a compelling reason to reroute the line through the Courtenay, Cumberland or Merville areas. However, B.C. Hydro may find it advantageous to consider rerouting of its transmission lines at a future date when the final routing of the Island Highway is complete. In keeping with the Government's "Guidelines for Linear Developments" and the concepts of common corridors for utilities and transportation systems, B.C. Hydro should reconsider the routing of its transmission lines in conjunction with the Ministry

of Highways and the appropriate Regional Planning Authorities to determine if there are any socio-economic advantages in locating the energy corridor and transportation corridor adjacent to each other.

It is therefore recommended that construction resume on the segment of the line where work was halted pursuant to Commission Order No. G-35-89.

4.2 B.C. Hydro's Buy-out Proposal

B.C. Hydro testified that, even if the transmission lines were rerouted, it intends to honour its offer to purchase properties adjacent to the existing transmission corridor. The evidence from several property owners was perhaps most clearly articulated in the submission by Mrs. Brenda Munro (Exhibit 45):

> "If B.C. Hydro did not believe that there was a health hazard, then I asked myself another question. Why did they start this buy-out program... The public perceived the buy-out offer as an admission of guilt and that there is a health hazard surrounding transmission lines."

The proposed buy-out offer from B.C. Hydro has caused intense speculation with respect to its motives. Notwithstanding the assertion in B.C. Hydro's letters of May 9 and 12, 1989, to the effect that no health hazards exist, many perceived the buy-out offer as an admission that a health hazard surrounds the transmission lines. This view exists despite B.C. Hydro's genuine efforts to dispel concerns with respect to health hazards.

Most of the testimony that addressed the issue of market values suggested that property values of the homes adjacent to the transmission line have fallen. Although B.C. Hydro took some comfort in the fact that one property had recently sold close to its asking price (T 736), there was evidence that property values had fallen somewhat and that interest in purchasing properties adjacent to the transmission line has lessened. It should be emphasized that there

was no expert evidence of a decline in values, only the opinions of members of the public.

Neither B.C. Hydro nor the Commission perceives an actual health risk from EMF emissions, however, it is clear that the good intentions of B.C. Hydro in making the buy-out offer has resulted in heightened public concern with respect to both the EMF health issue and land values. This report recommends that B.C. Hydro continue to honour its commitment to purchase properties because:

(a) its offer has created expectations and may have precipitated financial commitments on the part of some of the recipients.

(b) in fairness to those who failed or were unable to respond by May 31, 1989 and to those who met the criteria but were not included in the initial mailing and have been subsequently identified during and after the Inquiry; and to those who were unable to reach an informed and reasoned decision because of the continuation of uncertainty caused by the Inquiry process (delay).

It is therefore recommended that the B.C. Hydro buy-out offer not be closed as of May 31, 1989, but be continued with a deadline for residents responding to B.C. Hydro by September 15, 1989. B.C. Hydro should undertake to ensure that all the appraisals of properties to be purchased be based on market data and professional opinion, as if they (the appraisals) were actually performed prior to May 8, 1989. In other words, the appraised purchase price should reflect the market value of the property as of May 8, 1989. In addition, B.C. Hydro should ensure that all those involved in the buy-out scheme are given a clear understanding of what their options are (T 817). Purchases should be completed expeditiously.

The foregoing will set property values fairly as at May 8, 1989. If B.C. Hydro finds that property values in the Courtenay area generally have appreciated significantly from May 8 to the date of individual binding agreements to sell, the property values are to be adjusted by a percentage value to account for the upward market movement in the intervening period. The District Real Estate Board should be used as a reference. B.C. Hydro should honour its offer that the valuations be based on the three existing transmission lines in the corridor and exclude any impact that the proposed new 230 kV line may have on the property values (T 734-735).

The choice of which properties are to be offered the buy-out option should be based on a consistent rationale. B.C. Hydro has maintained that the offer resulted from the concerns raised by residents in the area with respect to magnetic field effects from the new transmission line. Since the purpose of the offer was to deal with concerns about perceived health risks from magnetic fields, the rationale that B.C. Hydro used in its offer to purchase properties should be related to proximity to the powerlines. However, B.C. Hydro excluded some dwellings in closer proximity to the transmission line than others receiving a buy-out option.

Under Tab 6 of Exhibit 14 of the Inquiry, B.C. Hydro identified its selection criteria for its offers to purchase properties. Additionally, in B.C. Hydro's July 19, 1989 response to outstanding Commission Counsel questions, the utility identified the farthest owner (dwelling) that received an offer to purchase as being located 356 metres from the ROW. This location is very far from the ROW, and the magnetic field resulting from the powerlines is only 0.3 mG. Exhibit 14, Tab 9, Table 2 on the following page provides a tabulation of calculated electric and magnetic fields for alternative line configurations.

B.C. Hydro has now identified six additional homes which meet the utility selection criteria. They will be included in the buy-out offer. Two other residents appeared at the Inquiry and stated that their homes were located close to the powerlines and had not received offers even though some of their neighbours whose homes were located further away from the powerlines had received offers (Guinette, T 764 and Miller, T 957). It is recommended that B.C. Hydro investigate these anomalies and report back to the Commission on their findings by August 18, 1989.

4.3 Treatment of Buy-out Costs

The evidence from the Inquiry results in the conclusion that B.C. Hydro acted imprudently in its decision to make the buy-out offer to the residents in the Courtenay area. The scientific evidence with respect to health hazards from EMF is such that no identified risk to human health has as yet been substantiated.

It is recommended that the Commission exclude the cost of this buy-out program from B.C. Hydro's cost of service. By excluding the costs of the program from any determination of revenue requirements, the Commission can ensure that the costs of this buy-out will not affect the rates of consumers generally within the Province of British Columbia. This action will also ensure that there is no precedent established or emanating from B.C. Hydro's buy-out in the Courtenay area with respect to other transmission lines in the Province.

The question whether the offers made might fall within the provisions of Section 65(2) of the Utilities Commission Act, as constituting unduly preferential conduct was raised during the questioning by Commission Counsel during the hearing (T 807-808). Although that issue may have potential significance, it was not pursued by the Inquiry on this occasion.

TABLE 2

Calculated Electric and Magnetic Field Levels

Location	Magnetic Field Peak Load*			Electric Field Peak Load		
	3-138 UNTRAN	3-138 1-230	UNTRAN 4-230	3-138	3-138 1-230	4-230
	mG	mG	mG	kV/m	kV/m	kV/m
1. Maximum level on ROW	105.90	123.00	96.910	1.690	1.862	2.763
2. Distance from west (230 kV) edge of ROW:						
0 m	4.465	36.450	34.690	0.091	1.238	1.117
50	1.174	3.860	2.380	0.022	0.055	0.028
100	0.562	1.570	0.886	0.010	0.017	0.007
150	0.339	0.913	0.525	0.006	0.008	0.003-
200	0.230	0.622	0.376	0.004	0.005	0.002
250	0.169	0.464	0.295	0.003	0.003	0.001
300	0.131	0.368	0.245	0.002	0.002	0.001
400	0.088	0.258	0.185	0.001	0.001	0.001
500	0.067	0.200	0.149	0.001	0.001	0.001
600	0.055	0.164	0.123	0.001	0.001	0.001
3. Distance from east (138 kV) edge of ROW:						
0 m	27.950	34.210	19.030	0.163	0.170	0.403
50	2.316	2.830	0.734	0.045	0.042	0.020
100	0.812	0.937	0.360	0.016	0.015	0.007
150	0.442	0.544	0.294	0.008	0.008	0.003
200	0.286	0.381	0.243	0.005	0.005	0.002
250	0.205	0.295	0.206	0.003	0.003	0.001
300	0.157	0.241	0.178	0.002	0.002	0.001
400	0.105	0.178	0.139	0.001	0.001	0.001
500	0.078	0.141	0.113	0.001	0.001	0.001
600	0.063	0.116	0.094	0.001	0.001	0.001

* For average load conditions, the magnetic field levels are 70% of the levels in the table.

The Commission has heard that land values adjacent to transmission lines have allegedly fallen in areas as far away as Victoria as a result of the B.C. Hydro buy-out offer. Because there is no reliable evidence that powerlines pose a risk to human health, it can be expected that any impact on land values will be alleviated as a result of the conclusions of this Inquiry.

4.4 B.C. Hydro Research into EMF

B.C. Hydro has recently appointed a new manager with exclusive responsibility for EMF issues. This focus provides an opportunity for it to undertake coordinated research through other agencies at arms-length. Dr. Marino and others pointed out that it is important that any scientific research be undertaken with complete independence from utility control or influence in order to assure the public that the research is not biased in favour of any vested interest. (However, other strident sweeping allegations by Dr. Marino in regard to utility funded research are emphatically rejected. Such unfounded opinion is irresponsible since no tangible evidence was presented to substantiate the allegations.)

It is recommended that B.C. Hydro collaborate with the British Columbia Ministry of Health to devise and fund research programs which will complement work now undertaken and funded elsewhere in North America on EMF related issues. In addition, B.C. Hydro should also develop public awareness information programs with respect to EMF concerns, and seek a leadership role by the Ministry of Health. It is also recommended that the Commission request the Government of British Columbia to clearly state its objectives and priorities with respect to the EMF issue so as to facilitate an appropriate environment for the implementation of B.C. Hydro's programs and those of other government agencies and public bodies.

It is very important that research be done in a coordinated manner so as to maximize the capability to resolve the EMF issue. B.C. Hydro should consider this in planning its own research funding. In addition, B.C. Hydro should investigate ways to assist in the coordination of studies and funding through the Canadian Electrical Association, other government agencies, or perhaps a new independent agency funded from many sources.

4.5 Future Transmission Line Extensions of 138 kV and Greater

Until scientific research provides sufficient evidence to make reasonably certain determinations about the health hazards related to EMF, the Commission may receive complaints whenever B.C. Hydro proposes to build a new high voltage transmission line in either new or existing corridors. Since the current evidence does not support the establishment of specific standards with respect to EMF emissions and ROW widths, it is recommended that the Commission utilize its powers under Section 51(3) of the Utilities Commission Act to require B.C. Hydro to specifically seek a Certificate of Public Convenience and Necessity ("CPCN") for any high voltage transmission line of 138 kV or greater. In dealing with such applications, the Commission has the latitude to issue or deny a CPCN and to make a determination whether a hearing is warranted. The Commission's consideration of each application will include an assessment of the scientific, environmental and socio-economic evidence currently available at that point in time, and the specific physical considerations related to the proposed line.

In making application for a CPCN, B.C. Hydro should allow sufficient lead time to ensure adequate input from all parties is obtained. Ms. Carswell of the Comox-Strathcona Regional District raised several recommendations for B.C. Hydro (T 682) and noted that the Board of the Regional District would require at least two months notice to ensure adequate review time.

4.6 Application for Costs of Intervenors

An Application was made by residents to have the Commission pay the costs of Dr. Marino. The Comox Valley Rerouting Committee hired Dr. Marino to provide expert evidence with respect to EMF health hazards. The Commission recognizes that the costs of hiring Dr. Marino will be onerous for the public participants and that the evidence of Dr. Marino ensured that all sides of the EMF scientific literature and positions of experts were brought to the attention of the Inquiry Officer. However, the Commission is expressly prevented under Section 133 of the Utilities Commission Act from ordering that the costs of a participant in a proceeding be paid by another participant, and neither is the Commission allowed to pay the costs of a participant in a proceeding. The residents had been advised of this legislation by Commission staff before they retained Dr. Marino. The Commission therefore cannot absorb the costs of Dr. Marino nor can it order that B.C. Hydro pay these costs.

Respectfully submitted,

Original signed by:
JOHN G. McINTYRE
Chairman and Inquiry Officer
British Columbia Utilities Commission